Brokerage in SME Networks

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Brokerage in SME Networks

PROEFSCHRIFT

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Yvonne Elisabeth Maria Kirkels

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CHAPTER 1
Introduction to the study

1.1 Introduction
The goal of this study is to build on the academic work regarding brokerage in social networks (Burt, 1992; Hargadon and Sutton, 1997; Obstfeld, 2005) by providing insights into the role of brokers in SME networks. Brokers, individuals who connect otherwise disconnected parties, are seen as important for small- and medium-sized enterprises (SMEs) which want to explore and exploit opportunities outside their own sector. Brokers can act as intermediaries who integrate individual creativity of multiple actors and co-develop new business. The idea that brokers not only exploit knowledge, but may co-develop knowledge in networks only recently gained attention in network literature (Obstfeld, 2005). Discussion in network literature has shifted from whether or not brokerage is (more) valuable to how brokers span structural holes. It has changed more towards the role of brokers in networks. It is our purpose to provide insights into that discussion. The main question of this dissertation is:

*Which factors contribute to the capacity of main brokers in a SME network?*

We will investigate their network and intrinsic characteristics that facilitate networking at individual level in order to answer the main research question. SMEs’ networks are often reflective of the founder’s personal network. The personal networks, *across* the design and high-tech industries in the Southeast Netherlands that SMEs draw on will be
at the heart of our research. Network characteristics can be studied by analyzing the topology of networks. A person’s surroundings and network position provide information about environmental and actor characteristics. Hence, the first aim of this research is to study the network environment and inter-company relationships of brokers by adopting a social network perspective. The study enables to understand the nature of the SME network; the network opportunities and constraints at network level and at individual level. To get a thorough understanding of value-contributing factors the research will be extended by studying characteristics of brokers. In-depth information regarding brokers’ affiliation, kinds of relationships, kinds of information exchanged and brokerage strategies needs to be analyzed. Such information enables to understand how brokers work to facilitate networking.

The research project is important from an academic perspective because it will address the gaps in research into brokers at the individual level who (consciously) position themselves between heterogeneous actors in networks; actors who differ in industry backgrounds and skills. It is unclear how the network structure of collaboration and strategic brokerage behavior of individuals looks like across various industries. In addition, there is not much literature about the characteristics of intermediaries and exploitation of the network structure (Hargadon and Sutton 1997; Obstfeld, 2005). Apart from some notable exceptions (De Rond, 2003), the alliance literature provides only superficial attention to the influence of actor properties, like individual behavior, skills or strategies (Doz, 1996; Honing and Lampel, 2000; Hutt et al., 2000; De Rond and Bouchikhi, 2004), on the success of cooperation. The research will contribute to these aspects in network literature.

Due to our focus on brokerage at the individual level, this research will have a descriptive and an explorative nature. It is necessary to take a look at empirical data in order to generate a better understanding of brokerage in networks first. Our research contrasts most other work about brokerage in SME networks by being mainly
quantitative and by combining quantitative and qualitative research. Furthermore it focuses on brokers identified in an actual network, based on both the supplier and user-side of the network. By taking this approach we try to make a contribution to network theory.

In general, the research contributes to theory on mediation processes, alliances, social capital, network dynamics, SMEs and innovation. Innovation receives increasing attention from scientists from various fields of social science. Innovation is associated with increasing levels of collaboration and has led scientists to investigate more closely the role of nodes and links in this process. The results are relevant for various social scientific disciplines: economic and regional geography, entrepreneurship and small business, sociological studies, organization & management science, technology management, and marketing and strategic management.

1.2 The growing importance of brokerage

Firms are increasingly facing their own limitations in today’s complex and demanding environment (Das and Teng, 2002; Duysters and de Man, 2003; Eisenhardt and Schoonhoven, 1996; Hagedoorn, 2002). The need for cooperation is evident in an environment characterized by uncertainty, complexity and rapid technological progress (Acs, Carlsson and Thurik, 1996). While most of the attention in the literature has been paid to the alliance activities of large multinational corporations, small and medium sized enterprises (SMEs) in particular seem to benefit from the opportunities associated with strategic partnering. A complex environment especially affects small innovative firms because they tend to rely more heavily than large firms on technological developments outside the firm to obtain new knowledge (Hicks and Hedge, 2005; Porter, 2000). In their effort to survive and overcome resource scarcities SMEs are increasingly looking for competent partners that provide them with complementary assets and resources (Almeida and Kogut, 1997; Audretsch and Lehmann, 2005; Hite and
According to Hesterly, McEvily and Zaheer, and Narula, the complex environment and the limited resources and scanning abilities make it difficult for SMEs to find competent partners.

Another complication is the increasing drive towards specialization. Increased global competition leads to an increase in specialization; uncertainty and market fragmentation forces organizations, especially SMEs, to enhance flexibility and search for new ways to differentiate (Acs, Carlsson and Thurik, 1996). Strategic management literature emphasizes the need to focus on a certain value discipline to create value (Treacy and Wiersema, 1993; Porter, 1980). No company can succeed today by trying to be all things to all people. The need to focus on an unique value that an organization alone can deliver to a chosen fmarket will influence their mix of in-house resources and capability. As a result, organizations increasingly have fewer knowledge bases in common and therefore lack a basis from which they can communicate with each other. Due to the differentiated technological know-how and large cognitive distance between them and partners (Nooteboom et al., 2007) it becomes more difficult to communicate with companies outside the own industry and also absorb the acquired novel knowledge. The absorptive capacity of organizations is challenged (Cohen and Levinthal, 1990; Nooteboom, 2000; Zahra and George, 2002). Moreover SMEs are above all affected by this problem, because they have less time and fewer resources to spend on learning to acquire and exploit novel knowledge outside their own industry (Lavie and Rosenkopf, 2006; MacGregor, 2004; Narula, 2004; Powell et al., 1996; Syntens, 2000).

Small and medium-sized enterprises are faced by a dilemma. On the one hand SMEs need to cooperate with others in order to acquire knowledge and other competencies; on the other hand they often face difficulties in finding partners and often they lack the knowledge base to acquire and absorb the required knowledge. The dilemma clearly points to the need for SMEs to thoroughly understand network characteristics, so they can use this knowledge to their own advantage. Furthermore it points to a need for
Brokers, also known as intermediaries or third parties, to facilitate dealing with the complex environment. SMEs need insights that enable them to understand who brokers are and what brokers can do for them.

Finding a partner is often associated with uncertainty about both the skills of the potential partner and his or her reliability (Powell, 1990). Startups which in general focus on creativity, or in other words product leadership, will want partners who can complement their shortage on commercial and material assets and consequently increase their effectiveness and efficiency. In contrast, incumbent companies are in general looking for socialization and intellectual assets who can increase their flexibility and creativity and ensure continuity in the future (Hardjono, 1995 & 2000, Quinn and Rohrbaugh, 1983, Verhoef, 2010). In any case, intermediaries claim to reduce uncertainties by being able to connect these heterogeneous partners in a mutually beneficial way for all parties (Howells, 2006). In the Sectoral Systems of Innovation literature intermediary organizations are regarded as organizations that compensate for weaknesses, such as the absence of domestic suppliers of key technologies, in the local innovation system (Sapsed et al. 2007). This literature points to the need for a better understanding of the agents and their interactions within the system (Malerba, 2002). Related literature on regional clusters highlights the importance of leader firms in knowledge exchange among SMEs. Recent research has shown that knowledge does not circulate freely among local actors (Bianconi and Barabási, 2001; Verspagen en Werker, 2004). Firms with a strong knowledge base and firms who are at the core of knowledge networks are preferred partners. Close social, cultural, organizational or geographical proximity of firms matters less in knowledge exchange processes than assumed in literature on regional clusters. Consequently the strategies and competences of leading firms in a local business network (mainly consisting of small firms) are important and are regarded as relevant for explaining local knowledge network dynamism and ultimately innovation activities (Giuliani, 2007; Morrison, 2008).
Although the attention toward brokers is increasing, there is a clear lack of understanding regarding intermediaries operating within SME networking structures (Hoang and Antoncic, 2003; Pittaway et al., 2004). Although SMEs are believed to provide vital energy and stimulate growth (Heilbroner, 1984; Schumpeter 1934) and recently regained popularity as an important topic in the academic literature and policy-making programs (Audretsch and Thurik, 2001; Baum et al., 2000; Corbetta et al., 2004; OECD, 2000; Powell et al., 1996; Shane and Venkataraman, 2000), quantitative research on networks in entrepreneurship has been limited to the most rudimentary of network data, especially in the field of regional clustering (Burt, 2000; Ter Wal and Boschma, 2009). In addition to quantitative research, also qualitative research is needed to stimulate further work in network development processes (Hoang and Antoncic, 2003). The support instruments in policy programs unfortunately do not increase the interaction between SMEs and knowledge providers from outside the business sector (Kaufmann and Tödtling, 2002). It is still unclear how individual brokers can facilitate networking and how specific characteristics influence the capacity of brokers in SME networks.

With regard to the level and focus of previous studies, quantitative network studies that do focus on third parties mainly investigate entrepreneurs and managers within firms or certain industries (Burt, 2005). Such research focuses on a group of individuals with a certain occupation, not on individuals with a cross-section of occupations in the network. The studies in this area also tend to focus on firms in vertical integrated supply chains (Hanna and Walsh, 2002) only sometimes extending their focus to sources of new ideas such as universities. Furthermore, qualitative studies regarding third parties (Howell, 2006; Klerkx and Leeuwis, 2008; Kunmar et al., 1998; Morrison, 2008; Winch and Courtney, 2007) mainly investigate broker firms. However, the literature on regional clusters suggests that geographical bounded communities should be considered as networks of heterogeneous agents, and that knowledge should be viewed as a personal and specific asset (Morrison, 2008). In addition, face-to-face intermediation of tacit
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Knowledge and consequently close proximity is of importance when firms engage in complex business transactions with one another (Scott, 2006). Although inter-organizational trust must be present in exchange relationships, increasing interpersonal trust clearly corresponds to lowering negotiation costs (Zaheer et al., 1998). Brokerage at an individual level is important. For SMEs it is also inevitable. Inside regional leader firms interactions with external actors are developed and maintained by specific departments (Morrison, 2008). In the case of small companies this means only one or very few people are involved in interactions. Entrepreneurs or SMEs do not have the resources to manage many parties. A few well positioned stakeholders can be dealt with.

1.3 Brokerage in social networks

Networks are increasingly viewed as a strategic way to gain access to resources and reduce costs in order to seize opportunities in an increasingly turbulent market. This stream of research based, known as the resource-based perspective (Combs and Ketchen, 1999; Wernerfelt, 1984; Williamson, 1991), views firms as the motor of change and focus on reasons for alliance formation. It is concerned with determining why and when networks are formed.

How networks are formed has been a less frequently the subject of research, particularly in the context of SMEs. Such research concentrates mainly on with whom a firm cooperates. Not the firm, but its various social relationships are the focus of attention. The network is seen as endogenous; a factor of influence on a firm as well as a result of a firm’s own influences (Schumpeter, 1934). Theory based on the network perspective builds on the general notion that economic actions of firms are influenced by the social context in which firms are embedded and that actions can also be influenced by the position of actors in social networks (Gulati, 1998). Contrary to the resource-based view, it takes into account the idea that a network has its own nature
and creates opportunities for firms. Still, SME research does not focus on entire networks and amplify the underlying processes dynamics (Powell et al., 2005) despite progress in that area by research of Powell in biotechnology networks or Baum, Shipilov and Rowley (2003) in the banking industry. Little attention has been given in the SME literature to entire networks, the underlying processes dynamics or to cooperation as a support strategy to discover and exploit opportunities (Hanna and Walsh, 2002; Johannisson and Mønsted, 1997; O’Donnell et al., 2001; Schilling and Phelps, 2007; Shaw, 2006).

In order to understand the characteristics of the network a deep understanding of social network processes is needed (Gulati, 1998; Gulati and Gargiulo, 1999). Social network theory describes these social dynamic processes between parties (Scott, 2000). Granovetter’s paper “the strength of weak ties” of 1973 drew attention to the theoretical orientation giving quantitative comments on the structure of networks. The theory is centrally concerned with questions related to with whom a firm collaborates (Scott, 2000). A few concepts associated with network theory are well-known: strong and weak ties (Granovetter, 1973) and the structural holes and social capital theory. Strong ties are related to bonding capital; weak ties are related to bridging capital (Fernandez and Nichols, 2002). The central debate in this literature is focused around the basic arguments stemming from Burt's (1992) structural holes argument and Coleman's (1988) closure argument. Burt (1992) suggests that firms that are able to build bridges between previously unconnected dense, i.e. redundant, parts of the network (Burt, 1992; Walker et al., 1997) will likely enjoy brokerage advantages based on access to non-redundant high yield information (see also Rowley et al., 2000). This argument is also known as the tertius gaudens orientation (third who unites). Alternatively, Coleman (1988) argues that being part of a dense knit (redundant) network brings important advantages because the degree of intimacy and trust in these densely connected areas facilitates interactions.
There is ambiguity within the academic literature regarding the appropriate kind of social capital in various fields of industries. Research suggests that both forms of social capital have to be present within networks, because firms want to efficiently absorb knowledge as well as create novel knowledge (Ahuja, 2000; Cohen and Levinthal, 1990; Gilsing et al., 2008). This idea is in line with the work of March (1991), in order to grow companies depend on both creating new possibilities and exploiting what is already known. Tushman and O’Reilly (1996) compared this to the god Janus who had two pairs of eyes; one for looking behind and one that focused on the issues ahead. In the context of SMEs, network literature indicates that the focus should not be on getting more and more, strong relationships, but also on diversity in relationships (Zahra and Hayton, 2004). It has been argued that the most successful organizations are those that are “ambidextrous” in the sense that they are successful in both exploiting existing competencies and also in exploring new innovations (Sadowski et al., 2008).

The tertius iungens (third who unites) orientation described by Obstfeld (2005) is a network theory that is in line with the idea that bridging and bonding activities need to be balanced. This approach discusses the role of companies that join alliances with the intention to co-develop expected network opportunities. They connect individual members in a social network by either introducing disconnected entities or by facilitating new coordination between those already connected. Those companies purposefully search for a role as integrator (Winch and Courtney, 2007). Related work of Fleming and Waguespack (2007) with regard to brokerage illustrates that boundary spanners, individuals who identify, translate, and relay information within and across engineering firms, are more likely than tertius gaudens brokers to advance to leadership in open innovation communities. Individuals with experience working across internal community boundaries do not suffer from a lack of trust. As discussed in the information systems domain, recognition of the existence of trust and cooperation in industrial districts helps to identify and create win-win strategies (Kunmar et al., 1998). The tertius iungens orientation emphasizes that being a broker may not only be about
1. Introduction to the study

connecting disconnected parties and avoid closure, but about connecting disconnected parties and embrace closure to create beneficial co-operations among all parties involved.

The discussion regarding brokers has changed from whether or not brokerage is (more) valuable to how structural holes are being spanned. In other words, it has changed towards the role of brokers in networks. A quote from Hargadon and Sutton (1997: 745) describes clearly the contribution of such research to network theory:

“The network perspective treats network actors largely as conduits that pass along unchanged ideas and resources to others. Little attention is devoted to how or why those ideas and resources are transformed and combined into new solutions for other actors and subgroups.”

In the context of SMEs, the importance of third parties in building interfaces and developing knowledge is acknowledged in innovation and SME literature (Kaufmann and Tödtling, 2002; Major and Cordey-Hayes, 2000; Sapsed et al. 2007). Very little network research examines the role of third parties in the context of SMEs. In order to understand how the behavior of network actors influences the actions of others, the linkage between network dynamics and the structure of fields needs to be made apparent (Powell, 2005). Despite awareness within the SME literature of the need to explore the structure and network processes of small firm networks, few empirical studies have sought to do so (Shaw, 2006). We will look into the personal networks, across design and high-tech industries in Southeast Netherlands, SMEs draw on to investigate the nature of this actual network and the characteristics of brokers in this network. The study will enable to make recommendations concerning the inception and maintenance of SME networks and the facilitation of the brokers operating in them.
1.4 Research questions

Social network theory offers an appropriate theoretical framework to investigate the structural and relational characteristics of intermediaries. At the macro level it is not the properties of actors that are central, but the larger picture of relationships between these actors (Knoke & Kuklinski 1982; Scott, 2000). Macro information, like overall network connectivity, is vital in order to understand opportunities and constraints facing groups and actors in general. For example, in a loosely connected network more brokerage opportunities will exist. A few general concepts that enable to describe the nature of the ties among and between network members have already been introduced: strong and weak ties, bonding and bridging capital. A related concept relevant to this research is the concept of small worlds described by Watts (1999). The theory of small worlds concentrates on efficiency and connectivity within networks and provides further insights into the nature of a network structure, as has been shown in the works of Cowan and Jonard (2004) and Verspagen and Duysters (2004). A small world is a part in a network in which actors are relatively highly connected and also have a considerable amount of relationships outside the connected group. The part is considered a theoretical optimal structure in the network were knowledge diffusion is optimal. Research on small worlds assumes that the actors of the small world fulfill a central role in a network and have a significant influence on connectivity. It is unclear how the underlying field compares to the theoretical optimal network structure of Watts (1999) or to other industry networks. Furthermore the concept of small worlds enables to study who are the dominant members that can alter the flow of information throughout the network structure. Thus, the concept will be used to provide the information about the structural characteristics of the underlying field. Sub-question one of this research is:

1. What are the structural network characteristics of the SME network, in particular at network and subgroup level?
At an individual level, social network theory provides properties and associated processes relevant only to the actors themselves (Wasserman and Faust, 1994). Relationships of actors differ according to activities or interests. Differences in preferences, i.e. whether a person is interested in receiving or scanning information, has an internal or external orientation or has a disciplinary or interdisciplinary focus, influences a person’s interaction with the region (Brennan and McGowan, in Ulijn et al., 2007). A social structure can show differences in interests (Gould and Fernandez, 1989). Analysis of actor networks provides information about the position of individuals, their behavior and properties of their relationships. The concept of Gould and Fernandez (1989) that delineate in particular to brokerage capacity and also focuses on the type of brokerage behavior in the SME network will be studied. Brokerage capacity is measured by investigating the extent to which an actor is capable of linking others in an indirect social relation, or equally importantly, of preventing such a link from being forged. By highlighting the personal networks of members across design and high-tech industries, the study attempts to answer the second research question:

2a Can brokers be identified within the SME network?
2b What types of brokers can be detected within the SME network?

In addition, we investigate whether specific characteristics are associated with these brokers. According to Howells (2006) brokering is more than information gathering, exchange and linking functions. Intermediaries can provide a much wider, more varied and holistic role for their clients in the innovation process than has generally been acknowledged. The work of Snow, Miles and Coleman (1992) regarding the construction of business networks mentions that managers operate as architects, lead operators and caretakers. Each role is critical to the success of an (operational) network. So, the way brokerage activities are put into practice is likely to be dependent on what actors seek to enable (just as the form taken by social capital is dependent on what actors seek). The personal goals and interests of brokers influence brokerage behavior (Gould and
Brokerage in SME Networks

Fernandez, 1989; Täube, 2004). These goals and interests seem in turn to be based on actors’ structural and relational environment and personal characteristics (Brüderl et al., 1992; Burt, 2005; Kakati, 2003). In particular, we will investigate if the affiliation of brokers, the kinds of relationships they have and the kinds of information they exchange are of influence on their capacity. Sub-question three is:

3. What are characteristics of brokers in the SME network?

Although network theory enables the study of brokers at the individual level in a social system (Burt, 1992; Gould en Fernandez, 1989), it also has a shortcoming. Network research does not consider how individual behavior affects what network opportunities are actually realized. Having a brokerage position implies little about the likelihood that actors actually engage in brokerage activities in practice (Gould en Fernandez, 1989). Furthermore, individual differences may affect the probability of how people take advantage of potential social network opportunities. Developing an understanding of how the individual interacts with different environments may be key to understanding “why, when and how different modes of action are used to exploit entrepreneurial opportunities” (Shane and Venkataraman, 2000: 218). Specific goals and interest of individuals are not considered in network theory. To develop a more individual-level understanding of brokers network theory must be combined with insights from other theories to provide insights into important aspects of brokerage. The personal network of brokers needs to be investigated taking into account individual abilities. The fitter-get-richer model (Bianconi and Barabási, 2001) and other reputation literature (Washington and Zajac, 2005) emphasize that fitter actors, like actors with novel knowledge, overpower the more connected, but less fit ones within a network. Fitness is defined as an intrinsic quality of actors that enables them to compete for links. Searching for additional literature regarding intrinsic qualities demonstrates that innovation and SME research investigating third parties do not take an individual level perspective. They focus on effectiveness of a broker firm and its activities (Klerkx and
Leeuwis, 2008; Sapsed et al., 2007) or activities of multiple broker firms in public/private partnerships (Tether and Tajer, 2008; Winch and Courtney, 2007). Also the literature is unclear about how in particular individual brokers contribute to the transfer and development of knowledge.

A combination of literature regarding entrepreneurship and innovation demonstrates that a person’s strategic goals, strategic actions and strategic behavior in a certain context can play an important role in how brokerage activities are successfully put into practice (Brüderl et al., 1992; Giuliani, 2007; Howells, 2006; Morrison, 2008). Related concepts important to highlight with regard to strategic goals are the tertius iungens and tertius gaudens orientation (Obstfeld, 2005). It is still unclear if brokers prefer to balance bonding and bridging capital or focus merely on the latter in practice. It is also unclear which brokerage activities are actually performed. Finally, with regard to strategic behavior it is interesting to highlight if brokers work according to the logic of causation or effectuation (Sarasvathy and Dew, 2005). It will make clear how brokers interact with their environment when pursuing their goals. How do leading brokers operate in the field of design and high-tech industries? We will explore the strategies of brokers and develop a theoretical framework. Sub-question four is:

4. How is brokerage enacted in the SME network?

We will answer these research questions by constructing the social network of SMEs across two different sectors, i.e. design and high-tech industries in a social network way. We will describe and explore empirical data in order to generate a better understanding of the concept of brokerage regarding SME networks across different fields. We will however not investigate to what extend characteristics affect uncertainty and relate to
the success of building interfaces and developing knowledge\textsuperscript{1}. An ultimate result of this study would be the framing of the relationships between characteristics of actors and emergent characteristics of the social system.

1.5 The network across design and high-tech industries

This study will investigate a network of SMEs across the design and high-tech industry. Although we consider SMEs, the greater majority of firms in these industries are small firms. High-tech industries in the Southeast Netherlands consist of medical technology, high-tech systems, automotive, nano- & microsystems, ICT, the field of design & technology and new materials. The area is an important driver for the Dutch economy, contributing 15% of gross domestic product, 30% of industrial employment and almost 40% of the added value of total Dutch manufacturing industry (Sistermans et al., 2005). The creative industries are a wide-ranging industry including arts & heritage, media and entertainment and creative business services of which the design sector is a part.

The design and high-tech industries are particularly dynamic environments. These sectors also become more and more important in modern economy (Jacobs, 2005). Recent government studies in the Netherlands and Great Britain emphasize the importance of the creative industries. Creative activities are defined as innovative activities that create value by adding a meaning, identity or experience to products or services (DCMS, 2001; Innovatieplatform, 2005). It is a sector which shows the necessity to cooperate in order to develop meaningful products. In the U.K. television industry groupings of individuals or teams persist through time and are periodically drawn together by network brokers for recurrent projects (Starkey, Barnatt, Tempest, 2000). The creative industry is known for its short product cycles, risky projects and fast changes in production processes. Its social network is built on the principles of

\textsuperscript{1} Relationships between brokerage, kinds of uncertainty and (realizing) strategic aims of organizations, like product leadership, resource enrichment, customer intimacy and operational excellence (Treacy and Wiersema, 1993; Verhoef, 2010) are beyond the scope of this research.
1. Introduction to the study

collaboration, participation, exploration and exploitation (Hartley, 2005). Actors are found to function as knowledge or technology brokers (Vanchan and MacPherson, 2008). Furthermore it is a sector which mainly consists of SMEs.

Over the past years design has become increasingly important the manufacturers of high-tech products. The two sectors seem to become more intertwined. The Southeast Netherlands is a top technology region in Europe which also shows a concentration of design firms. Design is increasingly seen as a ‘business creator’ involved in developing and exploiting new ideas. Designers in this region are often asked to join firms at a very early stage of the innovation process (TNO, 2005). The region itself has a high concentration of elite knowledge sources that cooperate widely across varieties of organizations: SMEs, educational institutions, university research institutes, large-scale industry and other knowledge institutions (Sistermans et al., 2005). The Southeast Netherlands will therefore be the starting point of our research.

1.6 Motivation to choose for the design and high-tech industries

The design and high-tech industries have been recognized as interesting for our research since their activities involve complex knowledge processes which in turn benefit highly from optimal knowledge creation and exchange (Scott, 2006). Furthermore acknowledgement of the importance of design in product development has resulted in increasing efforts by various parties to establish co-operations between design and high-tech organizations. We will focus on the network across the industries and not on the networks of the industries separately in order to investigate if the co-operation efforts towards these SMEs already resulted in increased interaction between actors in the network. Qualitative research reports that the network of design is very fragmented (Innovationplatform, 2005). High-tech organizations (i.e. original equipment manufacturers, first, second and third tier suppliers) work closely together with their partners in the region and strive to develop strategic, long-term relationships (Brainport,
Brokerage in SME Networks

2008 and 2009). By means of this study we aim to gain a better understanding of connectivity and efficiency across these particular fields.

The study will also provide insights to regional politics. According to the EU being a knowledge economy is the way to stay competitive in the world. The EU stimulates transnational co-operations between companies, public institutions, private research institutions and universities, the so called triple helix (Etzkowitz and Leydesdorff, 2000), in order to boost knowledge transfer, innovation capacity and eventually economic welfare in the EU. Goals of national programs are derived from this overall goal. The South of Netherlands concentrates on being a top-technology region in which new products and services of economic value are created (OP-Zuid, 2007). However it is difficult for interested parties to locate potential partners. Government stimulates the funding of projects in the triple helix to overcome these market imperfections. Special attention has been designated for research into SMEs and entrepreneurship. Regarding these goals it is interesting for policy makers to receive ideas on how co-operations can be stimulated best. They need to know how people from profit, non-profit and science domains cooperate and contribute to the transfer and development of knowledge at present. The high degree of heterogeneity of sectors as a whole demonstrates the need to shape specific programs that focus on crucial issues like localization, financing, integration in local networks, interfirm- and R&D-cooperation, survival and growth (Lasch et al. in Ulijn et al., 2007). Collective competencies are grown organically and are based on local factors (of culture, institutional forms, and so forth), which contribute critically to localization. It would be a mistake for policy makers to simply imitate the established regions (Brown and Duguid, in Lee et al., 2000).

Finally the study will provide insights into SMEs in general. Because brokers are becoming more and more important, in particular for SMEs, the need arises to provide them with insight into what makes brokers so valuable. This study enables SMEs to
decide with what kind of broker they should cooperate or how to improve their own role in the network.

1.7 Outline of the study

The first sub-question of this research will be addressed in the second chapter of this thesis. We will empirically study the structural characteristics of the network across design and high-tech industries by using the theory of small worlds. An empirical illustration will enable understanding of opportunities and constraints facing groups and actors, brokers in particular. The research will have a quantitative nature. The research design, including the method used will be introduced and elaborated upon with regard to the topic of the chapter.

Sub-questions 2a, 2b and 3 are addressed in the third chapter of this thesis. We will empirically study relational characteristics of the network by highlighting the personal networks of members in order to detect brokers and explore their characteristics. The research design, including the method section of this chapter builds on the introduction in chapter two.

Sub-question 4 will be addressed in the fourth chapter of this thesis. We will empirically study how brokerage ability is carried out in practice. The insight will provide more in-depth knowledge about broker characteristics. This part of the study has a qualitative nature and builds only partly on previous steps taken. Therefore a new research design, including the method used is introduced and elaborated upon in this chapter.

In Chapter 5 we will summarize, conclude and reflect on the outcomes of the three parts of our study. We will state the limitations of the study, when not given in the previous chapters, and make recommendations for further research.
CHAPTER 2
It’s a small world: efficiency in a SME network

2.1 Introduction

The growing importance of networks requires that SMEs thoroughly understand their characteristics, in order to use this knowledge to their own advantage. In this chapter we take a social network perspective in order to describe the structural network characteristics of a SME network, in particular at network and subgroup level. The first research question is addressed. Examining the actual personal network SMEs draw on will provide insight into the connectivity and efficiency of SME networks. These characteristics are likely to be different for networks of various industries. The differences in alliance network structures, nor the antecedents of this difference is well understood (Rosenkopf and Schilling, 2007). In this chapter we will use the concept of ‘small worlds’ (Watts, 1999), as used in the field of graph theory, to investigate knowledge diffusion in the network and consequently judge overall network efficiency. As shown in the work of Verspagen and Duysters (2004) the concept unites two well-known perspectives in social network theory; the perspectives regarding social capital and structural holes (Walker et al., 1997). We will compare the theoretical optimal network structure of Watts (1999) with the actual network and investigate whether the actual network can be classified as a highly connected, a highly fragmented or a small world. The efficiency of the actual network can be compared to other industry networks and thus can be valued. Furthermore we will examine the structure of the network in terms of sub-communities. Of interest is to investigate how actors from the profit, non-
profit and science sector relate to small worlds. These groups are focal point of EU and national knowledge stimulation programs (EC, 2006). The characteristics of dominant nodes in a network can alter the flow of information throughout the entire structure (Owen-Smith and Powell, 2004). We go beyond the mere detection of small world properties and look into who is highly involved in creating efficiency. Such an investigation will enhance the theory of small worlds.

Our study contributes to the existing literature in the following ways: First, it is one of the few contributions that take an inter-sectoral approach by considering the existing social network of SMEs across two different sectors, i.e. design and high-tech industries. Second, it is the first attempt to actually construct the design and high-tech network in a social network way. No such data was available before in the Netherlands. Moreover, our network is based on both formal (business) as well as informal (personal) oriented relationships at the individual level, while most relationships in the existing literature are based on formal relationships only and usually studied at firm level. Finally, by highlighting the general structure of the network across these sectors, the study identifies the opportunities and constraints faced by the members of this network. This has significant scientific and managerial implications. Network theory regarding small worlds will be enhanced as well because our insights contribute to the still infant field that studies the efficiency of partnerships in SME networks.

2.2 Theoretical background

The theory of small worlds can be seen as a model that unites the two perspectives in social network theory (Verspagen en Duysters, 2004); structural holes (Burt's, 1992) and closure (Coleman's, 1988). A small world is a part of a network in which a couple of actors are relatively highly connected, but also have a considerable amount of relationships outside the connected group. A small world therefore also combines the best of both perspectives. Cowan and Jonard (2004) define a small world as an
identifiable region of space of structures in which knowledge diffusion is much more complete than elsewhere. Having high levels of social capital is beneficial for local knowledge diffusion and exploitation. Also having a relatively high portion of bridging capital that span structural holes is beneficial for global knowledge diffusion between various groups.

There is a lack of small world research regarding the relationship between specific subgroups and the efficiency of a network, especially in the area of economics (Ozman, 2009; Watts, 2004). An industry network consists of relationships between various parties. Parties can interact with other parties who are alike, i.e. horizontally, with upstream suppliers and downstream users, i.e. vertically, as well as with regional or (inter)-national independent research institutes. Furthermore a party can have multiple roles; a customer to one organization as well as a consultant to another organization. However, other studies mostly deal with only one kind of (formal) network or role in a specific sector, like biotechnology (Baum, Shipilov and Rowley, 2003; Pittaway et al., 2004; Stuart et al., 2007). Therefore an investigation is of interest of the way various parties are related to a small world. In order to give a description of those who are relatively well connected, the full richness of relationships in the network needs to be studied. In addition, the work of Owen-Smith and Powell (2004) in biotechnology networks suggests that characteristics of nodes in the network, especially institutional underpinnings, alter the character of information flows. It seems that early coherence of regional networks stems from active participation of local public research organization and that later formal partnerships between for-profit organizations spring from public sector roots. It is interesting to compare these earlier findings at firm level in more formal networks with findings in networks of heterogeneous individuals and investigate which kind of people contribute to overall network efficiency.
2.2.1 Hypothetical network structures; Theory and Concepts of Small Worlds

In the work of Watts (1999) the small world model is explained by describing two extreme worlds first. The caveman world is one, completely connected group. In such a world “everybody you know, knows everybody else you know and no one else” (p. 43). When a stranger enters the group, this person has to get acquainted with only one other person of the group in order to get fully connected with the total group. A caveman world can be seen as a representation of the pure social capital perspective. At the other extreme, represented by the Moore graph, everybody lives in isolation and interacts via computers. Even if two persons in this world would engage in a personal connection, this world would still stay highly disconnected. The Moore graph can be related to the structural holes perspective of Burt (1992).

A small world is a network in which the two extreme worlds find an optimal balance. In a small world clustering of actors is high, but at the same time the characteristic path length between actors is relatively short\(^2\). In addition to high levels of bonding capital, there are just enough bridging relationships to achieve a balance. Any member of the small world can reach any other node of the network through a small number of steps.

In terms of advantages, a small world obtains the best of both social capital perspectives. In a Moore graph the network has a random local structure, but short paths between actors. New knowledge in such a world travels fast at first. But the process slows down relatively quickly when the knowledge which is to spread reaches high levels of complexity. In a caveman world the network is locally highly structured, but path lengths are long. Diffusion of new knowledge is slower than in the Moore

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2 Average path length is the average number of steps separating two randomly chosen actors in a network. Characteristic path length is the median of average path length of all actors in the network. A cluster can be determined by the number of actual relationships in a part of a network divided by the maximum relationships possible in that particular part. Clustering at the level of the network as a whole is defined as the average of clustering of all parts in the network (Watts, 1999).
Brokerage in SME Networks

d graph, but the process continues for a longer period, and knowledge can more fully exploited. Small world networks show advantages of both: because this part of the network has relatively short path lengths, diffusion in the early periods is relatively fast; because of local clustering, knowledge exchange continues longer than it does in random worlds (Cowan and Jonard, 2004). Firms embedded in alliance networks that exhibit both high clustering and high reach will have greater innovative output than firms in networks that do not exhibit these characteristics (Schilling and Phelps, 2007).

In reality social networks will have characteristics of both worlds. Local clustering and path length will be intertwined, but when can we speak of the presence of a small world? To trace what small world ratio is present in actual networks we need to know more about how many bridging relationships are present in an overall network. To find out about bridging relationships we can make use of the concept shortcuts. In graph theory bridging relationships are described as shortcuts. Shortcuts connect two actors who otherwise would be separated. They are represented by parameter Ф, the fraction of bridging relationships in a graph that are shortcuts. Path length and clustering size can be contrasted using the concept of shortcuts. As shown in Figure 2.1, lines of path length and clustering size are drawn as a function of parameter Ф. The graph shows the path from many shortcuts to very few shortcuts, i.e. the path from a strict social capital perspective to a strict structural holes perspective, in which the variables clustering and path length have different slopes. Note that the lines are not predictions, but theoretical calculations representing levels of intensity regarding ‘random partner seeking’.

At low levels of Ф (many shortcuts) high levels of path length and clustering are shown. This corresponds to the caveman world. At high levels of Ф (few shortcuts) the opposite is shown. The latter corresponds to the Moore graph. We can see that for rather low levels of Ф E [0.01, 0.1] path length and clustering diverge in a most optimal manner; characteristic path length is short, the amount of clustering is relatively high. In other words, an actual network has small world properties when at low levels of Ф, local
2. It’s a small world: efficiency in a SME network

clustering is much larger than the theoretical Moore graph and characteristic path length approximately equals the theoretical Moore graph values (see Watts, 1999, for more details).

Figure 2.1
Length and clustering contrasted with parameter $\Phi$, the fraction of bridging relationships in a graph that are shortcuts (adapted from Duysters and Verspagen, 2004).

![Graph showing clustering and path length contrasted with parameter $\Phi$.]

The concept of shortcuts to determine the ratio of bonding and bridging capital in a network is useful for our research; parameter $\Phi$ can be seen as a degree of presence of the structural holes in the overall network formation.

The presence of small worlds provides insights into connectivity and efficiency of a network. As shown in the previous section the small world of a certain network can be mathematically constructed. Such a construct provides a certain benchmark against which we can compare values of the actual practice. Empirical research will enhance our knowledge about the ratio of social capital and structural holes present in various fields.
Brokerage in SME Networks

of industries. What do the structural network characteristics of actual networks as a whole look like? Ambiguity about the appropriate kind of social capital that should be present in networks can be diminished.

We will investigate how actual network compares to the hypothetical optimal network structures mentioned in social network theories. As in the work of Verspagen and Duysters (2004) we will study whether the actual network is one with high levels of bonding capital, high levels of bridging capital or whether it can be classified as a small world. The efficiency of the actual network can be compared with other industry networks and thus we will be able to put a value on the relative efficiency of the whole network. Of interest is to see whether the networks of SMEs are different in social network terms compared to large firms or other sectors.

Furthermore we will address the structure of actual networks in terms of sub-concentrations. In reality multiple small worlds can occur in a network as well as no small worlds. If more local cores exist, subgroups will probably be formed around these cores. Studying subgroups will provide more in-depth knowledge about the way bonding and bridging capital are balanced. We will investigate to what extent subgroups are identifiable within the actual network. Related to this is the extent to which subgroup identities are useful to describe at least one possible core of the emerging field. Such detailed information will provide insights into the involvement of subgroups in building social capital as well as bridging structural holes. SMEs operating in a network with multiple cohesive groups will face different network efficiency and opportunities than when they operate in a more polarized network structure.

2.3 Research design

To get closer insights into the network of the design and high-tech industries in the Southeast Netherlands, an empirical study was conducted. A questionnaire was
constructed to map the most important work relationships between people who are active in the design and/or high-tech industries. Respondents were asked to mention the names and organizations of at most ten of their Dutch business partners who had had an important (qualitative) influence on their performance over the last five years. Partners who were most important to their work during the last five years were placed at the top of the ranking by the respondents. The limitation of five years was added to get insights into the present state of affairs since the industries are dynamic environments. Only Dutch partners are considered because the network would otherwise become too wide spread and fragmented (see also Appendix A for details).

The fields design and high-tech industries were not specified in the survey, because the aim of the study is to investigate the network between the industries, not to compare them. The aim was to map the most important work relationships between people who are active in the subsequent fields. In order to take into account the full richness of relationships in the network the respondent had to identify who was important to them in what way. Relationships within the actual network between actors \( i, j \) and \( k \) can be formal (business) as well as informal (personal) oriented; advice or trust related (Friedman and Podolny, 1992). It was not possible to identify in advance who is involved in what way in the network. Moreover, by limiting respondents we may have excluded important relationships. Network analysts work around definitions by asking people to define their own relationships (Burt, 2005 pg. 25). By taking this approach we pinpoint what the actors in the field consider important.

Since the population is a rather hidden one, it is hard to say something about the representativeness of the sample for the total group of people in the fields. For the initial sample set we selected organizations from the Chamber of Commerce industrial
classification list\(^3\) and further specified our sample on the basis of internet company descriptions. The survey was initially sent to a selected group of 33 people (2 female and 31 male) involved in design as well as in high-tech industries; sole traders as well as (managing) directors of Ltd companies. 3 organizations (of 33) were non-profit organizations. Firm sizes ranged from 1 to 37 full-time employed persons. In the Netherlands 93% of the consultancy firms ranging from management to innovation specialization have 1 to 10 employees (EIM, 2005)\(^4\). 93% of the group out of which the 33 people are selected has 1 to 10 employees. 86% of our selected group has 1 to 10 employees. Although including rather small firms, the initial group represents SMEs in the Netherlands. We decided to address the owners and directors since they are the driving force behind the social capital and innovative actions of these small firms (MacGregor, 2004). The respondents were asked to provide the names of work-related partners with whom they have the aforementioned relationship. Everybody who was listed in the response also received an invitation to fill in the survey. Data collection took place in several waves. This snowball technique is developed to identify hidden members and relationship patterns (Hanneman and Riddle, 2005; Salganik and Heckathorn, 2004). This technique was a useful way to get a clearer picture of their network and relationships.

We started distributing the questionnaire in January 2007. The results enabled us to construct the network between design and high-tech industries on July 29th 2007. At this point there were 468 names in the database. 405 persons received an invitation to participate. A social network was constructed based on the names and corresponding relationships mentioned by these respondents. The results reported in this chapter are based on the main component of the network which includes 440 names and 584 relationships mentioned by 93 respondents. We focus in this chapter on the group of

\(^3\) We selected companies out of the category 74205: Technical design and advice for instrument, machine and device building and 74207: Technical design and advice not specialized. The former category is officially lined among high-tech systems, the latter among design.

\(^4\) These percentages are in line with figures of the Dutch Chamber of Commerce.
440 names. The composition of this group is discussed later in this chapter. However, respondents include SME entrepreneurs, but are mainly employees of SMEs and even large organizations. Results are based on individual backgrounds of these people. Although there are some SME entrepreneurs whose relationships may represent their whole firm, most respondents’ relationships only partially represent the firm they work for. We chose to focus on the individual level because, as said in the introduction, the academic literature suggests that knowledge should be viewed as a personal and specific asset (Morrison, 2008; Scott, 2006; Zaheer et al. 1998). Charted are the most important relationships of actors across firms in the field of design and high-tech industries.

Social network analysis is used to answer the research questions. The results are used to describe the structural characteristics of the network and not to make statements. A macro analysis requires complete network data; the presence of all relationships of the whole population. We would need a 100% response rate to collect the complete network information. Such information can not be realized when using questionnaires and therefore hard statements about structural characteristics can not be made. However the response rate is sufficient to be able to draw a clear picture of the actual network.

How the actual network between design and high-tech industries compares with the theoretical model is described below.

### 2.4 Results

#### 2.4.1 The actual network compared to the hypothetical network structures

The various characteristics of the industries imply that the actual network will show small world properties. Note that we do not compare the two industries, but look at the
network between them. The high-tech sector as well as the design sector is known for its creativity. Exploration of knowledge is important; relationships with people who have relatively unfamiliar knowledge play an important role when generating ideas. The presence of bridging capital between the two industries is to be expected. On the other hand, local collaboration is important in both fields too. Interactions with other fields such as design may still be preliminary, suggesting that a more loosely connected network will be present. In short, both industries are dynamic and build on the principles of exploitation and exploration, co-operations between high-tech and design industries are stimulated and the Southeast area is an elite knowledge area which is attractive enough to keep hold of employees. Small world features should be present in the actual network.

To answer the first research question and find out how the actual network between design and high-tech industries compares with the theoretical model we made calculations for the fields together. The calculations for the actual clustering coefficient \( \gamma \) and the characteristic path length \( L \) between connected actors are shown in Table 2.1. We had to dichotomize and symmetrize the valued data in order to be able to calculate values that are comparable with the theoretical values. Since we asked respondents to mention their most important work relationships an actor, \( i \), can have mentioned another actor, \( j \), but actor \( j \) may not have mentioned actor \( i \). We assume there is still a work relationship between the two actors, even though the relationship may be considered more important to actor \( i \) than to actor \( j \). Partnerships are considered to be bidirectional (Newman, Strogatz and Watts, 2001), resulting in an undirected unipartite graph of work relationships in the network across design and high-tech industries. Furthermore when considering the network, we concentrated on the parts of the network that are connected. Results are therefore related to the principal component of the network (440 actors).
Table 2.1
Network statistics of the network between design and high-tech industries

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Caveman</th>
<th>Moore graph</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Φ</td>
<td>N</td>
<td>K</td>
</tr>
<tr>
<td>Actor-</td>
<td>0,834</td>
<td>440</td>
<td>2,523</td>
</tr>
<tr>
<td>level</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When putting these values in a graph we see how the actual network structure compares to the benchmarks of the random network with varying Φ. Figure 2.2 shows how the theoretical lines contrast with the clustering coefficient γ and the characteristic path length L (the dots) of the actual network. The distance between the dots and the lines is an indication of how much the observed network structure differs from the theoretical structure based on a random network of the same size (n) and average number of direct connections (K). Note that the theoretical lines do not represent predictions, but a benchmark corresponding to ‘random partner seeking’. The theoretical model is a random model without behavioral basis. This model assumes that the amount of connections of actors do not differ too widely from each other. In real cases these connections may just not be present. Consequently, for a certain observed value of Φ, path length and local clustering values of an actual network may be positioned off the theoretical curves.
We observe that the value for L is below the theoretical curve. This indicates that network path length is smaller than in a random network. Clustering is higher than the benchmark value. Hence, we conclude that there is a tendency for strong bonding capital.

So, is the network characterized by a small world in which distinct clusters are weakly connected to each other? The high value for clustering indicates that social capital is important in the actual network. On the other hand path length is below the Moore value, indicating a tendency for strategic partner seeking in line with the structural holes perspective. Consequently we can conclude that the network between design and high-tech industries shows small world properties. The low path length indicates the presence of efficient knowledge flows, high clustering of efficient knowledge exploitation. In addition, we noticed the density of the network in general is low; the
network is a loosely connected network even though small world properties exist. It indicates that the members of the small world are important in sustaining the network.

2.4.2 Subgroups in the network Design and High-tech SMEs

The actual network seems to contain a few people with high connectivity. We do not know yet how these people are structured at a sub-level. Does the network indicate that multiple small worlds are present? In other words, do these people represent two distinct industries or not? There is evidence that the industries increasingly interact. Design is becoming more and more important in product development. Technology has to look good in order to be sold. Furthermore, qualitative research reports that the network of design is very fragmented; loosely connected (Innovationplatform, 2005). A clear segment may not exist within the network. The boundaries of the two sectors may be not as sharp as expected.

The hypothesis can be examined by identifying substructures in the total network. A visualization of the network will show concentrations of people. The network structure can be visualized by making a 3D contour sociogram. As in the work of Moody (2004) local connectivity will be paired with higher density levels. A contour sociogram is based on density values present between closely connected actors. By using the bivariate distribution of points concentration of actors can be calculated. Visualizing the concentrations will show the substructures in the network; if none, one or more small worlds are present in the network. Figure 2.3 presents the 3D contour sociogram for the principal component of the network. To get a clear insight only the main component (440 actors) instead of the total network (468 actors) was taken into account.
The 3D contour sociogram shows a rather evenly spread network with one prominent hill. This result indicates that the network between high-tech industries and design...
contains one group of closely connected people; one small world. The question that remains is who are the key members in the core of this group? The next step is describing position of subgroups to the identified core of the field.

2.4.3 Describing the network of Design and High-tech SMEs
We know something about the efficiency of the overall network, but can we also say something about which kind of people contribute to overall network efficiency? We will have to examine what the origin is of those people that make up the closely connected group in the network. Since people within the actual network can have activities in design as well as high-tech industries it is difficult to investigate the efforts into building bonding and bridging relationships regarding industry.

An alternative is to see if the origin of relationships can be referenced to profit, non-profit and science domains. It would be interesting to know to what extent these labels are useful for describing the core of the emerging field, since these groups are focal point of EU and national knowledge stimulation programs (EC, 2006). Do the groups put in equal effort into building relationships or are some groups more dominant than others in the closely connected group? Figure 2.4 presents the composition, at various density levels (see Figure 2.3), of the network in terms of the division into profit, non-profit and science groups. This labeling was enabled by considering the organizations in which actors work.

The composition at density level 0 corresponds to the main component of the network. It can be observed that at this point the component consists approximately of 70% of people from profit organizations. The other two groups measure 18% (non-profit) and 12% (science). This division remains rather constant for the lower density levels.

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7 Focal point is the Triple Helix of university–industry–government relationships in which non-profit organizations represent public institutions, committees, councils and programming bodies and science organizations represent universities, applied science universities and public research institutes.
The interesting feature in Figure 2.4 is the increasing role of non-profit and science-oriented persons in the evolving density levels. These results reveal the division present in the hill in Figure 2.4. One may conclude from this that the more closely connected the actors get, the more noticeable non-profit and science relationships become. Among the most well connected people in the network are relatively more people who work for non-profit and science organizations. This prominent feature is interesting from a governmental point of view, trying to create a “triple helix” consisting of firms, governmental institutions and science organizations. The bias however seems to be too much towards non-profit and science organizations. More profit firm involvement by the stimulation of direct relationships between profit firms, rather than forming indirect ‘chains’ through shared science and non-profit connections, might however be desirable.

**Figure 2.4**
The evolution of the composition of sub-groups in the principal component
2.5 Conclusions

This chapter has undertaken the analysis of a SME network by making use of the theory of small worlds. It was argued that small worlds unify the best of two worlds; the theory of social capital (bonding capital) and the theory of structural holes (bridging capital). Both densely connected local environments and partnerships with interesting parts outside the local environment are needed to realize efficient knowledge flows. In a small world connectivity among local actors remains rather high; allowing the processing of complex information in the network. On the other hand ‘average’ path length is not very large; there is no impediment to the efficient spread of knowledge and information in the network. Understanding characteristics of the network, the presence of bonding and bridging capital, will enable SME to use this knowledge to their own advantage.

The theory of small worlds provides a useful way of representing bonding and bridging capital. A single parameter shows, by measuring the number of ‘shortcuts’ in the network, local clustering and average path length. Subsequently the range of ‘small worlds’ can be identified. When comparing the actual network between design and high-tech industries with the theoretical optimal configuration of Watts (1999), the actual network can be classified as one in which a small world is present. Bonding and bridging capital are balanced in a more optimal way than in a random network. It can be concluded that this formerly invisible network is a relatively efficient means of knowledge transfer and exploitation.

Furthermore an in-depth look at the way bonding and bridging capital are balanced reveals that the field does not seem to be divided into multiple small worlds. The analysis focused on studying substructures and was operationalized by means of identification of cohesive substructures at various levels of density. Visualization of the results shows a single core group in the network. This indicates that only a single densely connected group of people may be found in the field. The alternative would
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have been that the network breaks up into various sub-groups, embodying different sides in the industries, but this is not supported by the data. A further understanding of the characteristics of the network is enhanced by describing this core group of people. It was found that non-profit as well as science actors were overrepresented in the core of the field. It seems that the evolutionary pattern in which the community relies on the public sector in early stages of network development hold for the actor network across design and high-tech industries.

Together these results show structural characteristics of a SME network. Structural network characteristics provide background information on the current way of co-operating between organizations. The practical questions stated in the beginning of the chapter of whether knowledge is transferred in an efficient way, whether there are partnership concentrations and who is involved in co-operations, have been answered. The results will be useful for regional politics to improve their interventions in the economic structure of the region and inspire a favorable business climate for the realization of entrepreneurial projects. The questions are also interesting for SMEs, because it gives them an idea of where to turn to for knowledge in general.

Regarding the limitations of this study, we have little information on the representativeness of our sample for the total group of people involved in design and high-tech industries. A possible source of bias may be that the persons in the initial sample and first two waves have the advantage of being among the first mentioned. They have had more chance of being mentioned more often. Another possible source of bias is that the invitation to participate in the survey was signed by ourselves. Respondents might consider ourselves to be associated with a particular group, non-profit, and hence this may influence the willingness to participate in the survey. We have no opportunity to test the representativeness of the ‘invisible’ network sample against a more objective source of information. Therefore we can say little about the impact of this. Furthermore we have not addressed the potential impact of the nature
of information that is being accessed, diffused, and absorbed in the network. Different characteristics of information (e.g. the degree of codification or abstraction) influence knowledge diffusion within the network (Boisot, 1998).

In policy terms this chapter has brought about interesting findings. The triple helix between companies, governmental institutions and science organizations seems to be well represented in this network. Despite the positive results, policy makers may reflect on these findings in terms of improving the efficiency of this network even more. In order to provide even more policy implications, future research might replicate this study for other SME networks in order to be better able to compare the relative efficiency of SME networks. Furthermore, future research might focus on performance differentials of different network structures.

Finally, the chapter describes the core-group of people only to a certain extent. How the network looks and the origin of those who are relatively well-connected is now known. Future studies could examine whether specific parties make specific contributions to the efficiency of the network. Lawrence et al. (2005 and 2009) acknowledge that with regard to institutional research large gaps still exist in the ability to describe institutional work, let alone explain it and have articulated a research agenda for the study of institutional work. Regarding our research we will investigate who has significant brokerage capacity. Furthermore we will enhance our knowledge about the characteristics of brokers; those people who influence efficiency of networks.
CHAPTER 3
Brokers in SME networks

3.1 Introduction

The previous chapter discusses structural characteristics of the network across design and high-tech industries. The study attempts to identify the main brokers in this dynamic environment, by highlighting the personal networks of members in this chapter. Such an effort addresses the second research question. Can brokers be identified within the SME network and if so, what types of brokers can be detected within the SME network? In addition, we investigate whether specific characteristics are associated with these brokers. What are characteristics of brokers in the SME network? This third research question is also addressed. The main contribution of this chapter lies in the methodological approach; in contrast to most other research, it is quantitative and it focuses on brokers identified in an actual network (based on both suppliers and user-side of the network). There has not been enough empirical basis for brokerage because in the existing literature only two brokerage concepts have been operationalized. Furthermore the theoretical concept of brokerage roles deserves more empirical attention. It is necessary to take a look at empirical data in order to generate a better understanding of the specific concepts first. One can argue that we take a grounded theory perspective by trying to show how people handle information problems. In this way we try to make a contribution to network theory. Studying the

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phenomenon of brokerage will provide more insights into the concept of brokerage regarding SME networks in different fields. In particular it will highlight *how* third parties in general contribute to the transfer and development of knowledge.

### 3.2 Theoretical background

#### 3.2.1 Concepts of brokers

A number of authors have described brokers or intermediaries (e.g. Burt, 1992; Gould and Fernandez, 1989; Klerkx and Leeuwis, 2008). The concept of Gould and Fernandez (1989) in particular increases insight into brokerage behavior. Their concept of brokerage roles describes brokerage behavior as the facilitation of information flows whether or not a direct reward is involved. They argue that the various interests of actors will affect the way they seize the brokerage opportunities. The theory of Gould and Fernandez recognizes five different types of brokers.

**Figure 3.1**

Graphic presentation of the five types of brokerage. Open points represent the brokers. Ellipses correspond to subgroup boundaries (adapted from Gould and Fernandez, 1989).

- Coordinator: enhances interaction between members of the group he belongs to
- Gatekeeper: absorbs knowledge from a group and passes its to the group he belongs to
- Representative: diffuses knowledge of the own group to another group
- Cosmopolitan (Itinerant): mediates as an outsider between members of the same group
- Liaison: enhances as an outsider interaction between different groups
An individual \( j \) is said to broker between \( i \) en \( k \) (solid points in Figure 3.1) if and only if \( i \) is tied directly to \( j \), \( j \) is tied directly to \( k \), and \( i \) is not tied directly to \( k \). Depending on different configurations of group membership among actors \( i \), \( j \) and \( k \), one of five types of brokerage relationships may result. An actor in a network can fulfill several of these roles. On the one hand the actor can be a gatekeeper for the group s/he belongs to; on the other hand the actor can function as a liaison that passes along information to a cluster of people s/he does not belong to. This concept points to individual’s broker capacity in networks and also describes what types of brokers are present in a network. It provides information about the mixture of relationships in a network. A lack of certain roles in a network tells us something about the flow and transformation of knowledge in the field.

### 3.2.3 Characteristics of Brokers

Being a broker will not appeal to everyone. Whether or not people emerge as brokers seems to depend on the characteristics of people and the work context. This chapter focuses on affiliation, kinds of relationships and kinds of information exchanged (Brüderl et al., 1992; Burt, 2005; Gould and Fernandez, 1989; Ritter and Gemünden, 2003)\(^9\). We try to answer the question to what extent these characteristics relate to brokers’ capacity. The conceptual model (Figure 3.2) specifies the relationship between these characteristics of people and brokerage capacity. The model will be highlighted below.

\(^9\) Personal characteristics might also be a possible influence on broker opportunity (Brüderl et al., 1992; Kakati, 2003) as mentioned before, but these are beyond the scope of this chapter.
**Affiliation**

The affiliation of people can affect their interests. Working in a profit, non-profit or science organization will influence the behavior of people and consequently impacts on their personal network. Different kinds of people build different kinds of networks (Powell et al., 2005; Ulijn, Frankort and Uhlaner, in Ulijn et al., 2007). The sector in which an actor is operating can influence the broker opportunity they face (Sapsed et al., 2007). It would be interesting to investigate whether individuals in the triple helix spheres (Etzkowitz and Leydesdorff, 2000) indeed face other broker opportunities, since
the business community, knowledge institutions and government are a focal point of EU and national knowledge stimulation programs (EC, 2006).

Non-profit organizations provide collective support services to firms in the region. As intermediaries, regional (semi-)government agencies and non-profit discussion platforms facilitate the acquisition of competitive capabilities by compiling and disseminating knowledge and by reducing search costs (McEvily and Zaheer, 1999). A study by Van der Meulen and Rip (1998) shows that especially in the Netherlands there is a dense intermediary layer of network linkages between the institutions, committees, councils and programming bodies at the strategic research level which focuses on advising on science policy and also on the implementation of new initiatives in order to obtain ‘relevant science’. The government has moved to a role of enabling and stimulating contacts, instead of also carrying out scientific research.

Universities and research institutes are more focused on carrying out scientific research. However despite pressures put on them by other sectors to be relevant, they are still often guided by their own interests (Van der Meulen and Rip, 1998). They are important entities that can play a crucial role in innovation in increasingly knowledge-based societies (Etzkowitz and Leydesdorff, 2000). They indirectly transfer knowledge via graduates, the publication of research results, technology transfer offices, especially to SMEs in the high-tech sector (De Jong, 2006; Drejer and Jørgensen, 2005, Hoppe and Ozdenoren, 2005). Furthermore they can function as a neutral and trustworthy partner to profit organizations (Boulding et al., 1997; Winch and Courtney, 2007).

The third grouping of the triple helix is the for-profit sector. SMEs are used to working with various partners. Maybe they work unconsciously as brokers? Research regarding public-private collaboration (De Jong, 2006; Drejer and Jørgensen, 2005; Medda et al., 2006) shows that information from universities or government laboratories is not seen to be decisive for the innovation process. On the contrary suppliers of materials and
components are assessed to be only moderately significant sources of information. Thus, although the non-profit organizations and universities research institutions do play a role in the knowledge development processes in innovative firms; this role is not as significant as those played by supplier firms, customers and even competitors for example. This is in line with the idea that exploiting inventions takes place in more closely related, homogenous groups (March, 1991).

**Kind of Partner**

Not only do different kinds of people build different kind of networks, the kind of relationships people have with others can also influence their network. A wide range of studies have highlighted potential contributions of partners to a company’s innovation efforts and the positive impact of technological interweaving on a firm’s innovation success (de Man and Duysters, 2005; Hagedoorn, 2002; Keizer et al., 2002; Powell et al., 1996). Customers, consultants, co-suppliers, administration, suppliers, researchers & trainers, competitors and distributors, all contribute in different ways to their partners (Gemünden et al., 1996). An organization can fulfill many of these partner roles; it can be a supplier to a company, but also a customer to another. Do brokers have specific preferences regarding partners? The partner’s role may affect the broker opportunities they face. The relationships with researchers and administrators seem to be more enabling and supporting regarding innovation efforts (Grandinetti, 2003; Keizer et al., 2002). Customers (and co-suppliers) are seen as closely related partners with whom knowledge is mainly exploited. They are considered more similar and both parties will therefore feel more comfortable to cooperate (Ulijn, Frankort and Uhlaner, in Ulijn et al., 2007). In addition to more formal business relationships, people in organizations also have important informal, personal partners with whom they exchange work-related information. Personal relationships in business are difficult to separate from formal relationships. The two are clearly intertwined.
Brokerage in SME Networks

Again several kinds of relationships can relate positively to broker opportunity depending on what is considered important by the respondent. This is in line with the assertion that brokers can full their brokerage role in many ways (Gould and Fernandez, 1989; Howells, 2006).

**Kind of Information**

People who broker connections between others tend to posses a certain kind of knowledge to fulfill this role successfully. What exactly is being brokered, the characteristic of the information itself can also be a factor of influence which distinguishes a broker from a non-broker. Even though a broker may be situated within a certain sector and interact with certain partners, the kind of information they exchange with others may not always be the same. Do brokers merely focus on coordinating information, or is there room for exchange of in-depth information? As described above, besides being coordinators of spanning activities, brokers can also be the producers of extra value (Howells, 2006; Obstfeld, 2005). Several studies have identified criteria that relate to entrepreneurship and successful business in a high-tech environment (De Jong, 2006; Chen et al., 1998; Kakati, 2003; Ritter and Gemünden, 2003; Sawers et al., 2008; Zahra et al., 2007). Marketing, innovation, management and finance are areas in which entrepreneurial persons need to have skills. Knowledge of these areas is a precondition to success in business. If any of these areas are not developed enough, the gap can be covered by a broker (Papagiannidis and Li, 2005). Besides the more resource-based information, entrepreneurial persons also need to manage network relationships. Initiation information, operational information, personal information and relationship-specific expertise are needed in order to manage a single relationship (Ritter and Gemünden, 2003). It is unclear what kind of information is valued most in relationships with brokers.

Empirical research enhances our current knowledge about the existence and types of brokers present in various fields of industries. Furthermore we are able to extend our
knowledge regarding characteristics of brokers in general. The investigation of brokers requires foremost insights into connectivity of an actual network. A construction of an actual network provides information about who has brokerage opportunities and thus who can be identified as the leading brokers. Detailed information about broker characteristics in relation to broker opportunities will provide insights into the involvement of brokers in building social capital in a network. Ambiguity about how brokerage activities are successfully put into practice can be diminished.

3.4 Research design

The empirical study described in Chapter 2 enabled us also to get a closer insight into individual brokers and their characteristics. In addition to asking to mention the names and organizations of at most ten of their Dutch business partners who had an important (qualitative) influence on their performance over the last five years, the respondents also had to specify the main role of the partner and the main kind of influence the partner exerted on their performance in the questionnaire (see also Appendix A for details). The respondents were given examples of possible roles (customer, supplier, consultant, researcher, ...) and the kind of influences (influence on innovation, marketing, organization, finance, ...). The extra information about organization names and the content of relationships enabled us to construct independent variables concerning broker characteristics. Table 3.1 lists and describes all variables. The independent variable sector was constructed by considering the organizations in which actors work. The answers of respondents regarding the role and influence of partners were divided into categories (Chen et al., 1998; Papagiannidis and Li, 2005; Ritter and Gemünden, 2003) as described in Table 3.1. The categorization was done by means of an expert panel. The expert panel was used in order to reduce bias and maximize objectivity. The expert panel consisted of 3 people who were senior non-profit consultants in the field of research and therefore acquainted with most of the mentioned people and their work. The expert panel was well informed on the various
partner roles and kind of influences we instructed them to use. In cases where answers of respondents could not be assigned to a category directly, discussion regarding the work and relationships continued until agreement was reached. We extended the model of Gemünden et al. (1996) by making an additional category, that of informal discussion partner. The other categories of that model are considered to be more formal (business) oriented. By constructing the independent variable ‘informal’ we could investigate the influence of personally oriented network relationships on brokerage capacity. Eventually we were able to sum per respondent the connection between the various kinds of partners and kinds of information. Control variables are gender, educational level and working years in branch (industry sector). Age was left out as a control variable because it showed a high correlation with the variable branch years. Gender may be of influence on brokerage capacity because women might be hindered in their access to social capital. They are said to have less time to participate in business networks. Furthermore research indicates that women build closer relationships and share information, while men take on entrepreneurial roles and provide missing information and bridge organizational gaps (Timberlake, 2005). Also in order to seize opportunities, education and experience (human capital) seem to be prerequisites, especially in knowledge-intensive industries. These characteristics enable actors to process complicated and diverse information more efficiently and consequently enables them to act faster (Madsen et al., 2008).
### Table 3.1
Description of the Variables

<table>
<thead>
<tr>
<th>Type</th>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dependent</td>
<td>brokerage</td>
<td>Brokerage roles; Times a brokerage position is occupied</td>
</tr>
<tr>
<td>(count variable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>gender</td>
<td>Male or Female</td>
</tr>
<tr>
<td>control</td>
<td>education</td>
<td>Professional education (MBO, Applied Science University) or (Post-) University</td>
</tr>
<tr>
<td>(dummy variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>years branch 1</td>
<td>0 - 10 year</td>
</tr>
<tr>
<td>(dummy variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>years branch 2</td>
<td>10 - 20 year</td>
</tr>
<tr>
<td></td>
<td>years branch 3</td>
<td>more than 20 years</td>
</tr>
<tr>
<td>independent</td>
<td>non-profit</td>
<td>Public institutions, committees, councils and programming bodies</td>
</tr>
<tr>
<td>(dummy variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>science</td>
<td>Universities, applied science universities, public research institutes</td>
</tr>
<tr>
<td></td>
<td>profit</td>
<td>Profit-oriented organizations</td>
</tr>
<tr>
<td>independent</td>
<td>customer</td>
<td>Defining new requirement, solving problems of implementation and market acceptance, reference function</td>
</tr>
<tr>
<td>(count variables)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>consultant</td>
<td>Advise regarding the product development process, innovative concepts</td>
</tr>
<tr>
<td></td>
<td>co-supplier</td>
<td>Co-producer at strategic en/or operational level. Supplier of complementary knowledge</td>
</tr>
<tr>
<td></td>
<td>non-profit</td>
<td>Administration; advise regarding subsidies, regulations, political support</td>
</tr>
<tr>
<td></td>
<td>consultant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>supplier</td>
<td>Producer of means of production</td>
</tr>
<tr>
<td></td>
<td>knowledge</td>
<td>Research and training institutes</td>
</tr>
<tr>
<td></td>
<td>supplier</td>
<td></td>
</tr>
<tr>
<td></td>
<td>competitor</td>
<td>Joint basic research, establishing standards, getting subsidies</td>
</tr>
<tr>
<td></td>
<td>distributor</td>
<td>Dealers; Market en competitor information</td>
</tr>
<tr>
<td></td>
<td>informal</td>
<td>Informal discussion partner, informal contacts, producers of network information, reference function</td>
</tr>
<tr>
<td>Independent (count variables)</td>
<td>Innovation</td>
<td>In-depth product-related knowledge</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>finance</td>
<td>Information on finance-related issues</td>
</tr>
<tr>
<td></td>
<td>marketing</td>
<td>Information on market dynamics, customers and marketing</td>
</tr>
<tr>
<td></td>
<td>management</td>
<td>Information on strategy, structure and culture</td>
</tr>
<tr>
<td></td>
<td>network</td>
<td>Initiation information, network contact knowledge in order to be able to start relationships</td>
</tr>
<tr>
<td></td>
<td>operation</td>
<td>Coordination information in order to tune with each other</td>
</tr>
<tr>
<td></td>
<td>person</td>
<td>Personal needs, requirements and preferences to establish social bonds</td>
</tr>
</tbody>
</table>

We focus in this chapter on the 93 respondents of the main component (440) of the network. In this group the male respondents were slightly overrepresented (79 male /14 female), as were respondents from the non-profit sector (non-profit 31; science 12; profit 50). Respondents include SME entrepreneurs, but are mainly employees of SMEs and even large organizations. Results are based on individual backgrounds of these people and thus represent individual brokerage characteristics. Although there are some SME entrepreneurs whose characteristics may represent their whole firm, most respondents’ brokerage characteristics only partially represent their firm. We chose to focus on the individual level because, as said in the introduction, the academic literature suggests that knowledge should be viewed as a personal and specific asset (Morrison, 2008; Scott, 2006; Zaheer et al. 1998). From this perspective the individual level seems to be the most relevant level of analysis.

Social network analysis is used to draw the actual network and calculate the brokerage measures as proposed by Gould & Fernandez (1989) to detect brokers and brokerage roles. The network had to be divided into three groups; i.e. profit, non-profit and science. Depending on different configurations of group membership among actors in the field the five types of brokerage relationships can result. Every actor can have several of these types of relationships and thus fulfill several of these types. The
individual raw brokerage scores show how many times a person fulfills specific brokerage types in the network. The sum of all the individual raw scores, the overall raw brokerage level, indicates the individual’s total capacity for brokerage. Gould and Fernandez (1989; 98) indicate that the overall raw brokerage level measures an aspect of an actor’s structural position, namely the extent to which the actor is capable of linking others in an indirect social relation, or equally importantly, of preventing such a link from being forged. They also indicate that it is a necessary, but not sufficient condition for actual brokerage behavior. The overall raw brokerage measure is used in our research to construct the dependent variable brokerage. There are other measures to detect brokers, but they focus on centrality positions and do not take into account differences in actors’ interests (see Appendix B). The brokerage counts indicate which person has the most brokerage opportunities, and thus, in our research, who is the most important broker in the field. The sum of all the overall scores, the global raw brokerage level, provides information about brokerage in general in the network between high-tech and design industries.

3.5 Results

The replies of respondents enabled us to construct the network across design and high-tech industries. We took a bottom-up approach and analyzed the personal networks of members in order to identify (types of) brokers. Subsequently, negative binomial regression was used to investigate if main brokers have certain characteristics in common.

3.5.1 Brokerage in the network between design and high-tech industries

In SMEs the entrepreneur mostly fulfills the brokerage role. However, in larger organizations people with brokerage functions are much more difficult to identify. Furthermore in the design and high-tech industries, designers in particular are a rather hidden population. Some work in firms, some work as part-time freelancer, some have
their own firms. By analyzing the network we get a clearer picture of brokers’ network and relationships. Investigations of the degree to which actors actually are capable of mediating brokerage relationships in the actual SME network do show powerful brokers. Almost every respondent has the capacity to broker. However the overall raw brokerage scores of respondents can be compared with random expected scores\(^{10}\). This enables us to understand which brokers and types of brokerage roles are important. Despite the fact that the network in general (the main component) does not have a high density and that there are many cases where the expected random number of relationships is small, the identified brokers all differ greatly from what would be expected by chance. There is a large deviation between the expected values and the actual scores, indicating that our data is interesting\(^{11}\).

To describe what kind of brokerage is important in the field the global raw brokerage scores are standardized. Table 3.2 shows the values. These standardized scores represent the total number of brokerage relationships of each brokerage role actually present in the network. The significant values of gatekeepers and representatives suggest that actors in the system emphasize redundancy when searching for gatekeepers and representatives. In other words, organizations in the network tend to avoid depending on a few main brokers when they attempt to absorb knowledge from another group and when they use members of their group to communicate with other groups. The former is in line with the results of Cowan et al. (2007) who argue that a firm seeks a larger number of credible potential partners so that it can gather reliable information about more firms. The significant value of liaisons in the results suggests

\(^{10}\) Computer routines for calculating the expected values were requested from R. Fernandez. They matched Ucinet calculations almost completely.

\(^{11}\) Brokerage scores are highly related to ego-betweenness scores. Everett and Borgatti (2005) point out that ego-betweenness gives a good approximation to betweenness of an actor in the whole network if there are highly differentiated betweenness scores. Since this network shows small world properties this network falls in the category of networks with highly differentiated betweenness scores. In other words, also ego-betweenness scores show that it is highly likely that the person’s who have high brokerage scores are important in the actual network.
that there is close collaboration between the three groups. The significant positive value for the total raw global measure implies that actors in the system have sufficient capacity to broker relationships.

Table 3.2
Standardized global raw brokerage scores

<table>
<thead>
<tr>
<th></th>
<th>Coordinator</th>
<th>Representative</th>
<th>Gatekeeper</th>
<th>Cosmopolitan</th>
<th>Liaison</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores $\beta$</td>
<td>-0.593</td>
<td>3.987***</td>
<td>5.019***</td>
<td>1.055</td>
<td>3.056**</td>
<td>3.087**</td>
</tr>
</tbody>
</table>

**p<0.01

***p<0.001

A lack of roles in a network tells us something about the flow and transformation of knowledge in the field. Coordinator and cosmopolitan roles are trivial. Few individuals broker the information within a group. This may indicate that most actors organize their own network relationships. Limited mediation of an outsider between members of the same group indicates that possible problems are handled within the group. No outsiders are needed to exploit information.

This information provides insights about the mixture of relationships in a SME network. It provides a relevant description of general broker characteristics in this field. The question remains if specific attributes are associated with the main brokers.

The facts that there are only the two brokerage concepts operationalized and that the concept of brokerage roles (Gould and Fernandez, 1989) is not practiced substantially provides little basis for the creation of hypotheses. Therefore it is necessary to first take a look at empirical data. The actual network can provide insight into how actors grasp opportunities. One can argue that we take a grounded theory perspective by trying to show how people handle information problems. In our research it seems that there is no single way to handle information problems. Each person’s interest in each situation can be unique and therefore behavior can be different during each information exchange;
individual characteristics per situation resemble an incident. By comparing these individual incidents we will investigate whether there are generic individual characteristics that can be related to general brokerage behavior.

3.5.2 Characteristics of Brokerage
We tested for the relationships between the characteristics of people and brokerage capacity with controls for gender, education and years in branch as specified in Figure 3.2 by means of negative binomial regression. All the variables in this research represent individual characteristics. Results are based on personal dimensions.

The dependent variable brokerage capacity (individual raw brokerage scores) takes on only whole number values. Researchers often use Poisson regression to analyze such count data. However our data shows overdispersion - the variance is greater than the mean. There is dependence between events (in this case total brokerages role counts) and the mean and variance of the observed distribution are thus not equal. Negative binomial regression explicitly accommodates this overdispersion. According to this method individuals have a constant, but unequal probability of experiencing an event; brokerage capacity (Cameron and Trivedi, 1986; Fleming, 2001). Instead of using the expected mean ($\lambda_t$), like poisson models, it replaces the mean with a random variable. This replacement allows the predicted mean to vary randomly according to a probability law; distribution of the error term. The probability of the observed count of a person becomes conditional on the error distribution (Fleming, 2001). In this way inter-person heterogeneity is allowed for.

Table 3.3 presents estimates for the negative binomial regression models of overall raw brokerage counts. Model 1 estimates a model of controls only, model 2 includes all variables and model 3 adds only substantive variable to the baseline model.
Checking for multicollinearity, the first step in analyzing data, indicated no extreme correlations between the independent variables except, as expected, between the profit and non-profit dummy variables. The non-profit and science dummy variable show the least correlation and are therefore included in the model. Furthermore relationships with competitors and distributors were not mentioned by respondents as most important work relationships. Therefore no variables could be constructed for these partner roles.

Model 1 is constructed to identify the influence of the control variables on the dependent variable. A log-likelihood ratio test shows that the control variables significantly improve the constant-only model. The test compares the fit of more complete and restricted models to determine whether the inclusion of variables of interest improves the prediction of the dependent variable. However the control variables do not improve the prediction of the dependent variable largely. The calculation of the adjusted pseudo $R^2$ (Hoetker, 2007) shows it is an improvement of just 1,7%\(^{12}\).

\(^{12}\) Calculations were made with STATA. The program calculates a McFadden’s pseudo-$R^2$; an equivalent goodness-of-fit measure to $R^2$ in OLS. Since it is a pseudo statistic it should interpreted with caution. To avoid an overly optimistic sense of the models’ fit, the adjusted pseudo-$R^2$ was calculated alternatively.
Table 3.3

Negative Binomial Models of Overall Raw Brokerage Counts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 controls</th>
<th>Model 2 all variables</th>
<th>Model 3 substantives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>P&gt;IzI</td>
<td>Coef.</td>
</tr>
<tr>
<td>gender</td>
<td>-0.012175</td>
<td>0.966</td>
<td>-0.148024</td>
</tr>
<tr>
<td>years branch 1</td>
<td>-0.262290</td>
<td>0.196</td>
<td>0.182856</td>
</tr>
<tr>
<td>years branch 2</td>
<td>0.091633</td>
<td>0.719</td>
<td>0.211207</td>
</tr>
<tr>
<td>years branch 3</td>
<td>0.64228</td>
<td>0.007**</td>
<td>0.437421</td>
</tr>
<tr>
<td>non-profit</td>
<td></td>
<td></td>
<td>0.313062</td>
</tr>
<tr>
<td>science</td>
<td></td>
<td></td>
<td>0.439013</td>
</tr>
<tr>
<td>profit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>customer</td>
<td>-0.011546</td>
<td>0.905</td>
<td></td>
</tr>
<tr>
<td>consultant</td>
<td>0.011149</td>
<td>0.901</td>
<td></td>
</tr>
<tr>
<td>co-supplier</td>
<td>0.05079</td>
<td>0.616</td>
<td></td>
</tr>
<tr>
<td>non-profit consultant</td>
<td>0.14370</td>
<td>0.134</td>
<td>0.16165</td>
</tr>
<tr>
<td>supplier</td>
<td>0.056896</td>
<td>0.597</td>
<td></td>
</tr>
<tr>
<td>knowledge supplier</td>
<td>0.073144</td>
<td>0.559</td>
<td></td>
</tr>
<tr>
<td>competitor</td>
<td></td>
<td></td>
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<tr>
<td>distributor</td>
<td></td>
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<tr>
<td>informal</td>
<td>0.036113</td>
<td>0.712</td>
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<tr>
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<td>0.171449</td>
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<td>management</td>
<td>0.046477</td>
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<td>network</td>
<td>0.311864</td>
<td>0.000***</td>
<td>0.31068</td>
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<td>operation</td>
<td>0.104587</td>
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<td>person</td>
<td>-0.151356</td>
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<td>constant</td>
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<td>0.000***</td>
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</tr>
<tr>
<td>log likelihood</td>
<td>-309.541</td>
<td></td>
<td>-247.801</td>
</tr>
</tbody>
</table>

a p<0.1
* p<0.05
** p<0.01
*** p<0.001
By taking model 1 as the baseline model in further calculations, log-likelihood ratio tests of the models 2 and 3 show that both significantly increase the explanatory power of model 1 at the p-value of 0.001. A comparison of the log-likelihood of model 2 and 3 also demonstrates that model 2 clearly contains variables of no influence. Besides we have to be cautious in putting too many variables in the model regarding the amount of observations. A model with substantive variables only improves, in this case, the prediction of the dependent variable the best. To construct model 3, log-likelihood ratio tests are performed each time a variable was included until none of the variables left improved the model significantly at the p-value of 0.05. The adjusted pseudo $R^2$ shows an improvement of model 3 by 16.58%.

Returning to the results: Brokers seem to be present in the non-profit and science sector. Both sectors have a positive, but moderate significant coefficient estimate. (The opposite is true for the profit sector which is moderate significantly, negatively related to being a broker.) The work of Van der Meulen and Rip (1998) indicates that the main task of intermediaries in the Netherlands is to identify directions for programming ‘relevant research’ and thus linking basic science to socio-economic objectives. In other words, non-profit organizations are intermediaries between the science sector and profit sector. This observation is in line with our results. However individuals in the science sector also seem to have (moderate) brokerage capacity. Apparently those who are actually carrying out research are also at the crossroads of the network. It is important to be perceived as independent and objective in a brokerage role (Winch and Courtney, 2007). SMEs that want to engage in novel organizational forms have to discover opportunities, secure resources and organize legitimacy in order to survive and perform (Baum et al., 2000; Elfring and Hulsink, 2003). Non-profit and science actors can provide cognitive and socio-political support (Aldrich and Fiol, 1994) especially when novelty is high. They can be perceived as key stakeholders in their field, in addition to a handful of big profit organizations, who know about accepted rules and standards. Finally there is a trend towards scientific collaboration in contemporary science; big
science. Large scale research in life sciences is set up among various countries involving huge amounts of money and demanding careful planning and coordination. Scientists in this field have to play new roles and have to engage in discussions with managers, politicians and policy makers (Vermeulen, 2009). The stimulation of research activities by the EU is in line with this trend. Affiliation indeed influences behavior of people and consequently their personal networks.

The results indicate that high capacity brokers get information via non-profit consultants; persons who give advice regarding subsidies and regulations and provide political support. Brokers in the non-profit sector have important relationships with others in their own surroundings. This is an indication of the strength of the non-profit sector regarding brokerage activities. The other kinds of partner variables only improve the model marginally. Although brokers indeed interact with various partners (Gould and Fernandez, 1989; Howells, 2006; Powell et al., 2005), no other partner roles significantly relate to being a broker. Non-profit consultants apparently provide knowledge valuable to the region. The research of Morrison (2008) distinguishes between business networks and knowledge networks. Information is exchanged among many business partners, but knowledge is exchanged among only a few. It seems that interaction with closely related partners like customers and suppliers indeed revolves around day-to-day business information and exploitation of information. Interaction with, in our case, non-profit consultants may be concerned with exploration of knowledge.

The kinds of information variables show a different pattern. Innovation, network, operation, marketing and finance are significantly positively related with being a broker. Brokers have in-depth technical information and possess information on how to finance and market ideas. It seems that they are also operationally involved in brokerage activities. Furthermore they have valuable network information; they know people who might be of importance to others. The results are in line with Howells (2006) who argues
that brokers fulfill many brokerage roles and thus also discuss a variety of information with relationships. Totterman and Sten (2005) argue in particular that finance related initiatives are not the key aspect of support toward new companies. Focus should also be on the development of business networks. The results confirm that being positioned at the crossroads of a network has the advantage of enabling access to a wider diversity of information (Burt, 2005). Results regarding brokerage roles show that brokers perform as representatives, gatekeepers and liaisons. They provide information, filter information and inform various others more than they coordinate information among insiders. These results also indicate that brokers must have a more varied set of information available. The outcome regarding the kind of information show that information on various topics is of equal importance to actors in the field and is therefore discussed altogether with intermediaries in order to reduce uncertainty.

In all the models experience in the branch is significantly important. Apparently it takes time to become a stakeholder in a sector (and branch) and gain relevant information on various topics. Although we asked respondents to mention who has been an important business partner the last 5 years, the results indicate that those who have high brokerage capacity have been involved in the branch for more than 20 years. The main brokers must have been involved in various projects, as a direct or indirect business partner, in this field for at least a decade. The result shows that having experience and a broad knowledge base is valuable regarding brokerage. However, in small and large organizations, there is a tendency to focus on younger, less experienced people; people who are acquainted with the latest new knowledge, but who may not be well connected yet. Organizations must be careful in managing their knowledge base and social capital. A well balanced mix of personnel will influence the balance of bonding and bridging capital in organizations.
3.6 Conclusions

This chapter investigated the existence of main brokers in the network across design and high-tech industries and modeled the relationship between a person’s brokerage capacity and characteristics. Since the world surrounding organizations is becoming more and more complex, organizations will have to rely more on brokers to access external knowledge. Many companies find that they do not possess the necessary (scientific) resources to cope with additional burdens and seek external support to overcome their own cognitive and technical limitations. It is argued that the most successful brokers must have specific characteristics that enable them to transfer and develop knowledge optimally. The chapter highlights individual’s affiliation, kind of partner and kind of partner information as sources of brokerage capacity influence.

Our empirical results show that there are actors with significant brokerage capacity in the actual network. Instead of identifying brokers in the actual network, we could have started our research with a pre-selected group of brokers and constructed the network from there. However we would have missed information on less obvious brokers in the field. Furthermore we are not limited to a certain kind of broker or a certain sector. Our research enabled us to generate knowledge regarding brokerage in general. Consequently results can be relevant to other industries in dynamic environments in the Netherlands.

Empirical results also show that the most influential brokers are found in the non-profit and science sector and have a long track record in their branch. It seems that discussing finance is not sufficient. Actors in the field foremost like to discuss practical support in the form of valuable contacts and innovation-related information with intermediaries. However, finance, marketing and operational information are also discussed with them. The results show what specific characteristics influence the capacity of brokers. They also provide insight into how brokers bridge the cognitive and technical distance.
3. Brokers in SME Networks

between parties. In other words, the research indicates how companies can reach a better balance between the two forms of social capital.

The research findings imply that SMEs should get involved in projects in the non-profit or science sector. Furthermore SMEs or even non-profit organizations whose brokerage capacity is not in line with their ambitions should invest in connections with branch experienced people with a broad knowledge base.

From a non-profit consultant point of view this research is also interesting. They often have difficulties in proving their successes. Sometimes merely mentioning contact information leads to a successful match. Sometimes brokerage takes much time and effort and still the involved parties are dissatisfied. Moreover the effectiveness of non-profit organizations is subject to discussion in the Netherlands. Branch associations for example are already dozens of years old. Their contribution to the individual company is difficult to perceive. This research shows that the intervention of their consultants (eventually) is of value to companies.

Still, in the high-tech and design sector new product-service combinations have been established which have not been created through traditional interventions. Traditional supply-side innovation policies seem to be insufficient to meet the challenges posed in promoting competitiveness. At the European Union level interest is focused on public procurement as a means to spur innovation (Edler and Georghiou, 2007). Regarding the effectiveness of government expenditures it is relevant to know how new networks come to exist and what roles intermediate organizations play. Measurement at individual level gives a profound picture of actual contributions. It is now possible to review policy from the bottom up.

Regarding the limitations of this study, as said in Chapter 2, we have little information on the representativeness of our sample for the total group of people involved in design
Brokerage in SME Networks

and high-tech industries. Not mentioned before is that we have asked respondents to mention important Dutch partners in Southeast Netherlands thereby excluding foreign subsidiaries in the network. The exclusion is a limitation of our study. Foreign subsidiaries are more innovative compared to domestic firms. Their innovativeness is heavily based on knowledge transfers from associated companies in addition to local knowledge. Therefore a foreign subsidiary can be regarded as an important partner. On the other hand they are inclined to cooperate less with domestic public knowledge institutions, especially when proprietary knowledge is concerned (Van Beers, et al., 2008; Sadowski and Sadowski-Rasters, 2006). It seems that foreign individuals act as gatekeepers. Although some respondents have mentioned foreign partners who are working in the Netherlands our research did not take this perspective into account. However relationships in the field are subject to dynamic patterns of growth and development and (brokerage) positions in a network partly reflect the past. The actual network represents a network across design and high-tech industries in the Southeast Netherlands, with all its specific structures. In other countries, other relationships are present. For example, in China the absence of institutional trust based on unpredictable government action and control, mistrust of strangers and shortage of reliable market information, leads to an absolute reliance on trust-based personal connections as a means for almost any transaction. The so-called Guanxi is the Chinese version of social networks (Zhou et al., 2007). The interaction between non-profit, science and profit sector are different in this country; therefore characteristics of brokers will be different. Moreover, relationships of people will vary per lifecycle stage of the industries. We noticed that collaborations between design and high-tech industries in Southeast Netherlands have only recently been stimulated. This particular network may be in an early life cycle stage.

We look at brokerage capacity from a network perspective. Network analysis is limited to tertius gaudens measurements. It is not yet possible to measure closed triple relationships. Progress in those areas would be interesting. We do not measure the
amount of brokerage an actor actually performs, although opportunity and actual behavior will probably correlate highly. What level of brokerage, what exactly is being brokered is also not measured. Future, qualitative, research can complement this investigation by taking an in-depth look at what brokers actually do. The following chapter will initiate such a process. In spite of these limitations, this chapter represents one of the first empirical contributions discussing the issue of brokerage in SME networks. A better understanding of brokers in SME networks can be a starting point for more work on the managerial and policy implications of brokerage.
CHAPTER 4

Brokerage strategies in a SME network

4.1 Introduction

In the previous chapter we empirically examined the relationships between broker’s capacity and characteristics from a network perspective. Network analysis permits measuring a person’s brokerage opportunity and not the amount of brokerage an actor actually performs in a network. Brokerage capacity in networks does not measure what exactly is being brokered (Burt, 2005). We are not totally satisfied with the quantitative results in the second and third chapter. This chapter complements our research regarding characteristics of brokers by taking an in-depth look at what brokers actually do. Strategies of brokers will in particular be focused on. As has been said, the way brokerage activities are actually put into practice is likely to be dependent on brokers’ personal goals and interests (Gould and Fernandez, 1989; Täube, 2004). These goals and interests seem in turn to be based on actors’ structural environment, kinds of relationships, kind of information, but also on actors’ strategies (Stevenson and Greenberg, 2000). The creation of new opportunities, a related issue discussed in organization and entrepreneurship literature, shows that the success of newly found business is influenced by organizational environment, entrepreneur characteristics and organizational strategies (Brüderl et al., 1992; Herron and Robinson, 1993; Sandberg and Hofer, 1987). Although this study already investigated how some broker characteristics influence brokerage capacity, strategies of brokers are not investigated. By highlighting the strategic goals, activities and behavior of individual brokers the study
4. Brokerage strategies in a SME network

attempts to identify “how is brokerage enacted in the SME network”. The fourth research question is addressed.

Strategies and competences of leading firms in the SME network are important and are regarded as relevant for explaining local knowledge network dynamism and ultimately innovation activities (Giuliani, 2007; Morrison, 2008). Strategic goals, strategic activities and strategic behavior are fundamentals that shape strategy. Consequently these fundamentals play a vital role in how brokerage is successfully enacted. These strategic dimensions have been highlighted in various literature, however little empirical brokerage research addresses the range of intermediaries and their practices in detail (Klerkx and Leeuwis, 2009; Stewart and Hyysalo, 2008). In addition, such research lacks a focus on individuals, especially in a local system (Kaufmann and Tödtling, 2002; Klerkx and Leeuwis, 2008, Sapsed et al. 2007; Tether and Tajar, 2008; Winch and Courtney, 2007). However if we are to aid brokerage in networks we need to provide insights and guidelines for action to those who actually intermediate at their level of action.

The main contribution of this chapter is that it enhances the understanding of social network theory by integrating theories based on the fields of innovation and entrepreneurship regarding brokerage. To be able to develop a more individual-level understanding of brokers network theory must be combined with insights from other theories to provide insights into important aspects of brokerage. Cross theory studies create a more holistic view regarding brokerage at the individual level. Such research has not yet been undertaken. In addition, highlighting individual strategic dimensions separately as well as in combination will also contribute to an extended picture of how intermediaries contribute to the transfer and development of knowledge. By empirically highlighting brokerage in general, brokers of the actual network can be compared to other industry networks and thus can be evaluated.
4.2 Theoretical background

Strategies are not existing entities; they emerge and develop over time. By creating the right set of preconditions, emergence can be provoked (Hamel, 1998). Mainstream strategy research, until recently, did not give much attention to the practice of strategy; individuals whose emotions, motivations and actions shape strategy. Still, it is the activities of individuals, groups and networks of people upon which key processes and practices depend, not on organizations as a whole (Johnson et al., 2003, Whittington, 2006). By investigating practice, like those people who do the work of strategy, the stream of activity in which strategy is enacted and the social, symbolic and material tools through which strategy work is done, more insight is generated into the conditions within and outside organizations from which strategies emerge (Jarzabkowski and Spee, 2009; Whittington, 2006).

Dimensions of broker strategies

Social network and innovation literature have focused on strategic practices, especially with regard to brokers. Regarding network theory in general, the main subject of discussion are the strategic orientations of brokers – tertius gaudens and tertius iungens orientation - in order to seize opportunities (Burt, 1992; Obstfeld, 2005). Research regarding network competences argues that network activities and social qualifications of intermediaries are important in seizing network opportunities. Network management activities like initiation of relationships, exchange of information and project management are necessary to manage relationships (Batterink et al., 2010; Bessant and Rush, 1995; Ritter and Gemünden, 2003). Furthermore the social qualifications of a person, the extent to which a person is able to exhibit useful behavior in social settings, is also of importance in order to create and seize network opportunities (Ritter and Gemünden, 2003). Behavior is also emphasized in research regarding entrepreneurship and SMEs. Sarasvathy and Dew (2005) argue that the effectiveness of novelty creation can be influenced by the way this process is approached by a person. Behavior can make
a difference in novelty creation. Related to this, the personal background of a person like gender, age and education are not regarded as reliable predictors of future entrepreneurial behavior (Gartner, 1989; Shook et al., 2003). However skills, motivation, cognition and experience can influence the discovery of entrepreneurial opportunities (Baron, 2004; Busenitz and Barney, 1997; Gaglio and Katz, 2001; Shane, 2000).

The above illustrates that how brokers actually seize network opportunities can be investigated by studying specific strategic goals, strategic actions and strategic behavior. The conceptual model (Figure 4.1) specifies the relationship between the strategic dimensions\(^\text{13}\) and brokerage capacity. What brokers actually do to reduce uncertainty can be explained by taking a detailed look at these strategic dimensions.

\(^\text{13}\) Strategy is a broad understanding. We investigate specific dimensions with regard to emerged broker strategies. Other dimensions might also be a possible influence, like personality (Borghans et al., 2008), but these are beyond the scope of this work.
Figure 4.1
Strategic goals, activities and behavior of brokers

Brokerage in SME Networks

Strategic goals

According to network theory intermediaries can seek to enable two strategic brokerage goals. The tertius iungens (third who unites) orientation described by Obstfeld (2005) discusses the role of companies which join alliances with the intention to co-develop expected network opportunities. They connect individuals in one’s social network by
either introducing disconnected people or facilitating new coordination between connected individuals. This theory contrasts the tertius gaudens orientation (third who unites), based on the structural holes theory (Burt, 1992), which suggests that the brokers exploit the disconnected parties purely to their benefit. Obstfeld (2005, p. 104) illustrates four network strategies to bridge structural holes: 1. Coordinate action or information between parties who have no immediate prospect for direct introduction or connection. 2. Actively maintain and exploit separation between parties. 3. Introduce or facilitate ties between parties where a continuing coordinative role is unnecessary, diminishes in importance, or simply is not offered. 4. Introduce or facilitate interaction between parties while maintaining an essential coordinative role. The first two strategies relate to the tertius gaudens orientation, the latter two relate to the tertius iungens orientation.

The tertius iungens orientation can not be measured quantitatively, because a network measure is not yet operationalized. The measure of Gould and Fernandez (1989) used to identify brokers is based on the thought that an individual j is said to broker between i en k if and only if i is tied directly to j, j is tied directly to k, and i is not tied directly to k. Notice that the results from this analysis reveals only ‘tertius gaudens’ brokers; the two parties a broker connects are not directly connected (i is not tied directly to k). Present measurements do not permit the endpoints of the brokerage relationship to be directly connected. Most quantitative brokerage research, like our own research in Chapter 3, is limited to studying the tertius gaudens orientation of people. Still, organizations are reported to increasingly engage in ‘open innovation’ networks (Chesbrough and Kardon Crowther, 2006). In Silicon Valley companies can compete fiercely, but individuals are also open to win-win exchanges of knowledge that are not company-secret (Brown and Duguid, in Lee et al., 2000). Innovation results from inter-organizational networks, rather than from single firms (Powell et al. 1996). Technological dynamics are so fast that almost no single firm is able to keep up with their rapid changing environments on their own (Duysters, 2001). Furthermore the work of Krackhardt (1999) argues that
public behavior is constrained by norms. A person is not free to engage in different behaviors; encompass a tertius gaudens orientation in different groups, when these groups are aware of the different behaviors and are offended by being played off. Since profit, non-profit and science sector are heavily interrelated in the Netherlands (Van der Meulen, 1998), behavior is public and not private. Therefore it seems likely that during brokerage processes the tertius iungens strategies will be pursued rather than the tertius gaudens strategies.

**Strategic activities**

The four social network strategies to bridge structural holes provide insight into what brokers seek to enable, but do not describe in detail which strategic activities can be undertaken to reach the goals. Such brokerage activities also shape strategy and thus influence brokerage capacity. Activities of brokers are described in the innovation literature (Bessant and Rush, 1995; Howells, 2006; Stewart and Hyysalo, 2008). In general these activities involve knowledge creation, translation, and dissemination. The brokerage functions described by Howells (2006) provide the most extensive description of the strategic activities of brokers. His review and synthesis of various intermediary literature results in identification of 10 functions which are summarized in Figure 4.1 (see also Appendix C for details). The strategic activities related to these functions vary from pure information gathering and exchange to linking parties and co-development of products involving process- as well as content-oriented activities. However, the typology is based on intermediation in innovation processes by organizations. Individual brokers may not be associated directly with these separate functions and related strategic activities of intermediation, or there may be differences in emphasis. Howells admits that individual intermediaries are seldom involved in separate functional roles. The personal goals and the environment may influence the range of strategic activities brokers are involved in. It is unclear what type of strategic activities individual brokers offer in relation to local systems (Howells, 2006).
**Strategic behavior**

How strategic activities are performed, in addition to the activities itself, also needs to be taken into account when studying how brokerage is enacted. Strategic behavior may also shape strategy in order to create and seize network opportunities. More radical novelty in a corporate strategy is likely to have been preceded by autonomous strategic initiatives, instead of top-down induced strategic behavior, at the operational and middle level of organizations (Burgelman, 1983). Recently strategic management literature argues that successful opportunities can come about through control-oriented approaches emphasizing predictive behavior, but also emphasizing non-predictive behavior (Wiltbank et al., 2006). When the environment can not be predicted or envisioned -the case in dynamic markets or when novelty is pursued- one is not powerless. The work of Sarasvathy and Dew (2005) describes the two logics with regard to creation of novelty; causation and effectuation. People can try to set goals in an uncertain future by predicting goals via a search and selection process, the causation process. Or people presume the future is highly unpredictable and concentrate on controlling current means by transforming these means into co-created goals with others, the effectuation process. A broker, as observer and creator of opportunities, could also work according these logics. Given a certain goal a broker can carefully plan its bridging actions and exploit opportunities in a structured way: formulate the problem, gather information, analyze opportunities and implement findings. However a broker could also function as an expert entrepreneur (who work according to the logic of effectuation) and focus on the means needed to accomplish a desired future state. Given who s/he is, what s/he knows and whom s/he knows, s/he can actively search for stakeholders with whom possible opportunities are undertaken. The precise goal of this process is not clearly outlined; it is inherently unpredictable since it depends on which stakeholders come on board with what commitments. Results can range from the creation of new connections to co-development of products. The behavior characteristics of an architect (Snow, Miles and Coleman, 1992) show much resemblance with the key elements of effectuation. Effectuation involves seeing the
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world as open, still in-the-making (Dew et al., 2008). Other literature in entrepreneurship is in line with this view, arguing that opportunities are not sought, but accidentally found, probably as a result of heightened entrepreneurial alertness (Ardichvili et al, 2003, Gaglio and Katz, 2001).

Thus, in addition to the kind of activities performed, the engagement in a number of various activities may also influence brokerage capacity (Batterink et al., 2010). In general, investigating according to which logic a broker’s work will provide insights into how individuals make decisions that are effective in the creation and sustenance of brokerage in networks.

Certain combinations of strategic goals, activities and behavior seem logical and could be displayed in practice by brokers (stippled arrows in Figure 4.1). For example, it is likely that there is a relationship between a broker’s strategic orientation and behavior. At individual level, the logic of effectuation and the tertius iungens orientation are based on introducing or strengthening ties between parties and on dynamic interaction among all parties. Both focus on balancing the differences in parties’ interest in order to create benefits for all the parties involved. The two strategic dimensions seem to be intertwined. The same may apply to a broker’s strategic orientation and activities. As has been said, the functions and underlying brokerage activities performed are likely to be dependent on what brokers seek to enable through them. An investigation of brokerage goals, activities and behavior altogether may make general brokerage strategies of individuals more explicit.

The above mentioned brokerage goals, activities and behavior could be affected by brokers’ personality and their environment. The brokerage types of Gould and Fernandez (1989) discussed in Chapter 3 show that their background influences the light in which the project will be evaluated (Burgelman, 1983; Simsek et al., 2003; Stevenson and Greenberg, 2000; Whittington, 2006). Personality dimensions may affect the arrival
4. Brokerage strategies in a SME network

and processing of information in social networks (Anderson, 2008; Casciaro, 1998). Although personality dimensions are not within the scope of this study, brokers’ strategies dimensions have to be examined taking into account the background of the individual.

Empirical research will enhance our current knowledge about strategic goals, activities and behavior, and their interrelations, associated with brokers at the individual level. Previous quantitative research could not provide in-depth information, especially with regard to the strategic goals of brokers. Detailed information about actual broker strategies will provide insights into the involvement of brokers in building social capital in a network. Ambiguity about how brokerage is successfully put into practice can be reduced.

4.3 Research design

Maxwell (2005) suggested that researchers should use qualitative research designs when there is a need for in-depth understanding of meaning, context, unanticipated phenomena, process and causality for the people in the study. An empirical multiple case study design fits the aim of our study. Formal network analysis would yield little insight in what broker actually do. Also important to recall is that the measure of Gould and Fernandez (1989) used to identify brokers can only reveal ‘tertius gaudens’ brokers. A multiple case study can point out the actual strategic orientation of brokers and outline a profound picture of how this orientation is enacted upon.

Several steps were taken to get multiple sources of evidence. The information regarding the actual network across Design and High-tech industries was used to select brokers for semi-structured interviews. We were especially interested in people with high brokerage capacity since we assume that, just like leading firms, they can be regarded as important in knowledge exchange among SMEs. Besides our aim is to highlight their
strategies and not to compare people with low and high brokerage capacity. Using the standardized overall raw brokerage scores (Chapter 3) enables us to select not only the highly visible brokers, like design and high-tech oriented consultants, but also the more hidden ones. We decided to select 12 respondents (10 male, 2 female) in three different sectors: 4 people from the profit sector, 4 people from the non-profit sector, and 4 people from the science sector. Selecting the respondents in this way enabled us to control for common strategies in the same sector. Furthermore we certified that interviewees ranged from sole traders to employees in (non-profit) SMEs and large organizations. They operate at local level or country level. This variation enables generalization of results. Given these selection criteria, we further relied on a convenient sampling strategy. Every broker approached agreed to participate. Furthermore, during the interviews it became clear that the interviewees were indeed involved in brokerage; connecting disconnected parties. Some had a clearly defined work description in which brokerage was stated as a goal, some brokered because they considered it crucial to what they were aiming for.

We made use of interview cards to clarify the 10 strategic activities and the concepts of effectuation and causation. This method is appropriate when theoretical concepts are complex to explain (Emans, 1989). Interviewees were asked to elaborate on the elements and sort the ones they associated themselves with. Furthermore they were asked to rank the strategic activities they associated themselves with. Sorting techniques are useful both for indentifying relevant categorization and for investigating commonality and differences between experts in the use of that categorization (Rugg and McGeorge, 2005). The open semi-structured interviews, which lasted for about 1 hour, were geared towards identifying respondent practices (facts of a matter) and perceptions (opinion about practices and their brokerage capacity) (Yin, 2009). Information on the characteristics of brokers from previous research was taken into account during the interviews and their analysis. For the list of interview questions see Appendix D. This information enables us to reflect on previous research results, but also
provided more details regarding broker activities. Our study mainly focuses on investigating commonality and differences between main brokers. However since the categorization of strategic activity (Howells, 2006) is based on firm characteristics, the relevance of this categorization was also looked into. All interviews were tape recorded and fully transcribed.

As a final step the interviews were analyzed. The interviews were subject to qualitative analysis and qualitative comparative analysis (QCA)\textsuperscript{14} which are different research methods. QCA requires the construction of a dichotomous data table. The table was constructed by dichotomizing the answers regarding the goals, activities and behavior of interviewees, taking into account background knowledge (previous research, website information) of the interviewees. This data table was in turn validated by use of an expert panel; 3 people who were senior non-profit consultants in the field of research and therefore acquainted with the interviewees and their work. Validation of the card technique results is possible through corroboration from independent experts (Budhwar, 2000). The expert panel was well informed on strategic goals, activities and behavior we instructed them to use. In case answers of respondents to construct the data table were not straightforward, a discussion regarding the work and relationships between actors resulted unanimously in categorization of answers. Finally, the results of the qualitative analysis and qualitative comparative analysis were discussed with the expert panel. The final results were also compared with performance information in public reports of design and high-tech organizations in the Southeast region (Brainport, 2009 and 2008). The use of previous research information, interviews, the expert panel and reports enhanced the construct validity of the study.

\textsuperscript{14} Reports were created with Tosmana Version 1.301; tool for small-N analysis
4.4 Results

Diverse strategic goals, activities and behavior can be related to people with high brokerage capacity. Figure 4.1 already conceptualized the relationships. However too many combinations of variables can be made, making it impossible to formulate hypotheses. Our aim is to gain in-depth insight into the different cases and to capture their complexity, while still attempting to produce some form of generalization. This aim corresponds to a multiple case study strategy. The 12 interviewees reflect 12 cases. Each case has its own complexity, but at the same time we expect cross-case similarities. Strategic goals, strategic actions and strategic behavior of main brokers are examined in order to try and find cross-case similarities. Investigation of the strategic dimensions altogether is done by means of qualitative comparative analysis. QCA transforms the cases into configurations, a combination of conditions that lead to a given outcome of interest (Rihoux and Ragin, 2009). Such an approach takes a holistic view of the practices of brokers; it considers complex patterns rather than individual independent variables as related to an outcome. It contrasts other approaches that imply singular causation and linear relationships (Fiss, 2007). QCA is used more inductively, gaining insights from the case knowledge in order to identify key strategies to be considered.

4.4.1 Network strategies

None of the brokers in this field have a tertius gaudens orientation; they all report to have a tertius iungens orientation. It is not in their interest to keep parties, passively or actively, separated. “People understand, at present more than in the past, that they cannot operate alone anymore, also big organizations”. On the contrary, involving others creates exciting new solutions to problems. Connecting parties creates more value than keeping them separate. It seems that brokerage is indeed becoming a more public process to which a tertius gaudens orientation does not fit. Social desirability might be a factor of influence with regard to the many tertius iungens orientation reports. However, brokers seem not to neglect their personal aims in favor of others. It
is just that more can be accomplished together. This latter point of view is the basis of the two tertius iungens strategies, but also a basis of a nuance with regard to the absence of the tertius gaudens orientation.

Brokers from the profit sector mainly report they introduce or facilitate interaction between parties while maintaining an essential coordinating role over time. Their aim or task is to start activities to develop business and bring those to an end. They consider brokerage as essential, but it remains a means to achieve what they want. Such brokers unite, however if every party of the group enjoys (equal) benefits is not always clear. One could even argue that such brokers try to create (temporary) groups with whom structural holes can be spanned in a tertius gaudens way. This argument is contradicted by structural network information of the Southeast region. The network across design and high-tech industries indicates that only one small world is present. Furthermore regional reports indicate that high-tech organizations (i.e. original equipment manufacturers, first, second and third tier suppliers) work closely together with their partners in the region and strive to develop strategic, long-term relationships. Actors seem to be foremost regionally embedded and less locally competitive.

The brokers of the non-profit sector state it is important that parties have had the opportunity to get acquainted. If they subsequently get actively connected is beyond the broker’s scope of intention. Brokers from the science sector report both strategies related to the tertius iungens orientation. It seems that the kind of tertius iungens orientation depends on the kind of work brokers are involved in. There are people who are less involved in research and therefore operate more as a non-profit broker. In summary, 4 interviewees say they introduce or facilitate interaction between parties

15 The kind of and amount of activities can vary depending on client agreement or just having time to spare, therefore time is relative.
while maintaining an essential coordinating role (O4), while 8 state they only introduce or facilitate ties between parties (O3).

The results show that the environmental context, especially job boundaries, influences the network strategy. Described above is the general tendency per sector, although deviations occur. It is clear that people with high brokerage capacity strive to interconnect others. Interaction among various parties is necessary to create value. The kind of activities brokers are mainly involved in, described in the next paragraph, relate to this strategic goal.

4.4.2 Strategic activities

All brokers are in general heavily involved in the first four brokerage functions (Table 4.1). More specifically, there is clearly a tendency to focus on underlying Activities 1b to 4a: articulation of needs and requirements, information gathering, connecting partners, setting up projects in order to generate and combine information, and facilitating contract negotiations. The other activities are performed only by some. A turning point is visible regarding Activity 4b: contractual advice. Most brokers mention that this activity is an expert function just like, foresight and forecasting, testing and validation, accreditation and standards, regulation and arbitration and technology assessment and evaluation. Many respondents indicate that intellectual properties (8a) are immediately an issue when parties start working together, but that they are not themselves involved in formal advice since they are not experts. Advice on expert topics is sometimes given during the facilitation of contract negotiation (Activity 4a). Marketing activities are regarded as important, but are not considered as a main pursuit. Ranking of main activities does not provide a clear pattern\(^\text{16}\). Furthermore the focus on technology information in the typology of Howells (2006) only partially represents practice. Brokers

\(^\text{16}\) It is mentioned that in order to be able to perform Activity 3 and 4 one has to first perform Activity 1 and next Activity 2. Taking steps in the right order is import for success.
indicate that they discuss all kinds of information like innovation, network, operation, marketing and finance information.

Table 4.1
Shared main activities of main brokers

<table>
<thead>
<tr>
<th>Main focus</th>
<th>Engaged interviewees</th>
<th>Minor / No focus</th>
<th>Engaged interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foresight and diagnostics (b) Articulation of needs and requirements</td>
<td>11</td>
<td>1. Foresight and diagnostics (a) Technology foresight and forecasting</td>
<td>2</td>
</tr>
<tr>
<td>2. Scanning and information processing (a) Scanning and technology intelligence (b) Scoping and filtering</td>
<td>12</td>
<td>4. Gatekeeping and brokering (b) Contractual advice</td>
<td>2</td>
</tr>
<tr>
<td>3. Knowledge processing, generation and combination (a) Combinatorial (b) Generation and recombination</td>
<td>12</td>
<td>5. Testing, validation and training (a) Testing, diagnostics, analysis and inspection (b) Prototyping and pilot Facilities (c) Scale-up (d) Validation (e) Training</td>
<td>0</td>
</tr>
<tr>
<td>4. Gatekeeping and brokering (a) Matchmaking and brokering</td>
<td>11</td>
<td>6. Accreditation and standards (a) (b) (c)</td>
<td>0</td>
</tr>
<tr>
<td>7. Regulation and arbitration (a) Regulation (b) Self-regulation (c) Informal regulation and arbitration</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8. Intellectual property: protecting the results (a) Intellectual property (IP) rights advice (b) IP management for clients</td>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>9. Commercialization: exploiting the outcomes (a) Marketing, support and planning (b) Sales network and selling (c) Finding potential capital funding and organizing funding or offerings (d) (e)</td>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10. Assessment and evaluation (a) Technology assessment (b) Technology evaluation</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Differences are visible when the backgrounds of interviewees are taken into account. It seems that brokers from the profit sector are in general more involved in realization of outcomes. They occasionally smooth the progress of scaling-up, regulations and finding
funding. Brokers in the profit sector tend to facilitate such discussions if necessary. Only two other brokers, from the science sector, also indicated being involved in the realization process in general. They want to make sure the results of their scientific work are effectively utilized in practice, since the application of scientific knowledge in the everyday practice of the business community is seen as a societal responsibility by their university. The above described cases show that again job descriptions defined at organizational level influence brokerage at the individual level.

In terms of general management literature brokers are involved in the network management tasks initiating contacts, exchange of information and organizing rather than planning, coordination, staffing and controlling. They are almost all involved in knowledge processing, generation and combination which shows that they are process-as well as content-oriented. At individual level brokerage activities which only facilitate innovation are not valued. Brokers occasionally facilitate and monitor operating activities, if they are concerned with final outcomes. However in principle their goals are reached once the network is established and set in motion.

4.4.3 Strategic behavior

The activities engaged in indicate that brokers are involved in creating novelty. The same seems to be true with regard to strategic behavior. All interviewees state that they work according to the logic of effectuation, except one. Brokers in this field indicate that they act upon a frame of reference, mainly set by the organization they work in. However their goals are not straightforward. The starting point of their work is a couple of general ideas. The final outcomes of their work deviate from these original ideas. These results are inline with studies regarding how expert entrepreneurs behave. Effectuation involves seeing the world as open, still in-the-making. Ideas become clearer when the broker interacts with others. Other parties are seen as stakeholders by brokers who control pieces of the environment and value genuine novelty in outcomes (Dew et al., 2008).
Brokers’ interest in boundary-spanning information and their interest in the needs of others relates to previous results regarding the kind of information exchanged by brokers. Exchange of information on innovation, network, operation, marketing and finance are significantly positively related with being a broker in this setting as shown in Chapter 3. These quantitative results are supported by the qualitative results. Interviewees say they prefer to meet people who have different backgrounds than themselves. New information triggers them, but also the concerns of others insure that they discuss a broad range of topics. Technical aspects are just as important as organizational aspects in discussions. Brokers are not specialists and they do not want to specialize. They perceive the exchange of different kinds of information as a necessity in their work.

The main responsibility of the brokers in this field is to establish new projects or businesses. They work at the borders of various fields, where innovations come into existence. In their opinion working according to the logic of effectuation enables addressing many more possibilities. The aspect of getting commitment is also stated to be important. It is necessary to initiate activity: “If one does not work according to the logic of effectuation nothing will happen in reality”. Effectuators very rarely see opportunities as given or outside of their control (Dew et al., 2008). For the most part, brokers work to fabricate, as well as recognize and discover opportunities.

The person who indicated s/he worked according to the logic of causation was involved in developing new alliances. His aim was to match parties, not to develop new business. His goals and the steps required to succeed were fairly clear. However, this person specified that in a previous job s/he had worked according to the logic of effectuation. In these situations the pursued outcomes were vague. It is clear that people with high brokerage capacity are involved in entrepreneurial activities and thus use an effectual logic to succeed. Even in environments where policy documents are written (in
causation style), effectual behavior is preferred. “It is needed to realize plans”. To create and implement new policy plans these brokers exhibited effectual behavior.

4.4.4 Strategic configurations

Regarding the previous results it seems that the strategic goals, activities and behavior are interrelated. A review of the results altogether can provide a more general picture of brokerage strategies in the field than so far has been given. Qualitative comparative analysis of the results considers combinations of strategic goals, activities and behavior. It highlights general strategic brokerage patterns. Difficulty in this approach is that there are many conditions (various kinds of goals, activities and behavior) that can be included in the analysis. However a good balance must be reached between the amount of cases and conditions; if 10-40 cases, select 4 to 7 conditions (Rihoux and Ragin, 2009). The underlying activities of the strategic functions cause the wealth of conditions to choose from. Then again these activities represent the wide-ranging ways brokers can contribute to innovation and we want to make sure we cover that aspect. We decided to include Activities 1b, 3b and 4a and also Activities 1a, 5 and 9 as conditions (see Appendix C for the details).

Condition 1b, 3b and 4a represent the main preferred strategic activities. The main preferred Activities 2a, 2b and 3a do not vary at all across the cases and are therefore considered as constants which need to be excluded from analysis. Furthermore Condition 1a represents brokers who are active in foresight and forecasting. Condition 5 represents brokers who are active in business development by being involved in prototyping, scaling-up of ideas or training. Condition 9 represents brokers who are active in exploitation of outcomes by being involved in marketing plans or finding potential capital funding. The activities out of which the latter two conditions exist are not included as separate conditions in the analysis, because this would have individualized the outcomes. By focusing on this set of conditions we included invention-oriented, development-oriented and user-/ implementation-oriented
activities in the analysis. In doing so we covered the various ways in which brokers work. In addition these activities represent the ones that are performed the most by the brokers, as can be seen in Table 4.1. The other activities not included in the analysis are not reported or are considered as less important with regard to being a main, individual broker. We of course did include the tertius iungens strategies\textsuperscript{17} and the logic of effectuation as conditions in the analysis. Including more conditions would have individualized each case and regularities would not have shown.

Results showed that the brokerage behavior did not have an effect on the identified configurations. Since all but one interviewee reported to work according to the logic of effectuation, it is seen as a constant, a condition which is always present and is therefore left out of the final analysis. The assumed relation between effectuation and tertius iungens strategies can therefore not be explicated. It would have been interesting to see configurations when interviewees also had reported tertius gaudens orientations.

\textsuperscript{17} We only had to include O3 as condition, since if absent the interviewees reported to have an O4 strategy.
Table 4.2
Configurations of brokers’ strategic goals, activities and behavior

<table>
<thead>
<tr>
<th>Conditions included</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Foresight and diagnostics</strong></td>
</tr>
<tr>
<td>(a) Technology foresight and forecasting</td>
</tr>
<tr>
<td>(b) Articulation of needs and requirements</td>
</tr>
<tr>
<td><strong>3. Knowledge processing, generation and combination</strong></td>
</tr>
<tr>
<td>(b) Generation and recombination</td>
</tr>
<tr>
<td><strong>4. Gatekeeping and brokering</strong></td>
</tr>
<tr>
<td>(a) Matchmaking and brokering</td>
</tr>
<tr>
<td><strong>5. Testing, validation and training</strong></td>
</tr>
<tr>
<td><strong>9. Commercialization: exploiting the outcomes</strong></td>
</tr>
</tbody>
</table>

Tertius Iungens orientation
(O3) Introduce or facilitate ties between parties
(O4) Introduce or facilitate interaction between parties while maintaining an essential coordinative role.

<table>
<thead>
<tr>
<th>Configurations identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration 1: H1a(0) * H1b(1) * H4a(1) * H5(0) * H9(0) * O3{1}</td>
</tr>
<tr>
<td>Configuration 2: H1a(0) * H1b(1) * H3b(1) * H4a(1) * H5(1) * H9(1) * O3{1}</td>
</tr>
<tr>
<td>Configuration 3: H1a(1) * H1b(1) * H3b(1) * H4a(0) * H5(1) * H9(0) * O3{1}</td>
</tr>
<tr>
<td>Configuration 4: H1a(0) * H1b(1) * H3b(1) * H4a(1) * H5(1) * H9(0) * O3{0}</td>
</tr>
<tr>
<td>Configuration 5: H1a(0) * H1b(0) * H3b(1) * H4a(1) * H5(0) * H9(1) * O3{0}</td>
</tr>
<tr>
<td>Configuration 6: H1a(1) * H1b(1) * H3b(1) * H4a(1) * H5(1) * H9(1) * O3{0}</td>
</tr>
</tbody>
</table>

Table 4.2 presents the conditions that have been compared and the configurations identified. The first configuration represents the common strategy of a large number of brokers (6). The approach seems to be representative for the non-profit sector, since the configuration involves only brokers from the non-profit sector or science sector with a non-profit job-orientation. These brokers only introduce or facilitate ties between parties and are not involved in activities beyond gatekeeping and brokering. The

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18 Inclusion of remainders (non-observed cases) by the software did not produce fewer configurations.
strategic goal and activities seem clearly related. There is an in-group difference between brokers generating in-house research and technical knowledge to combine with partner knowledge and those who only help to combine knowledge of two or more partners. Overall, the strategy of this group is one of a catalyst, as some interviewees also indicate; they start a reaction and influence the interaction, but their contribution is not noticeably present in the outcome.

The other five configurations only represent one or two brokers, implying that results are undefined. A connection between configuration and affiliation can therefore not be distinguished clearly. However the results provide insights into the various ways individual intermediaries work in making innovation happen in an actual network.

The second configuration represents the approach of a broker who shows much resemblance with the previous mentioned group. Although this broker is mainly concerned with introducing or facilitating ties between parties his work does not stop after a match is made. His connection to science causes him to be involved in testing and commercialization. The third configuration shows a broker from the profit sector whose main objective is to explore knowledge. This expertise is again used in order to match parties in the field, not to coordinate projects. The broker wants to make sure parties understand each other. “You can not say; you and you, go and play. As an intermediary you have to act as some sort of teacher who takes the two parties by the hand. You have to raise the two so they understand each other. A project is not owned by one, but is of us all”. Once a match is made this kind of broker will gradually withdraw from the project. This approach seems to embody a knowledge exploring expert role. The fourth configuration represents brokers who have a coordinating role in projects in which they connect and unite various parties. Brokerage is a means to an end. This is what distinguishes them from others. Their activities only go, occasionally, beyond the first four main brokerage functions. The fifth configuration also represents a broker from the profit sector who has a coordinating role in projects. What distinguishes
him from others is that s/he is less involved in exploration and much more in exploitation of knowledge in the field. This broker’s main objective is the commercialization of outcomes. The fourth and fifth configuration seems to be representative for brokers in the profit sector. The sixth configuration represents a broker from the science sector who combines a coordinating role and involvement in research activities, like foresight and diagnostics or technology assessment. This broker fulfills an intermediate role in various stages of the innovation process, an approach which has not been shown by others.

It is clear that intermediaries with a non-profit orientation work according to the same configuration; they share the same general strategy. These actors aim to gather and exchange information by means of the facilitation of ties. This is in line with research regarding innovation brokers (firms) in the agri-food sector (Batterink et al., 2010). The results partly contrasts the view of Howells (2006) and Stewart & Hyysalo (2008) who argue that there is an ecology of intermediaries (firms) who can provide a much wider, holistic role for their clients in the innovation process. Our research shows that individual intermediaries do contribute to innovation in wide-ranging ways; however most concentrate on the exploration of knowledge (with or without an active coordinating role themselves). The brokers in the non-profit and science sector indicate that they are bounded by public regulations and cannot exploit knowledge; or operating in the competitive field. However they point out that knowledge processing and matchmaking is essential and needed in the field. Once parties are brought together they can continue on their own. Still, it seems that exploitation of knowledge can use intermediation too. User-side intermediaries play crucial roles in bridging “market gaps” between suppliers and users (Stewart and Hyysalo, 2008). Brokerage configurations with regard to commercialization of outcomes in particular seem not to be grounded firmly in practice in this field.
4. Brokerage strategies in a SME network

4.5 Conclusions

This chapter focuses on the strategies of individual brokers in the network across design and high-tech industries in order to gain insights into what brokers actually do. The case study covered the context, structure and process of the 12 main brokers in the field. The investigation of brokers required the insights of previous research into the connectivity of the actual network. The information enables us to select persons with high brokerage capacity in the profit, non-profit and science sector. An inductive approach is taken to attempt to explore their characteristics. The investigation leads foremost to an understanding of what strategic goals, activities and behavior the most powerful brokers of the field have in common. By highlighting preferences regarding these strategic dimensions and strategies in general, more insight is gained into how brokerage is enacted. Each strategy has its value; there is no ideal profile. What matters is which combination of elements fit the environment.

Empirical results show that specific strategic goals, activities and behavior are indeed associated with main brokers in the network across design and high-tech industries. The main brokers have a tertius iungens orientation, work according to the logic of effectuation and are mainly involved in articulation of needs and requirements, scanning & information processing, knowledge processing, generation & combination, and matchmaking. The employment context, not the sectoral context especially, influences which specific strategic goals, activities and behavior are preferred. The main brokers have much in common, but there are differences at sub-level regarding strategic goals, behavior and activities. These are made more explicit by comparative analysis. The comparative analysis shows a range of broker configurations among main brokers. In addition, the results also indicate which are among the main preferred configurations in this field.

The results imply that the brokers operate as architects and lead operators of the network (Snow, Miles and Coleman, 1992). The network architect has no clear goal to
pursue. The value chain required to succeed is therefore also vague. Concepts become clearer when the broker interacts with others. Information is gathered and a grid of people is formally clustered around a particular business. Projects are designed and set in motion. However brokers in this field are less involved in care-taking activities; maintaining and enhancing the existing network. Several reasons, like time constraints, interests, job boundaries, inhibit structural attention for planning, monitoring and sustained learning. Thus, depending on their context they may decide to start exploring the opportunity together with others, but generally they are not involved in exploitation of an opportunity; the building of efficient business systems for full-scale operations. Furthermore probably other kinds of people are necessary to sustain successful cooperation. Brokers may have managerial capabilities (Choi and Shepherd, 2004), but will be less motivated to manage processes. Their key interest is in the development of opportunities. In addition not all entrepreneurs will perceive the same opportunities since interests vary (Shane, 2000); some desirable entrepreneurial opportunities may go unnoticed and unexploited, which negatively influences economic output.

Regarding the effectiveness of government expenditures in order to spur innovation more attention should be given to this aspect in network constructions. The broker typology in particular described in configuration five; co-developing and coordinating projects concerned with commercialization of outcomes over time, may be worth stimulating. Furthermore since actors of the non-profit and science sector cannot operate in the competitive field, the research findings imply that an important role can be fulfilled by actors in the profit sector. “Identifying and nurturing best suited intermediaries is the challenge” (Stewart and Hyysalo, 2008 p. 320). SMEs can strengthen their broker capacity by brokering projects related to commercialization of outcomes.

Regarding the limitations of this study, the brokers we selected have various backgrounds and thus represent numerous categories. Although the brokers report
common general strategies, future research should take these categories into account in order to refine our results with regard to brokerage in general. We also have not included people with low brokerage capacity in our study. Their strategic goals, activities and behavior will vary, maybe even be absent with regard to brokerage. The QCA method generally prefers to include cases with a ‘positive’ and ‘negative’ outcome (Rihoux and Ragin, 2009). On the other hand it was not our aim to compare people with high and low brokerage capacity. We also did not interview those who are brokered, ‘brokerees’, in order to investigate their view on how brokers are enacted in the network. In addition future studies may include more raters and calculate the inter-rater reliability (Kappa) to assess consensus in the ratings given by the raters. However we did look into regional public reports regarding the performance of design and high-tech industries (Brainport, 2008 and 2009). The results underline the idea that strategic, trust-based relationships are preferred and that regional as well as firm based activities are focused on achieving that. We furthermore checked the robustness of our findings by taking the strategic goals (O3 Introduce or facilitate ties between parties and O4 Introduce or facilitate interaction between parties while maintaining an essential coordinative role) which do show positive and negative outcomes as the dependent variable and the set of strategic activities as independent variables in the QCA. Such an approach investigates how the strategic goals, not brokerage in general, are enacted. This QCA analysis shows the same six configurations, implying our finding is robust. Finally, our research is not longitudinal. Strategies of people may vary per lifecycle stage of the industries. As has been said in previous chapters only recently collaborations between design and high-tech industries are stimulated. This particular network is in an early life cycle stage.

The results do invite researchers to further investigate this topic. Future research might replicate this study for other SME networks in order to compare the strategies of main brokers and develop more insights into strategic configurations of brokers. A typology of individual brokers in SME networks can be developed further. Furthermore the fact that
people in the field may have a tertius iungens orientation instead of a tertius gaudens orientation leads to the conclusion that the concept needs to be operationalized; such a network measurement can expand knowledge in this particular area. Also an inductive approach like ours asks for more research regarding the precise relationships between brokerage strategies and brokerage capacity. For example is the tertius iungens orientation related to the logic of effectuation or is the tertius gaudens orientation related to the logic of causation. We tried foremost to contribute to network theory by cross-referencing with innovation and entrepreneurship literature. However these research areas can also use the results of this study to build upon.
4. Brokerage strategies in a SME network
CHAPTER 5

Conclusions

5.1 Introduction

It was our purpose in this empirical study to provide insights into the role of brokers in SME networks. An attempt has been made to answer the following main research question:

*Which factors contribute to the capacity of main brokers in a SME network?*

Understanding the role of brokers in bridging gaps between industries is important if we want to stimulate the recombination and transformation of pre-existing elements in industries by policy makers as well as SMEs themselves. From an academic perspective it is unclear what the network structure of collaboration and strategic brokerage behavior looks like across various industries. In addition, there is little literature about the characteristics of intermediaries and exploitation of the network structure. Apart from some notable exceptions (De Rond, 2003), alliance literature gives only superficial attention to the influence of actor properties, like individual behavior, skills or strategies (Doz, 1996; Honing and Lampel, 2000; Hutt et al., 2000; De Rond and Bouchikhi, 2004), on the success of cooperation. By investigating the network and personal characteristics of brokers who facilitate networking we contributed to the network literature. We developed five sub-questions to answer the main research question. The answers to
these questions are summarized below followed by reflection on and discussion of the conclusions in general in order to answer the main research question.

5.2 Conclusions of the chapters

1. What are the structural network characteristics of the SME network, in particular at network and subgroup level?

The study described in Chapter two analyzed connectivity and efficiency of a small and medium sized enterprise (SME) network across design and high-tech industries. These characteristics are likely to be different for networks of various industries. The concept of ‘small worlds’ was used to judge overall network efficiency. Insights into efficiency of the network is particularly important for design and high-tech industries since these involve complex knowledge processes which in turn benefit highly from efficient knowledge creation and exchange. Proximity to others is important in order to manage complex processes. However entrepreneurs or SMEs do not have the resources to manage a large network. A few well positioned stakeholders can be dealt with. A small world consists of a relatively small number of intermediaries who are relative closely positioned to people in the environment and who probably have stable reputations and diverse backgrounds. Knowing more about small worlds in this network is therefore highly interesting for science and valuable to the region. The actual network can be classified as one in which a small world is present. The low path length indicates the presence of efficient knowledge flows, high clustering of efficient knowledge exploitation. Visualization of the results shows a single core group, indicating that the design and high-tech industries are interrelated. The question remained who is highly involved in creating efficiency? It is found that non-profit as well as science actors are overrepresented in the core of the field.
The results will be useful for regional policy makers to improve their interventions in the economic structure of the region. The questions are also interesting for SMEs, because it gives them an idea of where to turn to for knowledge in general. How these findings contribute the main question can be discussed after the résumé of the conclusions of other chapters.

2a. Can brokers be identified within the SME network?
2b. What types of brokers can be detected within the SME network
3. What are characteristics of brokers in the SME network?

By highlighting the personal networks of members across design and high-tech industries, the study described in Chapter three attempted to identify the main brokers in this dynamic environment. In addition, we investigated whether specific characteristics are associated with these brokers. This part highlighted individual affiliation, kind of partners and kind of information exchanged in the network, with controls for gender, education and years in branch as sources of brokerage capacity influence. The main contribution of this part of the study lies in the fact that, in contrast to most other work, it is of a quantitative nature and focuses on brokers identified in an actual network. Studying the phenomenon of brokerage provided us with clear insights into the concept of brokerage regarding SME networks in different fields. In particular we highlighted how third parties contributed to the transfer and development of knowledge. Empirical results show that significant brokers exist in the network. They are found in the non-profit and science sector and have a long track record in their branch. Furthermore a wide variety of information is discussed with brokers; practical support in the form of valuable contacts and innovation-related information, but also finance, marketing and operational information.

Our research enabled us to generate knowledge regarding brokerage in general. Consequently the results can be useful for other industries in dynamic environments.
The results also provided insight into how brokers bridge the cognitive and technical distance between parties. In other words, the research indicated how companies can reach a better balance between the two forms of social capital. The research findings in particular imply that SMEs should get involved in projects in the non-profit or science sector. Furthermore SMEs or even non-profit organizations whose brokerage capacity is not in line with their ambitions should invest in connections with branch experienced individuals with a broad knowledge base. This research also shows that the intervention of their consultants (eventually) is of value to companies. Measurement at individual level gives a profound picture of actual contributions. It is now possible to review policy from the bottom up, enabling the effectiveness of government expenditures to increase.

4. How is brokerage enacted in the SME network?

Chapter four complemented the research regarding characteristics of brokers by taking an in-depth look at what brokers actually do. This part of the study focused on the personal strategies of high capacity brokers in the network across design and high-tech industries in order to gain further insights into broker effectiveness. By highlighting the personal goals, activities and behavior of main brokers the study attempted to identify strategies of brokers. The main contribution of this part of the study is that it enhances the understanding of social network theory regarding brokerage by integrating innovation and entrepreneurial theories. Empirical results show that specific strategic goals, activities and behavior are indeed associated with having high brokerage capacity in the network across design and high-tech industries. The main brokers have a tertius iungens orientation, work according to the logic of effectuation and are mainly involved in knowledge exploration. There are differences among main brokers regarding (the combination of) strategic goals, activities and behavior at sub-level which shows a range of broker configurations. It indicates that there are different kinds of brokerage among main brokers.
The results imply that the brokers operate as architects and lead operators of the network. However brokers in this field are less involved in care-taking activities; maintaining and enhancing the existing network. Therefore the broker typology described regarding co-development and coordination of projects concerned with commercialization of outcomes over time, may be interesting to stimulate in this field. Furthermore since actors from the non-profit and science sector cannot operate in the competitive field, the research findings imply that an important role can be fulfilled by actors in the profit sector. SMEs can strengthen their broker capacity by becoming involved in brokering projects related to commercialization of outcomes.

5.3 General discussion

An ultimate result of this study would be the framing of the relationships between characteristics of actors and emergent characteristics of the social system. The impact of individual and environmental characteristics on brokerage capacity is the basis of the general discussion.

In Chapter 2 it was found that non-profit as well as science actors were overrepresented in the core of the field. A comparison with the results in Chapter 3 indicates that the same actors are among the people with the highest brokerage capacity. The interviews highlight that a subsidy program has been successfully rolled out (creative challenge call) in the Netherlands. It aimed to create networks between the creative industries, thus design, and other industries (EZ, 2009). This may be an important reason for non-profit actors being overrepresented in the core of the field and being among the main brokers as network research has shown. Furthermore the non-profit and science sector may have access to a broader range of information concerning subsidy funds, IP advice, network contacts, etc. In addition it is primary their work to create the right circumstances in order for others to connect. Such work is especially important in the
early stages of network development which is the case among design and high-tech industries in the Southeast region. In a profit environment management activities may preoccupy time; little time may be available for brokerage activities. The distinctive system of innovation in the Netherlands is scientifically interesting. Profit, non-profit and science sector are heavily interrelated (Van der Meulen, 1998). Apparently the brokerage activities of the people in the non-profit and science sector lead to a better connected network in the field across design and high-tech industries. Future research should investigate the factors leading to this result.

Nevertheless, the resemblance between non-profit brokers and others remains generally high. In Chapter 4 it is shown that brokers focus on the same strategic goals, activities and behavior. The sector, especially the job context, influences strategy preferences only at sub-level. The results in Chapter 3 indicated that brokers discuss a variety of information with others. The relation between exploration and the discussion of various kinds of information is one that is already highlighted in research by March (1991). That this factor also contributes to the capacity of brokers is shown by this study.

The focus of brokers on exploration of information indicates that they are more involved in increasing the creativity and flexibility of organizations (Hardjono, 1995) and consequently in the network in general. However the fact that they discuss a variety of information and that brokers can be involved in harnessing projects to set off ideas, as shown in Chapter 4, indicates that they are contributing to material, commercial, socialization and intellectual assets. At least at project level they seem to be involved in increasing creativity, flexibility and also effectiveness and efficiency. More research is needed regarding the relation between brokerage and (realizing) strategic aims of organizations and alliances. It will highlight in more detail how brokers contribute to networks, specifically to efficiency in networks. Furthermore, the fact that the main brokers have the same strategic approach to combine ideas into new solutions implies
that brokers, as opposed to Howells’ findings (2006), do not provide a more varied role in the innovation process. Future, longitudinal research may show if the general brokerage approach found in this study is related to this networks’ early life cycle stage; a loosely connected network (even though small world properties exist). If in the various stages of the life cycle certain approaches are preferred, brokers do provide a more varied role in innovative networks.

The tendency for brokers to connect and unite disconnected parties, and their focus on exploration of knowledge seems to be related to the fact that the industries in the region are all somehow involved in manufacturing complex equipment. A particular industry defines a region's specialization. The technical issues surrounding the specific nature of the industries influence the kinds of social structures. What you do shapes how you do it (Cohen and Fields, in Kenney, 2000). Individuals and their firms in the region are more and more inclined to share information, since they realize they depend on each other. Furthermore their involvement in developing technology-intensive equipment increases their need to share in particular explorative knowledge. However, the focus of brokers on exploration of knowledge raises the question if enough attention is given to exploitation of knowledge. As said in Chapter 4, depending on their context the main brokers may decide to start exploring opportunities together with others, but generally they are not involved in exploitation of an opportunity; commercialization. More research should be undertaken regarding brokerage and business models after parties are united.

The results regarding brokerage configurations in Chapter 4 showed that there are differences in emphasis among main brokers. Some do focus on exploitation of an opportunity. Research regarding the management of networks argues that networks become more intentionally managed as firms mature (Hite and Hesterly, 2001). Related research (Möller, Rajala and Svahn, 2005; Snow, Miles and Coleman, 1992) discusses the types of strategic business networks and what kinds of managerial capabilities are
required in managing these networks. It seems that the development of full-scale 
operations can be stimulated. However such research focuses on intentionally formed 
networks that contain a finite set of parties and not on more general “networks of 
firms”. Furthermore, capital and intellectually property rights are areas of concern in the 
knowledge exploitation phase. Many main brokers indicated that intellectual properties 
rights were immediately an issue when parties started working together. Research 
regarding the Silicon Valley (Kenney, 200) indicates that lawyers, in conjunctions with 
the American system of laws, and venture capital firms are critical matchmakers in that 
area. The main brokers in our network did not report to have backgrounds in these 
areas. It would be interesting to study individuals or firms in these areas of expertise in 
order to understand their role in the network across design and high-tech industries in 
Southeast Netherlands. How development can be stimulated, in particular how brokers 
can contribute to the exploitation of innovation activities in networks of firms, is an 
underdeveloped area of study.

The focus on exploration of information indicates that the time spent on brokerage is 
important, but results are not predictable. The non-profit and science sector should be 
aware that the outcomes of this work are not predictable and should take this 
awareness into account when timetables are being made. The profit sector should be 
aware that investments without secure profit are necessary. Brokerage is labor with 
delayed profits; at the moment of investment it is still unclear if payment is possible and 
who will pay in the end. Furthermore, contrary to the usual problem-solving orientation, 
a good intuition for opportunities is desirable. Still in practice SMEs hardly realize that 
people are needed who are not involved in day-to-day activities, but in looking beyond 
borders of the own field of interest. Structural attention regarding exploration of 
knowledge is scarcely present.

Besides the preference of brokers to discuss a variety of information with others, they 
have a long track record in their branch and have a preference for the tertius iungens
orientation as well as for the logic of effectuation; they actively seek interaction with other stakeholders. Interviewees pointed out that their nature is an import aspect of having high brokerage capacity. It seems that personality plays a role with regard to being a powerful broker. Although personality is not within the scope of this research a description of comments of interviewees complement previous research results and shows how main brokers work.

The nature of brokers

The main brokers have several general intrinsic characteristics in common that enhance their ability to seize brokerage opportunities. Brokers share an interest in adventures. They want to undertake new activities, to invent. They have a wide-ranging interest. These features make them interact with others. They are intrinsically motivated; they meet people because it brings them pleasure or is important to them. Important to mention is that the interaction is not initiated with a clear goal in mind. Brokers are interested in other people’s needs. “I am interested in people”, is mentioned many times. “I want to know what people do and more important why they do things”. To the question what should you not do as a broker they answered that one should not go to (social) meetings with an own agenda. It is not done. Besides it is just not an issue, since they interact because it brings them pleasure. It seems that brokers are more capable of getting what they want because they know which social ties allow them to access the resources they need (Casciaro, 1998), but foremost because they are able to retrieve resources (generate commitment) since they are interested foremost in others and not in direct gains.

Although people with high brokerage capacity like new experiences, they are not impulsive people. They spend a lot of time and energy in networking, because eventually it pays out in one way or the other. “I go to receptions not to eat salty nuts, but to meet people”. Furthermore they operate within a, for them, clear context. They
are able to connect exchanged information to this context. Information is processed efficiently. It seems that brokers indeed have a high entrepreneurial alertness; a cognitive framework that assists persons in being alert to opportunities (Gaglio and Katz, 2001). Based on the people they meet, brokers make connections. They make connections which others may not think of. They are associative, intuitive. An interviewee describes this process as follows: “I have some sort of server in my mind to which I drag information. I do not know yet how I can use this information at that point in time. But at the moment I get a targeted question then connections are being made. It is not so that I know in the morning what I will have at dinner in the evening.” Brokers act when they are triggered. Entrepreneurial potential does not result in entrepreneurial intentions until a precipitating event triggers the intentions (Krueger and Brazeal, 1994).

Brokers try to make their insights clear to others. They translate and apply. As said before they describe themselves as catalysts. Brokers who are involved in design issues in particular, start with trying to help others to formulate the ‘right’ questions; to pinpoint the exact needs of others. They intrinsically want to motivate others and bring people together in order to set activities in motion. This does not mean they operate at the forefront or automatically take the lead. On the contrary, they stimulate others and try to keep an objective position; the interested third person. However if necessary, for example when projects do not come into existence, they do take on informal leadership.

Interviewees indicate that experience is important. This result endorses previous research which shows that years in branch are significantly related to brokerage capacity. On one hand brokers argue they have build up knowledge in various areas. It enables them to process complicated and various information more efficiently and consequently to act faster (Madsen et al., 2008). On the other hand the years also positively influenced their interpersonal skills, although results also indicate good interpersonal qualities are part of their nature. Years in branch are important because
people have been able to develop a broad knowledge-base and social network in the branch, but also because their personality has matured.

The remarks of interviewees regarding their own characteristics are partly self-reports. However they clearly describe how broker strategies actually are executed in practice. Brokers seem to be intrinsically motivated to understand what drives others. They spend a lot of time and energy in meeting others, especially in those who have boundary-spanning information. They generate, transform and execute information by making unusual connections between pieces of information and by discussing their insights with others. Work according to the logic of effectuation and tertius iungens orientation seems natural to brokers. They act as entrepreneurs. It seems that these more intrinsic characteristics affect strategic preferences and consequently brokerage capacity. Moreover the results with regard to years in branch (>20 years) are an indication of a broad knowledge-base, a broad social network in the branch and also of excellent interpersonal skills. Research shows that many personality measures like self control, openness to experience, lower level of anxiety, peak between the ages of 50-70, whereas cognitive ability (intelligence) reaches these same levels of stability by middle childhood (Borghans et al., 2008). It implies that organizations can undertake action in order to enhance such characteristics.

The importance of not acting upon an own agenda or not having a clear goal in mind implies that network meetings should have a certain atmosphere. A meeting with many people who consciously search for the right connections, ‘gold diggers’, will limit the character of the event. More research regarding intrinsic characteristics and brokerage capacity may show how actors can become fitter and how uncertainty within networks can be decreased.

We started this research because there was little attention devoted to how or why ideas and resources are transformed and combined into new solutions for other actors and
subgroups. Our goal was to investigate how structural holes are spanned by considering factors that contribute to the capacity of brokers. This study shows that brokers do not largely work as conduits that pass along unchanged ideas and resources to others. They do transform and combine ideas into new solutions for other actors and subgroups. How? By being at the core of knowledge networks and exploring a wide variety of information with contacts. Their affiliation, the independent nature of the non-profit and science sector, their long track record in their branch and their active search for interaction with other stakeholders make it possible to occupy the central position and also to exploit the position appropriately. They have acquired the ability to process a variety of information, make unexpected connections and to harness projects in order to set off ideas.
References
A


B


Brokerage in SME Networks


C


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Vermeulen, N. (2009). *Supersizing science; on building large-scale research projects in biology.* Maastricht University, Maastricht.


W


Y


Z


Appendix A Questionnaire Discerning The Invisible

Het onzichtbare in beeld gebracht; onderzoek naar netwerken & innovatie

Uw antwoorden zullen leiden tot meer inzicht in netwerken tussen sectoren en initiatieven die samenwerking kunnen verbeteren. Zou u net als uw collega's, een aantal in uw ogen belangrijke personen willen noemen om de opbouw van het ‘onzichtbare netwerk’ in kaart te brengen? We zullen met deze personen contact opnemen en ze dezelfde vragen voorleggen.

Mogelijk aarzelt u om namen te noemen, echter u en de informatie die u noemt blijven te allen tijde anoniem. NAW gegevens worden nu en in de toekomst niet verstrekt aan derden. Resultaten worden, anoniem, verwerkt in een wetenschappelijk artikel.

Als dank voor uw medewerking bieden we u -na afloop van ons onderzoek- graag het artikel en/of een persoonlijke analyse van uw positie in het ‘onzichtbare netwerk’ aan. U kunt aan het einde van de vragenlijst uw interesse aangeven.

   Uw Naam:

1. UW ACHTERGROND

We zouden graag enkele details willen weten over uw beroepsachtergrond. Wat is uw huidige functie? (indien u meerdere functies heeft, ga dan a.u.b. uit van de functie die u de meeste tijd vervult.)

   (Hoofd-)Functie:

Wat is de naam van de organisatie waarvoor u werkt?

   Naam organisatie:

Wat is uw hoogst genoten opleiding? (Streep a.u.b. door/verwijder wat niet van toepassing is):

   MBO / HBO / Universiteit / Post-HBO Universiteit / Geen van bovenstaande
Brokerage in SME Networks

Hoe lang bent u werkzaam in uw vakgebied? (Streep a.u.b. door/verwijder wat niet van toepassing is):

0-1 jaar / 1 - 5 jaar / 5 - 10 jaar / 10 – 20 jaar / meer dan 20 jaar

Wat is uw geboortedatum? dag maand jaar

Bent u op dit moment werkzaam in de sector design en/of technologie?

Ja / Nee (Streep a.u.b. door/verwijder wat niet van toepassing is.)

Beschouwt u de sectoren design en/of technologie als sector(en) waaraan u een bijdrage heeft geleverd of nog zal leveren in de nabije toekomst:

Ja / Nee (Streep a.u.b. door/verwijder wat niet van toepassing is)

Als u ‘nee’ heeft ingevuld op beide bovenstaande vragen, dan kunt u deze vragenlijst opslaan en het bestand opsturen zonder de overgebleven vragen in te vullen. Het is belangrijk voor ons onderzoek dat u de tot dusver ingevulde lijst daadwerkelijk opstuurt! U kunt een e-mail met het bestand als bijlage sturen naar: y.kirkels@fontys.nl. BEDANKT alvast voor uw medewerking!

2. UW NETWERK

In de onderstaande vragen zullen namen gevraagd worden van personen. Deze namen worden enkel voor het onderzoek gebruikt en niet herkenbaar in de openbaarheid gebracht. We willen u enkele algemene aanwijzingen geven voor het beantwoorden van de vragen.

• Plaats de meest belangrijke partner bovenaan de lijst, de op één na belangrijkste daaronder, etc.

• Beschouw enkel personen die u van invloed vindt op bedrijfsprestaties door UW werk op het gebied van Design en/of Technologie, al zijn deze personen geen specialisten op dit gebied.

• Kwaliteit van input is altijd een betere maatstaf dan kwantiteit.
Appendices

• Probeer tenminste vijf personen te noteren.

• Enkele aanwijzingen met betrekking tot het weergeven van namen: Schrijf a.u.b. in de volgorde VOORNAAM - ACHTERNAAM. Geef a.u.b. zoveel mogelijk details weer, bijvoorbeeld "Elvis Presley" in plaats van "E. Presley". Noteer ook alle initialen als u ze weet, bijvoorbeeld "Elvis A. Presley" in plaats van "Elvis Presley".

• Een persoon kan meerdere rollen vervullen, bijvoorbeeld zowel klant als leverancier tegelijk zijn; ga uit van de rol die de persoon de meeste tijd vervult.

2a. UW PARTNERS

We zouden graag willen weten wie u beschouwt als de meest belangrijke, Nederlandse partners met wie u samenwerkt of heeft samengewerkt de afgelopen 5 jaar. We definiëren ‘belangrijke partner’ als een persoon buiten uw bedrijf die een (kwalitatief) belangrijke invloed heeft/had op uw bedrijfsprestaties vanwege formele of informele gesprekken, ideeën uitwisseling en adviezen. Geef ook kort aan waaruit de invloed bestaat.

<table>
<thead>
<tr>
<th>Naam</th>
<th>Email/Organisatie</th>
<th>Rol partner: Klant, leverancier, adviseur, collega ander bedrijf, onderzoeker…</th>
<th>Soort invloed: Innovatie/kennis, marketing, organisatie, financiën, …</th>
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</table>

Dit is het einde van de vragenlijst!

Geef a.u.b. uw interesse aan:
Ik wil graag het artikel ontvangen?
Ja / Nee (Streep a.u.b. door/verwijder wat niet van toepassing is.)

Ik wil graag een korte analyse van mijn positie in het netwerk ontvangen?
Ja / Nee (Streep a.u.b. door/verwijder wat niet van toepassing is.)

Sla a.u.b. het bestand op en stuur een e-mail met het bestand als bijlage naar:
y.kirkels@fontys.nl.

HARTELIJK BEDANKT voor uw medewerking!
Ton Schurgers en Yvonne Kirkels
Appendix B Measures to detect brokers

A broker adds value by brokering connections between the clusters and creates opportunities to improve, heterogeneous, information flows. Consequently a broker must be a person that has connections that others do not have and connections which provide the actor with non-redundant information. Two signs of redundancy are cohesion and equivalence. Contacts that are strongly joined to one another are more likely to have redundant (homogeneous) information as are contacts that are positioned similarly in structure (Burt, in Lin et al., 2001). The literature has come up with specific measures of brokerage: network constraint and betweenness centrality. Network constraint measures the extent to which a person’s network time and energy is concentrated in one contact. A high constraint index score means that such a person’s network contains few structural holes and thus faces limited brokerage opportunities (Burt, 1992). A person’s network constraint score is based on three ways that networks can be closed to brokerage: too few contacts (size), contacts too interconnected (density) or contacts too strongly connected indirectly through a central person (hierarchy) (Burt, 2005). The constraint measure is part of the structural hole computation which is composed of effective size, efficiency, constraint and hierarchy (for extended discussion, see Burt, 1992). Network constraint is closely related to effective size, which measures the number of non-redundant contacts in a network. Borgatti (1997) showed that this redundancy measure, in turn, is highly correlated with degree centrality which measures the amount of direct ties a focal organization has relative to others in the network. The latter is reason not to use network constraint in this paper. We are not looking for organizations which are in the thick of things.

Betweenness centrality measures the extent to which a person brokers indirect connections between all other people in a network. In network terminology, it

19 A reason for the high correlation can be that Burt was looking for a measure of network diversity when the basic measure of such diversity is simply the number of direct ties in a network; the degree centrality.
calculates the centrality of actors based on the frequency in which they are positioned between others on the shortest geodesic path. Central actors are in a position to control information flows (Wasserman and Faust, 1994). It is one of the most successful measures of centrality (Everett and Borgatti, 2005). However fulfilling a central position within the network does not provide information about a person’s behavior. Although a person is positioned at the crossroads of a network, the way the actor bridges gaps will depend on its own background and with whom the actor has a relationship.
### Appendix C: Howells (2006) typology of intermediation in the innovation process

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Foresight and diagnostics</strong>&lt;br&gt;(a) Technology foresight and forecasting</td>
<td>Foresight, forecasting and technology roadmapping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Articulation of needs and requirements</td>
<td></td>
</tr>
<tr>
<td>2. <strong>Scanning and information processing</strong>&lt;br&gt;(a) Scanning and technology intelligence</td>
<td>Information scanning and technology intelligence</td>
<td>Information gathering and identification of potential collaborative partners</td>
</tr>
<tr>
<td></td>
<td>(b) Scoping and filtering</td>
<td>Selection and clearing function</td>
</tr>
<tr>
<td>3. <strong>Knowledge processing, generation and combination</strong>&lt;br&gt;(a) Combinatorial</td>
<td>Helping to combine knowledge of two or more partners</td>
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<tr>
<td></td>
<td>(b) Generation and recombination</td>
<td>As (a) above, but also generating in-house research and technical knowledge to combine with partner knowledge</td>
</tr>
<tr>
<td>4. <strong>Gatekeeping and brokering</strong>&lt;br&gt;(a) Matchmaking and brokering</td>
<td>Negotiation and deal making</td>
<td>Facilitating contract negotiation once partner(s) selected</td>
</tr>
<tr>
<td></td>
<td>(b) Contractual advice</td>
<td>Finalizing the contract</td>
</tr>
<tr>
<td>5. <strong>Testing, validation and training</strong>&lt;br&gt;(a) Testing, diagnostics, analysis and inspection&lt;br&gt;(b) Prototyping and pilot facilities</td>
<td>Test chambers and laboratories</td>
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<td></td>
<td>(c) Scale-up</td>
<td>Including manufacturing modeling to overcome bottlenecks</td>
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<tr>
<td></td>
<td>(d) Validation</td>
<td>Validation of analytic methods</td>
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<td></td>
<td>(e) Training</td>
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<tr>
<td>6. <strong>Accreditation and standards</strong>&lt;br&gt;(a)</td>
<td>Specification setter or providing standards advice</td>
<td>Includes developing reference designs</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>Formal standards setting and verification</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>Voluntary and de facto standards setter</td>
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<tr>
<td>7. <strong>Regulation and arbitration</strong>&lt;br&gt;(a) Regulation</td>
<td>Formal regulation</td>
<td>Quasi-formal basis as an agency involved in self-regulation</td>
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<tr>
<td></td>
<td>(b) Self-regulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) Informal regulation and arbitration</td>
<td></td>
</tr>
<tr>
<td>8. <strong>Intellectual property: protecting the results</strong>&lt;br&gt;(a) Intellectual property advice&lt;br&gt;(b) IP rights advice&lt;br&gt;(c) IP management for clients</td>
<td>Protecting the outcomes of collaboration</td>
<td>Help clients assess their ideas for IP protection</td>
</tr>
<tr>
<td>9. <strong>Commercialization: exploiting the outcomes</strong>&lt;br&gt;(a) Marketing, support and planning</td>
<td>Market research and business planning</td>
<td>Identify market opportunities and develop business plans</td>
</tr>
<tr>
<td></td>
<td>(b) Sales network and selling</td>
<td>Support in the selling and commercialization process</td>
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<tr>
<td></td>
<td>(c) Finding potential capital funding and organizing funding or offerings</td>
<td>Early stage capital</td>
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<td></td>
<td>(d)</td>
<td>Venture capital</td>
</tr>
<tr>
<td></td>
<td>(e)</td>
<td>Initial Public Offering</td>
</tr>
<tr>
<td>10. <strong>Assessment and evaluation</strong>&lt;br&gt;(a) Technology assessment</td>
<td>General assessment of performance and technologies (see 1)</td>
<td></td>
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<tr>
<td></td>
<td>(b) Technology evaluation</td>
<td>Specific evaluation of products and technologies once in the market (see 1)</td>
</tr>
</tbody>
</table>
Appendix D Semi-structured questionnaire

Vraag 1
Wat zijn uw belangrijkste werkzaamheden? / Beschrijf uw formele functie?

Vraag 2
Uit uw verhaal blijkt dat ......
Ik heb hier tien omschrijvingen van brokerfuncties (10 kaartjes). Kunt u de kaartjes selecteren die betrekking hebben op uw werkzaamheden. (Plaatje laten zien en opmerkingen opschrijven / bespreken).

Geeft u a.u.b. ook de volgorde van belangrijkheid aan, indien mogelijk.

Vraag 3
Heeft u veel contacten met mensen uit de profit, non-profit of science sectoren? Ik heb hier een plaatje van 5 type brokerrollen. (Plaatje laten zien en uitleggen). Vervult u de brokerfunctie(s) tussen personen in uw eigen sector en/of tussen personen in andere sectoren?

Vraag 4
Broker Strategies:
Als u als broker fungeert wat is het dan uw uiteindelijke doel?

Vraag 4b
Wat zouden de redenen kunnen zijn dat u zoveel brokerage capacity heeft?
(Voorbeelden: vv werk zelf, op veel gebieden informatie, uw netwerk, jaren in de branche, opleiding, meerdere functies die u bekleed, .....)

Wat voor informatie bespreekt u?
Vraag 5
We weten nu wat voor functies u vervult, maar nog niet de manier waarop u uw brokerfunctie vervult (hoe u de brug bouwt). Ik geef u twee voorbeelden (Plaatje laten zien en uitleggen). Kunt u aangeven op welke manier u werkt en of dit aansluit bij de voorbeelden?

Vraag 7
Wat zijn andere werkzaamheden die in uw ogen van belang zijn om te noemen? (wat moet je als broker vooral NIET doen?)

Vraag 8
We hebben het tot nu toe gehad over u en uw werkzaamheden. Kunt u me wat meer vertellen over de doelen en activiteiten van uw organisatie?
Summary

Firms are increasingly facing their own limitations in today’s complex and demanding environment. The need for cooperation is evident in an environment characterized by uncertainty, complexity and rapid technological progress. Small and medium-sized enterprises in particular are faced by a dilemma. On the one hand SMEs feel the urge to cooperate with others in order to acquire knowledge and other competencies; on the other hand they often face difficulties in finding partners and often they lack the knowledge base to be able to absorb the required knowledge. This dilemma clearly points to a need for understanding their environment, and brokers in particular, in order to deal effectively with the complex environment. Brokers, or intermediaries, are regarded as people who connect disconnected parties and facilitate knowledge flows in the local innovation system. Since brokers are becoming more and more important the need arises to provide SMEs with insight into the role of brokers in the network. The main question of this dissertation is:

*Which factors contribute to the capacity of main brokers in a SME network?*

This dissertation investigates their network environment, their inter-firm relations and intrinsic characteristics that facilitate networking at an individual level. The focus of this study is on the SME network of design and high-tech companies in Southeast Netherland. The fields are relevant to the research since the activities of companies located in it involve complex knowledge processes which in turn benefit highly from optimal knowledge creation and exchange. Design is seen as increasingly important in
product development and there is an increase in efforts to establish co-operations between design and high-tech organizations. The design sector in particular is a dynamic but highly fragmented industry. However, high-tech organizations (i.e. original equipment manufacturers, first, second and third tier suppliers) in the region seem to be highly interdependent. By means of this study we aim to gain a better understanding of knowledge diffusion across these particular fields.

To study the network environment, inter-firm relations and intrinsic characteristics of brokers, we have conducted quantitative and qualitative research. A questionnaire is used to map the most important working relationships between people who are active in the fields of design and high-tech industries. Respondents were asked to mention the names and organizations of at most ten Dutch business partners who had had an important (qualitative) influence on their performance over the last five years. In order to take into account the full richness of relationships in the network the respondent had to identify who was important to them in what way. Everybody who was listed in the response also received an invitation to fill in the survey. Data collection took place in several waves. This snowball technique is developed to identify hidden members and relation patterns. Social network analysis is used to draw the actual network and to identify the brokers. The results in Chapter two and three are based on the main component of this network which includes 440 names and 584 relations mentioned by 93 respondents. Finally, in order to investigate what brokers actually do an empirical multiple case study is conducted. The information regarding the actual network across design and high-tech industries is used to select 12 brokers for semi-structured interviews. A qualitative comparative analysis of the results has provided a more general picture of how brokers span structural holes between various social groups.

**Question 1**

This dissertation seeks to answer five sub-questions underlying the main research question. The first of these questions addresses connectivity and efficiency of the SME
network across design and high-tech industries. These characteristics are likely to be different for networks of various industries. The growing importance of networks requires that SMEs thoroughly understand their characteristics, so they can use this knowledge to their own advantage. The first question of this research is:

1) **What are the structural network characteristics of the SME network, in particular at network and subgroup level?**

Chapter two investigates whether knowledge is transferred in an efficient way, if there are partnership concentrations and who is involved in co-operations. The concept of ‘small worlds’ is used to investigate knowledge diffusion in the network and consequently judge overall network efficiency. Proximity to others is important in order to manage complex processes. However entrepreneurs or SMEs do not have the resources to manage a large network although a few well positioned stakeholders can be dealt with. A small world consists of a relatively small number of intermediaries who are relative closely positioned to people in the environment and who probably have stable reputations and divers backgrounds. Knowing more about small worlds in this network is therefore highly interesting for science and valuable to the region. The actual network can be classified as one in which a small world is present. The short paths between people indicate the presence of efficient knowledge flows, the high clustering of efficient knowledge exploitation. Visualization of the results shows a single core group in the network, indicating that the two industries are not distinctly separated. It is found that individuals of the non-profit as well as science sector are overrepresented in the core of the field. Still, this part of the study describes the core-group of people only to a certain extent. Chapters three and four explore who has significant brokerage capacity and the concept of brokerage.
Question 2a and 2b

In order to investigate brokers they first have to be identified. The second question is:

2a) Can brokers be identified within the SME network?
2b) What types of brokers can be detected within the SME network

Chapter three highlights the personal networks of members across design and high-tech industries and investigates the brokerage roles they fulfill. The concept of brokerage roles perceives brokerage behavior as the facilitation of information flows whether or not a direct reward is involved. A person in a network can fulfill several roles depending on their interests. The study of brokerage roles enables to identification of who has significant brokerage capacity in the network, and also enables description of what types of brokers are observed. Our empirical results show that there are persons with significant brokerage capacity in the actual network. Furthermore significant values with regard to gatekeepers, representatives and liaison roles are found.

Question 3

In addition to identifying main brokers, Chapter three investigates whether specific characteristics are associated with these brokers. Studying characteristics provides clear insights into how third parties contribute to the transfer and development of knowledge. Question three is:

3) What are characteristics of brokers in the SME network?

Whether or not people emerge as brokers seems to depend on their characteristics and the context in which they work. Chapter three highlights the following characteristics: individual’s affiliation, kind of partners and kind of information exchanged in the network, with controls for gender, education and years in branch as sources of brokerage capacity influence. Empirical results show that people with high brokerage
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capacity are found in the nonprofit and science sector and have a long track record in their branch. Furthermore a wide variety of information is discussed with brokers; practical support in the form of valuable contacts and innovation-related information, but also finance, marketing and operational information.

**Question 4**
The last part of the study complements the research regarding characteristics of brokers by taking an in-depth look at what brokers actually do. This leads to the fourth question of this study:

4. *How is brokerage enacted in the SME network?*

How brokers actually seize network opportunities can be investigated by studying their strategic goals, strategic actions and strategic behavior. Empirical results in Chapter four show that specific strategic goals, activities and behavior can indeed be associated with having high brokerage capacity. The main brokers have a tertius iungens orientation; they strive to interconnect others. It is not in their interest to keep parties, passively or actively, separated for their own personal benefit. They seem not to neglect their personal aims in favor of others. It is just that more can be accomplished together. Furthermore, brokers are mainly involved in knowledge exploring activities, i.e. articulation of needs and requirements, information gathering, connecting partners, setting up projects in order to generate and combine information, and facilitating contract negotiations. Finally, brokers work according to the logic of effectuation. They prefer to focus on current means and they transform these means into co-created goals with others. They consider it less important to focus on setting clear goals in advance and carefully plan and execute their bridging actions to accomplish these goals. At a detailed level, there are differences among main brokers regarding (the combination of) strategic goals, activities and behavior. This indicates that the main brokers between themselves have different emphases.
The answering of the various sub-questions enables us to draw a more detailed picture of how brokers span structural holes. People with the highest brokerage capacity are found in the non-profit and science sector. However, the resemblance between these brokers and others is high in general. Brokers discuss a variety of information with others and they have a long track record in their branch. Brokers in general focus on the same strategic goals, activities and behavior. The results indicate that the brokers operate as architects and lead operators of the network. Brokers in this field are less involved in care-taking activities; maintaining and enhancing the existing network. In Chapter 4 it is shown that the sector, especially the job context, influences strategy preferences only at sub-level.

**Theoretical implications**

The study is important from an academic perspective because it addresses the voids in research about brokers at the individual level who (consciously) position themselves between heterogeneous actors in networks; people who differ in industry backgrounds and skills. Our results are based on a network of both formal (business) as well as informal (personal) oriented relations at the individual level, while most relationships in the existing literature are based on formal relationships only and usually studied at firm level. The study in general provides more insights into the concept of brokerage regarding SME networks in different fields. In particular it highlights how third parties in general contribute to the transfer and development of knowledge.

Chapter two contributes to empirical research concerning structural aspects of a network as a whole and in particular on network structures that span sectors by taking an intersectoral approach. Furthermore network theory regarding small worlds is enhanced because our insights contribute to the still infant field that studies the efficiency of partnerships in SME networks. Chapter three generates knowledge regarding brokers in general. The main contribution of this part of the study is, in contrast to most other work than our own, that it is quantitative and that it focuses on
brokers identified in an actual network (based on both suppliers and users of the knowledge infrastructure). The research contributes to social network theory by taking a look at empirical data in order to generate a better understanding of the specific brokerage concepts first. One can argue that a grounded theory perspective is taken by trying to show how people handle information problems. Chapter four addresses the lack of empirical research regarding the range of brokers and their practices in detail. Chapter four enhances the understanding of social network theory by integrating theories based on the fields of innovation and entrepreneurship regarding brokerage. To be able to develop an individual-level understanding of brokers network theory must be combined with insights from other theories to provide insights into important aspects of brokerage. Cross theory studies create a more holistic view regarding brokerage at the individual level. Such research was not undertaken before. In addition, highlighting individual strategic dimensions separately as well as in combination will also contribute to an extended picture of how intermediaries contribute to the transfer and development of knowledge. By empirically highlighting brokerage in general, brokers of the actual network can be compared to others in other industry networks and thus can be valued.

In general, the research contributes to theory on mediation processes, alliances, social capital, network dynamics, SMEs and innovation.

**Practical Implications**

The study contributes to the efficiency of knowledge creation and exchange in dynamic industries, especially across sectors. It contributes to the design and high-tech industries in particular. The research is the first attempt to actually construct the design and high-tech network in a social network way. No such data was available before in the Netherlands. Chapter two shows that increased efforts of various parties to establish co-operations between the two industries seem to work. The triple helix between companies, governmental institutions and science organizations is well present in this
network. In policy terms these are interesting findings. Despite the positive results, policy makers may reflect on these findings in terms of improving their interventions in the economic structure of the region even more. Results of Chapter two and three imply that SMEs should get involved in projects in the non-profit or science sector. Chapter three also shows that SMEs or even non-profit organizations whose brokerage capacity is not in line with their ambitions should invest in connections with branch experienced people with a broad knowledge base. From a non-profit consultant point of view these findings are also interesting. They often have difficulties in proving their successes. Sometimes merely mentioning contact information leads to a successful match. Sometimes brokerage takes much time and effort and still the involved parties are dissatisfied. Moreover the effectiveness of non-profit organizations, like branch associations, is subject to discussion in the Netherlands. This research shows that the intervention of non-profit consultants (eventually) is of value to companies.

Traditional supply-side innovation policies seem to be insufficient to meet the challenges posed in promoting competitiveness. At the European Union level interest is focused on public procurement as a means to spur innovation. Measurement at individual level gives a profound picture of actual contributions of government expenditures. It is now possible to review policy from the bottom up.

Chapter four shows that brokers are involved in exploration of opportunities together with others, but generally are not involved in exploitation of opportunities; the building of efficient business systems for full-scale operations. The focus on exploration of information indicates that the time spend on brokerage is important, but the results are not predictable. The non-profit and science sector should be aware that the efficiency of this work is not predictable and should take this awareness into account when timetables are being made. The profit sector should be aware that investments without secure profit are necessary. Brokerage is labor with delayed profits; at the moment of investment it is still unclear if payment will be possible and who will pay in the end. The
results also imply that co-developing and coordinating projects concerned with commercialization of exploration outcomes over time, may be interesting to stimulate in this field. Furthermore since participants of the non-profit and science sector cannot operate in the competitive field, the research findings imply that an important role can be fulfilled by people in the profit sector. SMEs can strengthen their broker capacity by leaping in on projects related to the commercialization of outcomes.
Samenvatting

Bedrijven worden steeds meer met hun eigen beperkingen geconfronteerd in de complexe en veeleisende omgeving van vandaag. De noodzaak van samenwerking is evident in een omgeving die gekenmerkt wordt door onzekerheid, complexiteit en snelle technologische vooruitgang. Midden en klein bedrijven (MKB) worden in het bijzonder geconfronteerd met een dilemma. Aan de ene kant voelt het MKB de noodzaak samen te werken met anderen om kennis en andere competenties te verwerven, aan de andere kant ondervinden ze vaak moeilijkheden bij het vinden van partners en hebben ze vaak onvoldoende kennis in huis om vereiste kennis te kunnen absorberen. Dit dilemma wijst duidelijk op een behoefte aan inzicht in hun omgeving, en intermediairs in het bijzonder, om effectief om te gaan met de complexe omgeving. Intermediairs worden gezien als personen die partijen verbinden welke nog niet met elkaar verbonden zijn en die informatiestromen faciliteren in het lokale innovatiesysteem. Aangezien intermediairs steeds belangrijker worden is het belangrijk om het MKB inzicht te verschaffen in de rol van intermediairs in een netwerk. De centrale vraag van dit proefschrift is:

*Welke factoren dragen bij aan de capaciteit van belangrijke intermediairs in een MKB netwerk?*

Dit proefschrift onderzoekt de netwerkomgeving van intermediairs, hun inter-organisatorische relaties en hun intrinsieke karakteristieken welke netwerken op individueel niveau bevordert. De focus van deze studie is op het MKB netwerk tussen design en high-tech industrieën in Zuidoost Nederland. Deze industrieën zijn relevant
voor het onderzoek, aangezien de activiteiten van bedrijven in deze industrieën betrekking hebben op complexe kennisprocessen die op hun beurt sterk profiteren van een optimale kennisontwikkeling en -uitwisseling. Design wordt als steeds belangrijker gezien in productontwikkeling en er is een toename van inspanningen om samenwerkingsverbanden tot stand te brengen tussen design en high-tech organisaties. De design sector in het bijzonder is een dynamische, maar zeer gefragmenteerde sector. Echter, high-tech organisaties (d.w.z. original equipment manufacturers, eerste-, tweede- en derdelijns leveranciers) in de regio lijken sterk van elkaar afhankelijk. Met deze studie willen we een beter begrip krijgen van kennis diffusie tussen deze industrieën.

Kwantitatief en kwalitatief onderzoek is uitgevoerd om de netwerkomgeving, inter-organisatorische relaties en de intrinsieke kenmerken van de intermediairs te bestuderen. Een vragenlijst is gebruikt om de belangrijkste werkrelaties in kaart te brengen tussen mensen die actief zijn op het gebied van design en high-tech industrieën. De respondenten werden gevraagd om de namen en organisaties van ten hoogste tien Nederlandse business partners te noemen die een belangrijke (kwalitatieve) invloed op hun prestaties hebben gehad in de afgelopen vijf jaar. Iedereen die genoemd werd in het antwoordformulier ontving ook een uitnodiging voor het invullen van de enquête. Dataverzameling vond plaats in verschillende golven. Deze ‘sneeuwbal’ techniek is ontwikkeld om verborgen netwerkleden en relatiepatronen te identificeren. Sociale netwerk analyse is gebruikt om het feitelijke netwerk in de praktijk te tekenen en om de intermediairs erin te identificeren. De resultaten in hoofdstuk twee en drie zijn gebaseerd op de belangrijkste component van dit netwerk welke 440 namen en 584 relaties omvat genoemd door 93 respondenten. Ten slotte, om te onderzoeken wat intermediairs in de praktijk feitelijk doen is een empirische meervoudige case studie uitgevoerd. De informatie over het feitelijke netwerk in de design en high-tech industrieën is gebruikt om 12 intermediairs te selecteren voor semi-gestructureerde interviews. Een kwalitatieve vergelijkende analyse van de resultaten heeft een meer
algemeen beeld gecreëerd van hoe intermediairs structurele gaten tussen verschillende sociale groepen in het netwerk overbruggen.

**Vraag 1**

Dit proefschrift tracht vijf deelvraag te beantwoorden die ten grondslag liggen aan de centrale onderzoeksvraag. De eerste van deze vragen heeft betrekking op connectiviteit en efficiëntie van het MKB netwerk tussen design en high-tech industrieën. Deze kenmerken zijn waarschijnlijk verschillend voor netwerken van verschillende industrieën. Het toenemende belang van netwerken vereist dat het MKB goed de kenmerken ervan begrijpt, zodat ze deze kennis kunnen gebruiken in hun eigen voordeel. De eerste vraag van dit onderzoek is:

1) *Wat zijn de structurele netwerk kenmerken van het MKB netwerk, met name op netwerk en subgroep niveau?*

Hoofdstuk twee onderzocht of de kennis in het netwerk wordt overgedragen op een efficiënte manier, of er partnerschapconcentraties zijn en wie betrokken is in co-operaties. Het concept van 'small worlds' wordt gebruikt om verspreiding van kennis in het netwerk te onderzoeken en netwerkefficiëntie te beoordelen. Nabijheid is belangrijk om complexe processen te managen. Maar ondernemers of MKB'ers beschikken niet over de middelen om een groot netwerk te beheren. Wel kunnen relaties onderhouden worden met een paar goed gepositioneerd betrokkenen. Een small world bestaat uit een relatief klein aantal tussenpersonen die relatief dicht bij mensen in de omgeving staan en die waarschijnlijk een stabiele reputatie hebben en diverse achtergronden. Meer weten over small worlds in dit netwerk is dan ook zeer interessant voor de wetenschap en waardevol voor de regio. Het feitelijke netwerk kan worden aangemerkt als een netwerk waarin een small world aanwezig is. De korte paden tussen personen duidt op de aanwezigheid van efficiënte kennisstromen, de hoge clustering van personen duidt op een efficiënte exploitatie van kennis. Visualisatie van de resultaten
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toont één kerngroep in het netwerk. Dit betekent dat de twee industrieën niet significant zijn gescheiden. Het is gebleken dat zowel individuen uit de non-profit als de wetenschapssector zijn oververtegenwoordigd in de kern van het veld. Toch beschrijft dit onderdeel van de studie de kerngroep van mensen slechts tot op zekere hoogte. Hoofdstukken drie en vier onderzoeken wie aanzienlijke bemiddelingscapaciteit heeft en het concept intermediairs zelf.

**Vraag 2a en 2b**
Om intermediairs te onderzoeken moeten ze eerst worden geïdentificeerd. De tweede vraag is:

2a) *Kunnen intermediairs worden geïdentificeerd in het MKB netwerk?*
2b) *Welke intermediair types kunnen worden geïdentificeerd in het MKB netwerk?*

Hoofdstuk drie belicht de persoonlijke netwerken van netwerkleden en onderzoekt de intermediairrollen die ze vervullen. Het begrip rollen van intermediairs ziet gedrag als het faciliteren van informatiestromen waarbij al dan niet een directe beloning is betrokken. Een persoon in een netwerk kan afhankelijk van zijn belangen verschillende rollen vervullen. De studie van intermediairrollen stelt in staat te bepalen wie er significante bemiddelingscapaciteit heeft in het netwerk en ook te beschrijven wat voor type intermediairs er in het netwerk zijn. Onze empirische resultaten tonen aan dat er mensen in het feitelijke netwerk zijn met significante bemiddelingscapaciteit. Bovendien zijn significante waarden met betrekking tot ‘gatekeepers, representatives en liaison’ rollen gevonden.

**Vraag 3**
Naast de identificatie van de belangrijkste intermediairs, wordt in hoofdstuk drie onderzocht of specifieke kenmerken in verband kunnen worden gebracht met deze
intermediairs. Het bestuderen van kenmerken geeft duidelijke inzichten in hoe derden bijdragen aan de overdracht en ontwikkeling van kennis. Vraag drie is:

3) Wat zijn kenmerken van intermediairs in het MKB netwerk?

Of mensen wel of niet intermediairs zijn lijkt af te hangen van hun kenmerken en de context waarin ze werken. Hoofdstuk drie belicht de volgende kenmerken: de individuele achtergrond, de soort partners en de aard van de uitgewisselde informatie in het netwerk, met controles voor geslacht, opleiding en jaren in de branche als bronnen van invloed op bemiddelingscapaciteit. Empirische resultaten laten zien dat mensen met een hoge capaciteit worden gevonden in de non-profit en de wetenschapssector en vaak meer dan 20 jaar werken in hun branche. Verder wordt er een grote verscheidenheid aan informatie besproken met de intermediairs; praktische ondersteuning in de vorm van waardevolle contacten en innovatie gerelateerde informatie, maar ook financiën, marketing en operationele informatie.

Vraag 4

Het laatste gedeelte van de studie vormt een aanvulling op het onderzoek betreffende de kenmerken van de intermediairs door diepgaand te onderzoeken wat intermediairs daadwerkelijk doen. Dit leidt tot de vierde vraag van deze studie:

4. Hoe wordt bemiddeling uitgevoerd in het MKB netwerk?

Hoe intermediairs daadwerkelijk kansen grijpen in het netwerk kan worden onderzocht door het bestuderen van hun strategische doelen, strategische acties en strategisch gedrag. Empirische resultaten in hoofdstuk vier tonen aan dat specifieke strategische doelstellingen, activiteiten en gedrag inderdaad geassocieerd kunnen worden met een hoge bemiddelingscapaciteit. De belangrijkste intermediairs hebben een tertius iungens oriëntatie; ze streven ernaar anderen te verbinden en daarbij is het is niet in hun belang
partijen, passief of actief, gescheiden te houden voor eigen persoonlijk voordeel. Dit betekent niet dat ze hun persoonlijke doelen verwaarlozen ten gunste van anderen. Samen kan er gewoonweg meer verwezenlijkt kan worden. Verder zijn intermediairs vooral bezig met kennisexploratie activiteiten, d.w.z. articulatie van behoeften en eisen, informatieverzameling, partijen verbinden, het opzetten van projecten om informatie te genereren en te combineren, en het faciliteren van contractonderhandelingen. Ten slotte werken intermediairs volgens de ‘logic of effectuation’. Zij geven er de voorkeur aan zich te richten op aanwezige middelen en ze transformeren deze middelen met anderen in gemeenschappelijke doelen. Zij vinden het dus minder belangrijk zich te richten op het stellen van duidelijke doelen vooraf en het zorgvuldig plannen en uitvoeren van acties om deze doelen te bereiken. Op een gedetailleerd niveau zijn er verschillen tussen de belangrijkste intermediairs met betrekking tot (de combinatie van) de strategische doelstellingen, activiteiten en gedrag. Het geeft aan dat de belangrijkste intermediairs onderling toch verschillende accenten leggen.

De beantwoording van de verschillende deelvragen stelt ons in staat om een meer gedetailleerd beeld van hoe intermediairs structurele gaten in netwerken overbruggen. Mensen met de hoogste bemiddelingscapaciteit komen uit de non-profit en de wetenschapssector. Echter, in het algemeen is de gelijkenis tussen deze intermediairs en anderen hoog. Brokers bespreken een verscheidenheid van informatie met anderen en ze zijn lang werkzaam in hun branche. Intermediairs richten zich in het algemeen op dezelfde strategische doelstellingen, activiteiten en gedrag. De resultaten geven aan dat de intermediairs actief zijn als architecten en lead operator van het netwerk. Intermediairs op dit gebied zijn minder betrokken bij activiteiten t.b.v. het behoud en de versterking van het bestaande netwerk. In hoofdstuk 4 wordt aangetoond dat de sector, vooral de job context, uitsluitend op subniveau invloed heeft op strategievoorkeuren.
Theoretische implicaties

De studie is vanuit een academisch perspectief belangrijk omdat het zich richt op het onderbelichte onderzoek over intermediairs op het individuele niveau, die zich (bewust) tussen heterogene actoren positioneren in netwerken; mensen die verschillen in industrieachtergrond en vaardigheden. Onze resultaten zijn gebaseerd op een netwerk van zowel formele (zakelijke) als informele (persoonlijke) relaties gericht op het individuele niveau, terwijl de meeste relaties in de bestaande literatuur zijn gebaseerd op formele relaties en meestal alleen zijn onderzocht op bedrijfsovereenkomst. De studie geeft in het algemeen meer inzicht in het begrip van intermediairs ten aanzien van MKB netwerken in verschillende sectoren. In het bijzonder wordt belicht hoe derden in het algemeen bijdragen aan de overdracht en ontwikkeling van kennis.

Hoofdstuk twee draagt bij aan empirisch onderzoek inzake structurele aspecten van een netwerk en in het bijzonder op netwerkstructuren die sectoren overspannen door het nemen van een intersectorale aanpak. Bovendien wordt netwerktheorie m.b.v. small worlds verbeterd omdat onze inzichten bijdragen aan het nog jonge onderzoeksgebied dat de efficiëntie van partnerschappen in MKB netwerken bestudeert. Hoofdstuk drie genereert kennis over intermediairs in het algemeen. De belangrijkste bijdrage van dit deel van de studie is, in tegenstelling tot de meeste andere werken dan onze eigen, dat het kwantitatief is en dat het zich richt op intermediairs in een feitelijk netwerk (van zowel leveranciers als gebruikers van de kennisinfrastructuur). Het onderzoek draagt bij aan sociale netwerktheorie door te kijken naar empirische gegevens om zo eerst een beter begrip van de specifieke concepten betreffende intermediairs te genereren. Men kan stellen dat een 'grounded theorie' perspectief is genomen door te proberen te laten zien hoe mensen omgaan met informatieproblemen. Hoofdstuk vier heeft als basis het gebrek aan empirisch onderzoek m.b.t. ranges van intermediairs en hun praktijken in detail. In hoofdstuk vier wordt inzicht in de sociale netwerktheorie vergroot door het integreren van theorieën op het gebied van innovatie en ondernemerschap die betrekking hebben op intermediairs. Om op individueel niveau een meer holistische
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visie m.b.t. intermediairs te ontwikkelen, moet netwerktheorie gecombineerd worden met inzichten uit andere theorieën. Dergelijk ‘cross theory’ onderzoek was nog niet eerder uitgevoerd. Daarnaast draagt het benadrukken van de individuele strategische dimensies zowel afzonderlijk als in combinatie ook bij aan een meer uitgebreid beeld van hoe intermediairs werken aan de overdracht en ontwikkeling van kennis. Door intermediairs in het algemeen empirisch te belichten, kunnen intermediairs in dit netwerk worden vergeleken met anderen in andere netwerken en kunnen dus worden gewaardeerd.

Het onderzoek draagt in het algemeen bij aan theorie omtrent bemiddelingsprocessen, allianties, sociaal kapitaal, netwerk dynamica, MKB en innovatie.

Praktische implicaties

De studie draagt bij tot de efficiëntie van kenniscreatie en -uitwisseling in dynamische sectoren, met name tussen sectoren. Het draagt bij aan de design en de high-tech industrie in het bijzonder. Het onderzoek is een eerste poging om het sociale netwerk tussen design en high-tech industrieën daadwerkelijk te construeren. Dergelijke gegevens waren voorheen niet beschikbaar in Nederland. In hoofdstuk twee blijkt dat de inspanningsverhoging van verschillende partijen om samenwerkingsverbanden te creëren tussen de twee industrieën lijkt te werken. De triple helix tussen bedrijven, overheidsinstellingen en wetenschappelijke organisaties is duidelijk aanwezig in dit netwerk. Op politiek vlak zijn dit interessante bevindingen. Ondanks de positieve resultaten, kunnen de beleidsmakers verder nadenken hoe hun interventies in de economische structuur van de regio nog meer verbeterd kunnen worden. De resultaten van hoofdstuk twee en drie impliceren dat MKB'ers betrokken moeten raken bij projecten in de non-profit of de wetenschapssector. Hoofdstuk drie toont daarnaast aan dat het MKB, of zelfs non-profit organisaties waarvan de bemiddelingscapaciteit niet in overeenstemming is met hun ambities, moeten investeren in relaties met branche-ervaren mensen met een brede kennisbasis. Vanuit een non-profit consultant oogpunt
zijn deze bevindingen ook interessant. Zij kunnen vaak moeilijk hun successen bewijzen. Soms leidt alleen maar het noemen van contactinformatie tot een succesvolle match. Soms kost bemiddeling veel tijd en moeite en nog steeds zijn de betrokken partijen ontevreden. Bovendien is de effectiviteit van de non-profit organisaties, zoals brancheverenigingen, onderwerp van discussie in Nederland. Dit onderzoek laat zien dat het optreden van non-profit consultants (uiteindelijk) van waarde is voor bedrijven.

Het traditionele, op aanbodzijde gericht innovatiebeleid lijkt onvoldoende te anticiperen op uitdagingen ter bevordering van het concurrentievermogen. In de Europese Unie gaat aandacht uit naar openbare aanbestedingen als middel om innovatie te stimuleren. Meting op individueel niveau geeft een grondig beeld van de feitelijke bijdragen van de overheidsuitgaven. Het is nu mogelijk om beleid te herzien van onderuit.

In hoofdstuk vier blijkt dat intermediairs samen met anderen betrokken zijn bij de exploratie van kansen, maar over het algemeen niet betrokken zijn bij de exploitatie van kansen; het bouwen van efficiënte bedrijfssystemen voor full-scale operaties. De nadruk op de exploratie van informatie geeft aan dat de tijd gespendeerd aan bemiddeling belangrijk is, maar ook dat de resultaten niet voorspelbaar zijn. De non-profit en de wetenschapssector moeten zich ervan bewust zijn dat de efficiëntie van dit werk niet voorspelbaar is en moeten met dit bewustzijn rekening houden wanneer tijdschema's worden gemaakt. De profit sector moet zich ervan bewust zijn dat investeringen zonder zekere winst noodzakelijk zijn. Bemiddeling is arbeid met vertraagde winsten; op het moment van investering is het nog onduidelijk wanneer betaling mogelijk zal zijn en wie aan het einde van het traject zal gaan betalen. De resultaten implyceren ook dat co-ontwikkeling en coördinatie van projecten m.b.t. commercialisering van exploratieresultaten, interessant kunnen zijn om te stimuleren in dit gebied. Bovendien, aangezien personen van de non-profit en de wetenschapssector zich niet kunnen bewegen in het competitieve veld, implexeren de onderzoeksresultaten dat een belangrijke rol vervuld kan worden door personen in de profit sector. MKB’ers kunnen
hun bemiddeling capaciteit versterken door aan te haken bij projecten die bijdragen aan het commercialiseren van exploratieresultaten.
About the author

Yvonne Kirkels is born on January the 5th, 1975 in Weert. In 1993 she graduated from secondary school Philips van Horne Scholengemeenschap in Weert. In the same year she started her study International Business Studies at Maastricht University at the faculty of Economics and Business Administration. During her study she participated in a study abroad programme at the John Moores University in Liverpool. She furthermore conducted a work assignment at Janssen Pharmaceutica N.V. in Belgium as well as a research study for her final thesis on “The influence of interpersonal communication on innovative learning”. She graduated in 1998 in the field of International Innovation Management.

Yvonne worked several years in the fields of organization, marketing and sales before starting her PhD project in September 2005. She started working as a PhD candidate at the Business Management SME group at the Department of Business Management and Engineering of Fontys Hogescholen and as a visiting PhD candidate at the Innovation, Technology, Entrepreneurship & Marketing group at the Department of Industrial Engineering & Innovation Sciences of Eindhoven University of Technology. Her dissertation research has resulted in “Brokerage in SME networks”. Yvonne has published an article based on chapter 3 in Research Policy. Besides her PhD project, Yvonne was involved in teaching and mentoring in the field of marketing, innovation and academic competences at the Business Management SME group at Fontys Hogescholen. She is currently working as a lecturer and researcher at the same organization. Her research interests include innovation management, social networks, alliances and technology entrepreneurship. Together with her husband Paul Neijnens and her son Max, who was born in the period of her work as PhD candidate in 2006, she lives in Weert.