Resource acquisition and relationships in new technology-based firms

Ph.D. Dissertation

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Abstract

This thesis explores resource acquisition in science and technology-based entrepreneurial firms. Success and failure of these firms have been found to be intimately related to their resources, and conversely the lack thereof, as well as to the relations by which access to external resources is granted. Two areas of relevance to resource acquisition are of particular concern to this thesis: the role of personal relations and board ties.

The thesis includes four appended studies, each dealing with aspects of the areas of interest. Study I and II apply a case-methodology to investigate the role of personal relations for resource acquisition in Swedish university spin-offs and corporate spin-offs respectively. Study III is a theoretical paper that, building on theory and the findings in study I and II, seeks to address the role of personal relations in NTBFs more generally. Study IV, finally, builds on a large sample of firms started in the Swedish ICT-sector between 1997 and 2003, and investigates the role of boards and direct board ties for resource acquisition in these firms.

The findings of these studies support indications in the previous literature that personal relations are very important for NTBFs in their struggle to attract resources in the early phases. The findings also contribute to the literature by pointing to the variety of uses of these relations by themselves and as a generative mechanism for other means of resource acquisition. As such the findings also suggest potentially long lasting effects of these personal relations on, for example, network development, the efficiency of the firms operations, the adaptability of these firms, and hence also on the growth of these firms. It is argued that the benefits and constraints of personal relations are particularly important in new technology-based firms where high uncertainties, and possibly unavailable product and factor markets, may deprive these firms of the option to form alliances for long periods of time. Finally, the findings of this thesis also contribute to the literature on boards and interlocking directories by assessing the hitherto largely unattended role of such ties in new firms. The results indicate that boards and board ties to firms are important for the growth of NTBFs, and it is argued that appointing appropriate board members may be important both as means to access knowledge directly, as well as to communicate with and access resources from firms within the same industry.

From the point of view of theory, the results call for more research on personal relations to better understand the growth and failure of entrepreneurial firms, and in particular NTBFs. From a policy perspective it is important to note that much knowledge transfer occurs on individual rather than on organizational levels. The effectiveness of current, centralized mechanisms could thus be increased if they were to be restructured according to a regime that is based on coordination and facilitation of relations among actors. Finally, for NTBFs, the cost to build and maintain relations to acquire resources, especially research, must be contrasted with the risks of becoming too dependent on any one relation. Also, while NTBFs may need to bootstrap activities, it is important to bootstrap the right activities and not to cut on, for example, investments in good and skilled people.

Preface

This thesis is based upon the following studies which will be referred to in the text by roman numerals.

I. **Johansson, M.**, Jacob, M. & Hellström, T. (2005). 'The Strength of Strong Ties' – University Spin-offs and the Significance of Historical Relations. *Journal of Technology Transfer*, 30(3): 271-286.

II. **Johansson, M.** (2007). Corporate Spin-offs and the Significance of Historical Relations. *Technology Analysis and Strategic Management*, 19(6): 789.

III. **Johansson, M.** (2007). Resource acquisition in new technology-based firms and the notion of embedded opportunities. Working Paper.

IV. **Johansson, M.**, Dahlander, L. & Wallin, M. (2007). The Role of Boards and Board Connections for the Performance of Entrepreneurial Firms. RIDE working paper series.

1. Introduction

This thesis aims to explore the role and interplay of resources and networks in science and technology-based entrepreneurial firms. The notions of resources and networks each serves as the basis for theoretical streams with fairly long traditions of research attached to them. Still, many aspects of both streams and their intersections remain under-researched and poorly understood, particularly in relation to entrepreneurial settings. The following introduction and introductory literature review will carve out some of these aspects that justify this thesis.

The empirical object for the thesis is entrepreneurial firms, the rationale for which is the widely acknowledged importance attributed to these firms as drivers of industrial dynamics and growth. This importance is neatly exemplified by the fact that of the firms listed on Fortune 500 in 2000, almost half did not even exist 15 years earlier (Sarasvathy, 2001). New firms thus continuously emerge, grow, and overtake or replace the businesses of incumbent firms, or even create entirely new markets. Still, the success of such firms is accompanied by the failure of numerous other firms. From the point of becoming an entrepreneur to the point of becoming a firm with potential to threaten large incumbents runs a process in which many new firms fail to grow and indeed fail to survive (Stinchcombe, 1965). This has spawned a wide interest from many disciplines to understand and explain the hurdles involved. The present research draws upon many of these earlier findings, but does so primarily within the framework of perspectives that focus on firm's resources and networks. The reason is simple enough; access to resources, and conversely the lack thereof, has been found to be intimately associated with the success and failure of entrepreneurial firms, indeed access to resources such as information are frequently cited as a cause for firm establishments in the first place (Kirzner, 1997). Relations, in turn, constitute one important means by which access to resources is granted but also adds complexity to the entrepreneurial process by providing a social context that has been found to influence the economic actions of firms (Uzzi, 1996; 1997).

Simple as that may sound both resources and relations can take on many forms that may be of differential benefits under different circumstances, something which open up a complex and multifaceted problem space. Prior research has addressed a variety of topics within this problem space. Examples of more theoretical contributions include work on what network

structures that are conducive to obtain information and knowledge, and the role of networks to generate trust (e.g. Granovetter, 1973; Coleman, 1990). The vast amount of empirical studies include the role of alliances in the growth of new firms, the importance of venture capital and relations to investors, the influence of networks on innovation, and the entrepreneur as a resource (e.g. Baum et al., 2000; Shane & Stuart, 2002; Roberts, 1991; Powell et al., 1996).

The resulting findings of these studies are indeed valuable for our understanding of the growth and success of entrepreneurial firms, and the present research draws heavily on them. But many of the studies limit themselves to certain areas of the problem space set up by resources and relations. A common theme running through many studies is, for example, a focus on relations that are formal, or contractual. In such studies of formal relations, however, the role of more personal or informal relations is at best only inferred. Yet, qualitative studies point to the importance of personal relations, especially in the initial phases of new ventures (Starr & MacMillan, 1990; Larson, 1992). A second theme in much literature is a focus on product markets instead of factor markets (Sørensen, 2004). As a result many studies focus more on the deployment than the acquisition of resources. Firms, however, cannot possibly enter a product market without having first entered a factor market, that is, before having acquired the resources necessary for production. A third and related problem is that many studies implicitly assume product markets to be more or less given. By consequence, many studies seem to assume that entrepreneurial firms can make strategic choices as to whether or not to pursue, for example, alliances. However, the inherent uncertainties of many new firms may deprive the entrepreneur of the inputs for that very choice to be made. Fourthly, the studies that do focus on resource acquisition in entrepreneurial firms mostly focus on the effects of these resources on the success rate of the firm rather than on how the resources are acquired (e.g. Shane & Stuart, 2002). Finally, many studies motivate the importance of external ties with a firm's resources, or rather lack of resources. But fewer studies acknowledge the relationship between these ties and resources, and the consequences of this relationship. It therefore appears that there are plentiful of areas that invite further inquiry.

The present thesis will attempt to address some of these areas. In particular, this thesis will address the issue of resource acquisition in science and technology-based entrepreneurial firms. Resources are of vital importance to new firms in order to grow and, indeed, survive. At the same time most firms start out with a very limited amount of resource endowments, and

this highlights the importance of resource acquisition to new firms. Still, most literature focus on new firms product markets rather than their factor markets, and this invites further inquiry into how entrepreneurial firms acquire resources. There are, however, many factors operating on the ability of new firms to acquire the resources necessary to pursue their business. As many of the resources required may be outside of the new firm, one such factor is the firm's or the founder's relations with external actors that can provide them with resources. Such relations are always associated with relational properties that define the nature of the resource exchange relationship. Prior literature, though, has mostly focused on relations with contractual properties to the neglect of, for example, more informal relations. Moreover, different resources may require different relational properties motivating further attention paid to how such relational properties vary with the resources required and the circumstances of the firm. The purpose of this thesis is thus to address the following questions:

- What are the key factors when entrepreneurial firms acquire resources in their initial phases?
- What is the role of different relations and factor resources in this resource acquisition, and what benefits and constraints do such relations and factor resources imply?
- What, specifically, is the role of mechanisms such as informal relations and board connections in this acquisition of resources?

These research questions have been addressed in four studies appended to this thesis. Studies I and II explores the different mechanisms of resource acquisition in new technology-based firms originating from university settings and corporate settings respectively. Based on altogether seven case studies, the studies identify a number of mechanisms used to acquire resources. Prior social networks play a significant role in enabling many of these mechanisms, while at the same time also constraining the options and substitutability of the sources to resource acquisition depending on the nature of the resources. This point to a number of implications further elaborated upon in study III, as well as in the discussion part of this thesis. Study IV, finally, investigates another resource acquisition mechanism, namely that of appointing to the board persons that may bring access to, for example, experience or legitimacy. The results from the Swedish ICT-sector indicate that positive effects from such

appointments can indeed occur. This suggests board connections as one important mechanism to go beyond the immediate social network of the founders to acquire resources in the early phases of firm development. Altogether, the studies provide a more informed vantage point from which suggestions can be made to theory as well as to understand and facilitate resource acquisition in new entrepreneurial firms and hence start-up growth.

2. Theoretical framework

The notion of the entrepreneur has a long history, dating back at least to Richard Cantillon in the 18th century for whom an entrepreneur was essentially a person who worked for uncertain wages. That is, a person who was a risk-bearer, and whose income consisted of profit rather than ground rent, pensions and wages (Hayek, 1985 [1931]). While this is also much the modern conception of the entrepreneur, the notion of the entrepreneur has since then assumed a grander stature becoming someone with the potential ability to redefine industrial structures (Schumpeter, 1968). To be sure, that role is not acknowledged in all streams of economic thought, but the fact remains that the entrepreneur has received increased attention in theory and policy alike. In policy this attention shows in the multitude of measures to stimulate entrepreneurship, not least recently in the direction of the university. The literature reflects this attention by an explosion of journals devoted to the field, and a divergence of research into different aspects of entrepreneurship.

The following review will focus on previous results and lines of theory that deals with resources and networks. The literature review will first treat these streams of literature more generally and then specifically apply them to the setting of entrepreneurial firms. Before that, however, it serves to clarify some of the different definitions of entrepreneurial firms used in literature.

2.1. The entrepreneurial firm

In literature relating to the phenomena of entrepreneurship there is an abundance of definitions and abbreviations for entrepreneurial firms. This thesis primarily focuses on what has been referred to as new technology based firms (NTBFs) (e.g. Storey & Tether, 1998). These are defined as firms that base their core business idea upon invention or technological innovation (Little, 1977). NTBFs thus denote firms that bring to market new products or services, or

which rely on new production processes, based on the deployment or development of new scientific knowledge or high technology. However, in line with prior literature some other abbreviations are also used depending on the origin of the NTBFs and the circumstances around that origin. Accordingly there are, for example, university spinoffs (USOs) if the origin is the university (Lockett et al., 2003); corporate spinoffs (CSOs) if the origin is an incumbent (Cooper, 1973); and hostile, sponsored, or competitive spin-offs depending on the circumstances surrounding the creation of the new firm (Parhankangas & Arenius, 2003). Many of the firms considered in this thesis are spin-offs in the sense that the founders have drawn directly on their previous employment experience and knowledge. Generally these firms can be subsumed under the overarching definition of NTBFs when based on new technological or scientific knowledge.

2.2. Resources and the firm

The interest in resources as a unit of economic analysis has a long tradition in economics. Traditional economics focused, for example, from early on on the analysis of resources such as land, capital and labour. In what evolved into traditional neo-classical theory, though, the firm in itself came to be viewed as essentially a theoretical construct defined by the cost and demand curve. As this tradition also came to dominate much of the economic analysis there was consequently less interest paid to the analysis of a firm's internal resources as a determinant of growth. While some earlier researchers did pay attention to firms' internal constraints to growth, it was Penrose that introduced resources in general as a more fundamental explanatory factor for firm growth (Penrose, 1959). Since its publication, the work of Penrose has come to be widely influential in many streams of management research. Most notable among these streams of research is what has come to be called the Resource-Based View (RBV) of the firm. The following review therefore draws heavily on Penrose and the RBV perspective to investigate how resources influence firm growth, and how the explanations provided apply to entrepreneurial settings.

2.2.1. Basic ideas in resource-based perspectives

The overall objective of perspectives that focus on firms' internal resources is often to explain either growth or competitive advantage precisely in terms of those resources. A basic

assumption in this analysis is that firm growth is constrained by increasing costs of growth, not decreasing returns to scale or depletion of a market niche as traditional economics once would have it (Penrose, 1959). Thus viewed it becomes important to analyze how and why a firm's resources, and coordination of resources, enable and constrain growth. The account of competitive advantage follows from adding the basic assumptions that firms differ in the extent to which they control resources and that such differences in resource endowments cause performance differences, provided that firms seek to increase their economic performance. From these assumptions, competitive advantage is then analyzed either in terms of how firms render different services from the resources in possession (Penrose, 1959), or in terms of how resources, or lack thereof, influence the implementation of strategies (Foss, 1997, 2005). Either way, the basic premises of the perspective suggest that an understanding of firms' resources becomes crucial in understanding firm growth and competitive advantage.

2.2.2. Distinctions

Resource-based perspectives typically differentiate between resources and capabilities. Resources are often defined very broadly and encompass virtually anything that could prove advantageous for a given firm to conceive of and implement strategies (Wernerfelt, 1984, Barney, 1986). An often imposed constraint, though, is that the resources, or stocks of factors, should be owned or controlled by the firm, or be tied 'semi-permanently' to the firm (Amit & Schoemaker, 1993; Wernerfelt, 1984). While the definition of resources is very broad, focus is often narrowed down on typical resources such as financial, physical, human, technological, market, reputational and organizational resources (e.g. Grant, 1991).

Capabilities generally refer to the knowledge, experience and skills in a firm (Richardson, 1971). The literature is, however, ripe with qualifications to this definition. Amit & Schoemaker (1993:35), for example refer to capabilities as "the capacity to deploy resources …, using organizational processes, to effect a desired end", while Prahalad and Hamel (1990:82) talk about "core competencies' referring to 'the collective learning of the organization, especially how to coordinate diverse production skills and integrate multiple streams of technology" (Foss, 1997). Other scholars instead talk about 'dynamic capabilities' and emphasize the ability to achieve new forms of competitive advantage (Teece et al., 1997). Capabilities can therefore refer to a range of organizational as well as individual skills. As

with resources, however, focus is typically narrowed down to skills such as managerial abilities, and the ability to change and learn (Penrose, 1959; Teece et al., 1997; Prahalad & Hamel, 1990).

Even though the distinction between resources and capabilities is not always clear-cut, the rationale to make the distinction is often to emphasize that different assets may contribute differently to firms growth and competitive advantage. Those who use concepts such as capabilities and competences normally assume that such assets are more likely to contribute to a firms' competitive advantage. Another rationale for the distinction is to capture the distinction between stock, for example, resources, and the services that may be derived from the resources (Foss, 1997). That is, to emphasize that the use of a resource is dependent on the capabilities of a firm in the same way as a pen can either be used to make a beautiful drawing, or merely to write with depending on the capabilities of the one who holds it.

2.2.3. Research on firm resources

Analyses based on resource perspectives commonly attempts to explain competitive advantage in product markets by analyzing firms' internal resources. While such an analysis primarily concerns the deployment of resources, parts of the analysis also concern the accumulation or acquisition of internal resources, which is relevant for the aim of this thesis.

As mentioned above, Penrose (1959) posited that growth comes with increasing costs and that it is resource constraints that predicate the size and growth of firms. Explaining growth consequently becomes much an issue of explaining what resources may constrain growth and how. A number of such possible resource constraints easily comes to mind; finance, cost of research, cost of marketing, a rare mineral necessary for production, and so on. While acknowledging such factors as important possible constraints, though, Penrose put particular emphasis on constraints that derived from lack of managerial capabilities. Efficient management, Penrose argues, is a principal key to achieve growth because the efficiency of operations in every firm critically depends on the effectiveness and efficiency with which decisions are made. However, effective managerial decisions build much on past experience with operations and on the ability to operate as a team. With growth, newcomers must therefore gain experience from within the firm in order to be able to operate efficiently there, and this imposes costs on the firm. Similarly, as the management team and the organization

learns more about its current operations, they need less effort to do the same tasks, and resources becomes unleashed that may be used to new productive opportunities. On this account then, a firm acquire, or rather accumulate, resources by becoming more immersed in its current operations (Penrose, 1959).

Much subsequent work in this vein has primarily focused on how and when firms' internal resources can yield comparatively higher rents than other firms. Often, such an analysis emphasizes specific characteristics of resources and capabilities as particularly amenable for extracting rents. Examples of such characteristics include a difficulty to imitate, rarity, intangibility, immobility, and complementarity (Collis and Montgomery, 1995; Grant, 1991, Foss, 1997, 2005; Teece, 1986). These characteristics also preclude them from being acquired in factor markets, which implies a need to accumulate them internally (Dierickx & Cole, 1989). However, more attention is often devoted to the strategic implications of these resources than the process by which they are actually acquired.

2.2.4. Entrepreneurship and resources

Although the resource-based perspective has primarily been applied to incumbent firms, much of the analysis is applicable also to entrepreneurial settings. A fairly consistent interest around resources and capabilities can also be discerned in state-of-the-art books on entrepreneurship edited by Sexton and colleagues (e.g. Sexton & Smilor, 1986, 1997; Sexton & Kasarda, 1992) as well as in proceedings from the Babson 'Frontiers of entrepreneurship research'-conference. Towards the end of the 1990s this interest furthermore seemed to consolidate around the resource-based view of the firm, at least in so far as strategic considerations were concerned (Landström, 2005). Apart from studies that explicitly draw on resource-based perspectives, there is a multitude of research that focus on resources that readily fit within such a framework. This is exemplified by the number of studies focusing on the entrepreneur, who can also be viewed as a much important resource to the new technology-based firm. The following exposition therefore also includes research that does explicitly bases its analysis on a resource-based perspective.

2.2.4.1. Resources in entrepreneurship research

Similarly to research on incumbent firms, entrepreneurship research that focuses on new firms' resources has been much concerned with the resources that may improve likelihood for survival and success.

The entrepreneur and the entrepreneurial team are probably the resources that have attracted the vast majority of interest in entrepreneurship research, forming a multidisciplinary field of research in itself. The reason is that it is often the entrepreneur who possesses much of the technical and managerial knowledge that make up the initial assets of the new firm. The importance of this also shows in a number of studies that have related features of entrepreneurs' and entrepreneurial teams' backgrounds with success of new firms (Eisenhardt & Shoonhoven, 1990; Roberts, 1991; Feldman & Romanelli, 2006). The explanations for these results often contend that relevant prior experience increases the likelihood to make better decisions, and to more accurately spot market and technological opportunities (Shane 2000; Klepper, 2002). Naturally, counterexamples can also be found where, for example, prior experience may result in locking the firm into old trajectories when it requires new ideas to exploit its technology (Chesbrough, 2003).

Apart from the entrepreneur, prior research has also found a number of other resources to be important to entrepreneurial firms especially if one takes into account the broad definition of resources. Not only founders' skills are important, for example, but also those of other employees (Sørensen, 2004). Financing, and especially so venture capital, has also been found to be important to many new ventures, as has legitimacy, networks, patents, laboratory and manufactory equipment and so on (e.g. Shane & Stuart, 2002; Baum et al., 2000) The explanations provided often suggest that the more is generally the better. Again, examples of the opposite can be found where scholars argue that, for example, ample capital is not unambiguously a good (Bhidé, 2000).

The literature thus points to a number of resources potentially relevant for a new firm. Such a list can indeed be important to direct attention to what resources and capabilities a new firm might need depending on the setting. Even more relevant, however, is to set the list against the fact that most ventures start out with very limited resource endowments, sometimes only including the entrepreneurs themselves and a vague idea. How then do entrepreneurial

firms acquire these resources not possessed from start, whether tangible or intangible, rare or common?

Much of the resource-based entrepreneurship literature unfortunately provides limited guidance to answer the question. The reason is that much of the analysis focuses on the resources already possessed by a firm. By consequence, there is more focus on strategies to deploy resources than on how to acquire them. While deployment may also lead to resource acquisition as in the case of alliances with other firms, such analyses often centres on the strategic choice of whether or not to pursue a co-operative or do-it-alone approach based on the new firm's current assets (e.g. Gans & Stern, 2003). That is, the analysis does not focus on how new firms can generate such alliances to acquire resources, but rather on what alliances to pursue and when, and the effects of them. But such strategic choices often presume a given market to exploit in order to have the inputs (i.e. competitor analysis) for the decision to be made in the first place. Entrepreneurial knowledge, then, much becomes "the ability to take conceptual, abstract information of where and how to obtain undervalued resources, explicit and tacit, and how to deploy and exploit these resources" (Alvarez & Busenitz, 2001: 762). However, many entrepreneurs start out with only a vague idea of their potential market, and according to Knight ([1921] 1940) it is furthermore not possible to *know* if the resources to commercialize are undervalued or not, one can only make guesses of it. Some entrepreneurs may make more accurate such guesses because of, for example, prior experience, but an explanation of resource acquisition in new firms must also account for the cases where accurate estimations and guesses are difficult to make.

Still, resource-based perspectives can provide part of the answer to the question. Recalling Penrose's view of firm growth, one of the basic themes was that new resources and capabilities continuously emerge by the firm's learning experience in its current operations. In a similar manner the firm also generates new opportunities for expansion. That is, firms accumulate resources internally and in the very same processes generate opportunities for which unleashed resources can be used. This process is not necessarily straightforward or planned, but rather evolves from the past and current resources and operations of the firm. An essential part of the process is moreover to build on resources acquired through internal accumulation. A corollary to this line of reasoning but applied to an entrepreneurial setting can be found in Sarasvathy (2001). On her account, entrepreneurs do not necessarily choose

among a set of goals and acquire resources accordingly, as commonly envisaged in the literature, but rather select between possible effects that can be derived from a given a set of resources. This because it is many times more difficult to, for example, hire or even get people to apply to a contingent organization, or, as above, the goal itself may not be so clearly set, neither technologically nor marketwise. Similar to Penrose, the process of resource acquisition instead becomes one of a step by step expansion of current operations, building on resources that the entrepreneur already controls. One often important such resource to build on is the networks of the entrepreneur. However, Sarasvathy does not, nor does research that focuses resources, explicate in detail how new firms use such networks.

2.2.5. Benefits and shortcomings

Resource based perspectives of entrepreneurial firms can thus help to understand two aspects important for resources acquisition. First, these studies can provide a good understanding of the resources and capabilities important to new firms, their characteristics, and how and why they enable or constrain a new firm. This helps to direct attention as well as to understand the difficulties for new firms to obtain the resources. Secondly, parts of this perspective can also provide some clues to how new firms acquire resources by internal accumulation, and how they actually go about to acquire resources in more uncertain settings.

The shortcomings of studies adopting this perspective are often that they do not put sufficient attention to the acquisition of resources beyond the borders of the firm. By turning to a network approach one can account for this shortcoming. Another shortcoming, though, is the oft made assumption that entrepreneurial firms start out knowing what resources are undervalued, and how to exploit them, i.e. what their market is. While some entrepreneurs may make better guesses than others on the value of resources and their markets (e.g. in arbitrage and in the discovery of a drug for a given disease) uncertainties are still likely to prevail. Since such uncertainties are also likely to affect resource acquisition, greater uncertainties of a new firm may require the incorporation of a more means-oriented view to explain resource acquisition.

2.3. *Networks and the firm*

The analysis of firms' relations and networks is often subsumed under the broader research stream of economic sociology. A major theme within this research area is to combine analysis of economic interests with an analysis of social relations. Such an application of social explanations to economic phenomena has, like research on resources, a long standing tradition beginning in the 19th and early 20th century with sociologists and economists such as Weber, Marshall and Durkheim. With the advance of neoclassical economics, though, economic sociology came to experience decades of lesser attention until a revival occurred in the 1970s-80s. The reasons for this revival are somewhat unclear, but some scholars argue that it is due to a new competitive environment where scale have succumbed to flexibility, for which network arrangements are a more efficient organizational form (Piore & Sabel, 1984; Powell, 1990). A few very influential papers, in particular Granovetter's 1985 article, are likely also contributing factors, as is the improved techniques and tools for analysis (Granovetter, 1985; Smelser & Swedberg, 2005). Perhaps for those very reasons, a good part of this 'new economic sociology' is also particularly concerned with how social structures and relations affect economic processes.

2.3.1. Basic ideas in network theory

The most basic idea in economic sociology, including network theory, is that investigations of economic phenomena must include an analysis of social relations. The reason is an underlying assumption that 'social structures … are coins that do not readily melt' (Schumpeter ([1942] 1994:12) quoted in Smelser & Swedberg, 2005), a notion that generally stands in stark contrast to basic assumptions in traditional economics. The social context, culture, traditions, and positions in the social structure are thus believed to have a significant influence on the economic actions of actors (Swedberg, 2004). Much of the literature, though, and in particular network theory, emphasize the role of social structure and relations. Actors in this view are rather actors-in-interaction than isolated as traditional economics would have it, and the characteristics of actors' relations, individually and as a whole, have varying social and economic consequences for the actors joined by those relations (Tichy et al., 1979).

2.3.2. Distinctions

Within network theory there are several distinctions that separate different relational (or dyadic) properties as well as different properties that adhere to the network formed by those relations.

Firms' individual, or dyadic, relations are often characterized by their formality and their strength. As for the formality of a relation, more formal ties refer to relations that are based on explicit contracts such as licensing agreements whereas less formality implies more implicit contracts based on trust among people and where social exchange is an important part of the relation in addition to possible goods exchanged. Informal ties thus relate closely to personal networks and include possible previous working relationships, and kinship and community ties. A similar distinction is that between arm's-length and embedded relations, denoting relations based more on market and social grounds respectively (Uzzi, 1997). The strength of a tie on the other hand, refers to the frequency, intensity, and reciprocity of the relation (e.g. Granovetter, 1973). Strong ties thus signify relations characterized by closer cooperation and more frequent contacts, which generally requires more resources and time to build and maintain (Eisenhardt & Schoonhoven, 1996). Weak ties on the other hand signify more distant relations in ones network that are more flexible but generally thought to be less amenable to the transfer of complex knowledge (Powell & Smith-Doerr, 1994).

The network of a firm can be characterized along a multitude of measures aimed at describing how relations are structured among actors. Such structural properties of networks include the cohesiveness or density of a structure, which denotes to what extent actors are interconnected with each others; the hierarchy of a structure, denoting the tendency for ties to be sorted into patterns connoting status hierarchies; and centrality of actors, referring to if an actor is the object of many direct ties originating from others (see Lincoln (1982) for a more detailed account of both network and dyadic properties).

The rationale for these distinctions is to use them for interpreting the behaviour of the actors involved and to analyze how certain relations and structures can both enable and constrain actions. Firms, though, may be connected through a multitude of relations where some may be more significant than others for given purposes. As a result, some of the distinctions are more significant to some contexts and purposes than others. To understand the

importance of networks, it therefore becomes important to understand the nature and purpose of the network as well as the content flowing through it (Gulati, 1998). In the following, that context concerns the role of networks to the purpose of acquiring resources.

2.3.3. Research on firm networks

There is a plethora of research within economic sociology on firm networks and relations. Scholars have, for example, investigated firm networks in relation to opportunities, employment, mobilization of resources, diffusion of business models and practises, and organizational power, structure and strategy. Within this multitude of studies it is possible to discern two more general approaches; one that relies more on formal network analysis tools, and another that is more case-oriented in nature (Powell & Smith-Doerr, 1994).

Studies in the first line of research, relying on formal network analysis tools, are generally premised on the assumption that structures of inter-organizational relations are consequential for understanding the actions of firms. Accordingly, measures of network centrality, position, and the number and structure of direct as well as indirect ties often become important explanatory variables for firm behaviour or performance. A great deal of research has been performed in this vein and many interesting findings have emerged on structural positions in relation to resource acquisition. Studies have found network centrality to be influential for legitimacy and power, and structural holes for control and access to information (Benjamin & Podolny, 1999; Burt, 1992). The number and diversity of direct ties, sometimes mediated by indirect ties, have furthermore been found influential on organizational performance and innovation (Rowley et al., 2000; Ahuja, 2000). Other times, however, this line of research show mixed results at best. The frequently studied area of interlocking directories has, for example, yielded much inconclusive results as to the effects of direct board ties (Mizruchi, 1996). Similarly, there are also disagreements as to the benefits of densely and sparsely connected networks respectively. One reason for such inconclusive results may be that the benefits of certain networks and structural positions are ultimately contingent on the particular context of firms (Rowley et al., 2000). A closely related reason can be found in criticisms that relations and actors at times become secondary to the position the relations generate. That is, methodological sophistication at times outpaces content and substance (Powell & Smith-

Doerr, 1994). Still, many of the findings in this line of research indicate that firms' abilities to acquire resources do have a bearing on their structural positions in many circumstances.

The second, more case- and process-oriented line of research many times lends itself to address the shortcomings of more formal network analysis. Accordingly, studies in this vein investigate, for example, how ties are created, why they are maintained, what flows across the links, who decides on those flows in the light of what interests, and the consequences these relations bring. The findings suggest that much formal collaboration evolves out of pre-existing informal relations (e.g. Smith-Ring & Van de Ven, 1994). This has in turn been used to explain the abundance of collaborations in some areas, such as biotech, as simply the outcroppings of the professional lives of scientists (Powell & Smith-Doerr, 1994). Also, evidence has accumulated on how these informal relations themselves are used to acquire know-how and information (von Hippel, 1988). Such informal relations have also been found to constitute an important and efficient way of governing relations and networks, however, findings also indicate that there are risks of becoming too embedded in such networks (Uzzi, 1996, 1997). By focusing on the deeper causes and consequences of firm networks this line of research thus enables a richer understanding of relations role in resource acquisition. However, this vein of research is still much under-researched as compared to the more formal network analysis literature and has also tended to focus on 'success' stories (Swedberg, 2000; Powell & Smith-Doerr, 1994).

Both lines of literature provide important and complementary clues to resource acquisition in firms. Both veins also acknowledge that different kinds of relations and networks are differentially beneficial for acquiring different resources. However, research often proceeds from the effects of networks on acquisition of various resources, and by extension firm performance. Fewer studies address the reverse question of how resources requirements affect network development and the consequences that follow from this (Hoang & Antonic, 2003).

2.3.4. Entrepreneurship and networks

Like research on entrepreneurial firms' resources, networks have been a fairly consistent research topic within the entrepreneurship field since the mid 1980s. Proceedings from the Babson 'Frontiers of entrepreneurship research'-conference have, for example, maintained a small cluster around the role of social networks in the entrepreneurial process from early on

(Landström, 2005). Still, in comparison with other streams of entrepreneurship research, network studies have composed a minor albeit growing field (Swedberg, 2000).

2.3.4.1. Networks in entrepreneurship research

Network studies on entrepreneurial firms can for a large part be categorized along similar lines as network research on incumbent firms. That is, studies differ with regard to their emphasis on the effects of formal network structures on new firms, or on more detailed accounts of how new firms actually use their social networks (Hoang & Antonic, 2003). The majority of studies conducted in the field may arguably be placed in the former category.

There are a range of studies that attempt to relate resource acquisition and success in entrepreneurial firms to the pattern of the new firms' relations. Similarly to research on large firms, studies in this vein argue for the importance of position in the network and the structure of the new firm's ties. In fact, Burt even contends that a network with 'structural holes' is a defining characteristic of entrepreneurs due to the opportunities to combine and act upon the diverse information that follows from such a position (Burt, 2000). While findings may not lend credence to such strong a claim, findings do indicate that position and structure are important in the resource acquisition process. The number and diversity of alliances has, for example, been found to influence entrepreneurial firm performance, as has strategic alliances with prominent other firms (Baum et al., 2000; Stuart et al., 1999). The evidence is not without ambiguity however. In the spin-off literature, for example, there is mixed evidence on the importance of relations with the parent (Sapienza et al., 2004). Again, the reason may be that the benefits and constraints of relations depend on the context and purposes to which they are used. In case of entrepreneurial firms such contextual factors may relate to the technological advance of the firm, the industry it enters, as well as its phase. The latter may be particularly important because by and large, studies investigate the networks that result from different formal relations among firms, such as alliances and different contractual agreements. Many new firms, however, may find it very difficult to establish such networks in their initial phases and much research on entrepreneurial firms using formal network analysis tools hence tend to study new firms in somewhat later stages. Similarly to research on large firms, structural accounts by themselves have also been criticized for being to simplistic, focusing more on the reasons for new firms to enter, structure and manage their relations in certain

ways, than on how they can actually accomplish this (Hoang & Antonic, 2003). Still, depending on the circumstances the pattern of a firms relations indeed seems to be important, and perhaps especially so for resources such as information that flow more freely.

A smaller more case-oriented literature complement the formal analyses of entrepreneurial networks by putting more emphasis on the content, workings and consequences of relations in entrepreneurial contexts. Also this literature stresses the importance of relations and networks as means for quick access to resources and know-how that cannot be produced internally (e.g. Birley, 1985; Larsson, 1992; Winborg & Landström, 2005). However, it does so by focusing on how and for what purposes entrepreneurs use personal relations, the role of these relations in the firm's earliest phases of development, and how entrepreneurs may establish more formal relations (e.g. Larson & Starr, 1990; Starr & MacMillan, 1990; Hugo & Garnsey, 2005). Arguments for the importance of personal relations in firms' early phases have found support in studies that indicate the role of these relations to provide emotional support, valuable information and knowledge, low cost access to resources (Sarasvathy, 2001; Bhidé, 2000). This line of literature also tends to provide more substance to the effects of the nature of relations on the acquisition of various resources, showing how properties like strong ties and cohesive networks promote the transfer of more complex knowledge (e.g. Carayannis et al., 2000). While providing context and substance to the formal analyses, however, calls have frequently been made for more studies of this qualitative nature (Hoang & Antonic, 2003; Swedberg, 2000; Powell & Smith-Doerr, 1994). As for large firms, researchers have also pointed to that most studies depart from the effects of networks on the acquisition of resources. In entrepreneurial firms the reverse issue and the consequences resource requirements have for network development may many times be at least as interesting (Hoang & Antonic, 2003).

2.3.5. Benefits and shortcomings

A network perspective may thus be favourably applied to explain aspects of resource acquisition in entrepreneurial firms. The perspective not only acknowledges the roles of different relations to acquire resources generally, but also takes notices of that different relations and relational structures may be differentially beneficial for different resources. A general critique, though, is an overly focus on relations themselves, to the neglect of other

factors that may affect the pursuit of resource acquisition (Swedberg, 2000). Moreover, focus is often on certain formal relations such as alliances, which many times presupposes that the entrepreneurial firms have a concrete enough idea of their market and technology so as to be able to enter such alliances. While that may certainly be the case for many new firms, the opposite is equally plausible. In any case, but especially so in the latter, informal relations are likely to play an important role in acquiring resources, however, these relations have received comparatively little attention. Finally, many studies depart from the effects of relations on resource acquisition and entrepreneurial firm performance. Fewer studies address the reverse issue of how resource requirements influence network development and the consequences that may follow from this.

2.4. Industry and opportunities

In this thesis, resource-based theory and network theory forms the basis for understanding resource acquisition in new firms. As mentioned above in relation to resources and networks, however, other factors need also to be taken into account, or else the links between the resources and relations of new firms are likely to remain elusive. There are a number of such factors, but two, opportunities and industry, are of particular importance to this thesis and will be shortly reviewed here. Opportunities are important because these provide a context for the resources required, and because resources and relations are intimately related with the emergence of opportunities. Industry in turn is important as different industries have different requirements and hence different behaviours of actors (Powell & Smith-Doerr, 1994).

The notion of opportunities has come to occupy a central position in entrepreneurship research and some scholars even regard opportunities as distinguishing of the entrepreneurship field (Busenitz et al., 2003). Opportunities may be characterized along two dimensions. Firstly, opportunities may be viewed as containing both technological and market aspects, referring to the degree of technical advance and the possibility to make profits from new goods and services respectively (Klevorick et al., 1995; Shane, 2001; Sarasvathy, 2001). Secondly, the literature also distinguishes between opportunities as discovered and as created. Discovery-oriented views tend to see opportunities as pre-existing their discoveries, and once discovered by alert individuals, the realization of the opportunity is much a matter of exploitation and adaptation within the framework for a fairly specified supply and demand

(Shane, 2001). A creation-oriented view, instead considers opportunities as continuously negotiated and created in the interaction with others. An opportunity according to this view rather equals the opportunity to construct new markets (Sarasvathy, 2001). Rather than one view being right and the other wrong, both views likely form overlapping and complementary parts of entrepreneurial firms actually deploy resources (Sarasvathy et al., 2003).

While perhaps seemingly a result of academics predilection for arguing, the distinction has implications for explanations of how firms acquire as well as deploy resources. It has been argued that the accuracy of either view in any given new firm correlates with the degree of uncertainty involved, so that the greater the uncertainty the more the need to *create* a market or acceptance (Dew et al., 2004). This has implications for resource acquisition in new firms as uncertainties make the opportunity difficult to evaluate and hence difficult both to sell in and to acquire resources for. As uncertainty is positively related to the degree of novelty of the opportunity perceived, and hence the level of technical advance, it may be relevant for many NTBFs. Few studies, including studies on NTBFs, acknowledge this however (Sarasvathy, 2001). Instead, and as identified in both the resource- and network-based contributions to entrepreneurship literature, much literature often treats the market NTBFs address as more or less given from start. This may obscure some of the challenges faced in resource acquisition in ventures associated with high uncertainty, and the 'creation' view is thus an important aspect to consider in relation to NTBFs.

The industry of origin and the industry a new firm attempts to direct are other factors with bearing on resource acquisition. Without going into detail, several studies have found industries to vary in the amount of interactions both among firms and between firms and universities. Such differences are the consequence of, for example, traditions, the underlying science base, and the technical advance, size and competition of the industry (Meyer-Krahmer & Schmoch, 1998; Powell & Smith-Doerr, 1994). The possibilities of firms to engage in collaboration may thus vary considerably across industries. Also the origin of the firm itself, have been found to exhibit some fairly stable patterns that have a bearing on resource acquisition. Findings, for example, point to that NTBFs originating from universities often are more research-based and hence often farther from the market compared to other ventures (Shane, 2001). This should consequently lead to a greater need to acquire for example additional research and development from start compared to other new firms. As some

industries, like biotech, exhibits more start-ups with a university origin than other industries (Shane, 2001) more divergent mechanisms for acquiring resources may also have developed in such settings as compared to in less start-up prone industries. All in all, these findings point to the importance of incorporating the industry and context when explaining resource acquisition in NTBFs.

2.5. Summary

To summarize, it seems that an understanding of resource acquisition in NTBFs can benefit from combining perspectives departing from firm resources with network-based ones. In particular, both perspectives provide a more detailed account of resource acquisition together than either does as a standalone. Resource-based approaches are useful to explain the importance of some resources over others, as well as to problematize features of the resources that make them more or less amenable to acquisition. Besides aspects of the approach also helps explaining dynamics internal to the firm which have bearing on resource acquisition. Network-based perspectives on the other hand are useful to explain the different means available to a new firm for acquiring resources outside its boundaries, as well as the many advantages and constraints associated with these means. Resources and networks, and hence resource acquisition, are also intrinsically intertwined with the concept of opportunities as well as contingent on industry.

The current research frontier, however, only provides limited understanding on some aspects of resource acquisition that are crucial to NTBFs in their initial stages. These limits primarily concern the means for research acquisition studied and the premises under which these means are studied. Most studies that treat resource acquisition are concerned with relations that are formal in one way or another. While there are a multitude of such ties, though, studies often further limit their interest to only a small set of formal relations such as collaborative research agreements, joint ventures, and venture capital agreements. Many new firms may, however, lack either the legitimacy necessary or sufficiently clear perception of their market and offer required to close such agreements. There is thus a risk that an overly focus on contractual resource acquisition agreements fails to account for other resource acquisition practices much important in the early phases of firms. One such practice could be appointing appropriate persons to the NTBFs board in order to use these persons' knowledge

or ties to other firms' boards. Another practice is the role of the informal relations that often forego the more formal relations. Little attention is awarded either of these means, though, especially the former. Still, these relations may be particularly important in explaining how NTBFs manage to acquire resources in face of high initial uncertainties. Finally, many studies depart from the network of relations new firms currently posses to explain firm success. In many new firms, however, an equally important issue ought to be how the current resource requirements affect the relations used and developed, and the resulting consequences from this.

The rest of this thesis focuses on the appended studies that investigate in more detail the role of boards and informal relations for resource acquisition, and the influence of resource requirements on relations. The following section provides an account of the procedures in the studies while the subsequent section discusses the findings of the appended studies.

3. Methodology

Methodology should clarify both the methodological choices made with regard to a research question as well as account for the technical aspects of the methods chosen (Alvesson and Deetz, 2002). Accordingly, this section will account for the assumptions and justifications that guided the choice of method in the appended papers, as well as describe the procedures for collecting and analyzing the data.

3.1. Methodological choices

Methodology concerns criteria for choosing methods of investigation in a way that fulfils the original research purpose. Recalling the research questions stated in the introduction, the aim of this thesis is to investigate resource acquisition in new technology-based firms. More specifically, the aim is also to explore the role of boards and informal relations in such acquisition of resources, and the effects of different relations to acquire various resources. To enable a better understanding of these phenomena, both qualitative and quantitative methodologies have been applied. The appended papers hence apply different methodologies to meet the purpose and research questions posed in each study, as well as to meet the aim of the thesis as a whole.

Informal relations and the effects of different kinds of relations on resource acquisition are not easily observed without actually interviewing subjects. This is shown not least in the number of quantitative studies that acknowledge that informal relations has a role, yet can but infer this role, lacking the empirical foundation necessary to do anything else. Ironically enough, the resulting impression of these studies becomes one of that they lack the very *social* content that is the premise for the approach in the first place. Further, critics point out that in most of these studies much variance is left unexplained (Hugo & Garnsey, 2005). While still informative, these studies thus leave much to wish for concerning how formal relations are formed, managed, and sustained, and how NTBFs associated with higher uncertainties manages to acquire resources. Presumably and also indicated by the research in this area, informal relations play a role to these ends, and the complexity of social life itself further suggests that this role of informal relations in resource acquisition may be multifaceted. In such persistently problematic areas to which prior research general provides only limited guidance, case studies can often provide a deeper understanding of the mechanisms involved (Punch, 2005). In studies I and II that specifically address the role of informal relations in resource acquisition, a qualitative case-study approach was therefore deemed appropriate. More specifically, both studies utilized an instrumental case study approach, and both papers were also instances of a collective case study approach (Stake, 1995). That is, several cases were used collectively to understand the specific area of interest (instrumental to understanding) rather than to understand only the cases themselves.

Study III is a theoretical inquiry that is based on the empirical findings from studies I and II, and a literature exposition of central themes around resource acquisition. The method applied is one of analytical induction for the purpose of deriving hypotheses on the role of relations in resource acquisition in NTBFs.

The aim of the thesis, however, was not only to establish the role of informal relations, but to increase the understanding of resource acquisition generally by attending to hitherto under-researched mechanisms. The purpose of study IV was to investigate one such mechanism, boards and board connections. The literature on the subject has almost exclusively focused on incumbent firms, notably Fortune 500 firms, with mixed findings. Due to the relatively greater potential significance of board members' experience, legitimacy and networks in small firms, scholars argue that the impact of boards and board connections should be more

unambiguously positive in an entrepreneurial context. Few, if any studies, however, have tested these conjectures. In order to test for possible effects of boards and board connections, a quantitative study on readily observable and available data in Sweden was chosen. More specifically, the study applied network analysis tools to calculate measures that we used to statistically test hypotheses derived from literature. Furthermore, a longitudinal research design was chosen in order to be able to observe lagged effects of board membership.

3.2. Methodological procedure

3.2.1. Sampling

The general population from which the samples were drawn consists of firms that are based on advanced scientific or technological knowledge, i.e. new technology-based firms. One exception to this, however, is paper IV which also included firms that provide technological services to other firms.

Studies I and II were based on four and three detailed case studies respectively. The selection of the cases was purposive, meaning that the cases were actively sought out according to specified criteria in order to be able to elucidate the phenomena of interest and achieve theoretical focus (Glaser and Strauss, 1967). In study I, the purpose was to provide a more detailed understanding of university spin-offs' relations with universities. All firms included in the study thus originated out of university research (i.e. were university spin-offs). Given the limited number of cases, though, and in line with the purposive sampling approach, cases were sought for within this population that could render firm-university linkages 'transparently observable' (Eisenhardt, 1989). One way to try to achieve such 'transparency' is by way of choosing cases that differ with respect to one another. Based on findings in prior research that interactions differ because of traditions and also depending on scientific field (Meyer-Krahmer & Schmoch, 1998), the cases were sampled with regard to university origin and scientific field. An additional criterion, age, was also included. The firms were identified through an active search of public records and university homepages.

Study II instead aimed to provide a more detailed understanding of the role of informal relations in resource acquisition among corporate spin-offs initiated by employees. All firms included thus originated out of another firm (i.e. were corporate spin-offs or CSOs). Contrary

to most studies in the area, which focus on sponsored spin-off, the aim of study II was to include also other types of CSOs (e.g. hostile, non-sponsored). Part of the reason was that little research exist on such spin-offs, part was also to try highlighting the role of informal relations by including different types of CSOs (Parhankangas & Arenius, 2003). Sampling was further based on product similarity so as to limit possible effects of differences in business and product demands on the use and benefits of informal relations among the firms. The industry sector of optical telecommunications was chosen as it provided a suitable sampling base due to changes undergone in the 1990s that resulted in the emergence of several new companies. The firms were then identified by going through public records and industry homepages. In total eight firms were identified that started out as spin-offs manufacturing similar products. Two of these were acquired only two to three years after founding. Another firm was a larger divestment, and yet two other spin-offs were still very young. The remaining three spin-offs had been in business for some years, were still active, and represented three different types of spin-off processes. These three spin-offs were thus deemed as appropriate objects for the study.

In both studies I and II all participating companies were thus spin-offs that based their business on new scientific or technological knowledge. Their ages spanned from eight to 24 years, and their sizes varied between 13 and 50 employees. The locations of the spin-offs were overall very close to the sources that they had most frequent interaction with.

The aim of study IV was to test for possible effects of boards and board connections on the performance of NTBFs. Because of manageability the authors decided to restrict the sample to one industry sector, and one geographical are (the larger Stockholm area). The industry sector of Information Technology (SNI 72) was chosen because it underwent rapid technological developments in the 1990s and 2000s. These developments were assumed to be reflected in most of the new companies started in the sector, meaning that most of the new firms were based on knowledge of new technological developments. Within this sector, all firms that started between 1997 and 2003 were included, based on availability of data. The focus of the study was further on firms with intentions to grow. As there are numerous firms with no such intentions whatsoever, it was assumed that if the firms had had at least five employees at some point, that was an indication of intentions to growth, and only such firms were included. Based on these criteria, firms were identified by first using public records to generate a list of the

whole population. This resulted in a list of about 1000 firms that were then controlled by checking homepages and business press in order to single out the firms that were independently founded. The final sample then consisted of 405 seven firms that developed products or delivered services related to Information Technology.

3.2.2. Data gathering

The first two studies (I and II) applied two types of data collection approaches; face-to-face interviews and secondary sources. The interviews conducted were semi-structured and carried out with the founders of the firms. The interviews were conducted in an informal, conversational manner, during which open-ended questions were posed about founding conditions, the relation with the parent, the means of resource acquisition, as well as limitations and benefits in these regards. The interviews lasted for 1-2 hours and were documented through intensive note-taking. Interview notes were typed out immediately after the interviews and were sent to the participants to read for coherence and accuracy. In both papers, the participants were later contacted for follow-up questions in one to two rounds. These interviews were conducted by telephone, and again documented through intensive note-taking that was typed out immediately afterwards.

The secondary type of data was gathered from business and industry journals, company directories, press releases, annual reports, and homepages. This information was useful to get an idea about the competitive environment, the industry, and the perception of outsiders of the firms. The information also formed a background useful to put the spin-offs into a context, and provided a complementary assessment of the spin-offs' resource-bases in terms of, for example, venture capital attracted.

Study IV used several stages and sources of data collection. The first round of collection concerned getting the complete financial and board member records for all firms potentially interesting to the study. This data is unique in the sense that there are few other countries than Sweden in which such data can be obtained. The data was collected with the help from a firm that collaborates with and runs a complete and continuously updated record of the Swedish authority for company registration's database, to which all companies are required by law to report financial and board member data. The second round consisted of collecting data that to a large extent falls outside that which is kept in the public records of the Swedish Company

Registrations Office. This data included the more detailed circumstances of the founding and exits of firms. An extensive search in homepages and online newspaper databases were used to this end.

3.2.3. Data analysis

There exists a diversity of ways to analyze both quantitative and qualitative data. In qualitative analysis this diversity stems from the richness and complexity of social life which allows asking many questions and applying different angles to the data (Punch, 2005). The analysis in the qualitative studies in this thesis (study I and II) follows the main process described by Miles and Huberman (1994): data reduction, data display and drawing conclusions. That is, throughout the analysis, data was continuously reduced to focus on the most important themes concerning informal relations and resource acquisition mechanisms. This also helped in the process of compressing and assembling the data into case descriptions which could be used to draw conclusions and to inform theory. In both studies the dimensions of atypicality present (see sampling) served to help understand the general nature of the phenomenon of resource acquisition (Eisenhardt, 1989). Clearly, every case that can be studied is in some respect unique, and it is therefore important to keep in mind that in some sense, the case always represents itself. This, of course, does not mean that the case cannot also be used as a means to instantiate theory (Manning, 1991).

The analysis in study IV followed a different procedure. According to conjectures in prior literature, firms were hypothesized to benefit from board size, changes in board composition, and direct board ties to other firms, provided some criteria were fulfilled (e.g. size of the connecting company). In line with literature, firms were argued to have a board tie when an individual simultaneously formed a part of two different boards. To test the hypotheses, the study utilized a longitudinal research design in which board size, composition of boards, the number and diversity of board ties a given year were set against the performance of the new firm the following year. More specifically, a regression model (Arellano Bond) was used that takes into account the firms' previous year performance as this is likely to influence performance the following year.

3.2.4. Limitations and validity

How much confidence can put in the findings put forward in this thesis, and what can be concluded on the basis of what was found? These two questions correspond to the technical concepts of internal validity and external validity, or generalization.

Internal validity refers to the internal logic and consistency of the research and the isomorphism of findings with reality (Punch, 2005; Denzin & Lincoln, 1994). That is, to what extent are the concepts used internally consistent, and how can it be ensured that data is explained by those very concepts? There are two aspects to this here; the individual studies and the thesis as a whole. As for studies I and II, that were based on interview data, such data are always situated and complex (Silverman, 1993). To strengthen internal validity by correcting for misinterpretations, notes were handed to the interview subjects to read for accuracy and coherence. Secondly, because the data is situated it becomes important to understand the context, and much time was devoted to that issue in both studies. Furthermore, as sampling was driven by theory, i.e. was purposive, it fit well with the other components in the respective study thus adding to a coherent logic. As for the quantitative study IV, the question of internal validity becomes one of whether the relationships between the variables have been correctly interpreted or not. The variables used in the study were thoroughly based in prior research. In prior research, however, a debated issue is the cause-effect relationship between board connections and performance, especially since few studies are longitudinal and measure lagged effects (Mizruchi, 1996; Dalton et al., 1999). To try to account for such problems, study IV applied a longitudinal research design and used lagged performance measures. As for the thesis as a whole, finally, studies I-III display a similar logic and focus, which in turn increases the internal consistency across the studies. Study IV is somewhat of an outlier compared to studies I-III but still coherent with the more general aims and logics of this thesis.

External validity refers to the question of generalizability, i.e. if the findings are transferable to other contexts or not. In case studies the issue of transferability often relates to theory rather than populations, so called analytical generalization (Punch, 2005). Studies I and II aim for such analytical generalization by way of conceptualizing the role of informal relations for resource acquisition, while study III does so by way of developing propositions.

A researcher can furthermore take several actions to ensure as strong generalization as possible. Such actions include ensuring internal validity, pointing to the consistency of the phenomena, using existing literature to assess the extent of generalization, and to use multiple cases (Hartley, 2004). The issue of internal validity is dealt with above. The consistency of the phenomena, i.e. the extent to which the data is capable of being repeated with the same results, is to some extent ensured by using multiple cases that vary with respect to one another. The fact similar results were derived across the cases in both studies I and II provide further support for reliability as do the limited literature there is one the subject. Together, these studies, along with study III, may thus allow for some generalizations to other cases concerning the general role of informal relations in resource acquisition. In quantitative studies, the basis for generalization is more often the population the sample is drawn from. In study IV, the sample included the whole population of firms that met the specified criteria, which lends support for generalization to other similar firms, and, albeit to a lesser extent the results may also be transferable to startups in other industries. However, the results are not directly transferable to incumbent firms as the contingencies operating on incumbent firms differ considerably from those operating on startups.

4. Summary of appended papers

I

The strength of strong ties – University spin-offs and the significance of historical relations

Authors: Johansson, M., Jacob, M., and Hellström, T.

This article investigates the relationship between universities and academic spin-offs, with special emphasis on the antecedent conditions of, and the nature of the linkages that the spin-offs form, as well as the means for sustaining them. The article uses an instrumental case study approach, and is also an instance of a collective case study as four companies of various size and activities have been studied together. All companies were spin-offs from different Swedish universities. The results indicate that the network relations are characterized by a small number of strong ties to universities, with a high degree of trust and informality. Sustainability also seems to be a key characteristic of these linkages, considering the long history of many relationships and the general preference for long term commitments. The recurrent emphasis on putting efforts into finding mutual interests is likely to promote this sustainability, as is the fact that the locus of sourcing was in general with the founders' home departments. That is, sourcing was often with former colleagues between whom lasting reciprocities and friendships had likely developed. Moreover, several of the founders retained positions either part or full time in the academe. This likely further facilitated these relations as well as enabled the USOs to, for example, access low cost labour in the form of jointly financed PhD-students. Although fruitful for the transfer of complex knowledge, the strength of the ties also make them difficult to substitute, which may lead to problems as the spin-offs are highly dependent on continued basic research support. This may in turn lead to implications for policy at university, as well as higher levels.

II

Corporate spin-offs and the significance of founders' informal relations

Author: Johansson, M.

Research on corporate spin-offs has suggested that spin-off firms have advantages over other new entrants in an industry because of their founders' prior industry knowledge, and because they may form sourcing-agreements with the parent firms. This paper inquires into an additional aspect of prior experience, founders' informal relations and the use and benefits of these relations to source resources necessary for growth. The article uses an instrumental case study approach, and is also an instance of a collective case study as three spin-offs in the Swedish telecommunications industry were studied together. The three spin-offs all started out developing similar products, but differed from each other with regard to their spin-off process. The findings show that the founders' informal relations were much used both by themselves and as a generative mechanism for other means of acquisition. By themselves, the relations were used to acquire rudimentary resources, as well as to access expertise, and as a generative mechanisms the relations were used to initiate agreements and, in particular, to staff the spin-offs. The resulting benefits were particularly evident in the early phases when other means of sourcing were unavailable, but some of the uses had more lasting effects on the spin-offs. Recruitment of former colleagues, for example, likely contributed much to the efficient growth due to the skills acquired and easy assimilation of these former colleagues into the firm. That locus of sourcing was often with the parent, even though organizational agreements were lacking, also point to the importance of sourcing on the individual level in firms' early phases. The results thus indicate that future research on corporate spin-offs may need to better account for this variable in order to explain spin-off growth, and hence success.

III

Resources and relationships: startup growth and founders' social networks

Author: Johansson, M.

The growth of entrepreneurial firms is predicated on the access, acquisition and deployment of those resources essential for realizing an opportunity. However, these activities are interrelated

with the nature of the opportunity itself, as well as with entrepreneurs' abilities to translate their resources, actions and social practices into benefits for the firm. A NTBF's prospects to grow may thus be argued to be deeply embedded in factors that operate on the ability of the NTBF to realize an opportunity. This paper argues that viewing opportunities as 'embedded' in such a way can improve understanding of how emergent firms grow. From this perspective opportunities require more focus on the nexuses of different dimensions than has hitherto been present in much of the entrepreneurship literature. Based on prior literature in the area, the paper argues that the entrepreneur, the acquisition and deployment of resources in new firms, and the networks of the new firm may be relevant such dimensions. The paper thus contributes a literature-based explication on some of the key features of opportunities and their dynamic and embedding contexts set in relation to the specific challenges facing new technology based firms in their quest for growth. Based on this explication, a set of propositions are derived regarding the growth prospect of new technology based firms. More specifically, it is proposed that different types and structures of relations with upstream, horizontal, and downstream actors will yield different benefits depending on the degree of technical and market uncertainty associated with the NTBF's opportunity.

IV

The Role of Boards and Board Connections for the Performance of Entrepreneurial Firms

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This paper analyzes the role of boards of directors as one mechanism by which new firms can get access to other organizations' expertise. While prior literature suggests that the board of directors and their connections should have consequences for firm performance, there is little consistency in results. This inconsistency is part a result of that most research focuses on large firms where boards may have less direct control over firm outcomes, and part a result of that few control for effects over time. This paper uses a longitudinal research design to quantitatively assess the effects of boards and board connections over time in newly established firms. The sample consisted of 405 firms founded between 1997 and 2003 in the Swedich ICT-sector. Board and performance data was obtained for all firms up to 2005. Based on this data, the paper tests for lagged effects of board size, changes in board

composition and board connections in these firms. The results show a positive association between connections with firms within the same industry and performance, while a negative association between connections with firms in dissimilar industries and performance. The results may be explained by that focus is often very important in the initial phases of new firms. Board involvement with firms in similar industries can likely contribute to such a focus by way of gathering information, knowledge and expertise that can enhance the new firm's ability to create a viable entry strategy. Conversely, while a diversity of ties may be important for inputs of a broader range of strategic alternatives, the price for obtaining such inputs could well be higher than the resulting benefits in entrepreneurial settings. The results also show no relation between board size and performance, and while indicating positive effects of moderate changes to board composition, these results was not significant. One possible explanation for these results is that it may not be size itself that is the key factor influencing performance, but a sufficient size of the board so as to incorporate the necessary skills required. What constitutes a sufficiently large board, however, likely differ from firm to firm depending on the specific requirements in each case. The paper contributes to literature on boards and board connections by investigating the effects of these in entrepreneurial settings, and to entrepreneurship literature by suggesting the importance of a means for resource acquisition seldom attended to in that literature.

5. Discussion

Resource acquisition is a matter of utmost importance to many new firms, and the NTBFs included in the appended studies make no exception. In the present thesis, the purpose is to establish the role of means of resource acquisition that have received little attention in the larger part of literature. More specifically, these means related to the role of informal relations and the associated benefits and constraints of these relations, and to the role of appointing appropriate persons to the board of the firm. This section discusses the empirical findings from the appended studies and their theoretical and practical implications.

The appended studies differ with regard to both their specific focus and level of analysis, and hence lend themselves to different aspects of resource acquisition in NTBFs. Both studies I and II unfold aspects of the role of informal relations in resource acquisition whereas the theoretical explication in study III lends itself to making the discussion on the subject richer. Similarly, studies I to III also lend themselves to a discussion of the benefits and constraints that result from the relationship between resources and relations, and the consequences this may have for, for example, network development. Study IV finally investigates the effects of appointing persons to the board as a mechanism of acquiring resources. Whereas the study also treats resources and relations in this regard, the level of analysis is higher than in studies I and II, and study IV thus contributes more to the general discussion of resource acquisition and the role of relations.

The findings of the appended studies can be structured around a slightly modified version of the theoretical model developed in study III (see fig. 1). While the nexuses overlap to some degree, they still serve as a good basis for the discussion. The first nexus treats the overarching topic of this thesis; the role of entrepreneurs and their relations in the acquisition of resources. As mentioned in the theoretical background, though, the opportunity as well as the industry may influence the relationship between resources and relations. The following three sections therefore discuss aspects of the entrepreneur, networks, and organizing activities in relation to the opportunity and/or industry. The final sections of the discussion then summarize the most important findings and provide implications for theory and practice.

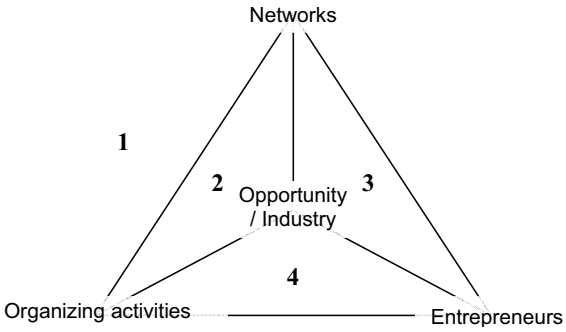

Figure 1: Model of important areas in relation to resource acquisition and the nexuses between them

5.1. The Entrepreneur – Network – Organizing activities nexus

This nexus between entrepreneurs, entrepreneurs' relations, and resource acquisition focuses on the more general roles of informal relations, boards, and board ties in resources acquisition in NTBFs, leaving aside for the moment the effects of opportunity and industry.

The findings in studies I and II suggest that founders' personal networks are important by themselves and/or are generative and facilitative of other means of sourcing especially in the early phases of NTBFs development. While the value of the informal relations to different ends is difficult to quantify and depends on the context of each firm, the results suggest that for at least two reasons, the incurred benefits are probably very important.

Firstly, in the present cases many of the NTBFs were very short of resources initially, including the financial assets and legitimacy necessary to purchase, hire or partner for the resources required. To access the resources necessary for growth it was therefore often critical for these firms to rely on their founders' personal relations. This was often the case whether the resources related to specialized and hence expensive equipment, information and expertise, or initial collaborative research agreements. In addition, informal relations also proved very important to the firms in the initial recruitments of personnel, both for locating skilled personnel and for convincing them to join the firm. These practices were moreover observed whether the NTBF originated from a university or an incumbent firm. Secondly, many of the cases required external expertise and knowledge within high-technology areas to further develop prototypes and existing products. The ability of the present NTBFs to utilize already

existing social ties to these ends were greatly facilitative for the transfer of this knowledge, not least because many of the resource providers were intimately familiar with the specific problems of the NTBFs from start.

In general, these results provide support for earlier research that point to the significance of founders' personal relations to access resources (Birley, 1985; Starr & MacMillan, 1990). Also the benefits of these personal relations as a generative mechanism of collaborative agreements and facilitator of knowledge transfer have been reported elsewhere and are hence supported by the present evidence (Cohen & Levinthal, 1990, Larson, 1992; Smith Ring & Van de Ven 1994). Not equally well reported, however, is the finding on the use of the personal relations to generate initial recruitments. While network research does report on the importance of networks for job seeking and employment in other contexts, little is related to the specific context of NTBFs (Powell & Smith-Doerr, 1994). Yet, it proved much important in the NTBF context in order to locate and convince skilled persons to join the firm during circumstances when job opportunities were abundant. Also, it may be argued that the benefits of the personal relations are especially important in the context of NTBS. This because while important to access rudimentary resources, many of the resources accessed were also of a very specialized nature and therefore not readily available on the factor market. Hence, while these networks were important on the one hand to bootstrap activities, which is well reported (e.g. Bhidé, 2000), they were on the other hand crucially important to access resources that would have been difficult to access at all otherwise. As this relates to the nature of the opportunity it will be further discussed in the following subsections.

It deserves also to be pointed out that while parts of the observed importance of personal relations in the present cases have been reported before, much literature on NTBFs still seem to deny or ignore the significance of these relations. The majority of literature at best only infers the role of these relations from the study of formal relations (e.g. Parhankangas & Arenius, 2003). Other times, studies acknowledge the role of prior social relations only to immediately turn focus away and explain success or failure only in terms of formal relations. For example, on the basis of their findings on alliances among biotech startups, Baum et al. (2000) contended that 'it is possible that firms that fail to configure effective alliance networks at the time they are *founded* will be inferior competitors at *every* age' (p. 288 emphasis added). Firms without alliances at founding thus fare worse in terms of performance regardless of the

social networks of their entrepreneurs. That indeed seems to be a harsh statement, especially given the evidence found in the appended studies and elsewhere that NTBFs without alliances at founding actually do get by and many times do it well (e.g. Sarasvathy, 2001). While the example of Baum et al. is particularly explicit, the tendency to focus on the relation between contractual agreements and success is similar in much entrepreneurship research (e.g. Stuart et al., 1999; Stuart, 2000; Baum & Silverman, 2004; Eisenhardt & Schoonhoven, 1996). Yet other times, studies neglect social relations altogether as significant in favour of, for example, prior experience (Klepper, 2002; Burton et al., 2002).

The findings of the appended studies do not deny any significant role of prior experience or formal relations, rather the opposite, but the findings do show that informal relations are vitally important to NTBFs. For all their value in their own right, however, the cases in the appended papers also point to that there are limits to the amount of resources that can be obtained solely from informal relations. On the one hand, this is likely the result of that informality and accompanying trust does not guarantee smooth and effective collaborations. To secure collaboration on a long-term basis may therefore require formal aspects regulating the collaborative framework. On the other hand, friends can likely put in only so much of their time, and company/university resources can only be so much used before a contractual agreement is required. While this provides some empirical support for conjectures previously made in literature (Hite & Hesterly, 2001), it does not diminish the use of informal relations to acquire resources. Rather these limits of informal relations may provide one explanation for how NTBFs develop a network of formal relations. However, as the firms matured, some of the uses of informal relations also decreased in importance per se relative other means of acquisition, which also provides some support for earlier observations in literature (Lechner, & Dowling, 2003; Almeida et al., 2003).

Study IV, finally, also suggests that other means of resource acquisition may be valuable to newly established firms. The results show that board connections with other firms within the same industry were positively related to the performance of these firms, and also indicated that moderate changes in board composition was positively associated with firm performance although not significantly so. These results could imply that boards are used as a mechanism to either access resources directly through persons appointed, or through their contacts with other boards, or both. One of the cases in study II reported such board appointments for those

very ends, which could provide support for such a contention. Prior literature on incubators also support such a contention, as helping appoint members to the boards of the incubated firms is often one important service provided. The results are intriguing because few, if any studies, have tested for the effects of boards and board connections in a large sample of newly established firms in a high tech industry. As such, the results also contribute to the literature on interlocking directories by suggesting that the effects of such interlocks may be more clearly visible in new firms within high-tech sectors.

As mentioned above, the findings also show that some of the benefits and constraints derived from personal relations are moderated by the nature of the opportunity. This is discussed in the following sections.

5.1.1. The Opportunity– Organizing activities – Network nexus

The observations suggest that the high-technological nature characterizing the opportunity upon which NTBF cases based their business upon, influence the relationship between resource acquisition and networks in at least two ways; by way of uncertainty introduced and by way of complexity of requirements. Both these factors have implications for the network that the NTBFs develop as well as possible consequences for their growth.

The cases in studies I and II experienced many uncertainties both technologically and marketwise, which induced needs for further technical development and sometimes lengthy periods of time of struggling to find a proper market niche, or building market acceptance. These and similar technological and market uncertainties have been reported elsewhere in literature, and have also been found to pertain in particular to NTBFs (Dew et al., 2004; Sarasvathy, 2001; Shane, 2001). However, the consequences of such uncertainties are less often incorporated into analysis. One consequence is, as argued in study III, that higher such uncertainties is likely to result in more enduring resource scarcity. The reason is that the higher the uncertainty the more difficult for potential partners to evaluate the firm and the technology, and consequently the more reluctant they will be to engage in an alliance. Venture capitalists and incumbent firms may, for example, not see the value in a new technological opportunity radically different from existing ones and which is also associated with high technological uncertainties (Dew et al., 2004, Christensen, 2000 [1997]). If the initial market opportunity addressed by the new technology is very small, or, indeed, if no market or market

acceptance yet exists for the technology it may be even more difficult to see the potential value. Similarly, a new firm struggling to find a proper market application may find it difficult to convince investors to finance them, and even more difficult to strategically choose, or even attract, partners as some scholars argue (Gans & Stern, 2003). To be able to form an alliance then likely requires that a NTBF has managed to reduce some crucial uncertainties and has formed a fairly clear idea of its market. By consequence, the extant literature that quantitatively relates entrepreneurial performance to the formation and configuration of contractual agreements such as alliances primarily explains performance in entrepreneurial firms that have reached a certain degree of maturity (Baum et al., 2000; Shane & Stuart, 2002; Stuart et al., 1999; Walker et al., 1997). These studies, however, cannot account for *how* the entrepreneurial firms endure the periods of uncertainty before they reach that stage of maturity. Still, considering the technological and/or market uncertainties associated with NTBFs it is likely that quite a few NTBFs lack the ability to form such contractual agreements at founding or even a long time after founding. To better account for how these NTBFs succeed, studies instead need to address how these firms manage to outlive and reduce the uncertainty associated with the ventures, and how they manage to create a market (Sarasvathy, 2001). The findings in this thesis suggest that a focus on personal networks of founders and, to a lesser extent, the boards of firms may be steps in that direction.

A second issue in relation to this nexus is the relation between resources and relations. As mentioned above, many of the resource requirements observed in the cases were characterized by a high degree of complexity and knowledge intensity. To support and facilitate the transfer of these resources many of the NTBFs, especially the more research-oriented cases in study I, developed or maintained relations that were characterized by sustainability. In view of the importance of knowledge transfer processes for the observed NTBFs, these findings are not surprising since such transfer is likely to require a mutual language, trust and similar knowledge assimilation processes (Cohen and Levinthal, 1990). The recurrent emphasis on putting efforts into finding mutual interests is also likely to promote sustainability and generate trust (Das and Teng, 1998). It should come as no surprise then that the network relations are characterized by a small number of strong ties which are in turn characterized by a high degree of trust and informality. The NTBFs reviewed here are rather limited in terms of network presence, with generally a few strong ties often related to the origin of the spin-off,

and weaker ties to other universities, institutes, or industry actors. This pattern of relatively few strong ties is supported by Liao and Welsch's (2003) findings that technology-based entrepreneurs benefit more from strong ties and a dense network than from an extensive social network. The reason is that this promotes trust and cooperation and so facilitates freer exchange of fine-grained, high-quality information and tacit knowledge. This relationship is likely also promoted because of the sustainability and the development of trust involved in, and facilitated by further knowledge transfer (Carayannis et al., 2000).

These ties become very strong and due to the history, reciprocity and location (social capital aspects), and the specificity of the knowledge transferred, becomes difficult to substitute. As a result, the ability to 'change' technology as proposed by some researchers (e.g. Shane, 2001), may be severely constrained by factual circumstances present in many of these cases. Developing several such strong ties is furthermore often a non-option due to the time and resources it takes to maintain these ties (Eisenhardt & Schoonhoven, 1996). Once an alliance or collaboration is formed it may thus well lock development of the NTBF onto a certain path, within which adaptation can only occur to a limited range. Just as the erosive power of a river changes the future options for the course of the river, the first strong ties of a firm whether informal or formal may well limit the future options of the firm. Thus, the ability to change and adapt in a new firm may be constrained by the nature of resource requirements that follow from the technological aspects of the opportunity. One case, however, does suggest the possibility of maintaining also several weaker ties, although this option was premised on that the technology was patented and generic. Since this likely reduces the risks of being overly reliant on only one source, a balanced mix may be beneficial where it is possible to develop such relations (Uzzi, 1997).

5.1.2. The Opportunity– Entrepreneur – Network nexus

In a more speculative manner, the findings in the appended studies may also be used to argue that the frequent use of and reliance on personal networks also confined the market adaptability of the NTBFs to a narrow space. The use of personal relations to acquire resources occurs on an individual level and up to a certain degree they are independent of agreements on an organizational level. As a result, it is not surprising that much of the locus of sourcing was with the parent across the settings. Apart from that large parts of the founders'

networks may be skewed toward former colleagues, many of these former colleagues were also friends between whom a strong sense of trust and lasting reciprocities had evolved. This continued close relation with former colleagues together with the work history of the founders likely influenced their perception of market opportunities. It is worthwhile to note that all of the cases addressed markets close the realms of their founders' experience, and hence probably often also the realms of their former colleagues experiences. It would not be too bold then to suggest that this provides some support for earlier findings in literature on the role of prior knowledge and the role of personal information networks for perceiving a market opportunity or a business idea (Shane, 2000; Burt, 2000).

Similarly to the above, however, the history and the personal relations of the founders also suggest that the market adaptability of a NTBF may equally be confined to a rather limited space. One case in particular experienced this. For a long time they struggled to address short distance applications, for which their solution was originally intended when the project commenced within the parent firm, oblivious of the long distance applications the solution was better suited for. The new market opportunity was recognized not by themselves, but by a member recruited to the board with deep experience from the industry. Combined with the suggestions made on the limits to technological adaptability, this may form part of an explanation for the findings in study IV where board ties to firms in other industries were negatively correlated with performance whereas ties to firms within the same industry was positively so. While board members may bring in novel perceptions of the opportunity and the business, chances to realize those opportunities may increase the closer they are to the first opportunity and business idea perceived.

5.1.3. The Opportunity – Entrepreneur – Organizing activities nexus

Finally, the founders' of the observed cases frequently used their informal relations as a generative mechanism to recruit people. This practice was observed whether the NTBF originated from a university or an incumbent firm, albeit the premises and effects differed. While the corporate spin-offs staffed their firms by making direct use of personal contacts, often with former colleagues, the university spin-offs more often made use of arrangements specific to that context such as the hiring of co-financed PhD-students. In either case, such recruitments likely entailed great advantages for several reasons. Firstly, given that founders'

inside knowledge and prior experience from an industry or of a technology has been found important to NTBFs (Klepper, 2002; Agarwal et al., 2004), more of such experience in terms of new employees should confer even greater benefits. Secondly, with similar frames of references as the founders and perhaps even sharing joint work experience, these new employees likely assimilated themselves quickly into the NTBF. This should sharply reduce the learning period to become a functioning team, something Penrose (1959) held to be very important to the growth of firms. Thirdly, such recruitments also provide a way around the competition for skilled labour, something which Sørensen (2004) found to be a constraint to new firms. Fourthly, in the case of the university spin-offs, co-financed PhD-students further provided a cheap way to mould persons to fit the firm should they choose to continue to work there. This may be especially important in NTBFs due to that competence may not be readily available on the factor market. Rather the NTBF need to train personnel, or, to make a parallel to the problem of creating product markets, need to create a factor market for themselves. In the present cases this probably reinforced sourcing with the parent as this was the place most likely to have the competencies similar to the ones required by the NTBF.

In sum then, recruitments through the founders' personal networks could well enable growth at a greater pace with sustained quality in product development than would otherwise be possible. Indeed, sometimes such recruitments may even be necessary as the specificity of the technologies developed may cause underdeveloped 'factor markets' in terms of employees with sufficient skills in the area. Yet, apart from some anecdotal evidence, not much literature focuses on this issue, especially not with regard to corporate spin-offs.

Another means to acquire such competence is, as already discussed, could be to appoint appropriate members to the board. Study IV, however, provides only partial support for prior conjectures in literature that on the effects of boards and their connections. It may be so, as argued in study IV, that the key factors are not board size or changes in composition per se, but a sufficient board size and sufficient changes as to match the requirements facing the firm. What makes up a sufficient board size and sufficient changes may, however, vary from case to case. Further research is needed to assess the benefits of the knowledge and resources appointed board members bring in and how they affect the performance of the new firms.

6. Implications and conclusions

Taken together, the observations made in this thesis may together with theory serve as a basis for a number of implications for theory as well as policy and NTBFs.

6.1. Implications

6.1.1. For research

The discussion has already hinted at several implications relevant for theory, and this section serves merely to bring these together. The first implication that follows from the discussion is that to better understand the growth of NTBFs and entrepreneurial firms more generally, theory should start to pay more attention to other means of resource acquisition than those generally investigated. The findings in this thesis suggest that personal relations are not only important in the early phases of NTBFs, but also have more lasting consequences through their effects on network development and recruitment. The findings also suggest the importance of appointing appropriate persons to the board as an alternative means of resource acquisition. Yet, the larger part of literature pays only scant attention to such mechanisms, usually in favour of strategic alliances.

A second and related implication follows from this prevailing focus on alliances in literature. While this literature has generated many insights on the resources, relations and relational structures associated with success, a focus on alliances often implicitly presumes a focus on firms at a certain stage of development. That is, firms with low enough market and/or technological uncertainties to attract partners. But the literature has less to say about how these firms manage to reduce uncertainties, manage to find their conception of their markets, or even 'create' a market for their solution. In the context of NTBFs though, such questions may be of much importance due to uncertainties often inherent in the high technological opportunities pursued (Dew et al., 2004)

Thirdly, the findings in the appended studies provide some support to the effect that resources and relations are both equally important to explain resource acquisition in NTBFs. This relation seems to be especially relevant for network development and its consequences, particularly when resources are not readily available on the factor market. While theory does

recognize this relationship between resources and relations, a more detailed analysis of it still suggests a fruitful way for further studies on NTBFs.

As for more specific implications and contributions related to the appended studies, study II indicates it worthwhile for theory to pay more attention to independently spun off firms and their relations with the parent on an individual rather than organizational levels. Research on spin-off founders' informal relations could thus provide a more detailed picture of resource-acquisition in CSOs and, indeed, their success. Study I reinforces these implications, and also highlights the possibly longer lasting and constraining effects of these relations. The results of study IV, finally, suggests that theory could benefit from open up the problem space set up by resources and relations, and include more resource acquisition mechanisms with potential bearing on NTBF performance into analysis.

6.1.2. For policy

The policy implications much echoes the implications made in the appended studies. Research is likely to be a critical resource for NTBFs to access at one point or another as NTBFs base their businesses on high-technological opportunities. In study I, the academic spin-offs were some kind of 'business developers of university research', and while the spin-offs in study II had not yet established much close collaborations there were indications of them going in that direction. Based on the observations about the high level of dependence that develop in relations set up to acquire research, some conclusions of interest to policy may be posited. One of the first is that long term consequences of continued dependence on the university for research may be problematic for NTBFs. The reason is that university research is dependent on budget allocations from the state and the ability of those who allocate budgets at this level to access information about the dependences in other parts of the system is limited to say the least. Thus, the NTBF may become dependent for its research on an organization that is in turn dependent on a well meaning but not equally well informed benefactor. Optimism for that the spin-offs expand to the point where they can fund their own research needs either in house or through an arrangement with the university should be tempered with existing evidence about the R&D funding behavior of large firms. Even in these cases, there is a critical dependence on university research, not to say pledges for continued public support to basic research.

From the point of view of national policy it is also important to note that many commercialization and knowledge transfer occurs on individual rather than on organizational levels. Centralized mechanisms for managing commercialization efforts may thus be superfluous since commercialization and follow up activities appear to take place at a lower level in the structure than that at which such services are usually placed. The effectiveness of mechanisms such as liaison offices could perhaps then be increased if mechanisms were to be restructured according to a regime that is based on coordinating and facilitating relations between departments and the networks that they create.

6.1.3. For firms

Taken together, the observations in this thesis also provide for implications for NTBFs. From the point of view of these companies, the continued need for research support coupled with the difficulty to substitute the strong ties, make these ties something of a double-edged sword. The cost to build and maintain them must be contrasted with the risks of becoming too dependent on one university department. These risks include both a dependency on the university department's ability to attract funding from other sources, as well as a risk of limiting the technological and/or market adaptability. One way to mitigate this risk may be to engage in a wider network of weak ties which, in time, may be developed to become strong ties (Uzzi, 1997). What seems to be particularly helpful in developing such collaborations is to find mutual interests, emphasize informality and bi-directionality, and to safeguard by articulating priorities on beforehand.

Also, while NTBFs often may need to bootstrap activities in face of shortages of resources and to endure periods of uncertainty, it is important to bootstrap the right activities. To keep investing in good and skilled people is, for example, still likely to pay better, especially in the initial phases. Such people can often do a better job, more efficiently, and without supervision, which may be crucially important in a NTBF. Recruiting people with similar prior work experience further provides for a more efficient integration of these people into the operations and decision-making processes. Alternative and less costly ways to tie skilled people to the firm is by recruiting them to the boards. Both these strategies indeed seem to be valuable especially in the initial phases of NTBFs where delays and faulty decisions are particularly costly.

6.2. Conclusions

To conclude, the research presented in this thesis has potentially significant implications for research on NTBFs in particular as well as for entrepreneurship research generally. The findings in the appended studies lend support for prior literature that assert the importance of personal relations in the early phases of NTBFs. The findings also contributes to this literature by suggesting that the many potential uses and benefits of these relations combined may not only affect NTBFs' early phases but have lasting effects on for example, how their networks develop, and how efficiently they can manage to achieve growth. More importantly in the context of NTBFs, these relations may be critical to outlive and reduce the higher technological and/or market uncertainties often associated with these opportunities. From the observations made in the appended papers it is evident that firms can get by quite well with the aid of informal or semi-informal relations. To be sure, there are also limits to the amount and range of resources these informal relations can provide the NTBF with. Also, these relations may, together with formalized agreements, lock the NTBF on to certain technological and/or market paths that may be difficult to break even in face of necessary changes. The appended study IV also contributes to the immense literature on boards and interlocking directories by assessing their role in new firms. The findings suggest that boards may primarily be important as a means to connect to other firms within the same industry.

While the appended studies point to the importance of two hitherto understudied yet important means of resource acquisition, the aim is not to question the results from studies on formal agreements or alliances in NTBFs. There are plenty of studies indicating that such relations indeed are important to new firms many times. What may be doubted, however, is a sort of single-mindedness that tries to explain the success of all NTBFs in terms of these relations alone. There are a wide variety of relations, and some are more appropriate in some settings, and under certain circumstances, than others.

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