CORPORATE VENTURE CAPITAL AND THE VALUE-ADDED FOR TECHNOLOGY-BASED NEW FIRMS

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Dissertation for the degree of Doctor of Science in Technology to be presented with due permission of the Department of Industrial Engineering and Management for public examination and debate in Auditorium Luna at Helsinki University of Technology (Espoo, Finland) on the 17th of December, 2001, at 12 noon.

The series deals with current issues in business strategy, technology management, marketing, and international business.

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ABSTRACT

This dissertation seeks to contribute to the body of literature covering the field of interorganizational relationships of entrepreneurial firms. More specifically, this study attempts to fill a significant gap in the research into relationships between entrepreneurial firms and their corporate venture capital investors. Even though it has been recognized that relationships with large corporations can have significant implications for the performance of technology-based new firms through corporate venture capital investments, there is little rigorous, theory-based, empirical research that focuses on the factors influencing the value-added that start-up companies receive from their corporate investors. This dissertation contributes to the literature by developing and empirically testing a model of the value-added mechanisms and of the factors influencing those mechanisms.

Based on a review of the literature covering corporate venture capital and related domains of research into interorganizational relationships, this dissertation identifies resource acquisition, knowledge acquisition, and endorsement benefits as the primary mechanisms through which corporate venture capital investments add value to technology-based new firms beyond financing.

Building on received theories, an integrated model of the value-added mechanisms, and the factors influencing those mechanisms is developed. The model draws on the resource-based view and the knowledge-based view of the firm in order to understand the factors influencing resource and knowledge acquisition by portfolio companies. These theories are complemented by social capital theory in providing predictions as to the factors facilitating the sharing of knowledge and opportunities for resource sharing across organizational boundaries. Organizational economics complement the other theories in helping to understand corporate investment in relationships with, and in support for, the entrepreneurial firm. The hypotheses concerning the endorsement benefits for entrepreneurial firms stemming from the relationships with corporate investors draw mainly on the sociological research examining interorganizational endorsement. To extend the literature on the factors influencing endorsements, the model draws on the asymmetric information and signaling theories to identify factors influencing the strength of the signals from the endorsements. Transaction cost theory provides further predictions as to the value of external endorsement for the portfolio company, depending on the switching costs for potential customers and partners.

In order to test the model empirically, primary data were collected from CEOs of U.S. corporate venture capital financed technology-based new firms using two sequential mail surveys. The primary data were complemented by archival data. The hypotheses were tested using multivariate statistical techniques, including multiple regression analysis and structural equation modeling. The model and the hypotheses received support from the empirical data.

This dissertation makes important contributions to the literature in the area of corporate venture capital and interorganizational relationships of technology-based

new firms on a more general level. The findings have important practical implications for entrepreneurs either seeking corporate venture capital or already managing an existing investor relationship with a corporate venture capital investor. In addition to entrepreneurs, the findings have important implications for corporate venture capitalists and venture capitalists.

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1 INTRODUCTION

1.1 Background

Technology-based new firms are, in general, highly dependent on external resources such as financing (Jarillo 1989, Pfeffer & Salancik 1978, Stinchcombe 1965). To finance their growth, high potential ventures have commonly turned to venture capital investors, who have been shown to provide not only money, but also, often valuable, hands-on help and expertise in turning new ventures into successes (Hellmann & Puri 2000a, 2000b, Sapienza 1992). However, independent venture capitalists are not the only alternative source of finance and value-adding support for technology-based new firms.

During the recent years, industrial corporations have made an unprecedentedly high share of all venture capital investments (Christopher 2000, Gompers & Lerner 1998, Maula & Murray 2000a). However, from the perspective of entrepreneurs, choosing a corporate venture capital investor is a major decision with potentially significant long-term consequences (Gompers & Lerner 1998, Hellmann 2001, Kann 2000, Maula & Murray 2000a). Compared to traditional venture capitalists, corporate venture capital investors often have a close connection to their parent corporation. This connection brings both advantages and disadvantages (Hellmann 2001, Maula & Murray 2000a). While having a close connection to a major corporation may help corporate venture capitalists provide a young start-up with valuable corporate resources, there is also a risk of a conflict of interests between the start-up company and the parent company of the corporate investor (Hellmann 2001, Kann 2000). Even with good intentions on both sides, it is not always easy to realize the potential benefits.

Given the high volume of corporate investments during the last few years, and their high potential for valuable benefits, given also the difficulties in realizing the benefits, and the potential risk of conflicts of interest, it is important for entrepreneurs to understand both what the key factors to consider are when selecting corporate investors, and how to manage the relationship for realizing maximal benefits after the investment. So far, there has been little rigorous empirical research into these issues (Kelley & Spinelli 2001:1, Maula & Murray 2000a). This dissertation seeks to fill this gap by focusing on the mechanisms through which corporate investors may add value to their portfolio companies and on the factors influencing those mechanisms.

This dissertation examines corporate venture capital from the perspective of *technology-based new firms* (Shrader *et al.* 2000, Shrader 2001, Yli-Renko *et al.* 2001a, Zahra *et al.* 2000a). In addition to the previously mentioned gap in research examining corporate venture capital from the portfolio company perspective, another reason for selecting the perspective of technology-based new firms is that the majority of corporate venture capital investments has been made into technology-based new firms. Furthermore, corporate venture capital investors can potentially have a significant

influence on the performance of technology-based new firms (Gompers & Lerner 1998, Hellmann 2001, Maula & Murray 2000a).

The main unit of analysis in this dissertation is the relationship between a technology-based new firm and its most important corporate venture capital investor, with importance here being measured in terms of ownership share. By in-depth analysis of the firm dyads, this dissertation also expands the existing body of literature on interorganizational relationships, which is largely dominated by research that counts the number of relationships and examines the network structures, rather than analyzing specific relationships in more detail (Stuart 2000:809, Yli-Renko *et al.* 2001a).

Building on received theories and empirical research, the present dissertation develops and validates an integrated multi-theoretic model of the value-added mechanisms and the factors influencing the value-added mechanisms in the relationships between technology-based new firms and their corporate venture capital investors.

One of the key perspectives of this analysis is the resource-based theory of the firm, which views firm resources as the primary determinant of competitive advantage of the firm (Barney 1991, Penrose 1959). It is recognized that technology-based new firms often lack some critically important complementary resources typically possessed by large, industry-leading corporations (Teece 1986). Therefore, resource-combining alliances with large corporations are often an important strategy for technology-based new firms (Deeds & Hill 1996, Eisenhardt & Schoonhoven 1996, Park *et al.* 2001, Rothaermel & Deeds 2001, Rothwell 1989, Rothwell & Zegweld 1982). Complementarities are seen as an important determinant of the potential for value creation in resource combining relationships between two companies.

The knowledge-based view suggests that knowledge is the most valuable source of competitive advantage in a firm (Grant 1996). Technology-based new firms are necessarily limited in their knowledge of markets, competition, and technologies and can potentially benefit from acquiring knowledge from large industry-leading corporations. For a technology-based new firm, corporate venture capital investments may be a potential way of establishing resource and knowledge sharing relationships with large corporations.

While it is well understood that there is often potential for value creation in combining complementary resources between technology-based new firms and large corporations (Laamanen & Autio 1996, Rothwell 1989, Rothwell & Zegweld 1982), it is not evident that this value creation potential will automatically be realized in these relationships (Madhok & Tallman 1998). Social capital, it has been argued, facilitates resource and knowledge sharing in intra- and interorganizational relationships (Nahapiet & Ghoshal 1998, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a). This dissertation applies social capital theory in explaining some of the variation in the level of resource and knowledge acquisition by portfolio companies from their corporate

investors. Contributing to the understanding of the creation of social capital, the present study argues that social capital is not exogenous but instead endogenous and influenced by initial conditions and incentives for corporations to invest in collaboration and the development of working relationships.

With limited track records and a high risk of failure, technology-based new firms have difficulties in accessing external resources (Aldrich & Auster 1986, Stinchcombe 1965). It has been argued that prominent exchange partners may help to certify the quality of young ventures. These endorsements improve the legitimacy of new firms and make it easier for them to attract new investors and partners (Stuart *et al.* 1999, Stuart 2000).

The present study seeks to contribute to the literature by developing an integrated model of the value-added mechanisms and of the factors influencing those mechanisms. By building the model on the basis of received theories and empirical research in related fields, and by testing the model and hypotheses by means of both primary and secondary data, the present study hopes to create a better understanding of corporate venture capital and of the value-added to technology-based new firms. In so doing, the present study also hopes to contribute to the larger body of literature on interorganizational relationships. The findings have important practical implications for entrepreneurs selecting investors or managing existing investment relationships with corporate venture capital investors as well as for corporate venture capitalists and independent venture capitalists seeking to maximize their investment performance.

1.2   Research Problem

Most of the research on corporate venture capital has examined the issue from the perspective of large corporations (Kann 2000, Kelley & Spinelli 2001). In this dissertation, corporate venture capital is examined from the perspective of technology-based new firms. The present dissertation focuses on the value-added provided by corporate venture capital investors for their portfolio companies.

Some of the few contemporary studies on corporate venture capital from the perspective of the portfolio company have suggested that corporate venture capital investments by strategically related investors make a positive impact on the performance of portfolio companies (Gompers & Lerner 1998, Maula & Murray 2000a). However, there is a significant gap in the research on the actual relationships and the mechanisms through which corporate venture capital investors may actually influence the performance of technology-based new firms. This dissertation attempts to fill this research gap by developing theory-based hypotheses about the factors affecting the value-added, and by testing these hypotheses using primary data collected from the CEOs of technology-based new firms with corporate venture capital investors. The main research problem can be defined as a question

What are the key mechanisms through which corporate venture capital investments add value to technology-based new firms, and what factors influence these mechanisms?

In order to tackle the research problem, the first challenge is to conceptualize the value-added mechanisms on the basis of the literature and theoretical reasoning. The research problem is broken into two generic research questions. The first generic research questions is

What are the key mechanisms through which corporate venture capital investments add value to technology-based new firms?

In addition to understanding what the value-added mechanisms are, it is important to understand how these mechanisms work, and what influences them. Therefore, the second generic research question is

What factors influence the value-adding mechanisms?

The above two research questions have normative implications for CEOs of technology-based new firms. The factors affecting the value-added can be divided into structural factors that can only be managed through selecting a right partner, and behavioral factors that can be managed within the relationship. Because of the structural factors that cannot be managed after the investment has been made, the selection of suitable investors is very important. Therefore, the third generic research question is

How should start-up CEOs select corporate venture capital investors?

In addition to structural factors that cannot be managed after the relationship has been established, there may be behavioral factors affecting the value-added that can be managed within the investment relationship. Understanding these factors helps in managing the investment relationships. Therefore, the fourth generic research question is

How should start-up CEOs manage their investor relationships with corporate venture capital investors?

1.3 Research Objectives

The overall objective of this dissertation is to identify the mechanisms through which corporate venture capital investors add value to their portfolio companies and to identify the factors that affect these mechanisms. The detailed objectives of the dissertation are

- to review and analyze the research on corporate venture capital and related fields, and the theoretical approaches applicable to the analysis of value-added provided by corporate venture capital investors

- to conceptualize the mechanisms through which corporate venture capital investors add value to their portfolio companies
- to conceptualize the factors that influence the mechanisms through which corporate venture capital investors add value to their portfolio companies
- to generate a set of empirically testable hypotheses linking the value-added mechanisms to the factors affecting them
- to empirically test the hypotheses. This will include operationalizing the theoretical constructs, designing the research instrument, identifying a suitable sample, designing and carrying out the data collection, and using suitable quantitative methods to statistically test the hypotheses
- to present conclusions regarding the significance, reliability, and validity of the results of the study, to discuss the theoretical, empirical, and practical implications of the findings, and to present suggestions for future research

1.4 Scope and Limitations

The research focuses on the value-added provided by corporate venture capital investors for technology-based new firms. This issue is examined from the perspective of technology-based new firms. The perspective of technology-based new firms was selected because technology-based new firms are the most important investment target group for corporate venture capital investors. Furthermore, corporate venture capital investors have become a very important source of equity funding for technology-based new firms.

In the previous literature, technology-based new firms have been defined as companies less than six years old operating in high technology sectors (Robinson & McDougall 2001, Shrader *et al.* 2000, Shrader 2001, Zahra *et al.* 2000a). This limit was applied also in the present study. Furthermore, since the focus of this dissertation is on the value-added provided by corporate venture capitalists, additional limitation was that these companies had received corporate venture capital financing.

Because the present study focuses on the relationships between the start-up CEOs and their investors, the focus is limited to privately held companies, with the requirement that the latest investment has taken place within the last two years in order to ensure that the investor relationship is still active. Companies that had made an initial public offering, or that had been acquired, were excluded from the study.

The geographical focus was limited to the United States because most corporate venture capital investing has taken place there. A single country focus reduces unobserved heterogeneity stemming from cultural differences. There are also differences in the data availability between countries with relatively comprehensive systematic information available about U.S. based venture capital investments. The sample frame contains the whole population of firms fulfilling the above criteria in December 2000.

The main unit of analysis in this dissertation is the relationship between a technology-based new firm and its most important corporate venture capital investor, with importance here being measured in terms of ownership share. By in-depth analysis of the firm dyads, this dissertation also expands the existing body of literature on interorganizational relationships, which is largely dominated by research that counts the number of relationships and examines the network structures, rather than analyzing specific relationships in more detail (Stuart 2000, Yli-Renko *et al.* 2001a).

1.5   Research Approach and Methods

The lack of research into the value-added provided by corporate venture capital investors raises a question of the most appropriate research approach. The lack of previous research could justify an explorative research approach. However, a wider perspective on the research problem suggests another approach. While there is little research into the specific topic of the present dissertation, the value-added provided by corporate venture capital investors for their portfolio companies, there is a lot of research into related, relatively similar contexts of interorganizational relationships. By reviewing thoroughly relevant research in these related fields and identifying the commonalities in these literatures, it is possible to build relatively strong hypotheses on the value-added in corporate venture capital. While this approach requires wide and extensive literature reviews of several fields, this approach both advances the understanding of value-added in corporate venture capital further than what would be possible through an explorative survey and helps to consolidate the existing streams of literature on interorganizational relationships by identifying commonalities in these literatures and validating the hypothesis in the context of corporate venture capital. By conducting a thorough literature review of several related fields of interorganizational relationships, consolidating the literature, building robust hypotheses, and testing them empirically in the context of corporate venture capital, the present study attempts to contribute not only to the understanding of corporate venture capital but also to a more general understanding of interorganizational relationships.

The conceptual frameworks and the hypotheses of the dissertation are developed on the basis of an extensive review of research into corporate venture capital and related fields, and of theoretical approaches relevant to the analyses of the value-added provided by corporate venture capital investors to their portfolio companies. Theoretical constructs are then operationalized by adopting measures from previous research, and by developing new theory-based measures where needed. Exploratory interviews with CEOs of technology-based new firms and corporate venture capital investors are used in developing the hypotheses and the questionnaire instrument.

The hypotheses are tested empirically using statistical methods. The data used in the analyses were collected with a mail survey in December 2000 from the CEOs of technology-based new firms in the target population. The primary data collected with the mail survey is complemented by secondary data gathered from several databases

such as Venture Economics. The hypotheses are tested by confirmatory factor analysis, multiple regression analysis, and structural equation modeling.

By building on received theories and empirical research and developing an integrated model of the value added mechanisms and the factors influencing those mechanisms in corporate venture capital, by collecting both primary and secondary data, and by subjecting the hypotheses to rigorous empirical testing, this dissertation aims to consolidate and expand the existing literature on relationships between corporate venture capitalists and their portfolio companies and to contribute also to a wider body of literature on interorganizational relationships between small and large firms.

1.6 Concepts

In this section, the key concepts are defined and explained. While this chapter presents some of the definitions, the operationalizations used in the empirical part of the dissertation are described in more detail in the methodology chapter (Chapter 4).

1.6.1 Technology-Based New Firms

The definition of technology-based new firms has many variations. For instance, the upper age limit varied in the earlier literature, but recently, six years has become the standard (Robinson & McDougall 2001, Shrader *et al.* 2000, Shrader 2001, Zahra *et al.* 2000a). Following this, technology-based new firms are defined here as privately-held companies less than 6 years old.

Typically, technology-based new firms have been defined as businesses based on the exploiting of technological resources (Yli-Renko 1999). In the present study, technology-based new firms are defined, for practical reasons, on the basis of the Venture Economics' classification of high technology firms, which includes companies operating in the following sectors: biotechnology, medical/health science, Internet specific, communications, computer software and services, computer hardware and semiconductors/other electronics. These sectors together comprise the high-technology sectors in the Venture Economics database.

In addition to the term *technology-based new firm*, I use synonymously the term *portfolio company*, which refers to a company in which a venture capitalist has made an equity investment. Similarly, words *investee, start-up,* and *venture* are also used as synonyms for portfolio company. All these terms are used to refer to technology-based new firms included in the study.

1.6.2 Venture Capital

The National Venture Capital Association defined venture capital as: "money provided by professionals who invest alongside management in young, rapidly growing

companies that have the potential to develop into significant economic contributors" (NVCA 2001). Lorenz (1989) defined venture capital as long-term equity-based risk finance where the primary reward for the investor is capital gain. Bygrave and Timmons (1992:1) described venture capital as having a catalytic role in the entrepreneurial process, being fundamental value creation that triggers and sustains economic growth and revival. Wright and Robbie (1998) defined venture capital as investments by professional investors of long-term, unquoted, risk equity finance in new firms where the primary reward is eventual capital gain supplemented by dividend yield. Hellmann (2000b) defined venture capital as "professionally managed, equity-like financing of young, growth-oriented private companies". All these definitions focus on the type of investments venture capitalists make and the rewards they gain from it.

However, there is more to venture capital than investing and exiting from investments. Gompers and Lerner (1999b:2-4) argued against the misguided belief that venture capitalists can add little value to young firms aside from providing money, or can be easily duplicated by an institution whose core strengths are very different. They went on to argue that these misconceptions have often led not only to a failure to capitalize on attractive opportunities but also to a substantial destruction of value. In their book, Gompers and Lerner defined venture capital as a process. They argued that venture capital can be viewed as a cycle that starts with the raising of a venture fund, proceeds through the investing in, monitoring of, and adding value to firms; the cycle continues as the venture capitalist exits successful deals and returns capital to their investors, to renew itself as the venture capitalist raises additional funds. This definition points to the very important value-adding role of venture capitalists (Hellmann & Puri 2000a, 2000b, Sapienza 1992). Supporting this view, Hellmann (2000b) argued that a simple analogy of the role of venture capital is to consider venture capitalists as sport coaches. In his view, entrepreneurs are like athletes, who fight the actual game and get most of the glory in case of success, while venture capitalists are like coaches, who choose which athletes get to play, who train and motivate them, and who try to create the most favorable conditions for them to succeed in. Without coaches, inexperienced athletes would spend extraordinary effort on the wrong task. According to Hellmann, venture capitalists can similarly provide mentoring and guidance that helps entrepreneurs to turn their efforts into success.

An important aspect in venture capital is the manner in which venture capital firms are organized. Most of the professional venture capital firms are organized as limited partnerships in which the partners of the venture capital firm act as general partners, while the institutional investors and other investors in the venture capital fund act as limited partners (Sahlman 1990). This structure has been found to be efficient in alleviating agency problems between the investors and venture capital firms by providing strong incentives for venture capitalists to add value to the ventures (Gompers & Lerner 1996, 1999a). The finite life and substantial profit sharing have been characteristics of private venture capital funds that have been identified as having

important differences when compared to the manner in which corporate venture capital funds are typically organized (Gompers & Lerner 1998, 1999a). However, because of the substantial benefits of limited partnership structure in traditional venture capital, corporations have recently adopted similar structures and principles in their corporate venture capital operations (e.g. Nokia Venture Partners).

There is more to what venture capital is and what venture capitalists do than can be included in this section. One excellent source of further information on venture capital is Gompers and Lerner (1999b). For the purposes of this study, there are two important ideas to remember. First, the value-added provided by venture capitalists for their portfolio companies is an important part of what venture capitalists do and why they are appreciated by entrepreneurs. The value-added provided beyond the financial investment is one of the most important considerations for entrepreneurs when selecting investors (Smith 2001). Second, venture capital is a well-defined form of equity funding for entrepreneurial companies. From the perspective of entrepreneurs, venture capitalists represent one potential source of financing. Corporate venture capital represents another important complementary alternative source of financing for technology-based new firms (Christopher 2000, Hellmann 2001, Maula & Murray 2000a).

1.6.3 Corporate Venture Capital

There are several ways to define and map the concept of corporate venture capital. The two main alternative perspectives are viewing corporate venture capital (1) as a mode of external corporate venturing from the perspective of the corporation (Henderson & Leleux 2001, Kann 2000, Keil 2000) or (2) as an alternative source of funding from the perspective of an entrepreneurial company (Gompers & Lerner 1998, Maula & Murray 2000a). This study employs primarily the latter perspective. Corporate venture capital is examined from the perspective of start-up companies with the focus on the influences of the special nature of corporate venture capital on the investment relationship and relationship outcomes.

In this study, corporate venture capital is defined as equity or equity-linked investments in young, privately held companies, where the investor is a financial intermediary of a non-financial corporation. The main difference between venture capital and corporate venture capital is the fund sponsor. In corporate venture capital, the only limited partner is a corporation. Alternatively, a corporate venture capital fund can be a subsidiary of a corporation. In this study, I consider corporate venture capitalists as all the equity investors classified by Venture Economics as affiliates or subsidiaries of non-financial corporations.

1.6.4 Resources

One of the key concepts of this study is *resources*. In her book on firm growth, which has become the foundation of the resource-based view of the firm, Penrose (1959) defined resources as "physical things a firm buys, leases, or produces for its own use, and the people hired on terms that make them effectively part of the firm" (Penrose 1959:67).

Some other authors have taken a broader view of resources. For instance, Wernefelt (1984:172) defined resources as "anything which could be thought of as a strength or weakness of a given firm. More formally, a firm's resources at a given time could be defined as those (tangible and intangible assets) which are tied semipermanently to the firm." As examples of resources, Wernefelt (1984:172) listed "brand names, in-house knowledge of technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, capital etc." Along similar lines, Barney defined resources as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney 1991:101). Although both of these definitions are broad, there is an important difference between the definitions of Wernefelt and Barney. Barney's definition includes only elements that are potentially rent yielding (i.e. strengths).

An important distinction is the inclusion of capabilities, skills, and competencies as part of the resource portfolio of the firm. While some of the definitions clearly include these (Barney 1991, Wernefelt 1984), some other authors have explicitly separated capabilities, skills, and competencies from other resources (Amit & Schoemaker 1993, Grant 1991). Amit and Schoemaker (1993) defined the difference between resources and capabilities as follows: "Resources can be defined as stocks of available factors that are owned or controlled by the firm… …Capabilities, in contrast, refer to a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end." Resources (such as individual employees, patents, brand names, finance etc.) are seldom productive alone but can be turned into outputs with the help of suitable capabilities (Grant 1991).

The present work makes a distinction between *resources* and *knowledge* and considers resources as tangible or intangible assets possessed by the firm or accessed through interorganizational relationships and knowledge as an ingredient that helps to get higher value from the resources (Penrose 1959:76).

1.6.5 Knowledge

The traditional definition of knowledge is "justified true belief", a concept first introduced by Plato (Nonaka & Takeuchi 1995:21). This definition, grounded in Western epistemology, focuses on the explicit nature of knowledge. Knowledge is modeled as an unambiguous, reducible and easily transferable construct, while

knowing is associated with processing information (Eisenhardt & Santos 2000). In contrast with this traditional conception, a newer view of knowledge, based on the distinction between explicit and tacit knowledge (Polanyi 1958), has emerged. Tacit knowledge is linked to the individual, and is very difficult to articulate.

This distinction between tacit and explicit knowledge has been the basis for the emergence of the knowledge-based view of the firm (e.g. Grant 1996, Kogut & Zander 1992). The knowledge-based view argues that because tacit knowledge is difficult to imitate and relatively immobile, it can constitute the basis of sustained competitive advantage (DeCarolis & Deeds 1999, Grant 1996, Gupta & Govindarajan 2000, Kogut & Zander 1993).

The relationship between the terms knowledge and resources varies in the literature. While physical resources such as land or money are clearly distinct from tacit knowledge possessed by the employees of a firm, there is a large overlap between the concepts. The present study focuses on the outcomes of relationships between technology-based new firms and their corporate investors. In the examination of these relationships, I refer to resource acquisition when meaning acquisition of, or access to, concrete resources such as distribution channels, production facilities and technology. When referring to knowledge acquisition, I mean the learning by portfolio companies from their corporate investors that helps them use their own resources more efficiently and effectively (Penrose 1959:76).

1.6.6 Complementarities

One of the key concepts in this study are complementarities between the technology-based new firms and (the parents of) their corporate investors. Complementarities refer to the degree the portfolio company and the parent corporation of the corporate venture capital investor complement each other. The complementarities can be related in resources and capabilities, products and services, or some other dimension. Complementarity is not necessarily related to the concept relatedness. The key determinant of complementarity is whether the success of one player is positively related to the success of the other player (Brandenburger & Nalebuff 1996).

One of the key dimensions of complementarities is the complementarity between the resources and capabilities of the two companies. In the previous literature, several authors have developed typologies of complementarities between small and large firms. One useful categorization of potential resource complementarities between small and large firms has been developed by Rothwell and Zegweld (1982), Rothwell (1989), and Laamanen & Autio (1996). Their list of dynamic complementarities between small and large firms is presented in Table 1-1.

Table 1-1   Dynamic complementarities between small and large firms in innovation (adopted from Laamanen & Autio 1996, Rothwell 1989, Rothwell & Zegweld 1982)

Area	Small firms: functional	Large firms: resource-based
Marketing	Ability to react quickly to keep abreast of fast changing market requirements	Comprehensive distribution and servicing facilities. High degree of market power with existing products
Management	Lack of bureaucracy. Dynamic, entrepreneurial managers react quickly to take advantage of new opportunities and are willing to accept risk	Professional managers able to control complex organizations. Can suffer from excessive bureaucracy. Managers often unwilling to accept risk.
Internal communication	Efficient and informal internal communication networks. Fast response to internal problem solving: provides ability to reorganize rapidly to adapt to change in the external environment	Internal communication sometimes cumbersome
Qualified technical manpower	Often unable to support a formal and sustained research and development activity	Can support the establishment of large research and development laboratories
External communication	Often lack the time and resources to identify and use external sources of information and expertise	Able to tap external sources of information and expertise. Can subcontract research and development projects to specialized organizations
Finance	Often difficulty in attracting capital	Ability to effectively use a broad range of financing instruments and the financial market
Economies of scale and the systems approach	In some areas, economies of scale can constitute a preventive barrier to entry. Inability to offer integrated product lines or systems	Ability to gain scale economies in production and marketing. Ability to maintain systemic products
Growth	Can experience difficulty in financing rapid growth. Entrepreneurial management can experience difficulty in coping with a growing organization	Ability to finance expansion of production base. Ability to fund growth via diversification and acquisition
Patents	Can experience problems in coping with the patent system. Cannot afford to litigate	Ability to employ patent specialists. Can afford to litigate
Government regulations	Often cannot cope with complex regulations. Limited chances of influencing the regulatory process	Ability to fund legal services to cope with complex regulations. Often good chances of influencing the regulatory process

Besides complementarities in resources, there can be complementarities in other dimensions as well. For instance, Amit & Zott (2001) argued that, "complementarities are present whenever having a bundle of goods together provides more value than the total value of having each of the goods separately." This definition is partly based on the work by Brandenburger and Nalebuff (1996) who highlighted the importance of providing complementary outputs to customers. In their game theory based co-opetition framework, they stated that that, "A player is your complementor if customers value your product more when they have the other player's product than when they have your product alone" (Brandenburger & Nalebuff, 1996:18). Following Brandenburg and Nalebuff (1996) and Amit & Zott (2001), I also consider complementarities in both inputs and outputs. In addition to resources,

complementarities in the product markets of the two companies are likely to influence their capability and willingness to collaborate.

1.6.7 Social Interaction

Social capital theory suggests that interorganizational relationships facilitate the exchange of knowledge and resources (Nahapiet & Ghoshal 1998, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a). According to Nahapiet and Ghoshal, relationships providing access to the physical resources can be considered as a higher-order resource for the individual or organization justifying the term 'social capital'.

Social capital is a multidimensional concept (Galunic & Moran 2000, Granovetter 1985, Nahapiet & Ghoshal, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a). Nahapiet and Ghoshal (1998) defined three dimensions of social capital: structural dimension, relational dimension, and cognitive dimension. The *structural dimension* refers to network ties, network configuration, and appropriable organization (Nahapiet & Ghoshal 1998), the *relational dimension* refers to assets that are rooted in relationships such as trust, norms, obligations, and identification (Nahapiet & Ghoshal 1998), while the *cognitive dimension* refers to shared codes and language as well as shared narratives that facilitate a common understanding of collective goals and the proper ways of acting in a social system (Nahapiet & Ghoshal 1998).

Given that the present study focuses on dyadic relationships between the corporate investors and start-up companies, the measurement of some of the network structure based constructs of social capital is inherently limited. Therefore, the present study follows Yli-Renko *et al.* (2001a) in measuring social capital in dyadic relationships. The present study focuses on social interaction between the corporate investor applying the measures from Tsai & Ghoshal (1998) and Yli-Renko *et al.* (2001a) measuring social interaction as closeness of the relationship, knowledge of investor on a personal level, and the existence of frequent informal meetings (Yli-Renko *et al.* 2001a). These measures were complemented by the frequency of interaction used earlier in the context of venture capital by Sapienza (1992) and Sapienza & Gupta (1994).

1.6.8 Endorsement

One of the key constructs of the present study is interorganizational endorsement stemming from the relationship between corporate investor and the portfolio company. The idea of endorsement is that the association with a prominent corporate investor has positive reputational effects for the new start-up.
There are several important distinctions that are required to describe the endorsement. When talking about effects of the identity of a firm or its partner on the performance, there are several more or less related concepts describing the identity including, for instance, status, legitimacy, reputation, or credibility, depending on the terminology used. Economists and strategy theorists typically use the term 'reputation' to describe a

rent-generating asset (Barney 1991, Deephouse 2000, Fombrun 2001, Grant 1991, Hofer & Schendel 1978, Peteraf 1993, Rao 1994). Sociologist and institutional theorists tend to use more often the term 'legitimacy' when referring to the acceptance of the focal actor by its institutional environment (Baum & Oliver 1991, 1992). Rao (1994) argued that reputation could be viewed as the outcome of legitimization process. Despite the differences in terminology and assumptions, all these views regard associations with respected partners as having potential commercially valuable effects.

Financial economists, building on asymmetric information theory (Akerlof 1970) and signaling theory (Spence 1973), have examined the role of prestigious underwriters (Beatty & Ritter 1986, Booth & Smith 1986, Carter & Manaster 1990, Carter *et al.* 1998), auditors (Beatty 1989, Michaely & Shaw 1995, Titman & Trueman 1986), and venture capitalists (Barry *et al.* 1990, Brav & Gompers 1997, Megginson & Weiss 1991) in certifying the quality of the ventures going public and reducing the problems stemming from asymmetric information between insiders and outside investors.

On another front, sociologists have focused on the mechanisms of interorganizational endorsement and the implicit status transfer stemming from affiliations with prominent partners. Assuming only a loose connection between the status stemming from interorganizational relationship with prominent partners and the true quality of the firms or its products, Podolny (1993, 1994) argued that a high status could be an important competitive advantage especially under uncertainty. Similarly, Stuart *et al.* (1999) and Stuart (2000) demonstrated in their rigorous empirical studies that prominence of the exchange partners is related closely to the performance of the focal firms. The present study adopts the view of Podolny (1993, 1994), Stuart *et al.* (1999), and Stuart (2000) where affiliations with prominent partners can have value creating effects even without them being necessarily highly correlated with the true quality of the firm. However, it is recognized that evidence of any endorsement signals being tightly coupled to the true quality are likely to be taken as more credible signals by outsiders.

1.6.9 Value-added

The primary role of venture capitalists and corporate venture capitalists is providing funding for young entrepreneurial firms. However, venture capitalist and corporate venture capitalists are typically far from passive investors. According to Gorman & Sahlman (1989) venture capitalists spend half of their time in monitoring and post-investment relationships with, on average, nine ventures each.

Because of their experience with numerous ventures and their large exposure to financial, labor, and other resource markets, venture capitalists are in a good position to support their portfolio companies. Venture capitalists have been acknowledged to provide valuable help for their portfolio companies in the form of serving as a sounding board to the entrepreneur team, for instance, or helping the firm obtain alternative further sources of equity financing, or interfacing with the investor group, monitoring

financial performance, monitoring operating performance, or helping their portfolio firms attract alternative sources of debt financing (MacMillan *et al.* 1988). Similar results have been found by Gorman and Sahlman (1989), Sapienza *et al.* (1996), and Rosenstein *et al.* (1993).

The special nature of corporate venture capital investments provides a unique opportunity for additional kinds of value-added. Because the parent firm of the corporate venture capital investor is typically a major industrial corporation, the corporate venture capital investment relationship may open up access to the resources of the parent corporation, including distribution channels, production facilities, research and development, technology, or pricing benefits on the products and services of the corporation (Alter & Buchsbaum 2000, Barry 2000, Christopher 2000, Kelley & Spinelli 2001, Maula & Murray 2000a). Large global corporations also conduct market research that may be valuable for new ventures operating in related fields (Dube 2000:49, Maula & Murray 2000a). Furthermore, an investor relationship with a major corporation may provide valuable endorsement for a new technology-based firm (Kelley & Spinelli 2001, Maula & Murray 2000a). In this study, the term 'value-added' is used to refer to all non-financial benefits the portfolio companies receive from the corporate venture capital investor as a result of the investment relationship.

1.7   Structure of the Dissertation

The rest of the dissertation is structured as follows: Chapter 2 provides a literature review, in which extant literature on corporate venture capital and related fields and relevant theories are reviewed; Chapter 3 presents the models and hypotheses; Chapter 4 describes methods, the sample, the selection and operationalization of the variables. Chapter 5 describes the empirical results of the study. Finally, Chapter 6 discusses the conclusions of the research, the possible interpretations of the findings and their theoretical and practical implications. The structure of the study is illustrated in Figure 1-1.
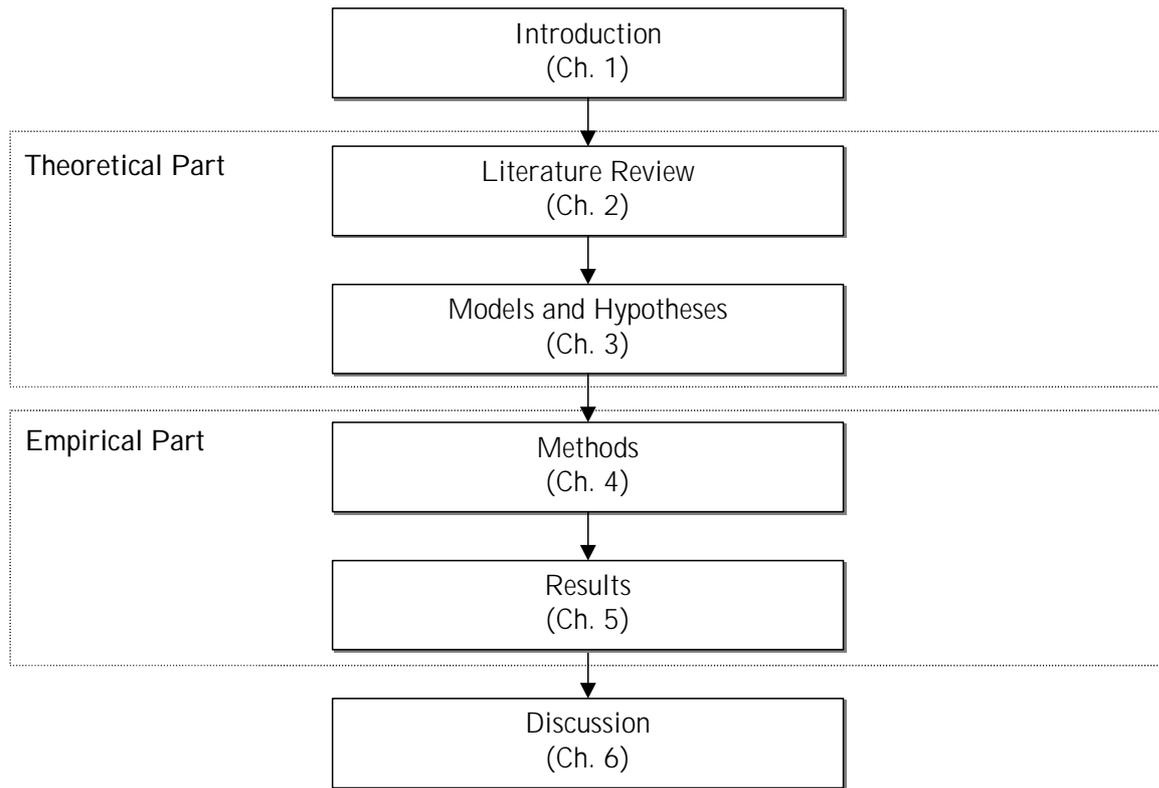
Figure 1-1   Structure of the study

2 LITERATURE REVIEW

This chapter reviews the relevant literature in two parts. First, the review focuses on the extant research on the topic area describing the role of interorganizational relationships for technology-based new firms. Thereafter, the review focuses on corporate venture capital, discussing it both from the corporate perspective and from the perspective of technology-based new firms, with a specific focus on the benefits from corporate venture capital for technology-based new firms.

Because there is very little earlier research on the value added provided by corporate venture capital investors for their portfolio companies, literature on other related types of interorganizational relationships is reviewed in order to build a solid basis for hypothesis development. The review covers research on value-added in venture capital, alliances between large and small firms, and the relationship between corporate ventures and parent corporation in internal corporate venturing. The relevant findings from the review of the extant empirical literature is summarized and compared across fields.

In the second part of the chapter, most relevant theoretical frameworks are reviewed. These theoretical frameworks include the resource-based view, knowledge-base view, social capital theory, resource dependence perspective, agency theory, asymmetric information theory, and transaction cost economics. For each theory, the development and key concepts of the theories are summarized and followed by an overview of the most relevant applications and a summary of the critique of the theories. Finally, theories are compared and their applicability to the present study assessed.

2.1 Extant Research on Corporate Venture Capital and Related Fields

2.1.1 Technology-Based New Firms and Interorganizational Relationships

Technology-based new firms have been argued to be highly dependent on resources available through interorganizational relationships (Jarillo 1989, Stinchcombe 1965, Yli-Renko *et al.* 2001b). Technology-based new firms usually operate in fields requiring substantial resources but typically have very little resources themselves. The objective often being rapid growth, technology-based new firms are forced to use external resources and form rapidly new business relationships and customer relations (Autio & Garnsey 1997, Jarillo 1989, Pfeffer & Salancik 1978).

Technology-based new firms may have various kinds of interorganizational relationships. There is a large body of literature examining the relationships of entrepreneurial firms with their *venture capitalists* (MacMillan *et al.* 1988, Sapienza 1992, Sapienza & Gupta 1994, Sapienza *et al.* 1994, Sapienza *et al.* 1996, Sapienza & Korsgaard 1996). Another stream has focused on *strategic alliances* of entrepreneurial

firms (Deeds & Hill 1996, Eisenhardt & Schoonhoven 1996, Rothaermel & Deeds 2001, Schoonhoven & Lyman 2000, Shan *et al.* 1994, Stuart *et al.* 1999, Stuart 2000). Other forms of interorganizational relationships of technology-based new firms include the personal networks of entrepreneurs (Birley 1985, Dubini & Aldrich 1991, Larson 1991, Larson & Starr 1993), customer relationships (Yli-Renko *et al.* 2001), and regional innovation networks (Lorenzoni & Ornati 1988, Saxenian 1990, Shepherd 1991).

Evolution of Interorganizational Relationships of Technology-Based New Firms

The emergence and growth of new firms has often been depicted as stage models (Churchill & Lewis 1983, Greiner 1972, Kazanjian 1988, Kazanjian & Drazin 1989, 1990, Quinn & Cameron 1983, Scott & Bruce 1987). Although criticized for not accurately representing the real development of entrepreneurial firms, these models have helped to understand the dynamic challenges of growing firms (Autio 2000, Autio & Garnsey 1997). Recent research has demonstrated that the interorganizational relationships of new firms also evolve dynamically (Hite & Hesterly 1999, 2001).

For emerging firms, the social network of the entrepreneur is virtually synonymous with the network of the firm, as network ties initially exist on the interpersonal level (Hite & Hesterly 1999, 2001). Emerging firms typically leverage entrepreneurs' existing ties such as family members and friends to gain the key resources needed to establish firm viability (Bhide 1999, Birley 1985, Dubini & Aldrich 1991, Hite & Hesterly 2001, Johannisson 2000, Larson & Starr 1993). Ostgaard and Birley (1996) assumed the personal networks of the owner-managers to be the most important resources upon which the owner-managers can draw in the early days of the firm's development.

As emergent firms evolve into growth firms, their networks evolve from identity-based, existing ties of the entrepreneur to more calculative relationships based on assessment of economic costs and benefits (Hite & Hesterly 2001). Firms in different life cycle stages have different strategic challenges (Hite & Hesterly 2001, Kazanjian 1988, Kazanjian & Drazin 1989, 1990, Quinn & Cameron 1983). In their attempt to respond to new strategic challenges and resource acquisition needs, evolving firms develop new interorganizational relationships to match the needs (Hite & Hesterly 2001). When moving into the early-growth stage, new firms make clear strategic decisions to grow intentionally beyond mere survival (Churchill & Lewis 1983, Hite & Hesterly 2001, Kazanjian & Drazin 1989). In this stage, a more extensive and broader set of resources is needed to enable growth. During the early growth stage, the search for external resources, and the building of interorganizational relationships to access them, becomes more intentional and calculative. Instead of leveraging resources from their families and friends, early growth stage companies often seek external financing from venture capitalists and other investors, and form alliances with other companies.

However, not only lack of resources constrains growth of technology-based new firms. Technology-based new firms are limited by their competencies and knowledge

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of the markets and customer needs. Acquiring knowledge is another important reason for technology-based new firms to enter into interorganizational relationships (Almeida *et al.* 2001, Liebeskind *et al.* 1996, McGee & Dowling 1994, Powell *et al.* 1996, Yli-Renko *et al.* 2001a). Commercializing new technologies also requires market acceptance and in some cases creation of new markets (Aldrich & Fiol 1994, Autio 2000, Stuart *et al.* 1999, Stuart 2000). Three broad categories cover most of the reasons why technology-based new firms establish interorganizational relationships: access to resources, access to knowledge, and enhancing external legitimacy through interorganizational endorsements.

Access to resources is an important reason for entrepreneurial technology-based new firms to engage in interorganizational relationships with other organizations (De Meyer 1999, Eisenhardt & Schoonhoven 1996, Hite & Hesterly 1999, 2001, Jarillo 1989, Park *et al.* 2001). Resources acquired through interorganizational relationships may include simple resources, e.g. financial, which are often sought from venture capitalists. Resources obtained through interorganizational relationships can also include access to distribution channels (Stearns 1996), production facilities or something else that is needed to create, produce and distribute the products competitively.

Access to knowledge is another important motivation for technology-based new firms to enter into relationships with external parties (Almeida *et al.* 2001, Liebeskind *et al.* 1996, McGee & Dowling 1994, Powell *et al.* 1996, Yli-Renko *et al.* 2001a). Technology-based new firms need external knowledge to focus their scarce resources to the most effective use and to develop their competencies and organizations. For instance, new firms are known to seek venture capital financing and select venture capital investors on the basis of strategic advice they believe to get from the investors (Smith 2001). Strategic advice has been confirmed as the most important form of hands-on value-added entrepreneurs gain from their venture capital investors (MacMillan *et al.* 1988, Sapienza 1992, Sapienza *et al.* 1994, Sapienza *et al.* 1996). Similarly, technology-based new firms use strategic alliances to acquire knowledge to develop their technologies and competencies (Baum *et al.* 2000, Chan & Heide 1993, Dickson *et al.* 1991, Gemünden *et al.* 1992, Kelley & Rice 2000, McGee & Dowling 1994, Powell *et al.* 1996).

Endorsement benefits are the third reason for technology-based new firms to enter interorganizational relationships (Dickson *et al.* 1991, Stuart *et al.* 1999, Stuart 2000). Legitimacy is important for new ventures since it increases the likelihood that customers will accept the new firm as a supplier and enables access to other external resources (Stinchcombe 1965, Aldrich & Auster 1986). Associations with prominent corporations have been shown to be valuable for improving the legitimacy of new firms (Stuart *et al.* 1999, Stuart 2000). When selecting venture capitalists, entrepreneurs prefer prestigious venture capitalists in order to convey an image of a reliable company. In his study of 143 entrepreneurs, Smith (2001) found that entrepreneurs ranked the

reputation of the venture capitalists in investing in successful companies as the most important selection criteria when selecting investors.

In the following chapters, I will examine closer some of the most relevant fields of research related to relationships between technology-based new firms and their corporate venture capital investors. I will first focus on corporate venture capital from the corporate perspective and thereafter discuss the extant (scarce) research on corporate venture capital from the venture perspective. Thereafter, I will focus on extant research on three forms of relationships of new ventures, which I believe are useful for understanding better the important dimensions in the relationships between ventures and their corporate venture capital investors. The three areas of research I review are value-added in venture capital, alliances of small firms, and relationships between corporate ventures and their parent corporations. I will employ the findings from these related, but more extensively researched fields, in developing hypotheses about the important factors to be considered in research on technology-based new firms and their corporate venture capital investors.

2.1.2 Corporate Venture Capital from the Corporate Perspective

In order to understand the relationships between new ventures and corporate venture capitalists, it is important to understand how corporations view corporate venture capital. In this section, corporate venture capital is first examined from the corporate perspective.

Corporate Venture Capital as a Corporate Venturing Mode

From the corporate perspective, corporate venture capital is one important tool in the corporate venturing toolbox used to develop new business (Keil 2000, Rind 1981, Roberts 1980, Roberts & Berry 1985, Venkataraman & MacMillan 1997). Other tools in this 'toolbox' include activities like internal corporate ventures, acquisitions, joint ventures, alliances, and spin-offs (Keil 2000, Rind 1981, Roberts 1981, Roberts & Berry 1985, Venkataraman & MacMillan 1997). There are some studies that have attempted to build a more systematic view of the various tools used in new business development by corporations. Building on Robert's (1980) earlier research depicting corporate venturing modes as a continuum from high corporate involvement/high risk internal ventures to low corporate involvement/low risk venture capital investments, Roberts and Berry (1985) argued that optimal venturing modes depend on the context and objectives. Roberts and Berry further proposed that the newness and the familiarity of the markets and underlying technologies would be key determinants of the optimal venturing strategies. In their categorization, corporate venture capital investments were recommended for probing new and unfamiliar markets or technologies. The matrix is depicted in Figure 2-1.

Market Factors	Technologies or Services Embodied in the Product		
	Current	New but Familiar	New and Unfamiliar
New and Unfamiliar	Joint Ventures	Venture Capital or Venture Nurturing or Educational Acquisitions	Venture Capital or Venture Nurturing or Educational Acquisitions
New but Familiar	Internal Development or Acquisitions (or Joint Ventures)	Internal Ventures or Acquisitions or Licensing	Venture Capital or Venture Nurturing or Educational Acquisitions
Current	Internal Base Developments (or Acquisitions)	Internal Development or Acquisitions or Licensing	"New Style" Joint Ventures

Figure 2-1   Optimal venturing strategies (adopted from Roberts & Berry 1985)

However, before discussing further the role of corporate venture capital in the corporate venturing toolbox of corporations, it is important to make clearer our understanding of the domain of corporate venturing. To sharpen the picture, an important distinction made in the earlier literature is the distinction between internal venturing and external venturing (Keil 2000, Sharma & Chrisman 1999). *Internal corporate venturing* refers to new innovations developed at various levels of the firm but within the boundaries of the firm (Burgelman & Sayles 1986, Keil 2000). Sharma and Chrisman (1999) defined internal corporate venturing as "corporate venturing activities that result in the creation of organizational entities that reside within an organizational domain". However, corporate venture capital is clearly a boundary spanning operation and belongs to the other class of venturing tools labeled as external corporate venturing. Sharma and Chrisman (1999) defined *external corporate venturing* as "corporate venturing activities that result in the creation of semi-autonomous or autonomous organizational entities that reside outside the existing organizational domain". Based on extensive case research of seven leading corporations in the information and communications technology sector in the United States and Europe, Keil (2000:109) developed a classification of external corporate venturing modes. The classification is shown in Figure 2-2 (direct corporate venture capital bolded).
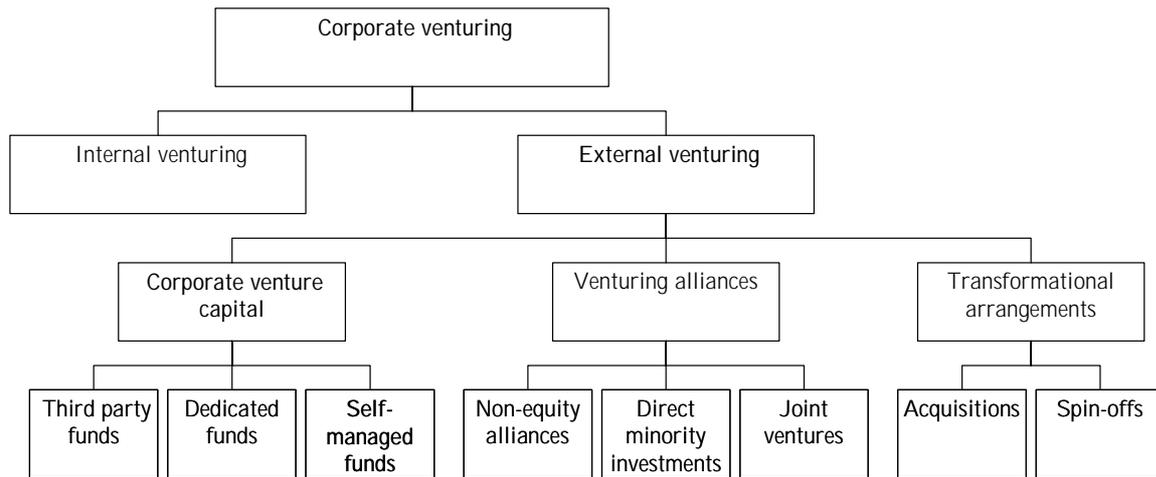
Figure 2-2   External corporate venturing modes (adopted from Keil 2000)

In this framework, Keil (2000) first distinguished external venturing from internal venturing and thereafter grouped external venturing modes into three groups: corporate venture capital, venturing alliances, and transformational arrangements. *Corporate venture capital* resembles the operations of traditional venture capital firms in referring to programs residing at various levels of corporations where investments are made in independent external companies. In the case corporations, investments were made directly into ventures or indirectly through dedicated funds or pooled funds managed by external venture capital firms. These modes are fairly well in line with the extant literature (Barry 2000, Bleicher & Paul 1987, Kann 2000, McNally 1997, Sykes 1990). Some additional distinctions have been made concerning the organization of direct investments. McNally (1997) proposed distinction between *Ad hoc* investments and a more formal fund. Similarly, Winters and Murfin (1988), Sykes (1990), and Mast (1991) recognized varying levels of formality in the organization of corporate venturing activities. An important point to remember from these distinctions is that the present study focuses on the direct investments made by corporations. This focus is highlighted by bolding in Figure 2-2.

The second group of external venturing modes in the framework of Keil (2000) includes various forms of alliances. This *venturing alliances* group includes non-equity alliances, direct minority investments, and joint ventures. In making his distinction between corporate venture capital and venturing alliances, Keil (2000) stated that in contrast to corporate venture capital, the relationship with the venture is built on intense cooperation rather than on investment. The distinction between corporate venture capital and joint ventures and non-equity alliances is quite clear. However, the distinction between direct minority investments and corporate venture capital is not always clear in the extant literature and may not be clear in practice either. For instance, McNally (1997:37) used the term 'corporate venture capital' to describe "instances where an equity stake has been taken by a large corporation in a small, unquoted company, whether it is coupled with further strategic relationship or not". In his classification framework of corporate venture capital activities McNally (1997:38)

proposed that both direct and indirect corporate venture capital might lead to further collaboration between the corporations and the ventures and involve strategic partnerships. Similarly, Kann (2000) argued "corporate venture capital investments often coincide with the establishment of a new business relationship with an entrepreneurial firm or are initiated to confirm an ongoing relationship such as a client/supplier relationship or a technology exchange agreement". Keil (2000:118) admitted the relative similarity between corporate venture capital and direct minority investments, but found three key dimensions, which, in the case companies, distinguished these two activities. First, case companies viewed corporate venture capital as a market monitoring activity whereas in direct minority alliances the focus was more on the value creation in specific relationships. Second, the corporate venture capital investments were often made in strategically less close ventures than direct minority investments. Third, corporate venture capital investments were driven more by direct financial objectives than direct minority investments. Keil (2000:119) also found that, whereas corporate venture capital investments were coordinated by corporate venture capital units, direct minority investments were typically managed by business units and supported by mergers and acquisition specialists.

The last group of external venturing modes in the framework of Keil (2000) is *transformational arrangements* consisting of acquisitions and spin-offs. In acquisitions, external ventures are internalized and in spin-offs internal ventures are externalized.

The present study takes the position that corporate venture capital is a specific tool in the external corporate venturing tool portfolio as outlined by Keil (2000). However, it also recognizes that corporations have varying motives for making corporate venture capital investments (Alter & Buchsbaum 2000, Kann 2000, Keil 2000, Maula & Murray 2000a, Siegel *et al.* 1988, Sykes 1990, Winters & Murfin 1988), and varying strategies regarding the level of hands-on involvement with the ventures in addition to financial investment (Henderson & Leleux 2001, Kann 2000, Kelley & Spinelli 2001, McNally 1997). Relationships stemming from corporate venture capital investments made for financial purposes may develop over time into relationships that may appear more like a direct minority investment (Henderson & Leleux 2001, Kann 2000, Kelley & Spinelli 2001, McNally 1997). It is this variation in the level of hands-on involvement in venture-corporate venture capital investor relationships that makes it important for entrepreneurs to understand the value-added mechanisms and the factors influencing those mechanisms.

The History of Corporate Venture Capital Activity

When examining the history of corporate venture capital, three different 'waves' of corporate venture capital activity have been identified (Gompers & Lerner 1998). First, in the late 1960s, corporations engaged in corporate venture capital in order to gain a "window on technology". More than 25% of the Fortune 500 corporations were engaged in corporate venture capital activities in the late 1960s and early 1970s

(Gompers & Lerner 1998). Following the collapse in the market for initial public offerings in 1973, the returns on venture capital rapidly declined and most of the corporate venture capital programs were soon dissolved. The second wave in corporate venture capital took place in 1980s, when it was used as a diversification tool. This wave peaked in 1986 when 12% of the total venture capital investments were managed by corporate venture capital programs (Gompers & Lerner 1998). However, not a great number of the corporate venture capital programs were successful and most of them were again quickly dissolved after the stock market crash in the end of 1980's. During the latter half of the 1990s, corporate venture capital emerged again, this time in a much larger scale than ever before, both in absolute terms, and in relative terms compared to traditional venture capital. Direct venture capital investments made by the subsidiaries and affiliates of industrial corporations more than doubled during each of the last six years of the decade. However, after the peak in 2000, the economic slowdown has resulted in a rapid decrease in the volume of corporate investments in the beginning of 2001. The development of corporate venture capital is depicted in Figure 2-3
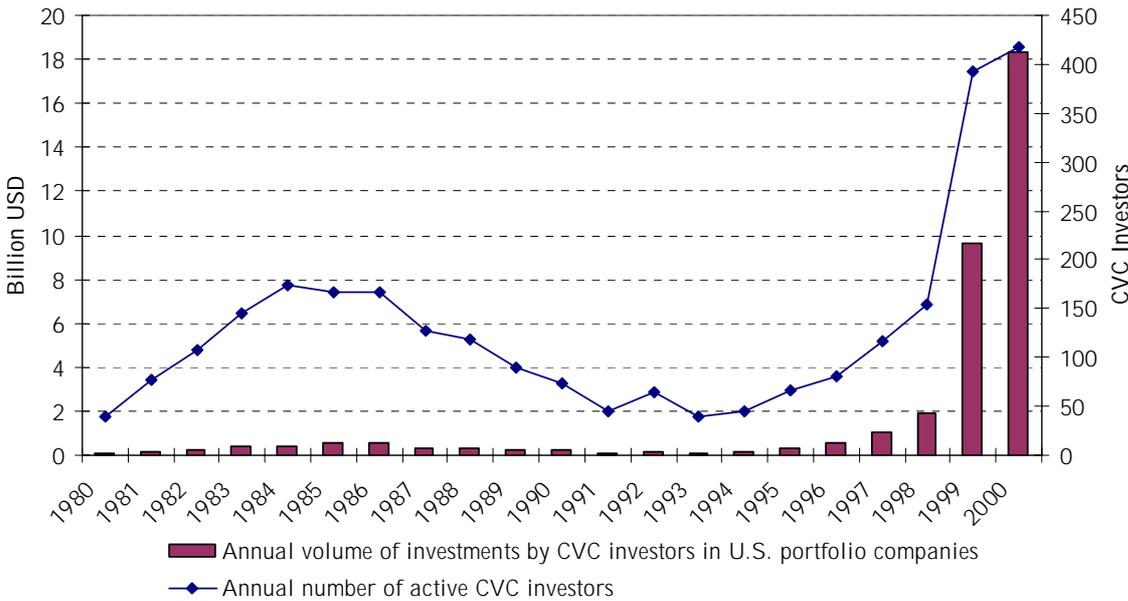
Figure 2-3   Annual volume of corporate venture capital investments and number of corporate venture capital investors invested in U.S. portfolio companies in 1980-2000[1]

The reasons for this renewed interest in corporate venture capital have been both economic and strategic. In many cases, the motivation for corporate venture capital activities that started in the late 1990's has been to set up an advanced intelligence system for the parent organization, giving them an early indication of major changes in their competitive environment via their association with new companies in emerging technologies and markets (Keil 2000, Maula & Murray 2000a). The emergence of the

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[1]   Based on Venture Economics data, September 2001

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Internet created a technological discontinuity (Christensen 1997) creating a need for large corporations to create options for rapid entry, and to explore new technologies and business models (Mishra & Gobeli 2000). Corporations have also seen their association with, and fostering of, highly entrepreneurial and innovative young businesses as having an important rejuvenating effect on the parent company. Hamel (1999) described this process of encouraging a renewed climate of idea generation and new enterprise formation within the parent organization as "bringing Silicon Valley inside". Corporate venture capital is currently used also as a mechanism to steer industry development, by supporting the emergence of suitable technological platforms and applications for those platforms. An example of this type of use of corporate venture capital is the string of investments made into the Linux companies at the end of 1990's. Many information technology companies wanted an alternative to the dominant Microsoft operating system, and therefore supported the creation of several Linux-based companies via corporate venture capital investments (Young & Rohm 1999). In the next chapter, the objectives of the corporations are discussed in more detail.

Objectives of Corporations

Some previous studies have compared the relative importance of the various goals corporations have for their corporate venture capital operations (Alter & Buchsbaum 2000, Bannock Consulting 1999, Kann 2000, Keil 2000, McNally 1997, Siegel *et al.* 1988, Silver 1993, Sykes 1990). However, no single goal appears to be consistently most important. Instead, corporations tend to have multiple goals and different strategies in their corporate venture capital activities. For instance, Siegel *et al.* (1988) found that return on investment was the most important goal of corporations, followed by exposure to new technologies and markets. Sykes (1990) found that identifying new opportunities and developing business relationships were the most important goals for corporations investing directly. Silver (1993) found in his survey that finding acquisition targets, getting exposure to new markets, adding new products to existing distribution channels, externalizing R&D, exposing middle management to entrepreneurship, training managers, and utilizing excess plant space, time, and people were the most important objectives. McNally (1997) surveyed U.K. corporations regarding their goals and found that identifying new markets, exposure to new technologies, financial return, identifying new products, and developing business relationships were the five most important corporate objectives for direct corporate venture capital. Bannock Consulting (1999) found in their survey of 150 European corporations that on average 62% had strategic goals, and 27% had financial goals, as their primary motivations for corporate venture capital investments, while many had several goals. In her analysis of 152 observed corporate venture capital programs, Kann (2000) classified 45% of the programs as being primarily focused on external R&D,

30% as investing with the goal of accelerated market entry, and 24% investing in order to enhance demand for their products.

Comparing the role of financial goals and various strategic goals, recent research has shown that strategic and financial objectives are not substitutes; instead both are very important motivations for corporations (Alter & Buchsbaum 2000, Bannock Consulting 1999, Keil 2000). Based on seven in-depth cases studies of external corporate venturing activities of information and communications technology corporations, Keil (2000) concluded that, while strategic objectives are often the driver for setting up corporate venture capital program, investments are often made using financial criteria. Financial investment goals and investments in the financially most promising companies give a window to the best companies (where there is more to learn from) and minimize conflicts of interests (Keil 2000). Overall, there is no single goal that is most important. Instead, corporations tend to have multiple goals and different strategies.

Most of the research on corporate objectives has been based on rankings of long lists of potential objectives by the respondents (McNally 1997, Siegel *et al.* 1988, Silver 1993, Sykes 1990). Besides these long lists and the distinction between strategic and financial objectives, some more fine-grained classifications of goals have also been made in the recent literature (Kann 2000, Keil 2000).

Based on an extensive archival research of 152 corporate venture capital programs, Kann (2000) distinguished three classes of strategic objectives for corporations: external R&D, accelerated market entry, and demand enhancement. *External R&D* is the most 'aggressive' goal referring to the intent of corporations to enhance their internal R&D by acquiring resources and intellectual property from ventures. *Accelerated market entry* refers to corporations trying to access and develop resources and competences needed to enter a new product market. *Enhancing demand* refers to corporations leveraging their strong resource base and stimulating new demand for their technologies and products by sponsoring companies that use and apply those technologies and products.

Based on seven in-depth case studies of external corporate venturing activities of information and communications technology corporations, Keil (2000) identified four primary strategic objectives: monitoring of markets, learning of markets and new technologies, option building, and market enactment. *Monitoring of markets* refers to a warning system or antenna for gathering weak signals on the future developments of the markets. *Learning new markets and technologies* refers to learning from the relationships with ventures and requires more collaboration with them. *Options to expand* refers to placing bets to be ready if certain markets prove important and valuable. *Market enactment* refers to a more proactive approach where corporate venture capital investments are used to shape markets, set standards and stimulate demand.

In the following, I integrate the goals identified by Kann (2000) and Keil (2000) to other extant literature and create a summary classification of the goals. The classification is illustrated in Table 2-1.

Table 2-1   Potential benefits for corporations from corporate venture capital

			Examples
Financial objectives	Financial gains	Financial gains	Alter & Buchsbaum 2000, Bannock Consulting 1999, Keil 2000, McKinsey & Co 1998, McNally 1997, Siegel *et al.* 1988, Silver 1993
Strategic objectives	Learning	Market-level learning	Antenna-like identification of, monitoring of and exposure to new technologies, markets, and business models (Keil 2000, McNally 1997, Silver 1993, Sykes 1990, Winters & Murfin 1988)
		Venture-specific learning	External R&D (Kann 2000, McKinsey 1998, McNally 1997, Silver 1993, Sykes 1990), Improving manufacturing processes (McNally 1997, Siegel *et al.* 1988)
		Indirect learning	Change corporate culture (McNally 1997, Sykes 1990), Train junior management (Silver 1993), Learn about venture capital (McNally 1997, Sykes 1990), Improve internal venturing (Keil 2000, Winters & Murfin 1988), Complementary contacts (Winters & Murfin 1988)
	Option building	Options to acquire companies	Identify and assess potential acquisition targets (Alter & Buchsbaum 2000, McNally 1997, Siegel *et al.* 1988, Silver 1993, Sykes 1990, Winters & Murfin 1988)
		Options to enter new markets	Accelerated market entry (Kann 2000), Option to expand (Chesbrough 2000, Keil 2000, Sykes 1986)
	Leveraging	Leveraging own technologies and platforms	Increase demand for technology and products (Kann 2000, Keil 2000), Shape markets (Kann 2000, Keil 2000), Steer standard development (Kann 2000, Keil 2000), Support development of new applications for products (McKinsey & Co. 1998)
		Leveraging own complementary resources	Add new products to existing distribution channels (Alter & Buchsbaum 2000, Siegel *et al.* 1988, Silver 1993, Sykes 1990, Winters & Murfin 1998), Utilize excess plant space, time, and people (Silver 1993)

In this classification, the first distinction is between strategic and financial goals. *Financial goals* of corporate venture capitalists have been reported in several studies; the term refers to gaining financial gains from investments (Alter & Buchsbaum 2000, Bannock Consulting 1999, Keil 2000, McKinsey & Co 1998, McNally 1997, Siegel *et al.* 1988, Silver 1993).

However, there are a wide variety of strategic goals reported in the extant literature. In this classification, *strategic goals* are divided in three main categories: learning, option building, and leveraging. All these main categories have subcategories, which are discussed below.

Learning. Learning can take place in corporate venture capital investments in many ways. Three categories of learning benefits are market-level learning, venture-specific learning, and indirect learning.

Market-level learning refers to learning from constantly monitoring the new ventures and therefore being exposed to developments of markets, technologies and business models (Keil 2000, McNally 1997, Silver 1993, Sykes 1990, Winters & Murfin 1988). Some corporations use their corporate venture function to support their strategy process (Keil 2000). Weak signals can be derived from deal flow, without having to invest in every opportunity in order to learn (Keil 2000). This allows investments in the financially most attractive companies while still delivering strategic benefits (Keil 2000).

Venture-specific learning refers to learning from the relationships with portfolio companies. Some corporations use corporate venture capital as a form of external R&D to develop their knowledge base, competencies, technologies, products, and processes (Kann 2000, McKinsey & Co 1998, McNally 1997, Siegel *et al.* 1988, Silver 1993, Sykes 1990). Realizing this type of benefits often requires closer collaboration and frequent communication with portfolio companies (Kann 2000, Keil 2000, Sykes 1990). Most investments with the goal of venture-specific learning and external R&D are made in ventures operating in the same or related industries (Kann 2000).

Indirect learning refers to learning from the corporate venture capital process. Corporate venture capital has been used to change corporate culture (McNally 1997, Sykes 1990), train junior management (Silver 1993), learn about venture capital (McNally 1997, Sykes 1990), support the development of internal venturing processes (Keil 2000, Winters & Murfin 1988), and to provide contacts with related actors like investment banks, scientists, and venture capitalists (Winters & Murfin 1988).

Option building. There are two categories of options building: options to acquire companies and options to diversify to new markets. These are explained in the following.

Options to acquire companies refers to corporate venture capital investments made as options to acquire the portfolio company later if it proves strategically valuable. Identification and assessment of potential acquisition targets has been reported as a goal of corporations in several studies (Alter & Buchsbaum 2000, McNally 1997, Siegel *et al.* 1988, Silver 1993, Sykes 1990, Winters & Murfin 1988). However, many studies have also argued that this goal does not work well because of the inherent conflicts of interest with entrepreneurs and other, financially oriented, investors (Keil 2000, Maula & Murray 2000b, Sykes 1990, Winter & Murfin 1998). Maula and Murray 2000b found that only a very small share of acquired corporate venture capital backed companies had been acquired by one of the corporate venture capital investors. Most of the acquisitions had been made by outsider companies. Similarly, Intel Capital had acquired only two companies from the 450 companies in their portfolio by 2000 (Christopher 2000). It has been suggested that a more successful way to view corporate

venture capital as a supportive tool for acquisitions is to refer potential acquisition targets identified in the deal flow to the M&A department or business units of the parent corporation (Maula & Murray 2000b).

Options to enter new markets refers to another form of options to enter new businesses. Besides building options to acquire portfolio companies, corporations can also prepare for entering new markets and use corporate venture capital investments as probes (Brown & Eisenhardt 1997, 1998) to learn the necessary skills and ensure right timing (Kann 2000, Keil 2000). Investments made with the goal of facilitating potential entry to new markets are made in ventures operating in industry sectors different from those in which the corporation currently operates (Kann 2000:107). Extant literature demonstrates that corporations use pre-entry alliances with new firms to prepare for entering new markets (Mitchell & Singh 1992). Similarly, corporations use corporate venture capital to hedge their bets and to ensure that they have some stakes in emerging technological platforms, in order to be prepared when the dominant design emerges (Keil 2000).

Leveraging. There are two categories of leveraging: leveraging own technologies and platforms and leveraging own complementary resources. These categories are explained in the following.

Leveraging own technologies and platforms refers to corporations using corporate venture capital to stimulate demand for their technologies and products by sponsoring companies using and applying them (Kann 2000, Keil 2000, McKinsey & Co 1998). Corporations can also use corporate venture capital to proactively shape markets, and steer and promote the development of de-facto standards around their technologies, by supporting favorable companies through corporate venture capital (Kann 2000, Keil 2000). As an example of proactive shaping of the industry, Intel, who has been highly dependent on the development of Microsoft operating systems in their own development, recognized the emergence of Linux as an alternative and made very early phase corporate venture capital investments in the most promising Linux operating system supplier, Red Hat Linux in 1998 (Young & Rohm 1999). Thereafter, Intel invested in many other Linux companies together with other companies, such as IBM, Compaq, Dell, Oracle, and Novell, who also wanted to reduce their dependence on Microsoft operating systems. These investments have been critically important in making the Linux a more credible alternative in the corporate world (Young & Rohm 1999).

Leveraging own complementary resources refers to corporations leveraging their complementary assets such as distribution channels and production facilities. Companies have been reported to use corporate venture capital to add new products to existing distribution channels (Alter & Buchsbaum 2000, Siegel *et al.* 1988, Silver 1993, Sykes 1990, Winters & Murfin 1998) and find use for excess plant space, time, and people (Silver 1993). Technology-based ventures are acknowledged to be better at commercializing new technology than large corporations, meaning that they are

superior in pursuing the highly focused rapid paced development of new product opportunities after the research phase is complete. This process leads often to opportunities for the corporate investor to acquire licenses for state-of-the-art technologies (Winters & Murfin 1988). Furthermore, technology-based new ventures have often limited distribution networks, at least when compared to any multinational corporation acting as a corporate venture capital investor. Even if the start-up would not like to license the technology, there is an opportunity for marketing agreements, especially in areas that the start-up could not otherwise access. This is especially important when the start-up operates in a small home market and has a foreign or global corporation as an investor.

These objectives have important implications for start-up companies, to the interests of which most of the goals may be well aligned. For instance, financial objectives align the corporate investors to maximize the value creation similarly to independent venture capitalists. Market monitoring, on the other hand, requires good deal flow and investments in the best possible companies in order to provide a good picture of the best companies. This in turn requires a good reputation and effective networking in the venture capital community from corporate venture capitalists (Keil 2000). Leveraging technologies means, in practice, investments in ventures applying those technologies and may provide valuable legitimization for those ventures. Leveraging complementary assets also provide valuable assets for ventures with limited resources themselves. Learning from ventures is also enhanced by collaboration that often enables ventures to gain benefits as well.

However, it is also possible that some of the objectives could lead to conflicts of interest between the venture and corporation. Potential conflicts of interests include competitive moves based on the deal-flow information in the market monitoring objective, misuse of the information learned from the ventures in due diligence or investment relationship in the learning objective, forcing the venture to stick to a less than optimal technology platform in the technology leverage objective, and unfair use of bargaining power in the leveraging of the complementary assets objective. Of the various goals, Kann (2000) argued that the use of corporate venture capital to externalize R&D creates the highest risk for opportunism by corporate investors, while use of corporate venture capital investments to enhance demand creates the lowest risk for opportunism.

From the perspective of the venture seeking investor, it is important to understand the objectives of the corporate investor and potential benefits and risks related to those objectives. However, objectives alone do not determine the success of the investment relationship.

The position taken in the present study is that there are factors related to partner fit (structural factors) and management of the relationship (behavioral factors) that influence the success of relationships between ventures and their corporate investors. The purpose of the present study is to create better understanding of the mechanisms

through which ventures receive value-added from corporate investors and the factors influencing those mechanisms. In the next section, earlier research on the potential benefits for ventures from corporate venture capital investments is reviewed.

2.1.3 Corporate Venture Capital from the Perspective of Technology-Based New Firms

The core focus of the present dissertation is to examine the benefits from corporate venture capital for technology-based new firms and the factors influencing those benefits. This focus is motivated by high potential value from corporate venture capital investors for technology-based new firms (Gompers & Lerner 1998, Kelley & Spinelli 2001, Maula & Murray 2000a), simultaneous high risk for new ventures (Hellmann 2001, Kann 2000), and the lack of rigorous empirical research examining the value-added mechanisms and the factors influencing the value-added mechanisms.

In the following sections, earlier studies on the performance implications, value-added mechanisms, and the factors influencing the value-added mechanisms in corporate venture capital are briefly summarized. Table 2-2 summarizes these studies focusing on three primary areas: performance implications, value-added mechanisms, and the factors influencing those mechanisms.

Table 2-2   Literature on value creation by ventures in corporate venture capital

Category	Studies
Performance implications for ventures	
	Gompers & Lerner 1998, Maula & Murray 2000)
Value creation mechanisms (non-financial)	
Resource acquisition	Maula & Murray 2000a, McNally 1997
Knowledge acquisition	Maula & Murray 2000a, McNally 1997
Endorsement	Kelley & Spinelli 2001, Maula & Murray 2000a, McNally 1997
Factors influencing the value creation	
Partner characteristics	-
Venture characteristics	-
Relationship characteristics	Gompers & Lerner 1998, Hellmann 2001, Kelley & Spinelli 2001, Maula & Murray 2000a

Performance Implications for Ventures from Corporate Venture Capital

Among the few studies examining corporate venture capital from the venture perspective, Gompers and Lerner (1998) found that corporate venture capital backing was associated with higher likelihood of initial public offering especially when the venture and the corporation were strategically related. This study did not focus on the value-adding mechanisms but provided strong empirical evidence on the benefits by covering 32,364 venture capital and corporate venture capital investments between 1983-1994.

In another study examining the benefits from corporate venture capital for technology-ventures, Maula and Murray (2000a) analyzed 325 initial public offerings between 1998-1999 by venture capital and corporate venture capital backed companies. In this study focusing on information and communications technology ventures, Maula and Murray found that ventures backed by Global Fortune 500 corporations in the same industry group received higher valuations at initial public offering than ventures financed by independent venture capitalists alone. Their conclusion was that prominent corporate venture capital investors complement traditional venture capitalists in syndicates and may provide valuable value-added for new ventures. Although that study did not directly test the role of various value-added mechanisms due to the limitation of using limited secondary data, they hypothesized that endorsement benefits, operational synergies and better selection were the key drivers of higher valuation.

Value Creation Mechanisms for Ventures in Corporate Venture Capital

McNally (1997) is among the few studies surveying the various benefits ventures receive from corporate venture capital investors. McNally (1997) surveyed technology-based firms in United Kingdom that had received indirect or direct corporate venture capital funding. In this review, I focus on his findings regarding direct corporate venture capital. His sample included 23 companies that had received direct corporate venture capital. As one of his key findings, McNally found that corporate venture capital had played an important role relative to other sources of external financing (McNally 1997:170, 181). The survey indicated that when selecting sources of funding to target, sample firms foresaw advantages to be gained from direct corporate venture capital investors when compared with other forms of external equity financing (McNally 1997:187). Some of the most important advantages were considered to be enhanced credibility, help with short-term problems, access to corporate management expertise, enhanced credibility, and access to corporate technical expertise (McNally 1997:189). Regarding the relationship with corporate investors, the survey suggested that the communication between the corporate venture capital investor and investee was typically relatively frequent and corporate venture capital investors provided hands-on value-added. Table 2-3 presents the benefits the 23 interviewed representatives of corporate venture capital-backed companies mentioned in his study (McNally 1997:196).

Table 2-3   Perceived benefits from corporate venture capital investments for ventures (adopted from McNally 1997)

Benefit from corporate venture capital investment	Number of mentions	
Help with short-term problems	19	83 %
Access to corporate management expertise	16	70 %
Credibility	16	70 %
Access to corporate technical expertise	11	48 %
Pricing benefits	10	43 %
Lower performance targets	9	39 %
Access to corporate marketing/distribution networks	9	39 %
Extra production/R&D support	8	35 %
Opportunity to establish further business relationships	8	35 %
Access to more sophisticated financial control systems	1	4 %
Access to corporate office space	1	4 %
Access to possible exit routes	1	4 %
Synergy	1	4 %
Enhanced attractiveness to other investors	1	4 %
Stability	1	4 %
Access to corporate operational expertise	1	4 %
Strengthening of vertical relationships	1	4 %

Source: Survey by McNally (1997:196). Total number of interviewed direct corporate venture capital backed firms was 23.

Focusing on the endorsement benefits, Kelley and Spinelli (2001) examined the role of corporate venture capital investments in improving the legitimacy of new ventures. In their analysis of 84 corporate venture capital backed technology ventures, they found that corporate venture capital backed ventures with business relationships with their corporate investors were able to form higher number of alliances with other firms. They argued that not only corporations have strategic objectives in corporate venture capital but perhaps also start-ups have strategic reasons for seeking corporate venture capital financing.

Factors Influencing Value Creation for Ventures in Corporate Venture Capital

There is no earlier research systematically examining the factors that influence the value-added in corporate venture capital for technology-based new firms. Gompers and Lerner (1998) identified strategic relatedness as an important determinant of the benefits for ventures. Similarly, Maula & Murray (2000a) predicted that complementarities would be important but did not directly test this hypothesis. They found that Global Fortune 500 corporations operating in same broad industry sectors had a positive influence on the IPO valuation of the portfolio companies. Further, Hellmann (2001) assumed in his theoretical analysis that complementarities would be a key determinant of the benefits for the ventures.

As another factor that has received attention is the strength of the relationship between the venture and the corporate venture capital investor. Kelley and Spinelli (2001) found that corporate venture capital backed ventures with business relationships

with their corporate investors were able to form higher number of alliances with other firms.

Conclusions from Research on Value Creation for Ventures in Corporate Venture Capital

Overall, it can be concluded that there is no extant rigorous empirical research comprehensively examining the value-added mechanisms and the factors influencing the value-added mechanisms in corporate venture capital from the perspective of corporate venture capital backed new ventures. The present study attempts to fill this gap by building a theory-based model of the potential value-added mechanisms and the factors influencing those mechanisms, and testing the model by employing data collected from corporate venture capital backed ventures.

In the following sections, extant research on other related fields is reviewed to create a better understanding of the potential forms of value-added. These fields include value-added provided by independent venture capitalists, benefits for ventures from strategic alliances with large firms, and benefits from the parent corporation for the ventures in internal corporate venturing. These reviews examine the performance implications for the ventures, value creation mechanisms for ventures, and the identified factors influencing the value creation.

2.1.4 Venture Capital from the Perspective of Technology-Based New Firms

From the start-up perspective, corporate venture capital is often perceived as an alternative source of funding for traditional venture capital. In venture capital, the research on the value-added provided by venture capitalists is the most relevant area of research for this dissertation. The key difference between independent venture capitalists and corporate venture capitalists is the direct link between the investors and the parent corporation in the case of corporate venture capital. In traditional venture capital, the venture capital firm has commonly several limited partners. These limited partners have primarily financial interests and are not directly involved with the portfolio companies.

In the research on the value-added provided by venture capitalists for their portfolio companies, three streams can be identified: (1) the performance implications from having venture capital investor(s), (2) different types of value-added provided by venture capitalists, and (3) factors influencing the value-added. In the first stream examining the impact of venture capitalist involvement on the performance of the portfolio companies, secondary data is normally used in order to cover a large number of companies. In the second stream focusing on the forms of value-added, surveys and other primary data are often employed in order to understand what is really happening in the relationships. The third stream also relies primarily on surveys. This literature review is organized according to these groups. Studies focusing on these areas are summarized in Table 2-4.

Table 2-4   Literature on value creation by ventures in venture capital

Category	Studies
Performance implications for ventures	
	Bamford & Douthett 2000, Barry *et al.* 1990, Brav & Gompers 1997, Busenitz *et al.* 1997, Davila *et al.* 2000, Francis *et al.* 1999, Franzke 2001, Gompers & Lerner 1997, Hamao *et al.* 2000, Hellman & Puri 2000a, 2000b, Hsu 2000, Jain & Kini 1995, 2000, Lange *et al.* 2000, Lin & Smith 1998, Ljungqvist 1999, Manigart & Van Hyfte 1999, Manigart *et al.* 2001, Megginson & Weiss 1991, Schoonhoven *et al.* 1990
Value creation mechanisms (non-financial)	
Resource acquisition	-
Knowledge acquisition	Barney *et al.* 1996, De Clercq & Sapienza 2001, Fried & Hisrich 1995, Gorman & Sahlman 1989, Landström 1990, MacMillan *et al.* 1988, Rosenstein *et al.* 1989, 1993, Sapienza 1992, Sapienza *et al.* 1994, 1996, Smith 2001, Steier& Greenwood 1995
Endorsement	Barry *et al.* 1990, Brav & Gompers 1997, Francis *et al.* 1999, Franzke 2001, Fried & Hisrich 1995, Hamao *et al.* 2000, Lin & Smith 1998, Ljungqvist 1999, Megginson & Weiss 1991, Seppä & Maula 2001, Smith 2001, Steier & Greenwood 1995, Stein & Bygrave 1990
Factors influencing the value creation	
Partner characteristics	Barry *et al.* 1990, Lange *et al.* 2000, Megginson & Weiss 1991, Rosenstein *et al.* 1993, Seppä & Maula 2001, Stein & Bygrave 1990
Venture characteristics	Barney *et al.* 1989, Barney *et al.* 1996, Elango *et al.* 1995, Gompers 1995, Lerner 1995, Sapienza 1992, Sapienza *et al.* 1994, 1996, Sapienza & Gupta 1994
Relationship characteristics	Busenitz *et al.* 1998, De Clercq & Sapienza 2001, Elango *et al.* 1995, Fredriksen & Klofsten 1999, Fried *et al.* 1998, Higashide & Birley 2000, 2002, Landström 1990, Sapienza 1992, Sapienza *et al.* 1994, Sapienza & Gupta 1994, Sapienza & Korsgaard 1996, Stein & Bygrave 1990

Performance Implications for Ventures from Venture Capital

One important stream of research examining the performance implications for new ventures from having venture capitalists has assumed the monitoring role of venture capitalists improving the credibility of venture capital backed companies (Barry *et al.* 1990, Francis *et al.* 1999, Megginson & Weiss 1991). This idea has been tested in analyses of initial public offerings hypothesizing lower underpricing in initial public offerings for venture capital backed companies compared to non-venture capital backed companies. In these studies, underpricing is viewed as a cost caused by the asymmetric information between insiders (entrepreneurs and venture capitalists) and outside investors.

In one of the first studies in this stream examining the role of venture capitalists certifying new companies in initial public offerings, Barry *et al.* (1990) analyzed 433 initial public offerings by venture capital and non-venture capital financed companies. They found that the quality of the monitoring by venture capital investors was negatively related to underpricing in initial public offerings as expected. However, they did not find statistically significant differences between venture capital and non-venture capital backed companies. Soon after this study, Megginson and Weiss (1991) published a study where they compared matched samples of initial public offerings by 320 venture capital backed, and 320 non-venture capital backed, companies. In this

study, they found differences in the underpricing between venture capital backed and non-venture capital backed ventures demonstrating lower underpracing for venture capital backed firms as hypothesized. They attributed the difference in results between this study and the study of Barry *et al.* (1990) to better methodology, because they used matched samples. Consistent with these findings, Lin and Smith (1998) also found that the more reputable venture capitalists were associated with lower underpricing.

However, the influence of venture capital backing on underpricing has been questioned later. For instance, Gompers and Lerner (1997) demonstrated that the relationship between venture capital backing and underpricing varied over time and was positive during the period five years preceding the sample of Megginson & Weiss (1991). Contrary to the findings of Barry *et al.* (1990) and Megginson & Weiss 1991), Francis *et al.* (1999) found in their analysis of 415 venture capital backed, and 428 non venture capital backed, initial public offerings in 1990-1993 that the initial returns of venture-backed initial public offerings were in fact higher than the non venture-backed group, with a significant portion of the initial day returns being due to deliberate underpricing in the pre-market. However, they found that venture-backed initial public offerings were managed by more reputable underwriters and were generally associated with less underwriter compensation.

Examining the relationship between venture capital and underpricing in Germany between 1997-2001, Franzke (2001) also found higher underpricing for venture capital backed initial public offerings than for non-venture capital backed initial public offerings. Similarly, examining the influence of venture capital backing in Japanese initial public offerings, Hamao *et al.* (2000) found that the long-run performance of venture capital-backed initial public offerings was not better than that of other initial public offerings, with the exception of firms backed by foreign owned or independent venture capitalists. When breaking down venture capital holdings by their institutional affiliation, they found that firms with venture backing from securities company subsidiaries did not perform significantly worse over a three-year time horizon than other initial public offerings. However, they found that initial public offerings in which the lead venture capitalist was also the lead underwriter had higher first-day returns than other venture capital-backed initial public offerings. They viewed this as evidence of conflict of interests when the venture capital investor and underwriter were affiliated.

Ljungqvist (1999) reanalyzed the data of Megginson and Weiss (1991) and argued that differences in underpricing per se are uninformative and possibly misleading when not controlled for differences in entrepreneurs' incentives to control underpricing. He did not find support for the certification hypothesis predicting lower wealth losses for venture capital backed companies in initial public offerings.

Examining *long-term value creation* differences, Brav and Gompers (1997) analyzed 934 venture-backed, and 3407 non-venture-backed, initial public offerings in 1972-1992. Finding support for their hypothesis that venture capital investors add value, they

found that venture-backed initial public offerings outperformed non-venture-backed initial public offerings over a five-year period when using equal weighted returns (the difference was smaller when using value weighted returns). Similarly, Jain and Kini (1995) analyzed 877 initial public offerings in 1977-1990 and found that venture capital backed companies exhibited superior post-issue performance compared to non-venture-backed companies.

Examining *long-term performance* implications from another perspective, Jain and Kini (2000) employed the same dataset and found that venture capital backed firms had a higher *survival profile* after the initial public offering compared to non-venture capital backed firms. Also examining the influence of venture capital on the likelihood of survival, Manigart and Van Hyfte (1999) examined the performance differences of 187 matched pairs of Belgian venture capital and non-venture capital backed companies. Contrary to their expectations, venture capital backed companies did not have a higher survival rate. However, venture capital backed companies did have a higher post-investment *growth rate* in total assets and cash flow over a five-year period. In another study, Manigart *et al.* (2001) compared matched pairs of 565 venture capital backed and non-venture capital backed companies. Again, contrary to their expectations, they did not find differences in the likelihood of survival between the two groups. However, they found that companies financed by the two oldest government venture capitalists had higher survival rates and concluded that it might be more important to have the right investor rather than receiving venture capital per se.

Examining the influence of venture capital investments on growth, Davila *et al.* (2000) compared 494 venture and non-venture-backed start-ups and found that venture capital was significantly related to future growth in the number of employees. In an analysis of 118 projects financed by SBIR program, Hsu (2000) found that subsequent venture capital financing increased the likelihood of collaborating in commercialization. He also found that venture capital backing made firms more sensitive to the business environment.

Examining *time-to-market*, Schoonhoven *et al.* (1990) analyzed the introduction of the first product by 98 new semiconductor ventures between 1978-1985. They predicted that venture capital investments and the existence of outside board members would reduce the time-to-market. While the results were in the correct direction, they were not statistically significant. Later, Hellmann and Puri (2000a) conducted a longitudinal analysis of 173 start-up companies and focused on the influence of venture capital investments on the time-to-market by new firms. They found that for innovator firms, venture capital backing shortened the time to market. Using the same data in another study, Hellmann and Puri (2000b) found that companies that obtained venture capital were faster to professionalize their organizations, meaning that founders were more likely to be replaced by outsider CEOs in venture capital backed companies. These CEO replacements appeared to include both "soft" and "hard" changes.

Bamford and Douthett (2000) predicted different *risk profiles* for venture capital and non-venture capital backed companies and found in their analysis of 81 venture capital backed companies, and 186 companies that were non venture capital backed, initial public offerings. They found that venture capital backed firms had higher threats to their profit margin and sales scheme measured as identified risk factors in IPO prospectuses.

Taken together, these studies suggest having venture capital investor(s) is positively related to the performance of the ventures. However, there is some variation in the results depending on the performance measurements. Particularly research on the role of venture capital influencing the IPO underpricing has yielded mixed results. However, in research examining other measures such as time-to-market or professionalization of the ventures, the influence of venture capital backing is more consistent.

Value Creation Mechanisms for Ventures in Venture Capital

The studies reviewed above have examined the performance of venture capital backed companies compared to companies without venture capital backing. The studies have had various assumptions on what might cause the potential performance differences, but ultimately they have treated venture capital involvement as a black box (Sapienza 1992). Another stream of research has focused more on what venture capitalists do, what are the forms of value-added and how the value-added influences performance. This stream of research on venture capital value-added is reviewed here.

In one of the earliest studies examining the nature of value-added support provided by independent venture capitalists, Gorman and Sahlman (1989) analyzed 49 venture capitalists and documented a ranked order of the forms of assistance as follows: (1) help with obtaining additional financing, (2) strategic planning, (3) management recruitment, (4) operational planning, (5) introductions to potential customers and suppliers, and (6) resolving compensation issues.

In another early study examining the nature of venture capital value-added, MacMillan *et al.* (1988) analyzed 62 venture capitalists and reported that activities attracting the highest degree of venture capitalists involvement were: (1) serving as a sounding board to the entrepreneur team, (2) helping the firm obtain alternative further sources of equity financing, (3) interfacing with the investor group, (4) monitoring financial performance, (5) monitoring operating performance, and (6) helping their portfolio firms attract alternative sources of debt financing. Rosenstein *et al.* (1989, 1993) examined the contributions of venture capitalists in the boards of high-technology companies. They surveyed 162 high tech firms asking about the same potential categories of value-added as MacMillan *et al.* (1988) and found that contributions of venture capitalists as a group did not differ significantly from other board members. However, the advice from the board members of the top-20 venture capital firms was valued higher than the advice from other board members or venture

capital firms not in the top-20 (Rosenstein *et al.* 1993). They also found that the areas where CEOs rated outside board members (both venture capitalists and others) as most helpful were in their roles as a sounding board, interfacing with the investor groups, monitoring operating performance, recruiting/replacing the CEO, and assistance with short-term crisis. The help was rated higher for early stage companies than for late-stage companies.

Sapienza *et al.* (1994) analyzed the differences in the value-added between venture capitalists in UK, France, and the Netherlands in addition to the United States. Corresponding to the findings of U.S. research, they found that strategic roles were viewed as the most important roles by venture capitalists, followed next by interpersonal roles and finally by operational roles. The order was same in all countries. Continuing the comparisons between United Kingdom, France, the Netherlands and the United States, Sapienza *et al.* (1996) found, consistent with prior research, that of the three main value-adding roles (strategic, interpersonal, and networking), venture capitalists viewed strategic involvement (providing financial and business advice and acting as a sounding board) as their most important value-added role. Interpersonal roles (acting as a mentor or a confidant to the CEO) were evaluated as being the second most important in value. Networking roles (i.e. contacts to other firms and professionals) were third most important. Sapienza *et al.* (1996) found that these ratings were consistent across the countries. Overall, venture capitalists were most involved and provided the highest value-added in the United States and United Kingdom.

Examining the various value-added roles of venture capitalists using a case-based approach, Steier and Greenwood (1995) carried out an in-depth longitudinal case study of the venture capital financings of a single venture. They found that social endorsement from the first investor superseded business plans in attracting additional financing from new investors. Venture capitalists provided considerable value-added to the entrepreneurial firm giving knowledge, expertise, and experience, as well as funding, to the enterprise. Fried and Hisrich (1995) also employed case methodology in order to create understanding of the relationships of entrepreneurs and their venture capitalists. Based on their interviews of 14 venture-capital financed start-ups, they identified seven areas where venture capital had influence: money, operating services, networks, image, moral support, general business knowledge, and discipline.

Examining the role of venture capitalists certifying the quality of their portfolio companies, Seppä and Maula (2001) employed data from 2,327 venture capital investments in U.S. information and communications technology companies between 1982 – 2000 and found that despite the fact that top venture capitalists are hard to get and require large discounts, prominence of the venture capitalists was strongly related to future value creation supporting the certifying hypothesis.

Taken together, these studies suggest that venture capital investors add value primarily by advising ventures and by employing their contact network and reputation

to open doors for the entrepreneurs. In contrast to corporate venture capital investors backed by major corporations, independent venture capital investors have few resources that they could share. On a rough level, the benefits from venture capital for entrepreneurs are relate to learning benefits and endorsement benefits.

Factors Influencing Value Creation for Ventures in Venture Capital

There are several streams of research examining the factors influencing value-added in venture capital. For instance, Sapienza (1992) surveyed 51 venture capitalist-CEO dyads in order to create understanding of when venture capitalists add value and whether the value-added influences performance. He found that the greater the innovation pursued by the venture, the more frequent the contact, and the more open the communication, the greater was the value of the involvement. Replicating these results in Europe, Sapienza *et al.* (1994) found that corresponding to the findings of U.S. research, European venture capitalists spent more time and communicated more frequently with highly innovative ventures and early stage ventures. Surprisingly, CEO experience had a positive rather than negative influence on the amount of working hours or frequency of contact. Elango *et al.* (1995) also examined the amount of value-added provided by venture capitalists and the factors influencing it in their analysis of 149 venture capitalists. They found that the amount of assistance was not strongly related to the target stage of the venture capital firm. Active venture capitalists viewed their involvement as more important. Landström (1990), in his study of the Swedish venture capital backed firms, also concluded that hands-on involvement appeared to be related to better performance of the ventures.

Some studies have focused on the boards of venture capital backed companies (Fried *et al.* 1998, Fredriksen and Klofsten 1999). For instance, Fried *et al.* (1998) analyzed 68 venture capital firms finding that venture capital representation on the board was positively related to board involvement with firm strategy. Fredriksen and Klofsten (1999) surveyed 41 venture capital backed companies finding that firms where the power over decision-making was equally distributed between the CEO and the board had better performance. Openness and trust in the relations between the CEO and the board were posited to have a positive influence on performance

Applying agency theory, Barney *et al.* (1989) analyzed a sample of 270 venture capital backed firms, demonstrating that the level of monitoring and control depended on the level of business and agency risks associated with investing in the start-ups. In another study applying agency theory, Sapienza and Gupta (1994) examined 51 venture capitalist-entrepreneur dyads and found that the frequency of interaction was shown to depend on the extent of venture capitalist goal congruence, the degree of the CEO's new venture experience, the venture's stage of development, and the degree of technical innovation pursued by the venture. However, the degree of management ownership had no impact on the frequency of interaction.

Also, examining the venture capital involvement from the viewpoints of agency theory and asymmetric information theory, Gompers (1995) analyzed 794 venture capital backed firms and found that asymmetric information (decreases in the industry ratios of tangible assets to total assets, higher market-to-book ratios, and greater R&D intensities) was associated with more frequent monitoring. Similarly, Lerner (1995) analyzed 271 venture capital-backed biotechnology firms finding that venture capitalists representation on the board of directors increased around the time of the chief executive officer's turnover, while the number of other outsiders remained constant. He also found that the distance to the firm was an important determinant of the board membership of the venture capitalists.

Sapienza and Korsgaard (1996) examined venture capital value-added from the procedural justice perspective. They carried out a simulation with 44 graduate students and administered a survey answered by 118 U.S. venture capital firms. Corresponding to the procedural justice theory-based hypotheses, timely feedback was found to be important in promoting positive relations between investors and entrepreneurs. In another study examining the influence of procedural justice on the relationships between venture capitalists and entrepreneurs, Busenitz *et al.* (1998) analyzed 201 venture capital backed firms in the United States and found that use of covenants and the background of the new venture team influenced the perceived procedural justice in investor relationships.

In a study examining the receptiveness of entrepreneurs for advice from venture capitalists Barney *et al.* (1996) analyzed 205 venture capital backed firms and found systematic differences among new venture teams in their evaluation of learning assistance from venture capitalists. New venture teams with more industry experience and longer team tenure in the current venture were negatively related to both business management advice and operational assistance offered by their venture capitalists. When a new venture team had previously worked together and its primary experience is from another industry, the new venture teams tended to welcome business management advice from its venture capitalist. Business management advice was not highly valued by new venture teams that pursued more technical innovations. Barney *et al.* (1996) found that current performance was not related to a new venture team's evaluation of venture capital assistance. They concluded that an optimal level of involvement by venture capitalists was contingent on the new venture team's openness to learning.

Higashide and Birley (2002) surveyed 80 venture capitalists about their portfolio companies. Controlling for the agency risk and business risk explanations, they examined the role of cognitive conflict between the venture and the investors on the venture performance (measured as Sapienza (1992)). In support of their hypotheses, they found that cognitive goal conflict (disagreement) was positively related to venture performance while affective goal conflict (as personal friction) was negatively related to venture performance. Contrary to their expectations, the level of involvement was

negatively related to venture performance. They concluded that the problem might be in the causality, so that the more troubled the venture, the more venture capitalists have to get involved. In another study, Higashide and Birley (2000) examined the same sample from another perspective and found that the quality of information being exchanged between venture capitalists and entrepreneurs was positively related to venture performance. In support of their hypotheses, they also found that the venture capitalist continuance commitment was negatively, and venture capitalist affective commitment was positively, related to venture performance.

Taken together, these studies suggest some factors that may influence the value-added provided by venture capital investors. Related to the partner characteristics, there are a few studies suggesting that the prominence of the venture capitalist is positively related to the endorsement benefits. Related to the venture characteristics, this research suggests that the younger, less experienced, and riskier the venture is, the more it receives attention from the venture capitalist. Related to the relationship characteristics, the reviewed research suggests that the closer and the more open the relationship is between the venture and the investor, the more the venture benefits from hands-on involvement.

Conclusions from Research on Value Creation for Ventures in Venture Capital

There is a wide body of literature comparing the performance of venture capital backed ventures to ventures without venture capital investors. While some of these studies have not found differences in their performance, many studies have found differences and also identified mechanisms through which venture capitalists add value to ventures. The most important forms of value-added by independent venture capital investors can be synthesized to be in arranging additional financing, supporting strategy making, and recruiting key executives. These benefits can be described as endorsement and learning benefits from the perspective of the venture.

Regarding the factors influencing the value-added mechanisms, it has been found that the prominence of the venture capital investor and the uncertainty of the venture influence certification benefits. Regarding the other types of benefits, it has been found that social interaction is an important factor influencing the extent of value-added perceived by portfolio companies.

The key difference between the corporate venture capitalists and independent venture capitalists from the start-up company perspective is the strategic link between corporate venture capital investor and their parent company. Whereas independent venture capitalist are typically quite independent of their limited partners, corporate venture capitalists may have very strong link to a single corporation. This strategic link may have both positive and negative implications for a start-up company.

2.1.5 Strategic Alliances from the Perspective of Technology-Based New Firms

There is a wide body of literature examining different types of alliances (see, e.g. reviews by Feldman 2001, Gulati 1998, Keil 2000, Siegel 2001). In this review, I focus on strategic alliances from the perspective of technology-based new firms, firstly reviewing studies that examine the influence of alliance on the performance of new firms, and secondly reviewing the literature that focuses on the mechanisms through which alliances may influence the performance of new firms. Finally, I review the literature examining the factors influencing those mechanisms. Studies focusing on these areas are summarized in Table 2-5.

Table 2-5   Literature on value creation by ventures in strategic alliances

Category	Studies
Performance implications for ventures	
	Artz *et al.* 1999, Baum *et al.* 2000, Das *et al.* 1998, Deeds & Hill 1996, Deeds *et al.* 1999, Lee *et al.* 2001, Lu & Beamish 2001, Powell *et al.* 1999, Rothaermel & Deeds 2001, Schoonhoven & Lyman 2000, Shan *et al.* 1994, Shrader 2001, Zahra *et al.* 2000b
Value creation mechanisms (non-financial)	
Resource acquisition	Alvarez & Barney 2001, De Meyer 1999, Dickson *et al.* 1991, Eisenhardt & Schoonhoven 1996, Elfring & Hulsink 2001, Jarillo 1989, Lee *et al.* 2001, Lu & Beamish 2001, Mitchell & Singh 1992, Park *et al.* 2001, Rothwell 1989, Rothwell & Zegweld 1982, Schoonhoven & Lyman 2000, Starr & MacMillan 1990, Stearns 1996, Stein 1997, Wisnieski & Dowling 1997
Knowledge acquisition	Almeida *et al.* 2001, Audretsch 2001, Baum *et al.* 2000, Chan & Heide 1993, DeCarolis & Deeds 1999, Dickson *et al.* 1991, Dodgson 1993, Elfring & Hulsink 2001, Gemünden *et al.* 1992, Kelley & Rice 2000, Lang 1996, Larson & Starr 1993, Lee *et al.* 2001, Li & Atuahene-Gima 2001, Liebeskind *et al.* 1996, Lu & Beamish 2001, McGee & Dowling 1994, Powell *et al.* 1996, 1999, Shan *et al.* 1994
Endorsement	Aldrich & Auster 1986, Baum & Oliver 1991, 1992, Baum *et al.* 2000, De Meyer 1999, Dickson *et al.* 1991, Lee *et al.* 2001, Stuart *et al.* 1999, Stuart 2000
Factors influencing the value creation	
Partner characteristics	Baum *et al.* 2000, Lu & Beamish 2001, Mitchell & Singh 1992, Schoonhoven & Lyman 2000, Stuart *et al.* 1999, Stuart 2000
Venture characteristics	Almeida *et al.* 2001, Baum *et al.* 2000, De Meyer 1999, Eisenhardt & Schoonhoven 1996, Lee *et al.* 2001, McGee *et al.* 1995, Mitchell & Singh 1996, Park *et al.* 2001, Schoonhoven & Lyman 2000, Shan *et al.* 1994, Shrader 2001, Singh 1997, Stuart *et al.* 1999, Stuart 2000, Zahra *et al.* 2000b
Relationship characteristics	Almeida *et al.* 2001, Alvarez & Barney 2001, Baum *et al.* 2000, Deeds & Hill 1999, Dickson *et al.* 1991, Dodgson 1993, Forrest & Martin 1994, Lu & Beamish 2001, Niederkofler 1991, Rothaermel & Deeds 2001, Schoonhoven & Lyman 2000, Stuart *et al.* 1999, Weaver & Dickson 1998, Wisnieski & Dowling 1997

Performance Implications for Ventures from Strategic Alliances

In this section, research examining the performance implications for new ventures from strategic alliances is reviewed. Following the same structure of analysis as the previous chapters, the impact of the existence or number of strategic alliances is first reviewed.

One significant stream of research on strategic alliances has examined the existence and number of alliances on *research productivity and new product development.* For instance, Shan *et al.* (1994) analyzed alliances of 85 biotechnology firms finding a

positive relationship between the number of strategic alliances and a firm's research productivity. Later, Deeds and Hill (1996) analyzed alliances of 132 entrepreneurial biotechnology firms and found a curvilinear (inverted U shape) relationship between a start-up's strategic alliances and its new product development. Building on the study of Deeds and Hill (1996), Rothaermel and Deeds (2001) analyzed 2,226 strategic alliances entered into by 325 new biotechnology firms confirming the curvilinear (inverted U) relationship between the number of alliances and new product development. In addition, they found that the curvilinear relationship holds when splitting alliances by alliance type. Further, the type of alliances was found to influence the relationship between new product development and the number of alliances a firm can manage. They also demonstrated that there exists an experience curve in alliance management. However, research by Deeds et al. 1999 did not find a significant relationship between alliances and product development when including several measures of the capabilities of the firms in the models.

Examining the influence of alliances on the *likelihood of survival*, Baum *et al.* (2000) carried out a longitudinal analysis of alliances by 142 Canadian biotechnology start-ups finding that ventures that, at the time of their founding, formed upstream and downstream alliances, and configured them to provide access to more diverse information and capabilities, exhibited stronger initial performance. They found that alliances with potential rivals led to weaker performance. However, alliances with potential rivals were less harmful for companies with broader market domains than they were for the partner, or when allying with an innovative partner.

Examining the influence of alliances on *market valuation*, Das *et al.* (1998) analyzed 119 alliances to examine the influence of alliances on firm valuation. They found that alliances in general did not create abnormal returns, but this was because technology alliances did create value while marketing alliances did not. They reported that small companies gained higher abnormal returns from alliances compared to larger firms. This was hypothesized to be because of large companies are dependent on the technology of small companies. However, their secondary justification pointed to the reputational benefits for the smaller company. Lee *et al.* 2001 hypothesized positive relationship between alliances and organizational performance but did not find significant relationship in their analysis of 137 Korean technology start-up companies. Similarly, Schoonhoven & Lyman (2000) did not find a significant relationship between the number of alliances and the performance of new ventures in their analysis of 105 U.S. semiconductor ventures. However, in an analysis of panel data on nearly 400 biotechnology firms, Powell *et al.* 1999 examined the role of alliances on various dimensions of performance and found that central role in the alliance network was positively related to the performance.

Examining the role of alliances in *internationalization*, Zahra *et al.* (2000b) analyzed the impact of alliances on the speed and degree of sales internationalization among 159 software new ventures. Applying the resource-based view of the firm, this

paper explored the impact of leveraging selected tangible and intangible technological resources on the speed and degree of sales internationalization among 159 software new ventures. They found that technological networks were positively related to internationalization. Further, the interactions of R&D investments with both technological networks and reputations were positively and significantly associated with higher sales internationalization. Technological investments also interacted positively with technological networks to speed up sales internationalization, but the interaction of these investments with technological reputations was not significant. In another study, Shrader (2001) analyzed 70 high-technology manufacturing firms that had entered foreign markets as new ventures. He found that, when combined with high advertising intensity, collaboration was positively related to international growth and profitability. Artz *et al.* (1999) found that collaboration moderated the relationshp between international diversification and performance. Also Lu and Beamish (2001) examined the influence of alliances on internationalization and performance and found in their analysis of 164 Japanese small and medium sized firms that alliances with partners in the target country were positively related to performance. They concluded that forming alliances with partners with local knowledge could be an effective strategy to overcome the deficiencies SMEs face in resources and capabilities when they expand into international markets.

Taken together, these studies examining performance implications of alliances for new ventures generally support positive relationship between alliances and performance. However, there is variation in this relationship. The inconsistent results suggest that there are factors that influence the benefits from alliances for ventures.

Value Creation Mechanisms for Ventures in Strategic Alliances

Various benefits have been identified for technology-based new firms from strategic alliances. However, most of these potential benefits fall in three categories: access to complementary resources, knowledge acquisition, and endorsement benefits. For instance, Stuart (2000) viewed alliances as access relationships and predicted that start-ups could benefit from large partners through accessing resources and knowledge or through endorsement benefits. Similarly, Elfring & Hulsink (2001) identified access to resources, recognition of opportunities, and increased legitimacy as three mechanisms through which alliances can create value for entrepreneurial firms. Similar types of benefits for small firms have been found in many other studies (Dickson *et al.* 1991, Forrest & Martin 1994). All these mechanisms have received a lot of attention in alliance literature. In the following, I review the literature focusing on the research demonstrating benefits stemming from resource acquisition, knowledge acquisition, and endorsement.

Resource acquisition. A large body of literature has proposed and empirically shown that start-ups can access complementary resources through alliances (De Meyer 1999, Dickson *et al.* 1991, Elfring & Hulsink 2001, Park *et al.* 2001, Rothaermel & Deeds

2001, Rothwell 1989, Rothwell & Zegweld 1982, Starr & MacMillan 1990). In one study that examined the role of resources in the alliance formation of start-up firms, Eisenhardt and Schoonhoven (1996) examined the alliances of 98 semiconductor start-ups and found that firms entered into strategic alliances because of a lack of internal resources when in the vulnerable strategic position of pursuing innovative strategies in emerging competitive industries. In a study examining alliances between small and large firms, Mitchell and Singh (1992) analyzed pre-entry alliances by 87 incumbent firms in the medical diagnostic imaging industry. While they focused primarily on potential threats to ventures in establishing alliances with large firms that might later be used as options to expand, they also identified some opportunities for new ventures from alliances with large firms. They concluded that access to an incumbent's distribution system or contribution by an incumbent of a minority investment may increase the ability of a new entrant to participate in an emerging field. Similarly recognizing the potential value of the distribution channels of large firms, Stearns (1996) analyzed alliances of 225 high technology firms and found that high-technology new firms (less than 6 years old) benefited most from marketing alliances. He speculated that this might result from the lack of own distribution channels and the benefits of forming alliances to distribute the products via other distribution channels. Other resources were identified by Alvarez & Barney (2001) who pointed out that when entrepreneurial and large firms control *complementary resources,* gains from trade are possible and strategic alliances can create economic value. They noted that large corporations have often developed manufacturing, marketing, sales, distribution, financial, and other organizational resources that an entrepreneurial firm needs to commercialize. These resources make large firms attractive alliance partners for entrepreneurial firms with new technologies (Alvarez & Barney 2001). The use of alliances with large corporations to access complementary resources was also documented by De Meyer (1999), who carried out longitudinal case studies on five alliances of five start-ups with large firms and found that small high-tech ventures used partnerships to get access to complementary assets from corporations.

Knowledge acquisition. A large body of literature has documented the importance of interorganizational learning as a motivation for establishing alliances and as a factor contributing to alliance performance (Badaracco 1991, Hamel *et al.* 1989, Hamel 1991, Inkpen 1996). While many of these studies have focused on the corporate perspective, there is also a large set of literature examining knowledge acquisition by entrepreneurial ventures from their alliance partners (Almeida *et al.* 2001, Dickson *et al.* 1991, Liebeskind *et al.* 1996, Shan *et al.* 1994). Audretsch (2001) argued that "if strategic research partnerships are important to large corporations, they are even more important to small firms. This is because that a small enterprise is more likely than its larger counterpart to be lacking a key component involving control, capabilities and context."

Besides enhancing capabilities, interorganizational learning is important for start-ups for learning about market opportunities (Elfring & Hulsink 2001, McGrath 2000, Penrose 1959). In the following, some of the studies examining knowledge acquisition by entrepreneurial ventures from strategic alliances are reviewed.

Liebeskind *et al.* (1996) carried out case studies of two new biotechnology firms finding that informal collaboration by the scientists with external organizations was highly important for knowledge sourcing. Scientists in these firms entered into large numbers of collaborative relationships with scientists at other organizations. These firm boundary-spanning activities were important for sourcing scientific knowledge.

Dickson *et al.* (1991) carried out case studies on 27 research projects involving large/small firm collaboration and found that collaboration often led to the development of new products or processes that would not otherwise have been developed. Similarly, Shan *et al.* (1994) analyzed alliances of 85 biotechnology firms finding a positive relationship between the number of strategic alliances and a firm's research productivity.

Almeida *et al.* (2001) examined the influence of age on the knowledge acquisition via alliances with incumbent firms. In their analysis of alliances of 71 semiconductor start-ups, they found that external learning increased with start-up size. With regard to the specific mechanisms of learning, they found that firms learned from alliances regardless of their size. For the informal mechanisms of external learning, however, learning decreased with firm size. They concluded that as start-ups grow, they may have increasing opportunities to access and exploit external knowledge, but their motivation (and hence ability) to learn from more informal sources may decrease.

Endorsement Several studies have documented the liability of newness and other problems of new firms stemming from low legitimacy (Stinchcombe 1965, Aldrich & Auster 1986, Singh *et al.* 1986). There is a strong stream of research examining the role of alliances and interorganizational relationships enhancing legitimacy through endorsement (Baum & Oliver 1991, 1992, De Meyer 1999, Dickson *et al.* 1991, McGrath 2000, Stuart *et al.* 1999, Stuart 2000).

For instance, Dickson *et al.* (1991) carried out case studies on 27 research projects involving large/small firm collaboration and found that small firms benefited from the collaboration in the form of increased legitimacy. Similarly, De Meyer (1999) carried out longitudinal case studies on five alliances of five start-ups with large firms and found that one reason why small high-tech ventures established partnerships with large corporations was to get support for creating dominant designs.

Stuart *et al.* (1999) analyzed alliances of 301 dedicated biotechnology firms finding strong support for their predictions that endorsement is an important value-adding mechanism in alliances of start-ups. They found that technological and commercial prominence of the alliance partners were associated with faster initial public offerings and higher valuations at initial public offerings. Further, the endorsement effects were stronger for young and small companies. They also found that the prominence of

investment banks was positively related to the IPO market valuation with a stronger endorsement effect for younger and smaller companies

Similarly, Stuart (2000) analyzed over 1600 alliances of 150 semiconductor firms. He predicted three types of benefits from alliances for start-ups: resource access, learning, and endorsement benefits. He viewed alliances as access relationships and therefore predicted that advantages that a focal firm derives from alliance partners depend on the resource profiles of its alliance partners. He posited that large firms and those that possess leading-edge technological resources would be the most valuable associates for technology-based start-ups. He found support for these resource access and learning predictions and demonstrated that the size of the partner firms was positively related to focal firm sales growth and that the patent portfolio of the partner firm was positively related to the focal firms patenting. Consistent with the status-transfer arguments, young and small firms benefited more from large and innovative strategic alliance partners than did old and large organizations

Taken together, these studies focusing on different forms of value created in alliances suggest that resource acquisition, knowledge acquisition, and endorsement benefits are important value creation mechanisms for ventures in their strategic alliances.

Factors Influencing Value Creation for Ventures in Strategic Alliances

Various factors have been identified in alliance literature to influence the value creation for new ventures in strategic alliances. These factors are reviewed in three groups: partner characteristics, venture characteristics, and the relationship characteristics.

Partner characteristics. The influence of *partner prominence* has been identified in several studies examining strategic alliances between small and large firms (Mitchell & Singh 1992, Stuart *et al.* 1999, Stuart 2000). It has been argued and demonstrated that industry-leading corporations are more valuable partners for start-ups than smaller companies (Stuart *et al.* 1999, Stuart 2000).

Venture characteristics. Uncertainty of the venture, commonly proxied with age, has been found to influence the benefits from alliances for ventures. Stuart *et al.* (1999) and Stuart (2000) found higher benefits from alliances for younger and more uncertain ventures. Examining the influence of *complexity and systemic nature of products* on firm survivability, Mitchell and Singh (1996) and Singh (1997) examined longitudinal data on 973 firms in the U.S. hospital software industry. They found that companies commercializing complex technologies using collaborative strategies were more likely to survive when the environment did not change rapidly, but were also more likely to be acquired when the environment changed rapidly. Singh (1997) found that companies commercializing highly complex technologies faced higher risks of failure than other businesses because of greater competency demands and higher organization costs. He predicted that alliances would moderate the risk of failure so that they would

reduce further risk for companies commercializing high-complexity technologies. He found support for the higher risk of high complexity companies, but only partial support for the higher risk reduction of high-technology alliances.

Relationship characteristics. In their analysis, Alvarez & Barney (2001) found many threats and problems for entrepreneurial firms in alliances with large firms. However, they pointed out that when entrepreneurial and large firms control *complementary resources,* gains from trade are possible and strategic alliances can create economic value. They noted that large corporations have often developed manufacturing, marketing, sales, distribution, financial, and other organizational resources that an entrepreneurial firm needs to commercialize. These resources make large firms attractive alliance partners for entrepreneurial firms with new technologies (Alvarez & Barney 2001). Park *et al.* (2001) found in their analysis of alliances of 171 U.S. semiconductor start-ups that resource-rich start-ups were well positioned to use both exploration and exploitation alliances. This is in line with Eisenhardt & Schoonhoven (1996:147) who noted that the problem for technology-based ventures was that "cooperation requires resources to get resources."

The relationship between the alliance partners has also been argued and shown to influence value creation in alliances. The influence of the relational capital has attracted significant attention in theoretical research (Dyer & Singh 1998) and empirical research on various forms of interorganizational relationships and alliances of larger firms (Anderson & Narus 1990, Kale *et al.* 2000, Mohr & Spekman 1994, Sarkar *et al.* 2001, Yli-Renko *et al.* 2001a). In addition to studies focusing on large firms, there are also some studies focusing on various dimensions of relationship in empirical research on strategic alliances of entrepreneurial ventures (Larson 1992, Niederkofler 1991, Stuart *et al.* 1999). For instance, Larson (1992) conducted case analyses of seven alliances of entrepreneurial firms and developed a three-stage model of the formation of entrepreneurial dyads. She found that economic incentives and mutually beneficial strategic rewards were a necessary but not a sufficient condition for the development of exchange relationships, but that informal and implicit social contracts arising from trust, reciprocity, interdependence and reputation were the most emphasized by informants as determinants of the relationship success.

Taken together, these studies on the factors influencing the value creation for new ventures suggest that there are important factors related to partner characteristics, venture characteristics, and relationship characteristics. Partner prominence was identified as one of the factors. Also venture uncertainty and the complexity of its products were found to influence the benefits from alliances. Finally, complementarities with the alliance partner and quality of the relationship were identified as important determinants of value creation.

There are a large number of studies examining the influence of strategic alliances on the performance of technology-based new firms. While earlier studies focused primarily on whether the number of alliances is related to the performance of the ventures, later studies have increasingly recognized various contingencies on the performance effects of alliances. Most of the benefits found in alliance research can be categorized in one of the three categories: resource acquisition, knowledge acquisition, and endorsement. Prominence of the alliance partner, venture uncertainty, resource complementarities, and complexity and systemic nature of the products have been identified as some of the factors that influence the value creation mechanisms.

The key difference between strategic alliances between small and large firms and corporate venture capital investor relationships is the predominant role of the equity investment in corporate venture capital relationships. The investment makes the relationship relatively strong and stable in corporate venture capital compared to for instance non-equity alliances. On the other hand, resource sharing and other forms of collaboration are not necessarily a part of the relationship with corporate venture capital investors.

2.1.6 Internal Corporate Venturing from the Perspective of Technology-Based New Firms

One area of research with relevance to the present study on corporate venture capital is research on relationships between ventures and their parent corporations in internal corporate venturing. In internal corporate venturing, ventures are owned by corporations and therefore have a strong link to them. Some of the major differences in internal venturing compared to independent ventures financed by corporate investors are that internal corporate ventures have typically originated within the corporation and are controlled by corporate parents. However, as in corporate venture capital, the relationship with a large corporation can bring about both benefits and problems. While there is a vast literature on internal corporate venturing (for an overview, see Thornhill & Amit [2000] and Backholm [1999]), this review focuses on the performance implications of corporate parents, the benefits corporate ventures receive from their parents, and the factors influencing those benefits. Studies focusing on these aspects are summarized in Table 2-6.

Table 2-6   *Literature on value creation by ventures in internal corporate venturing*

Category	Studies
Performance implications for ventures	
	Caves & Porter 1977, Hines 1957, McDougall *et al.* 1992, Shrader & Simon 1997, Sorrentino & Williams 1995, Thornhill & Amit 2000, Van De Ven *et al.* 1984, Weiss 1981, Zahra 1996, Zahra & Bogner 1999
Value creation mechanisms (non-financial)	
Resource acquisition	Burgelman & Sayles 1986, Caves & Porter 1977, Hines 1957, MacMillan & Day 1987, Miller *et al.* 1991, Parhankangas 1999, Shrader & Simon 1997, Starr & MacMillan 1990, Weiss 1981, Zahra & George 1999
Knowledge acquisition	Backholm 1999, Parhankangas 1999, Shrader & Simon 1997, Zahra & George 1999
Endorsement	Backholm 2000, Miller *et al.* 1991, Shrader & Simon 1997, Starr & MacMillan 1990
Factors influencing the value creation	
Partner characteristics	Williams *et al.* 1991
Venture characteristics	Backholm 1999, Zahra 1996, Zahra & Bogner 1999, Zahra & George 1999
Relationship characteristics	Backholm 2000, Dougherty 1995, Miller *et al.* 1991, Parhankangas 1999, Sorrentino & Williams 1995, Thornhill & Amit 2001

Performance Implications for Ventures from Internal Corporate Venturing

The results on performance differences between corporate ventures and independent ventures are mixed. Whereas Hines (1957) and Caves & Porter (1977) predicted that corporate ventures would outperform independent ventures, Weiss (1981) and Zahra (1996) found that independent ventures outperformed corporate ventures. Most of the studies have found no differences between the performance of corporate ventures and independent ventures (McDougall *et al.* 1992, Shrader & Simon 1997, Van De Ven *et al.* 1984, Zahra & Bogner 1999). Some explanations for varying resources have been offered by Shrader and Simon (1997) who argued that resource benefits may be counterbalanced by problems stemming from less autonomous position. Lack of autonomy has also been identified as a key problem counterbalancing any resource benefits in other studies including Block (1983), Kanter (1985), Sykes and Block (1989), Block (1989), Dougherty (1995), and Backholm (2000). Shrader and Simon (1997) also attributed some of the mixed results to the concept of equifinality meaning that both venture types may be equally successful even though they might follow different strategies.

Indeed, several studies have found significant differences in the strategies and success factors of corporate ventures and independent ventures. For instance, Zahra (1996) analyzed 112 biotechnology ventures and found that corporate ventures and independent ventures emphasized different dimensions of technology strategy. He found that the primary success factors of independent ventures included technological pioneering, a focus on applied R&D, and extensive use of the internal R&D sources. In comparison, primary success factors of corporate ventures included heavy R&D spending, the use of both internal and external R&D sources, frequent product

introductions, and patenting. In their analysis of matched samples of 30 corporate ventures and 30 independent ventures, Shrader and Simon (1997) found that corporate ventures emphasized internal capital resources, proprietary knowledge and marketing expertise whereas internal ventures emphasized external capital resources, technical expertise, and development of brand identification. They concluded that parents may share resources but may constrain ventures when translating those resources into strategies. Also finding significant differences in strategies and success factors between independent and corporate ventures, Zahra and George (1999) analyzed 112 biotechnology ventures and found significant differences in the manufacturing strategies between corporate ventures and independent ventures. Relevant to the present study, corporate ventures leveraged external resources more than independent ventures.

Taken together, the comparative studies between independent and corporate ventures suggest that there are no consistent differences in performance between independent and corporate ventures. The benefits are often counterbalanced by problems and realization of the potential benefits is not easy.

Value Creation Mechanisms for Ventures in Internal Corporate Venturing

The premise in much of the research examining the differences between corporate ventures and independent ventures is that linkages to the corporate parent have influences on the strategies, success factors, and performance of corporate ventures. It has been suggested that corporate ventures are able to potentially benefit from their corporate parents by *acquiring resources* (Burgelman & Sayles 1986, Caves & Porter 1977, Hines 1957, McMillan & Day 1987, Miller *et al.* 1991, Shrader & Simon 1997, Starr & MacMillan 1990, Zahra & George 1999), *acquiring knowledge and skills* (Backholm 2000, Shrader & Simon 1997, Zahra & George 1999), and *improving their legitimacy* (Backholm 2000, Miller *et al.* 1991, Shrader & Simon 1997, Starr & MacMillan 1990).

Factors Influencing Value Creation for Ventures in Internal Corporate Venturing

As discussed above, the influence of the existence of a corporate investor does not appear to have high predictive power on the performance of new ventures. An important line of research has examined more thoroughly the factors influencing the performance of corporate ventures and the role of their relationship with the corporate parent influencing the corporate venture performance (Miller *et al.* 1991, Sorrentino & Williams 1995, Thornhill & Amit 2000).

Parent firm characteristics. Review of the literature on internal corporate venturing reveals that there is not very much research on the parent firm characteristics on the benefits for corporate ventures. Among the few studies considering partner characteristics is Williams *et al. (*1991) who identify the role of corporate image.

Venture characteristics. In contrast to parent characteristics, the literature has identified several characteristics of the venture influencing the benefits from

relationships with the parent corporation (Backholm 1999, Zahra 1996, Zahra & Bogner 1999, Zahra & George 1999). Among the most important factors is the type of business of the venture (Zahra 1996).

Relationship characteristics. In the stream of research focusing on the relationships between corporate ventures and their parents, one of the most important focus areas has been the *closeness of the relationship.* Most of the researchers have documented a trade-off between the tightness of the relationships (argued to enable better resource sharing) and lack of autonomy stemming from close relationship. Because of these trade-offs, there are mixed results on the influence of relatedness on the venture performance.

Among the empirical studies examining the fit between corporate venture and their parents is the study by Miller *et al.* (1991), which analyzed 94 new corporate ventures in the PIMS database and found that resource sharing had a beneficial effect on product quality and a deleterious effect on production costs. However, reporting to top management did not influence the cost or the quality but interacted significantly with resource sharing to affect the both. Miller *et al.* (1991) argued that this interaction served to moderate performance in terms of competitive advantage achieved. Finally, they found that top management overview appeared to provide safeguards against runaway production costs, but it also appears to limit product quality. Similarly employing PIMS databases in the analysis of 88 new industrial corporate ventures, Sorrentino and Williams (1995) examined the factors influencing the performance of corporate ventures assuming that relatedness with the corporate parent would have a positive influence on corporate venture performance. However, they did not find any direct relationship between relatedness and performance. They concluded that the degree of relatedness with the corporate parent did not, by itself, explain venture performance or the entry strategy chosen at the venture level. Only when combined with the intangible assets held by the firm at the corporate level did relatedness appear to determine venture success.

Employing survey data collected from 97 Canadian corporate ventures, Thornhill and Amit (2000) examined the influence of the internal fit between the corporate venture and parent corporation, as well as the evolution of the fit over time. They found that a tight fit was positively associated with venture performance because of the venture's access to its parent's resources. They also distinguished two dimensions of the fit between corporate parents and their ventures: relational and economic. A relational fit reflects organizational culture and structure, while an economic fit is a function of the needs of the venture and the resources of the parent. Thornhill and Amit concluded that that the degree of fit between a corporate parent and its venture was positively related to the success of the venture, and that success was associated with high levels of awareness, commitment, and connection. Further, the relational dimension of the parent-venture interface appeared to have a greater association with venture success than did the economic dimension; the parent-venture relationship is

dynamic in nature (ventures generally lessened their economic connections with their parents as they mature). However, the relational bonds remained more or less intact. The exceptions to these general trends were an increasing emphasis on financial targets along with decreasing CEO involvement as ventures matured.

Taken together, there studies suggest that there are factors related to the characteristics of the parent firm, venture, and their relationship, influencing the benefits of corporate ventures received from the parent corporations. The quality of the relationship between corporate ventures and parent corporations has been identified as an important determinant of the performance.

Conclusions from the Research on Value Creation for Ventures in Internal Corporate Venturing

Earlier research on internal corporate venturing suggests that the linkage between the parent company and the venture may have important performance implications for the venture.

A major conclusion from the research on internal corporate venturing relevant to the present study on corporate venture capital is that while access to corporate resources via close association may have potential positive influences on venture performance, it is not always easy to realize those potential benefits and that they may be offset by other problems. Rules for riches rarely exist.

Another conclusion from the research on internal corporate venturing concerns the types of potential benefits from corporate parents and the factors influencing the realization of those benefits. Some of the most valuable potential benefits from the corporate parent for corporate ventures include access to resources, learning, and improved legitimacy. The realization of the benefits is often difficult but it is influenced by the quality of the relationship between the corporate venture and the parent corporation.

The key difference in internal corporate venturing compared to corporate venture capital is that the company originally related to the corporation and commonly does not have other investors in addition to the parent corporation. Therefore, internal corporate ventures are often more dependent on a single corporation than independent ventures financed by corporate venture capital investors.

2.1.7 Conclusions from Research on Corporate Venture Capital and Related Topics

The previous sections have reviewed the research relevant for this study. Because there is very little research on the specific topic of the present study, value-added provided by corporate venture capitalists for their portfolio companies, the literature review was expanded to other related and partly analogous contexts. In order to build a solid basis for hypothesis development, the earlier research was also reviewed in related areas including value-added provided by venture capital investors, benefits for ventures from

strategic alliances with large firms, and benefits for ventures from parent corporations in internal corporate venturing.

The overall synthesis of the review of the literature on corporate venture capital, traditional venture capital, strategic alliances, and internal corporate venturing from the perspective of value-added provided for ventures, suggests that there are potential benefits from these relationships for the ventures, but that the potential of the benefits and the realization of the potential benefits are contingent on various factors. Most of the benefits can be categorized in one of three categories: resource acquisition, knowledge acquisition, or endorsement benefits. Factors influencing the potential benefits and their realization include the characteristics of the partners, characteristics of the focal venture, and characteristics of the relationship between the venture and the partner.

As a conclusion from this review of research into corporate venture capital and related empirical fields, there appears to be a clear research gap related to the value-added mechanisms in corporate venture capital and the factors influencing the value-added mechanisms. This dissertation seeks to fill this research gap by building on earlier research on value creation in venture capital, alliances between small and large firms, and relationships between parent corporations and ventures in internal corporate venturing. It was also noted that earlier research touching this area is predominantly explorative in nature. Therefore, this dissertation seeks to build on a strong theoretical approach. In the next chapter, potentially relevant theoretical approaches are reviewed.

2.2 Relevant Theoretical Approaches

This chapter reviews the literature on theories potentially relevant to this study. The theories included in this review are the resource-based view, knowledge-based view, social capital theory, resource dependence perspective, asymmetric information and signaling theory, agency theory, and transaction cost economics. For each theory, the development of the theory is discussed first. Thereafter, most relevant empirical applications are reviewed followed by the critique of the theories presented in the extant literature is reviewed. In the last part of the chapter, theories are compared and their applicability to the present study is assessed.

2.2.1 Resource-Based View

The resource-based view of the firm dates back to the seminal work of Penrose (1959) who conceptualized the firm as a collection of productive resources and viewed firm growth as a process of using these resources to exploit the firm's "productive opportunity" and also increasing the firm's resource base. Penrose defined productive opportunity as "the collection of all possible productive possibilities entrepreneurs can identify and are willing and able to pursue". Because productive opportunities are

unlimited, the firm's growth is limited by the existing resource base and the competence of management to exploit the resource base.

Penrose's ideas did not receive much attention before Wernefelt (1984) introduced the term "resource-based" in his characterization of firms as collections of resources rather than sets of product-market positions. At the same time, Rumelt (1984:557-558) suggested that a competitive advantage is determined by the firm's unique resources that are handled by the management: "… a firm's competitive position is defined by a bundle of unique resources and relationships and that the task of general management is to adjust and renew these resources and relationships as time, competition, and change erode their value." After the writings of Rumelt (1984) and Wernefelt (1984) "the resource-based view" rapidly emerged. The key idea of the resource-based view is that firm-specific skills, competencies, and other tangible and intangible resources are viewed as the basis for the competitive advantage of a firm (Barney 1991, Peteraf 1993, Prahalad & Hamel 1990). Because of environmental uncertainty, the firm-specific resources and capabilities are considered as a more sustainable basis for competitive advantage than product-market positioning (Grant 1991). The essence of a firm's strategy lies in the ways that the firm uses existing resources and in the means the firm acquires or develops internally additional unique resources (Wernefelt 1984). Barney's (1991) conceptual paper has become the cornerstone of contemporary research on the resource-based view (Priem & Butler 2001). In this paper, Barney presents the two key axioms of the resource based view: (1) resources are distributed heterogeneously across firms, and (2) these productive resources cannot be transferred from firm to firm without cost (i.e. resources are "sticky") (Barney 1991, Priem & Butler 2001). According to Barney (1991), in order to sustain long-term competitive advantage, resources must be valuable, rare, imperfectly imitable, and without strategically equivalent substitutes.

Valuable resources. Not all resources are valuable. According to Barney and Arikan (2001) firm attributes, whether they are tangible or intangible, are strategically relevant only if they enable a firm to efficiently and effectively develop and implement a strategy that, in turn, generates superior performance. Barney and Arikan recognized that the value of resources could not be evaluated independently of the market context within which a firm is operating.

Rare resources. Barney and Arikan (2001) argued that resources are scarce to the extent that demand for them exceeds supply. As long as the number of firms that possess certain resources is less than the number of firms required to generate the perfect competition around the strategies whose choice and implementation is facilitated by the resources, then those resources can be considered as scarce.

Non-imitable resources. Dierickx and Cool (1989) identified five characteristics of the processes through which resources are accumulated and that influence their imitability: time compression diseconomies, asset mass efficiencies, interconnectedness of asset stocks, asset erosion, and causal ambiguity. *Time compression diseconomies*

mean that resource accumulation takes time and is not linearly related to the investments made in resource acquisition. Doubling the inputs does not halve the time it takes to accumulate the resources. *Asset main efficiencies* arise if an existing resource stock facilitates accumulation of additional resources stocks. *Interconnectedness of asset stocks* implies that additions to existing resource stocks are linked to the level of other resources stocks. *Asset erosion* occurs when resource stocks decay if not maintained. *Causal ambiguity* arises when it is impossible to specify how resource stocks are accumulated (Dierickx & Cool 1989). Similarly, Barney (1991) argued that resources are inelastic in supply when they are path dependent, causally ambiguous, or socially complex. Reed & DeFilippi (1990) argued that tacitness, complexity and specificity create ambiguity and thus reduce imitability.

Non-substitutable resources. Barney and Arikan (2001) argued that resources are non-substitutable to the extent that they can be uniquely used to help conceive of and implement a strategy. To the extent that such a one-to-one correspondence exists between a resource and a strategy, the resource is non-substitutable. However, it is important to note that it may not be a single resource but instead a bundle of resources that enable a firm to implement a strategy. Further, some of the resources within such a bundle may be substitutable.

Although some of the earlier papers on the resource-based view have focused largely on the internal resources of the firm, in more recent research the resource-based view has later been extensively applied in the analysis of interorganizational relationships of firms (Dussauge & Garrette 1999, Eisenhardt & Schoonhoven 1996, Hitt *et al.* 2000).

The resource-based view has important implications for the formation and performance of interorganizational relationships of entrepreneurial firms. The resource-based view highlights the role of resource complementarities influencing the alliance formation and performance (Das & Teng 2000, Hitt *et al.* 2000, Eisenhardt & Schoonhoven 1996, Hellmann 2001). Das and Teng (2000) applied the resource-based view in their framework of alliance formation and performance. They recognized resource complementarities as one of the key drivers of alliance formation and performance. Resource complementarities are also important for alliances between small and large firms. Focusing on relationships between small and large firms, Rothwell & Zegweld (1982) argued that small firms entered into alliances in order to capitalize on their innovative capabilities through leveraging the complementary resources of large firms. Similarly, Teece (1986) argued that innovating firms without the necessary manufacturing and related capacities might die, even though they are the best at innovation. He recommended that innovating firms should in some cases establish a prior position in certain complementary assets in order to be able to capitalize on the innovations. Alliances may give small firms access to complementary assets that are often necessary to commercialize innovations (Hobday 1994, Teece 1986) especially in technology intensive industries (Forrest & Martin 1994, Pisano 1989, 1991, Pisano & Mang 1993). Combination of complementary resources and

capabilities can be one potential source of superior value creation (Zajac & Olsen 1993).

Related Empirical Applications of the Resource Based View of the Firm

Since the emergence of the resource-based view, it has been widely applied in empirical research explaining the success of entrepreneurial ventures. In the following, some of the most relevant streams of research from the perspective of the present study are reviewed.

One stream of resource-based theory of the firm, which is particularly related to this study, is its application in interorganizational relationships. In this stream, interorganizational collaboration and alliances are usually viewed as a mechanism to share or acquire resources. In his research on the use of external resources, Jarillo (1989) found that entrepreneurial, fast growing firms used more external resources than their competitors. Eisenhardt and Schoonhoven (1996) extended the application of resource-based view to strategic alliances of young firms. In their analysis of a sample of 98 semiconductor firms, they found that firms entered into strategic alliances because of lack of internal resources in a vulnerable strategic position when pursuing innovative strategies in emerging competitive industries. Another reason why firms engaged in strategic alliances was because of the opportunity to take advantage of their own capabilities such as a large, experienced management team. Park *et al.* (2001) found in their analysis of 171 semiconductor start-ups that firms' use of alliances as mechanisms to adapt to market uncertainties was contingent on internal resource conditions. In growing markets, resource-rich firms leveraged their resources by accessing external complementary resources and reduced uncertainty through alliances while resource-poor firms were less likely to do so. However, in relatively stable markets this relationship reversed and resource-poor firms became more active in alliance formation because of the need to enhance their short-term viability.

In the resource-based view of strategic management, the fundamental argument for alliance formation is that firms try create and appropriate value in inter-firm relationships by leveraging superior resources they posses with complementary resources (Stein 1997). There is a growing body of literature examining the role of resource complementarities influencing the formation and performance of various forms of interorganizational relationships. For instance, Hitt *et al.* (2000) analyzed 202 companies in developed and emerging market countries and found that firms in both considered complementary resources as a valuable determinant in partner selection. Firms in emerging markets emphasized financial assets, technical capabilities, intangible assets, and willingness to share expertise in selection of partners more than developed market firms. Firms in developed markets tried to leverage their resources through partnering, and therefore emphasized unique competencies and local market knowledge and access to their partner selection more than emerging market firms. Similarly, confirming the role of complementarities in alliance formation, Chung *et al.*

(2000) analyzed 6178 deals for new common stock issues by 308 investment banks and demonstrated that the likelihood of investment banks' alliance formation was positively related to the complementarity of their capabilities. In his longitudinal case studies of five start-ups, De Meyer (1999) found that small high-tech ventures used partnerships to get access to complementary assets and to develop dominant designs.

In addition to the empirical research on alliance formation, the research has also tested the role of resource complementarities on alliance performance. For instance, Beamish (1987) found that partner firms' collective strengths, or the overall resources and competencies of the alliance, contributed to better alliance performance. In a case study of a highly successful alliance, Sankar *et al.* (1995) found that the main reason for the success had been a combination of complementary assets and compatible goals. Deeds and Hill (1996) argued that strategic alliances often enable a faster access to complementary resources than building these resources internally. Testing this proposition, they found that alliances had a curvilinear (inverted U) shaped relationship to product development. This finding was later confirmed by Rothaermel and Deeds (2001), who analyzed 2,226 strategic alliances entered into by 325 new biotechnology firms, and demonstrated a similar curvilinear (inverted U) relationship between the number of alliances and new product development.

Besides the relatively large and rapidly growing literature applying the resource-based view to strategic alliances, there is little rigorous empirical research applying that perspective to venture capital or corporate venture capital. In their analysis of initial public offerings by 325 venture capital and corporate venture capital backed companies, Maula & Murray (2000a) found that investments from industry-leading corporations had a positive influence on the valuation of the high-technology start-ups. Although arguing that acquisition of complementary resources was one potential mechanism of value creation, this study was not able to separate resource acquisition from other potential value creation mechanisms such as knowledge acquisition and endorsement.

Critique of the Resource Based View of the Firm

As in the case of other influential theories, the resource-based view has received some criticism. One of the criticisms of the resource-based view is the all-inclusive nature of the definitions of resources (Priem & Butler 2001). Further, it has been argued that the definitions of the key concepts of the resource-based view lead to tautological statements (Priem & Butler 2001). The all-encompassing notion of resources has lead to limited understanding of the boundaries of the theory. The resource-based view argues that resources may be valuable, but does not answer when, where, and how they can be useful (Miller & Shamsie 1996, Priem & Butler 2001). Only recently has research focused on the contingencies influencing the value of resources (Brush & Artz 1999, Miller & Shamsie 1996, Priem & Butler 2001).

The resource-based view has also been criticized for being excessively focused on internal resources with the unit of analysis being a single firm and neglecting the role of resources available through interorganizational collaboration (Dyer & Singh 1998). This criticism has lead to the development of the "relational view" extension to the resource-based view focusing on the sources of competitive advantage residing in dyads or networks of firms (Dyer & Singh 1998).

As with many other theoretical approaches, such as agency theory and transaction cost economics, the resource-based view has been criticized for being a static theory (D'Aveni 1994, Garud & Nayyar 1994, Priem & Butler 2001). This criticism has prompted the emergence of dynamic capabilities to extend the resource-based view to explain the sources of competitive advantage under volatile markets (Teece *et al.* 1997, Eisenhardt & Martin 2000). The resource-based view has also been criticized for neglecting the product market while focusing purely on resources (Priem & Butler 2001). Finally, some authors have argued that the resource-based view offers limited prescriptions for managers (Priem & Butler 2001). This is because resources, as defined in the resource-based view, are largely path-dependent and unique (Conner 1991).

2.2.2 Knowledge-Based View

Summary of the Knowledge-Based View

The knowledge-based view has emerged from the resource-based view of the firm. Distinguishing knowledge from other types of resources, this view of strategy considers knowledge as the strategically most significant resource of the firm (Grant 1996). Its proponents argue that heterogeneous knowledge bases and capabilities among firms are the main determinants of sustained competitive advantage and superior corporate performance (Decarolis & Deeds 1999, Kogut & Zander 1993). The knowledge-based view of the firm depicts firms as repositories of knowledge and competencies (Kogut & Zander 1996, Spender 1996). According to this view, the "organizational advantage" (Ghoshal & Moran 1996) of firms over markets arises from their superior capability in creating and transferring knowledge. Knowledge creation and innovation result from new combinations of knowledge and other resources (Cohen & Levinthal 1990, Kogut & Zander 1992). The accumulation of knowledge through learning constitutes a driving force in the development and growth of young firms (Penrose 1959, Spender & Grant 1996), because knowledge acquisition opens new "productive opportunities" (Penrose 1959) and enhances the firm's ability to exploit these opportunities.

Although a variety of definitions of organizational learning have been proposed, a common notion for various definitions is that learning involves acquisition and exploration of new knowledge by the organization (Kumar & Nti 1998). In this study, I follow Huber (1991:89) who assumed that "an organization learns if any of its units acquires knowledge that it recognizes as potentially useful to the organization."

Similarly, Argote (1999) depicted organizational learning as a process consisting of knowledge acquisition, retention, and transfer. Relationships with other organizations are therefore an important source of new information for organizations (Argote 1999, Steensma 1996). Indeed, numerous studies have identified learning and knowledge acquisition as important motivations for entering interorganizational relationships (Badaracco 1991, Hamel *et al.* 1989, Hamel 1991, Inkpen 1996, Kogut 1988).

Factors influencing transfer of knowledge over organizational boundaries are important for the present study. The knowledge-based view argues that *tacit knowledge* (Polanyi 1958) is most valuable for organizations because it is difficult to transfer and thus can give a sustainable competitive advantage. Tacit knowledge is linked to individuals, and is very difficult to articulate. Polanyi (1966) defined tacit knowledge as "knowing more than we can tell," and viewed this knowledge as largely inarticulable. According to Polanyi (1958, 1966), tacit knowledge is primarily seen through an individual's actions rather than through specific explanations of what that individual knows. The knowledge-based view argues that because tacit knowledge is difficult to imitate and relatively immobile, it can constitute the basis of sustained competitive advantage (DeCarolis & Deeds 1999, Grant 1996, Gupta & Govindarajan 2000, Kogut & Zander 1993). A stream of research building on the knowledge-based view has shown that strong ties and collaboration are positively related to the transfer of knowledge over organizational boundaries (Bresman *et al.* 1999, Kogut & Zander 1992, Mowery *et al.* 1996, Steensma 1996, Steensma & Lyles 2000).

Absorptive capacity is an important concept for interorganizational learning and thus for the present study (Cohen & Levinthal 1990, George *et al.* 2001, Lane & Lubatkin 1998, Van den Bosch *et al.* 1999, Zahra & George 2001). Absorptive capacity has been first defined by Cohen and Levinthal (1990) as the firm's "ability to recognize the value of new external information, assimilate it, and apply it to commercial ends." They argued that interorganizational learning is most effective when there is sufficient similarity in the basic knowledge of the firms (enabling effective communication) but simultaneously sufficient diversity in the special knowledge (non-redundancy makes knowledge valuable).

Related Empirical Applications of the Knowledge-Based View

Despite of the relative newness of the knowledge-based view as a theoretical perspective, it has already been applied in a large number of empirical studies. While a large share of the empirical research applying the knowledge-based view focuses on the characteristics of different types of knowledge and the use of knowledge within firms, the most relevant stream of research for the present study focuses on the role of interorganizational relationships in knowledge acquisition and learning.

The *characteristics of the knowledge* influencing the transfer of knowledge over organizational boundaries have also received empirical attention. For instance, Inkpen and Dinur (1998) reported that in their longitudinal analysis of five international joint

ventures in automotive industry knowledge transfer was negatively related to the tacitness of knowledge and the organizational level at which the transfer took place. Similarly, Simonin (1999) found in his analysis of 147 alliances by U.S. multinationals that tacitness, complexity of knowledge, and cultural and organizational distance (mediated by knowledge ambiguity) were negatively related to knowledge transfer.

However, although tacit and ambiguous knowledge have been shown to be more difficult to transfer over organizational boundaries, empirical research has identified *social capital* and *frequent communications* as factors facilitating the knowledge transfer. For instance, Simonin (1999) found that collaborative know-how from past alliances was positively related to transfer of ambiguous knowledge. Mowery *et al.* (1996) found in their analysis of 792 alliances that strong ties (i.e., equity joint ventures) were more likely to be used to transfer complex capabilities than weak ties (i.e., contract-based alliances). They also found that strong ties (i.e., bilateral contracts) were more effective than weaker ties (i.e., unilateral contracts) for knowledge transfer. Further, alliances between two domestic partners and between partners with experience in related technological areas (i.e. greater sender-recipient similarity) resulted in greater knowledge transfer. Similarly, Kale *et al.* (2000) found in their research on alliances of 278 U.S. companies that relational capital was positively related to learning from the alliance partner. Examining knowledge acquisition in key customer relationships of 180 technology-based new firms, Yli-Renko *et al.* (2001a) found that social capital embedded in the key customer relationship greatly facilitated the knowledge acquisition from key customers.

Besides social capital and frequent communication, *absorptive capacity* has been shown to be among the most important things influencing interorganizational learning. Demonstrating the important role of absorptive capacity, Lane and Lubatkin (1998) analyzed 69 R&D alliances between pharmaceutical and biotech companies and found that learning tacit and embedded knowledge required absorptive capacity in the recipient firm. They found that similarity of the basic knowledge between the alliance partners was positively correlated and similarity of the special knowledge was negatively correlated with learning from the alliance partners.

Learning through interorganizational relationships has been shown to be important for the performance of technology-based new firms. For instance, the research by Powell *et al.* (1996) examining panel data on alliances of dedicated biotechnology firms demonstrated that when the knowledge base of an industry is complex, expanding, and widely dispersed, the locus of innovation will be found in networks of learning, rather than in individual firms. They found that in those situations, building external collaborations was central to updating the knowledge base of the firm. R&D collaborations became admission tickets to the knowledge network, and vehicles for the rapid communication of new knowledge. Providing more evidence on the important role of interorganizational knowledge acquisition for the performance of technology-based new firms, Yli-Renko *et al.* (2001a) demonstrated that knowledge acquisition was

positively related to product development and technological distinctiveness. Also arguing for the value of interorganizational learning for the performance of start-up companies, DeCarolis and Deeds (1999) analyzed 98 initial public offerings of biotechnology firms and found weak support for the positive relationship between alliance count (as a measure of knowledge flows) and IPO market valuation.

There is also some empirical research examining the learning by entrepreneurs from their *venture capital* investors. Barney *et al.* (1996) analyzed a sample of 205 venture capital backed firms and found systematic differences among new venture teams in their evaluation of learning assistance from their venture capital investors. They found that new venture teams with more industry experience and longer team tenure in the current venture were negatively related to both business management advice and operational assistance offered by their venture capital investors. When a new venture team had previously worked together, and its primary experience was from another industry, the new venture team tended to welcome business management advice from its venture capital investors. However, business management advice was not highly valued by new venture teams that pursued more technical innovations, and the researchers could not find a relationship between the current performance and the new venture team's evaluation of the assistance. Barney *et al.* (1996) concluded that an optimal level of involvement by venture capitalists was contingent on the new venture team's openness to learning.

Critique of the Knowledge-Based View

The knowledge-based view has also faced some criticism. One of the criticisms is that research on the knowledge-based view is highly abstract (Argote 1999). The concepts are hard to measure and learning is often treated as a 'black box'.

Perhaps because of the abstractness of the concepts and difficulty of operationalizing them, research on the knowledge-based view has become highly fragmented. While there is agreement within the research on the knowledge-based view on the basic assumption that knowledge is the source of competitive advantage, there is less agreement on the terminology and levels of analysis. Because of this fragmented nature of research, the knowledge-based view has not been seen as a coherent theory (Grant 1996), but rather as an umbrella covering a variety of processes (Argote 1999). Recently, it has also been pointed out that there seems to be little research providing strong empirical support for the basic assumption of the knowledge-based view that knowledge is the firm's most important resource (Eisenhardt & Santos 2000).

It has also been argued that when the knowledge-based view is used as a theory of strategy, knowledge is typically conceptualized as a resource that can be acquired, transferred, or integrated to achieve sustained competitive advantage (Eisenhardt & Santos 2000). Because of this, the knowledge-based view is thereby reduced to simply a special case of the resource-based view, rather than a unique theory of strategy.

Summary of the Social Capital Theory

Bourdieu and Wacquant (1992:119) developed a definition of social capital as "the sum of resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition". This definition focuses on benefits that can be achieved by participating in social networks and on deliberate construction of social relationships for the purpose of achieving these benefits. In the work of Bourdieu (1985) and Bourdieu and Wacquant (1992), the social relationships that allow individuals or groups to claim resources are distinguished from the amount and quality of these resources. The distinction between the physical resources and social capital that provides access to those resources is important for understanding social capital (Galunic & Moran 2000, Portes 1998:5). According to Nahapiet and Ghoshal (1998), the relationships providing access to the physical resources can be considered as a higher-order resource for the individual or organization justifying the term social capital. In this study, social capital is considered as a factor facilitating resource and knowledge acquisition and improving legitimacy.

Social capital is a multidimensional concept (Galunic & Moran 2000, Granovetter 1985, Nahapiet & Ghoshal, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a). Nahapiet and Ghoshal (1998) defined three dimensions of social capital: (1) structural dimension, (2) relational dimension, and (3) cognitive dimension. The structural dimension refers to network ties, network configuration, and appropriable organization (Nahapiet & Ghoshal 1998), while the relational dimension refers to assets that are rooted in the relationships such as trust, norms, obligations, and identification (Nahapiet & Ghoshal 1998), and the cognitive to shared codes and language, as well as shared narratives which facilitate a common understanding of collective goals and proper ways of acting in a social system (Nahapiet & Ghoshal 1998). Later, there have been other distinctions such as those of Galunic and Moran (2000) who distinguished two dimensions: *structural embeddedness* and *relational embeddedness* They defined structural embeddedness as an actor's exchange configuration and relational embeddedness as specific qualities of those relations.

Related Applications of the Social Capital Theory

In empirical research, social capital has been applied in various levels of analysis including individuals (Galunic & Moran 2000, Geletkanycz & Hambrick 1997, Higgins & Gulati 2001), teams (Hansen *et al.* 1999, Reagans & Zuckerman 2001), projects (Hansen 1999b), organizational units (Tsai & Ghoshal 1998, Tsai 2000, 2001), firms (Stuart *et al.* 1999, Stuart 2000), dyadic interorganizational relationships (Mohr & Spekman 1994, Yli-Renko *et al.* 2001a), interorganizational networks (Uzzi 1997, Walker *et al.* 1997), and firm-market interfaces (Baker 1990). In empirical research on

social capital, research on structural dimensions in networks has dominated the research (Hansen *et al.* 1999) and more attention has been warranted focusing on these relational qualities (Galunic & Moran 2000, Uzzi 1997, Yli-Renko *et al.* 2001a). In this study, the focus is on social capital residing in dyadic interorganizational relationships.

Most of the empirical research on social capital has not considered the endogenous nature of social capital. There are numerous studies examining the value of social capital. However, there are very few studies examining what influences the creation of social capital (Higgins & Gulati 2001, Gulati & Gargiulo 1999). Little attention has been paid to the motives of individuals and organizations to invest in creating social capital. Hite and Hesterly (2001) are among the few who have considered the economic motives driving the creation of firm networks. Borrowing the term 'calculativeness' from Williamson (1993) they examined the creation of how firm interorganizational networks of entrepreneurs evolved over time, and demonstrated a development from 'identity-based networks' of founder managers' old contacts towards 'calculative networks' were driven by economic motives to acquire resources needed to expand the firm. The present study argues that investment in social capital is not exogenous but instead endogenous and driven partly by economic motivations of the actors.

Critique of the Social Capital Theory

While most of the recent research on social capital has considered only the benefits of social capital, it has been increasingly acknowledged that social capital can also be a constraint (Adler & Kwon 2000, Galunic & Moran 2000, Gargiulo & Benassi 1999, Giddens 1984, Portes 1998, Uzzi 1997, Yli-Renko *et al.* 2001a). For instance, Uzzi (1997) argued that excessive embeddedness insulates companies from their environment, which can be harmful, especially during rapid change in the environment. In recent research, it has been also acknowledged that there are costs in maintaining social capital (Leana & Van Buren 1999) and therefore the value of social capital is contingent on whether the benefits exceed the costs (Hansen *et al.* 1999, Hansen 1999b, Higgins & Gulati 2001). Some authors have also criticized social capital for being merely a new label for previously studies processes (Portes 1998). Furthermore, some have criticized the distinction between relationships and the resources acquired through them as often being unclear (e.g. Madhok & Tallman (1998) view an alliance relationship as a resource).

2.2.4 Resource Dependence Perspective

Summary of the Resource Dependence Perspective

Resource dependency perspective (Jacobs 1974, Pfeffer & Salancik 1978) argues that no organization can survive alone. Resource dependence perspective argues that firms have to enter into interorganizational relationships because they cannot generate all

the necessary resources internally (Aldrich & Pfeffer 1976, Jacobs 1974, Pfeffer & Salancik 1978).

Resource dependence perspective builds on social exchange theory (Blau 1964, Emerson 1962) and explains dependence on interorganizational relationships (Jacobs 1974, Pfeffer & Salancik 1978). Pfeffer and Salancik (1978) argued that when conditions of exchange and competition are uncertain and problematic, organizations attempt to establish linkages with elements in their environment and use those linkages to access resources, to stabilize outcomes, and to avert environmental control. However, using external links to gain access to resources makes firms dependent on the environment (Boyd 1990, Pfeffer & Salancik 1978).

Resource dependence perspective assumes that firms avoid environmental uncertainty (Pfeffer & Salancik 1978), seek to reduce dependency on the environment (Pfeffer & Salancik 1978), and anticipate reciprocity in resource exchange relationships (Blau 1964, Emerson 1962, Jacobs 1974, Pfeffer & Salancik 1978)). The resource dependence perspective views the goal of organizations being the reduction of environmental uncertainty through resource sharing, while avoiding excessive dependence on external parties to resource exchange. The main goals of firms in managing interorganizational relationships are minimizing dependence on others, controlling critical resources, and gaining access to critical resources (Pfeffer & Salancik 1978). Pfeffer (1981) argued that firms could manage their resource-dependence primarily in two ways. First, they can acquire control over resources to reduce their dependence. Second, they can acquire control over resources that make other firms more dependent on them.

Related Applications of the Resource Dependence Perspective

While the central tenet of the resource dependence perspective that organizations are dependent on their environment is widely adopted in research examining the performance and interorganizational relationships of entrepreneurial firms, (Autio 2000, Jarillo 1989), there is relatively little research on entrepreneurial firms really applying and testing the resource exchange model of Pfeffer and Salancik (1978) or developing hypotheses based on the resource dependence perspective.

Among the studies explaining performance and interorganizational relationships of entrepreneurial firms applying the resource dependence perspective is the study by Venkataraman *et al.* (1990) that analyzed the effects of the liability of newness on the likelihood of failure of 10 U.S. software companies and found that these firms used their existing customer relationships to attract other resource providers. This made the firms highly dependent on a few key relationships, exposing them to failure in turbulent environments. They proposed that a high growth orientation pushes entrepreneurs toward using such a risky strategy.

Larson (1992) examined the governance of exchange relations of seven high-growth entrepreneurial firms. She concluded that high reliance on exchange partners was risky

because changes in competitive conditions and strategic direction caused changes in the terms of relationships and in some cases abruptly terminated the relationships. Threats to the alliances and their dissolution or decline should be expected. Too heavy reliance on partners made entrepreneurial firms vulnerable when in-house capacities were not cultivated. She noted that the exchange of proprietary information also represented a risk but participants' concern for preserving the ongoing exchange and protecting reputations appeared to offer strong protection against this risk.

Parhankangas (1999) applied the resource dependence perspective in her analysis of the dependence of 54 Finnish spin-off firms on their parent firms. She found that the more closely related the resource base of the spin-off firm was to the parent corporation, the more closely integrated the spin-off firm was with the parent corporation. Close relationships between spin-off firms and parent corporations made the spin-off firms dependent on the parent corporation. She found support for the hypothesis derived from the resource dependence perspective that vertical complementarities (argued to cause resource dependence) between the spin-off firm and the parent corporation were negatively related to the spin-off firm growth.

Yli-Renko *et al.* (2001b) examined dependence in key-customer relationships of technology-based new firms in United Kingdom. They examined whether the manner in which a contractual agreements were implemented affected the outcomes of customer relationships of technology-based new firms at high levels of exchange dependence on the key customer. They found that in relationships with a high level of exchange dependence, greater contractual governance flexibility was associated with greater new product development and sales cost advantages. No such benefits were realized for relationships in which exchange partners relied heavily on the contract. They concluded that technology-based new firms could derive benefits from their key customer relationships by applying more flexible contractual governance. However, in their data, many companies appeared to be relying on strict contractual governance and thus failing to realize the potential benefits of the relationships, such as gaining access to complementary resources and reducing costs.

Bygrave (1987, 1988) applied resource dependence perspective in his analysis of syndication by venture capitalists. In his resource exchange model, he explained the interconnectedness of venture capitalist networks by concentration of venture capitalists in the area, munificence of the environment, and uncertainty of the target ventures, and found support for the model from the data on co-investments of 61 leading U.S. venture capital firms.

Applying resource dependence and resource-based perspectives, Park *et al.* (2001) analyzed alliances of 171 U.S. semiconductor start-up firms between 1979-1989. They did not find support for the resource dependence perspective based hypothesis that resource scarcity would drive alliance formation. Instead, they found support for the their hypothesis that alliance formation is driven by an attempt to exploit market opportunities.

Critique of the Resource Dependence Perspective

One of the criticisms of resource dependence perspective is that, although it highlights the importance of resource acquisition, it does not really explain how performance results from resources (Lumme 1998, Yli-Renko 1999).

Resource dependence perspective has been criticized for being essentially reactive (Keil 2000). Resource-based theories of strategic management have added a proactive dimension to firm behavior by proposing that firms establish alliances and other interorganizational resources in order to create value through combining complementary resources rather than by being forced to rely on others to survive (Keil 2000, Madhok & Tallman 1998, Park *et al.* 2001). It has also been argued that resource dependence is not always harmful for organizations when considering value creation in interorganizational relationships (Yli-Renko *et al.* 2001b).

Resource dependence perspective has also been criticized for focusing on resource needs as a motivation for establishing interorganizational relationships with little attention on the opportunities and factors enabling the creation of successful, value-creating interorganizational relationships (Gulati 1998).

2.2.5 Asymmetric Information and Signaling Theory

Summary of the Asymmetric Information and Signaling Theory

In the theory of asymmetric information, the seminal paper of Akerlof (1970) is often referred as the first investigation of the economics of unevenly distributed information. In his paper, Akerlof demonstrated, using an example from the market for used cars, how markets can break down when potential buyers cannot verify the quality of the product they are offered. Faced with the risk of buying a "lemon" (bad quality product), the buyer will demand a discount, which in turn discourages the potential sellers who do not have "lemons". Akerlof gave examples of the possible application areas of the theory in many areas including insurances. In the context of insurances, the theory of asymmetric information helps to understand the problem of *adverse selection,* which means that as the price level of insurance increases, the people who insure themselves will be those who are increasingly certain that they will need the insurance (Akerlof 1970).

In the context of corporate finance, Leland and Pyle (1977) applied the theory of asymmetric information in their seminal work on the signaling role of management ownership. In their paper, Leland and Pyle built a signaling model, which assumed that the entrepreneur knows the expected future cash flows of the firm and potential investors do not. It is costly for the entrepreneur to retain a significant ownership interest in the firm since by doing so he forgoes diversification of his personal portfolio. Therefore, the entrepreneur will retain a significant ownership interest only if he expects the future cash flows to be high relative to the current firm value. Rational investors will see the fraction of equity retained by the entrepreneur as a signal of firm

value. Later, the *signaling hypothesis* of Leland and Pyle (1977) was tested and developed further in several papers focusing on initial public offerings (e.g. Courteau 1995, Downes & Heinkel 1982, Eyssel & Kummer 1993, Gale & Stiglitz 1989, Keloharju & Kulp 1996, Krinsky & Rotenberg 1989). In these studies, the evidence on the existence of signaling effect has been mixed, partly due to the different designs of the empirical studies.

Of special importance for the present study is the stream of research examining the role of involved third parties in "certifying" the value of new ventures (Booth & Smith 1986). Much of this research is focused on initial public offerings because of the ideal and constrained context for examining the role of asymmetric information and the role of prominent partners in reducing that asymmetric information between insiders and outside investors. Booth and Smith (1986) formalized a certification hypothesis predicting the certification role of prestigious underwriters in reducing the asymmetric information in initial public offerings. Other studies in this stream include Beatty and Ritter (1986), Carter and Manaster (1990), and Carter *et al.* (1998) who, among others, have examined how investment bankers and auditors can help to resolve the information asymmetry inherent in the initial public offering process.

In venture capital, investments are made in young and highly uncertain ventures. Chan (1983) developed a model on how venture capitalists, as better-informed intermediaries, may relieve the problems caused by asymmetric information. Other studies examining the role of asymmetric information in venture capital contracting include Amit *et al.* (1990), Admati and Pfleideler (1994), Bergemann and Hege (1998), and Trester (1998). In venture capital contracting, various methods are used to deal with asymmetric information including monitoring and staged investments (Gompers 1995, Sahlman 1990). Focusing on the initial public offerings of firms backed by venture capital investors, Barry *et al.* (1990), Megginson & Weiss (1991), Francis *et al.* (1999), Hamao *et al.* (2000) among others have examined the role of venture capitalist in reducing the problems from asymmetric information in initial public offerings.

Critique of the Asymmetric Information and Signaling Theory

There is relatively little critique of the asymmetric theory as such. Asymmetric information theory plays an important role in agency theory, transaction cost economics, game theory, and organizational economics and corporate finance in general. It is harder to criticize a theory, which is one of the foundations of many other theories.

The weaknesses of asymmetric information are perhaps the very strong assumption that insiders are always better informed than outsiders. This may not be true in some cases. For instance, it may very difficult for entrepreneurs to know whether their ventures have potential whereas outsider professionals such as venture capitalist and investment bankers might have better view of the markets and could have better understanding of the value of the venture.

Further, empirical research building on the signaling theory has yielded mixed results. The results testing the signaling by management (Leland & Pyle 1977) or certification by investment banks (Booth & Smith 1986) have not been consistent. Signaling is obviously only one factor among others that influence the behavior of managers in uncertain new ventures.

2.2.6 Agency Theory

Summary of the Agency Theory

The origins of the agency theory date back to Adam Smith, who already in 1776 described how managers of companies owned by others cannot be expected to manage the business as well as if it was owned by themselves (Smith 1776). In the modern literature, Berle and Means (1932) were apparently the first to discuss the incentive problems between the management not having ownership in their companies. However, in this stream of literature, the work of Jensen and Meckling (1976) is the one most often cited. They introduced the agency theory viewing external financing of a company as a principal-agent problem. In their paper, Jensen and Meckling defined the agency relationship as "a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent". Jensen and Meckling continue, "if both parties to the relationship are utility maximizers, there is good reason to believe that the agent will not always act in the best interests of the principal". In the agency theory, both principals and agents are assumed to be self-interested, rational, and risk-averse (Eisenhardt 1989).

Based on the assumptions of agency theory, the objectives of the agent may not align perfectly with those of the principal. Furthermore, asymmetric information makes it hard for the principal to select and monitor the agent. Goal incongruence and asymmetric information may give rise for agency problems including adverse selection and moral hazard problems (Barney & Ouchi 439-440, Eisenhardt 1989).

Adverse selection refers to a problem where it is difficult for the principal to ensure that the agent is of required quality and possesses the capabilities of performing according to the agreement (Akerlof 1970, Barney & Ouchi 1986: 439, Eisenhardt 1989)

Moral hazard is one of the potential agency problems. Pauly (1974) developed the concept of moral hazard in the context of insurances where the insurance taker has control over actions in the present that affect the future state of nature (preventive activity), but in which the insurer cannot directly observe the insured's actions (Pauly 1974). In general, moral hazard refers to the problem that an agent might purposefully not perform as agreed (Eisenhardt 1989, Jensen & Meckling 1976). The agent might have an own hidden agenda that it would pursue after the principal has delegated the decision-making authority.

Agency problems create agency costs, which are defined by Jensen and Meckling (1976) as (1) the monitoring expenses by the principal, (2) the bonding expenditures by the agent, and (3) the residual loss. The monitoring cost mean the costs paid by the principals in building sufficient incentives and monitoring the performance of the agent. The bonding costs mean the costs for the agent in certain situations where the agent has to guarantee the principal that he will not take certain actions which would harm the principal or to ensure that the principal will be compensated if he does take such actions. The residual loss refers to the reduction in welfare of the principal caused by the divergence in the agent's decisions and the decisions that would have maximized the welfare of the principal (Jensen & Meckling 1976).

Related Empirical Applications of the Agency Theory

In the research on strategic alliances, Alvarez and Barney (2001) analyzed 128 alliances between small and large firms. They found that in about 80% of the alliances, managers from entrepreneurial firms felt unfairly exploited by the large firm partners. They argued that in alliances between small and large firms, typically, once a large firm has learned about the new technologies provided by its entrepreneurial partner, it can begin to *under-invest* in its relationship with the entrepreneurial firm. This can happen in at least two ways. First, a large firm can shift organizational resources away from supporting the alliance to other activities in the large firm. Second, it can place unreasonable demands on the entrepreneurial firm, which can hurt its ability to create economic value. In the literature on organizational economics, the first problem is known as *moral hazard* while the second problem is an example of *hold-up* (Barney & Ouchi 1986:439-440).

In the context of venture capital, agency theory has typically been used in the analysis of principal-agent problems considering the entrepreneur as an agent working for the principal venture capitalist. For instance, Sapienza and Gupta (1994) analyzed 51 venture capitalist-CEO dyads and found support for agency theory predictions in that frequency of interaction depended on the extent of venture capitalist-CEO goal congruence, the degree of CEO's new venture experience, the venture's stage of development, and the degree of technical innovation the venture was pursuing. However, the degree of management ownership had no impact on the frequency of interaction. Also applying agency theory in his analysis, Gompers (1995) analyzed 794 venture capital backed firms and found support for the agency theory predictions in that asymmetric information (decreases in the industry ratios of tangible assets to total assets, higher market-to-book ratios, and greater R&D intensities) lead to more frequent monitoring. Along the same lines, Lerner (1995) analyzed 271 venture capital backed biotechnology firms and found support for agency theory predictions. He found that venture capitalists' representation in the board of directors increased around the time of turnover of chief executive officers, while the number of other outsiders remained

constant. He also found that the distance from the firm is an important determinant of the board membership of the venture capitalists.

However, there is another way to look at the relationship between venture capitalists and portfolio companies. One can also consider the venture capitalist as an agent providing value-added benefits for entrepreneurs, principals (Cable & Shane 1997, Fiet 1991, Gifford 1997, Kann 2000, Smith 1998, 2001). The present study follows this approach and considers potential agency problems in the relationship of corporate venture capitalists as agents and original owners of the ventures as principals. In the relationship between entrepreneurs and investors, entrepreneurs may face agency problems related to the asymmetric information in forms of moral hazard and adverse selection risks when "hiring" venture capitalists to invest money and to perform value-added services (Smith 1998). There is great potential for conflicts of interests between start-up companies and their corporate investors operating in related fields (Hellmann 2001, Kann 2000, Maula & Murray 2000a, 2000b).

Critique of the Agency Theory

The agency theory has also received criticism. One of the main criticisms concerns the strict assumptions of self-interest, risk-aversion, and rationality (Yli-Renko 1999). The theory has also been criticized for being static (Yli-Renko 1999). Furthermore, the hierarchical setting consisting of principal and agent has been found to be hardly applicable to real life (Cable & Shane 1997, Larson 1992, Uzzi 1997).

2.2.7 Transaction Cost Economics

Summary of the Transaction Cost Economics

The central question addressed by transaction cost economics is why firms internalize transactions that might otherwise be conducted in markets (Coase 1937). According to Williamson (1981:552), "a transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates, and another begins." Transaction cost economics is concerned with the governance structures of economic transactions and the factors influencing the choice of governance structure. The theory proposes that firms organize transactions in a manner, which minimizes the sum of transaction costs (Williamson 1975, 1979, 1981, 1983, 1985).

Williamson identified bounded rationality coupled with uncertainty and complexity, asymmetric information, and opportunism in small-numbers as situations under which transactional inefficiencies may arise. These transaction costs vary with the adopted governance mechanism. Transaction costs consist of search costs, contracting costs, monitoring costs, and enforcement costs (Williamson 1985, Dyer 1997). Transaction cost theory is concerned with explaining the choice of the most

efficient governance form, given a transaction that is embedded in a specific economic context. The critical dimensions of transactions influencing the choice of governance mode are uncertainty, exchange frequency, and the specificity of assets enabling the exchange (Klein *et al.* 1978, Williamson 1979, 1981).

According to Williamson (1981:555), asset specificity is the most important dimension for describing transactions. Transaction-specific, or 'idiosyncratic' assets refer to assets that are specialized to a particular transaction. Asset specificity can be site specificity (close location required between the buyer and the seller), physical asset specificity (systems have to be adapted to facilitate exchange), or human asset specificity (transactions require special skills and capabilities). Transaction-specific assets are such assets that are valuable for a particular transaction but not equally valuable elsewhere.

Transaction-specific investments give rise to switching costs. Asset specificity makes it expensive to switch the partner thereby causing dependence between the exchange partners. Because of the risks involved in becoming dependent, transactions requiring investments in transaction specific assets have to be 'safeguarded'. According to transaction cost economics, choosing a hierarchical governance mode is the primary way for firms to safeguard transactions requiring idiosyncratic assets.

Transaction cost economics identifies transaction efficiency as a major source of value, because enhanced efficiency reduces costs (Amit & Zott 2001). According to transaction cost economics, value creation can derive from the attenuation of uncertainty, complexity, information asymmetry, and small-numbers bargaining conditions (Amit & Zott 2001, Williamson 1975). In addition, reputation, trust, and transactional experience can lower the cost of idiosyncratic exchanges between firms (Williamson 1979). In general, organizations that economize on transaction costs can be expected to extract more value from transactions.

Related Applications of Transaction Cost Economics

There is a wide body of literature testing transaction cost economics. One important stream of research has used transaction cost economics in explaining the governance mode in alliances (Gulati 1995a, Gulati & Singh 1998). In the context of this study, the focus is in relationships between corporate venture capital investors and their portfolio companies. Given the focus on single governance mode of relationships, transaction cost economics is not directly applicable to analysis of this relationship.

However, when considering the value-added from the start-up perspective, transaction cost economics can play some role in the present study. Transaction costs between the start-up company and it's potential customers and partners may be reduced by effective endorsements by corporate venture capital investors. Among the few studies considering this perspective, Swaminathan *et al.* (2001) examined the U.S. automotive industry between 1918-1942 and found that suppliers of architectural goods

(lower switching costs) benefited more from high-status customers than suppliers of modular goods (lower switching costs).

Critique of Transaction Cost Economics

Transaction cost economics has received some criticism. One of the criticisms is that transaction cost economics has an excessive focus on efficiency. The emphasis of transaction cost economics on efficiency may divert attention from other fundamental sources of value such as innovation and the reconfiguration of resources (Ghoshal & Moran 1996). The theory also focuses on cost minimization by single parties and neglects the interdependence between exchange parties and the opportunities for joint value maximization that interdependence may enable (Dyer 1997, Ghoshal & Moran 1996, Hagedoorn 1990, Khanna 1998, Madhok & Tallman 1998, Zajac & Olsen 1993)

Transaction cost economics has also been criticized for its static nature (Hennart 1988, Lorenzoni & Lipparini 1999, Zajac & Olsen 1993). Furthermore, the focus on single transaction has been seen as a severe limitation (Zajac & Olsen 1993, Powell *et al.* 1996, Lorenzoni & Lipparini 1999). Further criticism concerns the strict assumption of opportunism. Because of this assumption, transaction cost economics has been criticized for being an asocial theory (Granovetter 1985). Gulati (1995a) suggested an accommodation of trust as an important extension to the research employing transaction cost economics

2.2.8 Summary of the Related Theoretical Approaches

The previous sections briefly introduced seven theoretical frameworks: (1) resource-based view of the firm, (2) knowledge-based view, (3) social capital theory, (4) resource dependence perspective (5) asymmetric information and signaling theory, (6) agency theory, and (7) transaction cost economics. Table 2-7 compares the theoretical approaches in research in interorganizational relationships with the specific attention on their conceptualization of the firm and behavioral assumptions.

Table 2-7   Summary of the related theoretical approaches

Theory	Conceptualization of the firm	Behavioral assumptions
Resource-based view	Bundle of resources	Creativity, search, learning
Knowledge-based view	Concentration of firm-specific knowledge	Capability to acquire, assimilate, ands diffuse knowledge
Social Capital	Social actor embedded in a network of social relationships	Deliberate construction of social relationships to achieve benefits
Resource dependence perspective	Dependent on resource exchange with other actors in environment	Quest for autonomy
Asymmetric information and signaling theory	Insiders well informed of the value of the firm	Opportunism, management signaling the true value of the firm through their behavior
Agency theory	Nexus of contracts	Opportunism, bounded rationality, risk-avoidance
Transaction cost economics	Nexus of contracts	Opportunism, bounded rationality, cost minimization

Table 2-8 compares the theoretical approaches in research in interorganizational relationships with the specific attention on their notion of interorganizational relationships and the main motives for firms in managing interorganizational relationships.

Table 2-8   Comparison of the theoretical approaches in research in interorganizational relationships: notion of interorganizational relationships and main motives

Theory	Notion of interorganizational relationships	Main motives for firms in managing relationship
Resource-based view	A means to acquire or gain access to external resources	Building sustainable competitive advantage through new resource combinations
Knowledge-based view	A means to acquire information and generate knowledge	Building the organization's knowledge base, which is the basis for competitive advantage
Social Capital	Consists of structural, behavioral, and cognitive elements	Gaining benefits from relationships
Resource dependence perspective	Structures of dependence and power	Minimizing dependence on others; controlling critical resources
Asymmetric information and signaling theory	Means of signaling the value of the firm	Investing in certifying relationships and thus signaling the value of the firm
Agency theory	Principal-agent ties	Minimizing agency risks and costs
Transaction cost economics	Governance for between markets and hierarchies	Minimizing transaction costs Protection from opportunism

Table 2-9 compares the theoretical approaches in research in interorganizational relationships with specific attention to the critique these theories have received.

Table 2-9   *Comparison of the theoretical approaches in research on*
                interorganizational relationships: critique

Theory	Major criticisms
Resource-based view	• All-inclusive definitions of resources • Little attention on contingencies influencing resource value • Excessive focus on internal resources • Static theory • No attention on product market • Lack of normative guidance for creating competitive advantage
Knowledge-based view	• Abstract notions • Learning often treated as a 'black box' • Difficult to measure • Research fragmented • Not necessarily a new theory of strategy but rather an extension from the resource-based view • No clear evidence of knowledge as the most important resource
Social Capital	• Costs and negative consequences of social capital often ignored • New label for previously studies processes • Distinction between relationships and resources acquired through them often unclear
Resource dependence perspective	• Sole focus on resource acquisition, not on their use • Reactive approach • Assumes dependence is always non-beneficial • No attention of the opportunities and factors enabling resource sharing interorganizational relationships
Asymmetric information and signaling theory	• The assumption of insiders always being better informed than outsiders does not always hold • Myopic view of management actions only as signaling
Agency theory	• Real relationships often cannot be explained in simple principal-agent relationships • Strict assumptions of self-interest, risk-aversion, and rationality
Transaction cost economics	• Excessive focus on costs, little attention on value creation • Strict assumption of opportunism • Static focus on choice of governance mode • Ignores dynamic evolution and management of relationships

2.2.9 Applicability of the Theoretical Approaches to the Present Study

The present study develops a multi-theoretic framework of the mechanisms of value creation in interorganizational relationships and of the key factors influencing those mechanisms. The integrative use of several theories in building the models is justified by numerous studies suggesting that a multi-theoretic approach is required to understand the complexity of interorganizational relationships (Gulati 1998, Osborn & Hagedoorn 1997, Park *et al.* 2001, Smith *et al.* 1995:19). I believe that the relationships between start-up companies and their corporate investors with a mix of strategic and financial objectives are by no means less complex than other potential interorganizational relationships and thus require ideas from several theories to be

properly understood. In this study, I build the models applying primarily the resource-based and the knowledge-based views, and the social capital theory. Ideas from other theoretical approaches are used to complement these theories. Table 2-10 summarizes the primary applications of the reviewed theoretical approaches in the present study. The use of these theoretical approaches is explained below in more detail.

Table 2-10   Application of the selected theoretical approaches in the present dissertation

Theoretical approach	Application in the present study
Resource-based view	Predictions as to the role of interorganizational resource combinations for value creation; the role of complementarities in value creating resource combinations
Knowledge-based view	Predictions as to the importance of knowledge acquisition for value creation; factors affecting knowledge acquisition
Social Capital	Predictions as to the role of social capital facilitating resource and knowledge acquisition and endorsement
Resource dependence perspective	Supportive role: Predictions as to the reliance of technology-based new firms on external resources
Asymmetric information and signaling theory	Supportive role: Predictions as to the conditions influencing the strength and value of endorsements
Agency theory	Supportive role: Predictions as to the incentives of corporate investors to add value
Transaction cost economics	Supportive role: Predictions as to the role of transaction costs between the focal venture and it's potential customers and partners influencing the value of endorsements by prominent corporate investors

In the present study, the resource-based view (Barney 1991, Penrose 1959, Peteraf 1993) is used to derive predictions on the influence of complementarities in resources influencing the motivations of large corporations to deepen the relationship beyond pure financial relationship. Although some of the first papers on resource-based view focused on the internal resources possessed or directly controlled by the firm, later research has increasingly recognized the role of interorganizational relationships in building bundles of resources that are valuable, rare, non-imitable, and hard to substitute (Chung *et al.* 2000, Das & Teng 2000, Deeds & Hill 1996, Eisenhardt & Schoonhoven 1996, Lado *et al.* 1997, Rothaermel & Deeds 2001). The resource-based view has been used to explain the potential value of external resources and also the factors influencing creation of interorganizational relationships. Complementarities between two firms have been identified as a key factor in creating value through combination of resources and thereby making one firm an attractive partner for another (Eisenhardt & Schoonhoven 1996, Park *et al.* 2001). To quote Eisenhardt and Schoonhoven (1996:147): "cooperation requires resources to get resources." In this sense, resource-based view takes a more proactive approach to resource acquisition than resource dependence perspective (Pfeffer & Salancik 1978), which well acceptably suggests that firms, especially small firms, are dependent on their environment for acquiring critical resources. However, the resource dependence perspective provides less understanding on how resources are used to create value and what enables resource combining interorganizational relationships (Park *et al.* 2001).

Organizational economics, especially agency theory and game theory, provide further understanding of the motivation of partners to collaborate and not to under-invest in the relationships (Alvarez & Barney 2001).

The line between the resource-based view and the knowledge-based view as a newer outgrowth of the resource-based view is not very clear because of the broad definitions of key concepts in these literatures (Eisenhardt & Santos 2000). I make a distinction between the two by considering separately on one hand concrete resources like distribution channels and production facilities and on the other hand knowledge of markets, competition, and technologies that help ventures make better use of their scarce resources (Penrose 1959). Knowledge-based view has been applied extensively in research examining knowledge transfer over organizational boundaries (Kogut & Zander 1992, Lane & Lubatkin 1998). I apply knowledge-based view to develop hypotheses on the importance of knowledge acquisition for value creation and to determinate the factors affecting the knowledge acquisition.

While knowledge-based view recognizes the problems in transferring knowledge (especially tacit knowledge) over organizational boundaries (Kogut & Zander 1992, Lane & Lubatkin 1998), social capital theory helps to understand factors facilitating the transfer of knowledge and opportunities for collaboration over organizational boundaries (Nahapiet & Ghoshal 1998, Yli-Renko *et al.* 2001a). Extant research has found social capital (particularly social interaction) to be an important facilitator of resource and knowledge exchange (Nahapiet & Ghoshal 1998, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a).

Besides facilitating resource and knowledge acquisition, interorganizational relationships have also been found to create endorsement benefits (Podolny 1993, 1994, Stuart *et al.* 1999, Stuart 2000) and to reduce the problems from asymmetric information (Booth & Smith 1986, Megginson & Weiss 1991). These endorsement benefits have been shown to be particularly valuable when the quality of the focal company is uncertain (Stuart *et al.* 1999, Stuart 2000). In the present study, sociological theories on interorganizational endorsements (Stuart *et al.* 1999, Stuart 2000) are supplemented with ideas from asymmetric information and signaling theory as well as from the transaction cost economics. Asymmetric information theory argues that the more uncertainty there is about the true quality of the venture, the more valuable certification is likely to be. It also argues that the more costly the signaling is for the focal firm, the more credible the signals are. Transaction cost economics argue that when asset specificity and switching costs are high, there will be a high need for safeguards against opportunism and uncertainty in exchange relationships. Considering prominent partners as certifiers against opportunism and other risks, the value of interorganizational endorsements is likely to be higher when there are high transaction costs between the start-up company and its potential customers and partners (Swaminathan *et al.* 2001).

3   MODELS AND HYPOTHESES

In this chapter, models and hypotheses on the influence of corporate venture capital on the performance of technology-based new firms are developed on the basis of key insights gained from the literature review. In the first section, the various potential forms of value-added are synthesized to a simple and testable framework of value-added mechanisms. The first section argues that start-ups receive value-added mainly in three forms: (1) concrete resource acquisition including access to distribution channels, production facilities and research and development; (2) learning benefits on markets, customer needs, competition, and technological issues, and (3) endorsement benefits increasing the external legitimacy of the start-up. The second section develops a model and hypotheses on factors influencing the resource acquisition and knowledge acquisition benefits. The third section develops a model and hypotheses on factors influencing the endorsement benefits.

3.1   Value-adding Mechanisms

In earlier surveys and anecdotal accounts, corporate venture capitalists have been suggested to provide many different forms of value-added services for their portfolio companies. Earlier research on the forms of value-added was reviewed in Chapter 2.1.3. In this section, I develop hypotheses on three specific theoretically and empirically grounded mechanisms of value-added benefits that are hypothesized to account for the majority of the value-added received by portfolio companies from their corporate venture capital investors. The three forms of value-added are (1) resource acquisition, (2) knowledge acquisition, and (3) endorsement. *Resource acquisition* refers to the concrete resources of the parent corporation of the corporate investor the start-up company gets access to through the investor relationship. *Knowledge acquisition* refers to the learning benefits start-up gain in an investment relationship with a corporate investor. Finally, *endorsement* refers to the external legitimization the start-up company receives from the investment by the corporate investor. Resource acquisition, knowledge acquisition, and endorsement are all hypothesized to be positively related to the value-added received from the corporate investor. These forms of value-added are hypothesized to account for most of the value-added received. These forms of value-added and the related hypotheses are discussed more thoroughly in the following section. The model on the value-added mechanisms is illustrated in Figure 3-1.
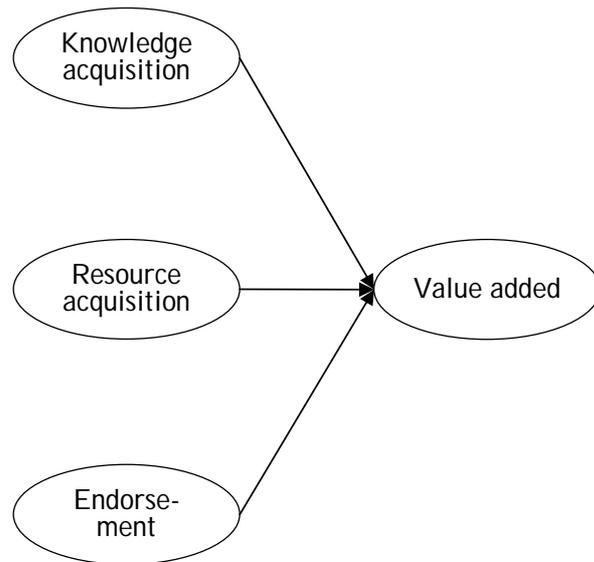
Figure 3-1   Model of the value-added mechanisms

3.1.1 Resource Acquisition and Value-added

Various studies on technology-based new firms have argued that technology-based new firms are highly dependent on their external environment for acquiring the necessary resources (Jarillo 1989, Yli-Renko *et al.* 2001b). While the resource dependence perspective (Pfeffer & Salancik 1978) suggests that small firms are dependent on others but try to reduce their dependence, resource-based view provides more proactive arguments for interorganizational relationships between small and large firms suggesting that interorganizational relationships are established to create added value through combination of complementary resources (Das & Teng 2000, Park *et al.* 2001). This proactive logic has been explicated by Dyer and Singh (1998) who suggested that not only resources inside the company are critical for competitive advantage but that non-imitable resources can also be associated with interorganizational relationships instead of, or in addition to those controlled exclusively and internally by the benefiting firm.

In relationships between technology-based new firms and corporate venture capitalists, the corporate parent often possesses complementary resources that the venture might be able to access through the relationship including distribution channels, production facilities, research and development, technology, and input products and services at lower cost. Globally leading corporations have typically developed sophisticated distribution channels spanning several markets, which is rarely the case for technology-based new firms. Similarly, technology-based new firms are often superior in developing technology and new products but inferior in putting the product in large-scale production (Teece 1986). Access to production facilities of large corporations would be valuable for scaling up the production in many industries. Yet another area of potential sharing of concrete resources is the research and development of the parent corporation. For instance in biotechnology, the equipment needed in the

research and development is often extremely expensive and not necessarily available for start-ups. Further, there are situations where technology-based new firms develop technologies or products that must be complemented with complementary technologies of large corporations in order to be able to be sold. A preferential access to the complementary technologies of a large corporation may be valuable for a technology-based new firm. In some cases, technology-based new firms develop products or services where other products or components or services by large corporation are needed as inputs. A preferential access (lower cost) to such products or services of a large corporation may also be valuable for a technology-based new firm.

These resource-combining relationships can be grouped in two groups: a) access to resources related to production and b) access to resources related to distribution. These categories are well in line with other divisions of resource-combining relationships such as division of strategic alliances into upstream and downstream alliances (Rothaermel & Deeds 2001). These categories are used throughout in hypotheses related to resource acquisition.

To summarize, I first argued that technology-based new firms could build their competitive advantage not only on the basis of the resources they control themselves, but additionally on the basis of resources available through relationships with corporate investors. Thereafter, I explicitly discussed several forms of potentially valuable, complementary resources of large corporations a start-up company may potentially be able to access through corporate investment relationship. Each of these resources is important and hard to acquire by an independent technology-based new firm. Therefore, I hypothesize:

> *Hypothesis 1a: The higher the acquisition of production-related resources from the corporate investor, the higher the value-added benefits perceived by the portfolio company.*

> *Hypothesis 1b: The higher the acquisition of distribution-related resources from the corporate investor, the higher the value-added benefits perceived by the portfolio company.*

3.1.2 Knowledge Acquisition and Value-added

A wide body of literature has examined knowledge acquisition in interorganizational relationships between small and large firms. While many of these studies have examined large corporations learning from small firms, a number of studies have also examined the value of knowledge acquisition by technology-based new firms from larger corporations (Forrest & Martin 1994, Lang 1996, Shan *et al.* 1994, Yli-Renko *et al.* 2001a). For instance, Yli-Renko *et al.* (2001a) demonstrated that knowledge acquisition from key customers influenced the new product development, technological distinctiveness, and sales costs of technology-based new firms. While

there appears to be no empirical research focusing on the value of knowledge acquisition by technology-based new firms from their corporate venture capital investors, the existence of learning benefits in corporate venture capital investments has been suggested in previous research on corporate venture capital (Dube 2000:49, Kelley & Spinelli 2001, Maula & Murray 2000, Maula *et al.* 2001).

Important for the creation of value through knowledge acquisition is the existence of complementary knowledge. There are good reasons to believe that large corporations often possess non-redundant knowledge that might be valuable for technology-based new firms. While technology-based new firms typically focus on some specific technological area and are very knowledgeable about the specific technology, large corporations often have more experience and a broader view. There are various potential areas of knowledge often possessed by large corporations that would be non-redundant and valuable for technology-based new firms should they gain access via relationship with their corporate investors.

For instance, regarding technological knowledge, large corporations commonly conduct research on much broader scale than small start-up firms. Although it is often new entrants to an industry that engender radically novel ideas (Tushman & Anderson 1986), industry leading corporations in systemic business environments have a significant power to influence which new technologies are adopted by the sector. Leading corporations typically create very detailed, strategic 'road maps' as to how they see individual technologies and their market potential developing over time. This intelligence can be of major value to the young firm starting or expanding its sales activities. Thus, access to complementary, technological information from the corporation may generate major savings in cost and, critically, time. It may also represent a material reduction in both market and technology uncertainties given the superior intelligence resources of the corporation.

Technology-based new firms are also often predominantly focused on their technologies and products. However, they can sometimes lack a broader perspective on the market and customer needs. On the other hand, corporations spend large amounts of money on their market research and operate globally. From their existing customer relationships, they have a different and deeper understanding of the market needs than a start-up developing a product for future markets. Access to the market understanding of the large corporation may be invaluable for a technology-based new firm.

Corporate investors can also provide their portfolio companies with relevant information on competition. Whereas technology-based new firms are focused on their product development, they often have fewer resources for competitor intelligence. Many start-ups also try to avoid publicity until they are ready to launch their products. Large corporations often put large resources into competitive intelligence. They understand where other large corporations are trying to position themselves in their markets. Access to this kind of information on the competitive situation may be valuable for technology-based new firms.

To summarize the above discussion, I first argued the importance of knowledge for the sustainable competitive advantage of the technology-based new firm. Thereafter, I explicitly described several areas of knowledge, which large corporations typically possess, and which can be valuable for technology-based new firms. Therefore, I hypothesize:

> *Hypothesis 2: The higher the knowledge acquisition from the corporate investor, the higher the value-added benefits perceived by the portfolio company.*

3.1.3 Endorsement and Value-added

"The endorsements from Dell, Compaq, and IBM cemented the perception that Red Hat Linux was a technology on which reliable, multibillion-dollar companies were going to build products." Robert Young (Founder, President & CEO of Red Hat, Inc. 1999)

Technology-based new firms are typically highly risky (Ruhnka & Young 1991). They operate in fields requiring substantial resources but typically have very little resources themselves. Being new by definition, they have short track records that could be used in direct evaluation of the quality of the companies (Stuart *et al.* 1999). Due to the lack of experience and routines, the risk for operational failures is high and the relationships with customers and other constituencies are often new and unstable (Stinchcombe 1965). As the objective is often rapid growth, technology-based new firms are forced to use external resources and form rapidly new business relationships and customer relations (Jarillo 1989, Pfeffer & Salancik 1978). However, because of the high risk of technological and operational failures, technology-based new firms face a high risk of early dissolution (Hannan & Freeman 1984). Because technology-based firms are usually small, they often have very limited financial and other resources to survive over a sustained period of poor performance leading to high probability of failures (Aldrich & Auster 1986, Levinthal 1991). These problems of young and small firms have led organizational sociologists to argue that young (or small) organizations are highly vulnerable to environmental selection (Carroll 1983, Freeman *et al.* 1983). These problems of new and small firms are known as *liability of newness* and *liability of smallness* (Aldrich & Auster 1986, Freeman *et al.* 1983, Stinchcombe 1965)

The high risk of early dissolution and often directly unobservable quality of technology-based new firms make it difficult for outsiders to evaluate the potential, sustainability and value of technology-based new firms (Stuart *et al.* 1999). The problem is especially difficult for new firms established to pursue commercial applications of novel technologies (Aldrich & Fiol 1994). In addition to typical problems stemming from the inexperience, technology-based new firms often require substantial up-front investments and resources to carry out long product development projects, while revenue cannot be expected until well into the future. Commercialization of new technologies is highly risky because of simultaneous technology and market risks (Ruhnka & Young 1991). The first question is whether the

start-up will ever manage to create the project it is developing. However, even if the product development was successful, it is hard to predict the demand for new products. Also, there are often competitors developing similar products, and it is hard to predict the competition. The problem is made worse by the fact that customers do not always prefer the technologically most advanced product (Arthur 1988, Farrel & Saloner 1985, Katz & Shapiro 1985, 1986, Podolny & Stuart 1995, Wade 1995). Instead, especially if the product in question is important for the customer and creates high switching costs, customers may wish to choose a less advanced product version from a more reliable supplier (Swaminathan *et al.* 2001).

Several streams of research have argued and demonstrated the influence of prominent exchange partners providing endorsement benefits for new ventures. For instance, a stream of research building on the asymmetric information theory has demonstrated the role of prestigious venture capitalists (Barry *et al.* 1990, Brav & Gompers 1997, Megginson & Weiss 1991), underwriters (Beatty & Ritter 1986, Booth & Smith 1986, Carter & Manaster 1990, Carter *et al.* 1998), and auditors (Beatty 1989, Beatty & Welch 1996, Titman & Trueman 1986) reducing the problems stemming from asymmetric information between insiders and outside investors. Similarly, from another perspective, organizational sociologists have demonstrated prominent partners improving the legitimacy of new ventures through implicit status transfer in interorganizational relationships (Stuart *et al.* 1999, Stuart 2000).

Although previous research has not focused on the endorsement provided by corporate venture capitalists, the descriptive results of McNally (1997) suggest that endorsement might be an important contribution of corporate venture capital investors. In his study, McNally found that increased credibility was high on the list of the value-added forms provided by corporate venture capital investors for their portfolio companies with 70% of the 23 interviewed portfolio companies of direct corporate venture capital investors mentioning it as a contribution. Similarly, Maula and Murray (2000a) and Kelley and Spinelli (2001) argued that endorsement benefits would be an important form of value-added by corporate investors.

Therefore, I hypothesize that prominent corporate venture capital investors can provide their portfolio companies with endorsement benefits. These benefits to the smaller companies are directly related to their public association with corporate investors enjoying international reputations. Whereas most new enterprises and traditional venture capital firms are familiar to only a very limited number of people, the majority of the portfolio companies' prospective partners, customers, and suppliers are likely to recognize and accept the high credibility and status of large corporations. The founder management of a new enterprise can leverage to their direct advantage the fact that an industry-leading corporation has chosen specifically to invest in their enterprise. That such a relationship has been offered by a corporation, through the agency of its corporate venture capital organization, is seen as being indicative of the investee firm's potential. This potential is a consequence of the young firm's

technology/intellectual property rights rather than its production, sales, or marketing capabilities - each of which the corporate is likely to already command internally. The commercial advantages of this exploitation of the more powerful partner's status and social capital have been shown in several studies (Stuart *et al.* 1999, Stuart 2000). Therefore, I hypothesize:

> *Hypothesis 3: The endorsement effect associated with the corporate investor is*
> *positively related to the value-added benefits perceived by the portfolio company*

3.2   Resource and Knowledge Acquisition Model

In this chapter, a model is developed to describe the factors influencing the resource and knowledge acquisition by start-up companies from their corporate investors. The resource and knowledge acquisition model focuses on the factors influencing the incentives of the corporate investor to cooperate with the start-up, as well as the actual mechanisms leading to resource and knowledge acquisition. The resource and knowledge acquisition model is illustrated in Figure 3-2 and described in the following sections.
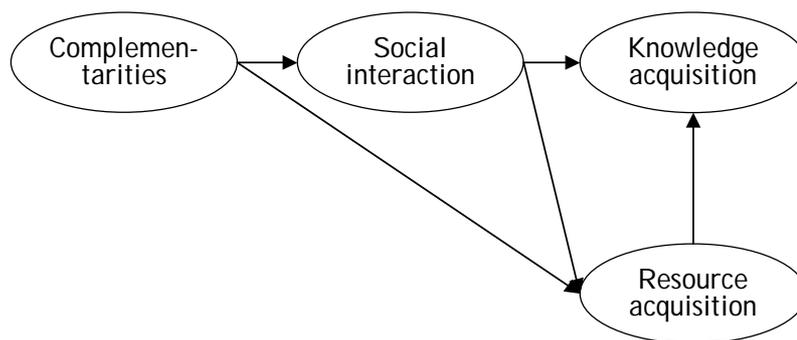
Figure 3-2   Resource and knowledge acquisition model

3.2.1   The Role of Complementarities as a Precondition for Value Creation

Ghoshal and Moran (1996) argued that three conditions must be in place for value creation through exchange and combination of resources to be possible: (1) opportunity must exist, (2) opportunity must be recognized, (3) there must be motivation for realizing the opportunity. I argue that complementarities between the corporate investor and the portfolio company are likely to be highly related to these conditions. Existence of complementary resources between small and large firms often creates the opportunity for value creation through combining complementary resources collaboratively (Rothwell & Zegweld 1982, Rothwell 1989). Existence of suitable reciprocal benefits from collaboration should also create incentives for collaboration. The predictions regarding the roles of complementarities enabling and motivating collaboration are formalized in the following chapters.

Complementarities and Social Interaction

While it has been recognized in earlier research that social capital is beneficial and can provide access to resources and knowledge, it is not fully understood what creates social capital. Social interaction has been found to facilitate knowledge transfer (Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a) but more understanding is needed to explain what causes social interaction.

In this study, I argue that expected economic benefits from collaboration are an important factor determining the willingness of corporate investors to devote time for start-up management and to engage in social interaction. Because strategic benefits are typically the main objective for corporations in making corporate venture capital investments (Kann 2000, Keil 2000, Siegel *et al.* 1988, Sykes 1990, Winters & Murfin 1988), the potential for strategic benefits should be the prime determinant of economic decisions. Complementarities both in resources and product markets are key determinants of potential strategic benefits. Therefore, complementarities should be positively related to strategic benefits creating economic incentives to engage in social interaction.

The resource-based and the knowledge-based views regard complementarities in resources and capabilities as the primary reason for firms entering into interorganizational relationships (Chung *et al.* 2000, Das & Teng 2000, Hitt *et al.* 2000). Closely related to the context of the present study, Teece (1986) argued that firms in high-growth industries have to form alliances with partners with complementary capabilities to ensure timely product introduction and to marshal a full array of the required capabilities. The role of complementarities has been found to influence both the formation of interorganizational relationships (Chung *et al.* 2000, Doz 1988, 1996, Gulati 1995b, Hitt *et al.* 2000, Niederkofler 1991, Nohria & Garcia-Pont 1991, Shan & Hamilton 1991) and their performance (Harrigan 1985, Johnson *et al.* 1996, Sarkar *et al.* 2001).

Contributing to the literature on the influence of resource complementarities on partner selection, Doz (1988) observed that the complementarities between partnering firms were typically clear prior to the negotiations on the terms of alliances. It was the existence of complementarities that brought the potential alliance partners together in the first place. Similarly, Shan and Hamilton (1991) found support for the important role of complementarities in forming strategic alliances in the biotechnology industry. Nohria and Garcia-Pont (1991) reported that in the global automobile industry, firms in certain strategic groups formed alliances in a complementary manner with firms in other strategic groups in order to increase the benefits of cooperation. Supporting the importance of complementarities in partner selection, Gulati (1995b) found that firms occupying complementary niches had higher likelihood of forming alliances. When complementary assets are idiosyncratic and indivisible, and thus not readily available in factor markets, alliance formation can be the primary vehicle for accessing them. Similarly, Chung *et al.* (2000) examined new common stock issues by 308 investment

banks and found that the likelihood of investment banks' alliance formation was positively related to the complementarity of their capabilities. Doz (1996) analyzed six cases on alliance evolution and concluded that that initial conditions such as resource complementarities may lead to a stable 'imprinting' of fixed processes that influence how alliances will perform. Similarly, based on six case studies on alliances, Niederkofler (1991) concluded that one of the important areas of managerial influence on partnership success is the negotiation process where managers should ensure that there are complementary resources and compatible interests and clear understanding of the implementation. Hitt *et al.* (2000) examined 202 companies in developed and emerging market countries and compared the factors affecting their alliance partner selection. They concluded that firms both in emerging and developed markets consider complementary resources as a valuable determinant in their partner selection.

While the resource-and knowledge-based views focus on the complementarities in resources and knowledge bases as the sources of potential value creation in interorganizational relationships, organizational economics, particularly agency theory and game theory, have not limited their perspective to complementarities in resources and capabilities, but have also considered other types of complementarities such as complementarities in the product market (Brandenburger & Nalebuff 1996). These theories have been used to explain the partners' incentives and willingness to invest in the relationship. For instance, Alvarez & Barney (2001) argued that in alliances between small and large firms, it is typical that once a large firm has learned about the new technologies provided by its entrepreneurial partner, it can begin to *under-invest* in its relationship with the entrepreneurial firm. To prevent this from happening, Alvarez and Barney suggested that entrepreneurial firms should slow the large firm's rate of learning and bring other resources to the alliance besides a single technology. They argued that as long as there are complementary resources and incentives for the large firm to invest in the relationship, alliances could potentially be valuable for entrepreneurial firms. Also supporting the role of economic motivation for successful collaboration, Park and Ungson (1997) found in their event history analysis of 186 joint ventures that opportunistic threat and rivalry were positively related to the dissolution of joint ventures. Similarly, Larson (1992) conducted case analyses of seven alliances of entrepreneurial firms and found that economic incentives and mutually beneficial strategic rewards were a necessary condition for the effective development of an exchange relationship.

Summarizing the arguments derived from the above-described literatures, it can be concluded that they all lead to similar conclusions regarding the relationship between complementarities between the portfolio companies and their corporate investors and the incentives to collaborate and to invest in the creation of social capital. While resource-based and knowledge-based views emphasize the attention corporations pay to the potential resource combination and learning benefits in corporate venture capital activities, agency theory and game theory highlight the risk of potential under-

investment in the relationship in cases where there are no economic incentives for the corporation to invest in the relationship. Synthesizing these arguments leads to the hypothesis that complementarities create incentives for collaboration and social interaction. Therefore, I hypothesize:

> *Hypothesis 4: The greater the complementarities between the corporate investor and the portfolio company, the more intense will be the social interaction between the two firms.*

Complementarities and Resource Acquisition

The combination of complementary resources is a significant potential source of interorganizational competitive advantage (Dyer & Singh 1998). The previous section argued that complementary resources are one of the primary reasons for firms to enter interorganizational relationships. Central to this argument is the idea that complementarities create the potential for value creation through combination of complementary resources. After forming a relationship with a partner possessing complementary resources, it is likely that some of the complementary resources will be combined (Larsson & Finkelstein 1999). Therefore:

> *Hypothesis 5a: The greater the complementarities between the corporate investor and the portfolio company, the greater the acquisition of production-related resources from corporate investor by the portfolio company.*

> *Hypothesis 5b: The greater the complementarities between the corporate investor and the portfolio company, the greater the acquisition of distribution-related resources from corporate investor by the portfolio company.*

3.2.2 The Role of Social Interaction as a Facilitator in Value Creation

Social Interaction and Resource Acquisition

Although the complementarities between the venture and the corporate investor are argued to create potential for value creation through combination of complementary resources and that potential is likely to be exploited in these relationships, we still lack understanding as to what facilitates the realization of the potential. I argue that social capital, particularly social interaction, plays a key role in the realization of the potential benefits from complementarities between the two companies.

Similarly as Larsson and Finkelstein (1999) argued in their research on synergy realization in acquisitions, I argue that the existence of complementary resources is not enough for fully realizing the potential benefits. It takes interaction between the parties to realize the potential benefits from complementarities. Social interaction facilitates the exchange of information and other resources and assists in the identification of opportunities for cooperation (Cohen & Levinthal 1990, Dyer & Singh 1998, Lane &

Lubatkin 1998, Nahapiet & Ghoshal 1998, Starr & MacMillan 1990, Zahra *et al.* 2000a).

Examining the entrepreneur-venture capitalist relationship from the Prisoner's Dilemma perspective, Cable and Shane (1997) argued that the probability of cooperative entrepreneur-venture capitalist relationships increases with the quality and frequency of their communications. I predict a similar effect in corporate investor - portfolio firm relationships because of the opportunities for value adding knowledge combinations and strategic complementarities (Hellmann 2001, Maula & Murray 2000). Therefore:

> *Hypothesis 6a: The higher the social interaction between the corporate investor and the portfolio company, the greater the acquisition of production-related resources from corporate investor by the portfolio company*

> *Hypothesis 6b: The higher the social interaction between the corporate investor and the portfolio company, the greater the acquisition of distribution-related resources from corporate investor by the portfolio company*

Social Interaction and Knowledge Acquisition

Previously, I argued that corporations are likely to possess knowledge of markets, technology, and competition that would be useful for their portfolio companies. However, the mere existence of complementary knowledge is not enough for the realization of the potential learning benefits.

The extent to which a technology-based new firm can acquire external knowledge from its corporate venture capital investors will depend on the existence of external knowledge, on the ability of the firm to recognize and assess the value of the knowledge, on repeated, intense interaction, and on the willingness of the dyad firms to share information (Cohen & Levinthal 1990, Dyer & Singh 1998, Lane & Lubatkin 1998).

I follow Nahapiet and Ghoshal (1998) in arguing that social capital facilitates knowledge acquisition by affecting conditions necessary for the exchange and combination of existing intellectual resources. Lane and Lubatkin (1998) have pointed out that dyadic learning relationships involve a pattern of interactions that affects the learning of both members of the dyad.

In this study, I focus on one specific dimension of social capital, i.e. social interaction, which has been found to be an important facilitator of knowledge transfer (Bresman *et al.* 1999, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a). Social interaction facilitates the exchange of information and assists in the identification of opportunities for cooperation (Dyer & Singh 1998, Lane & Lubatkin 1998, Zahra *et al.* 2000a). Therefore:

Hypothesis 7: The greater the level of social interaction between the corporate investor and the portfolio company, the greater will be the level of knowledge acquisition by the portfolio company from the corporate investor.

The existence of complementary knowledge creates a learning opportunity but it does not yet make the learning happen. According to received theories and empirical research, social interaction is a mechanism for organizational learning (Bresman *et al.* 1999, Cohen & Levinthal 1990, Nahapiet & Ghoshal 1998, Yli-Renko *et al.* 2001a). While complementarities are likely to create potential for valuable learning opportunities, these opportunities would remain unrealized without social interaction acting as the mechanism for knowledge transfer. Therefore, I predict that social interaction will mediate the effect of initial conditions on knowledge acquisition in the corporate investor-portfolio firm dyad:

Hypothesis 8: Social interaction mediates the positive relationship between complementarities and knowledge acquisition.

Resource Acquisition and Knowledge Acquisition

Strong ties have been argued to facilitate the transfer of tacit knowledge (Bresman *et al.* 1999, Kogut & Zander 1992, Mowery *et al.* 1996, Steensma 1996, Steensma & Lyles 2000). If a start-up company has access to some concrete resources of the parent company of the corporate venture capital investor in addition to the investment relationship, it is likely that the company also learns more from the corporation when using these resources. Therefore:

Hypothesis 9a: The greater the acquisition of production-related resources from the corporate investor, the greater the knowledge acquisition from the corporate investor by the portfolio company.

Hypothesis 9b: The greater the acquisition of distribution-related resources from the corporate investor, the greater the knowledge acquisition from the corporate investor by the portfolio company.

3.3 Endorsement Model

In this chapter, a model of the endorsement benefits and factors affecting those benefits is developed. Adding to the previously described resource and knowledge acquisition model, this endorsement model focuses on the idea that besides influencing the actual capabilities of the venture, relationships also influence others' perceptions of those capabilities (Baum *et al.* 2000, Stuart *et al.* 1999, Stuart 2000).

As with the previously discussed model on knowledge resource acquisition by portfolio companies in their relationships with corporate venture capital investors, there are no precedents examining comprehensively the factors influencing the

endorsement benefits start-up companies receive through their relationships with corporate venture capital investors. Therefore, I build the model and the hypotheses primarily on the basis of the related theories and applicable empirical research in related domains.

Of the papers examining interorganizational endorsement, Stuart *et al.* (1999) have probably gone to the greatest lengths in developing understanding of the conditions and social mechanisms making endorsement work. The starting point in their development of a framework on the social mechanisms of endorsement was the sociological observation that social or industrial structures can be represented as a set of positions that are arranged hierarchically according to the prominence of their occupants (Stuart *et al.* 1999). They also acknowledged the general belief that uncertainty about the true quality of the focal actor increases the role of associations with other prominent actors in determining the quality of the focal actor. Building on these assumptions, they argued that there are three possible social mechanisms that could lead would-be investors, customers and other potential exchange partners to take into account the characteristics of a focal new venture's affiliates as they strive to assess its unobserved and uncertain quality: (1) the relationships have reciprocal effects on the reputations of those involved and therefore the partner is selective in establishing relationships with ventures (2) the partner is known to have capabilities to determine the quality of the ventures and therefore the selected venture can be assumed to be of high quality, and (3) the partner is able to select the venture from a large number of alternatives thus implying that the selected venture is of higher quality than the others.

In the following, I extend the framework of Stuart *et al.* (1999) and integrate mechanisms and conditions from other disciplines to develop a more comprehensive view of the factors influencing interorganizational endorsement. Extending the literature on interorganizational endorsement (Stuart *et al.* 1999, Stuart 2000), this model considers simultaneously the influences of partner characteristics, relationship characteristics, characteristics of the focal actor, and contextual factors on the endorsement benefits. The endorsement model summarizing the hypotheses to be tested in the present study is presented in Figure 3-3.
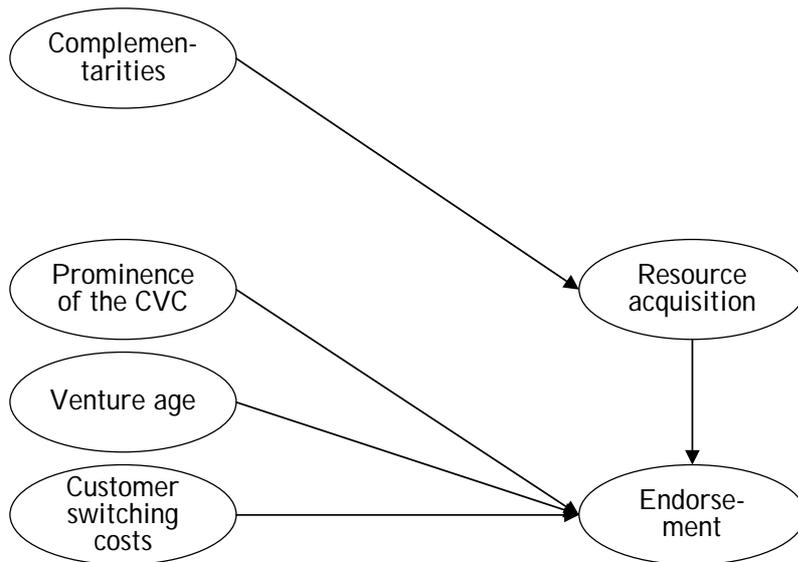
Figure 3-3   Endorsement model

3.3.1 Characteristics of Corporate Venture Capital Investor Influencing Endorsement

Several studies have identified the status of the exchange partners of the focal firm driving the legitimacy-enhancing endorsement benefits (Podolny 1993, 1994, Stuart *et al.* 1999, Stuart 2000). I identify five reasons why I argue the prominence of the partner is important also in corporate venture capital.

First, I argue that more prominent organizations have higher *reputational risks* and are therefore likely to avoid questionable partners thus increasing the value of the endorsement. Reputational risk is the first mechanism in the framework of Stuart *et al.* (1999). They argued that prominent organizations are likely to be selective in their choice of strategic partners in order to preserve their own reputations, which may be damaged if they transact with low-quality or disreputable firms. This argument is well established in the earlier research both in sociology (Blau 1964, Podolny 1993) and economics (Carter & Manaster 1990). Thus, even when an association is between a prominent organization and a new venture, the prominent organization's reputation may be damaged if the new venture is of very low quality. In general, as long as exchange relations create the possibility of a loss of status, those held in high regard will have a strong incentive to avoid low-quality exchange partners. Therefore, prominent organizations will be exclusive in their selection of associates: to do otherwise would be to risk the economic and social rents generated by a good reputation (Blau 1964, Goode 1978, White 1985, Podolny 1994, Podolny & Phillips 1996). Through this dynamic, relationships with prominent actors may raise third parties' estimates of the quality of the affiliated enterprises. For instance, Podolny (1994) argued that in markets where there is high uncertainty about the quality of a good or service that an actor brings to market, an actor's status may limit the potential exchange partners to which the actor has access. High status actors must avoid affiliating with low status actors in

order to avoid risking a loss of their own status, and low status actors are thereby constrained in their ability to enter into exchange relations with high status actors.

I argue the same logic applies to corporate venture capital setting. The higher the potential risk of damage to reputation when making a low quality investment, the higher the incentive to be selective; the higher the reputation, the higher the potential reputational losses from being associated with a venture of bad quality. Prominent corporate investors have therefore a higher incentive to avoid low quality ventures. This suggests that the higher the prominence of the corporate investor, the higher the selectivity and therefore higher the endorsement benefits.

Second, I argue that more prominent corporate investors have better *deal flow* and can therefore be more selective. Stuart *et al.* (1999) assumed that prominent organizations typically have many potential strategic partners, and therefore the selected partners have been considered more desirable than those that have not been selected. The higher the 'deal flow' of potential partners to choose from, the stronger the endorsement to become selected.

Again, I argue the same logic applies to the corporate venture capital setting. The larger the pool of potential ventures to choose from, the more selective the investor can be, and the higher the quality of the selected ventures that can be expected. The more prominent the corporate investor, the higher the deal flow that can be expected. Therefore, the more prominent the corporate investor, the higher the endorsement benefits.

Third, I argue that more prominent corporate investors have better *quality assessment capability* thus increasing the signaling effects of their investments. The second dimension in the framework of Stuart *et al.* (1999) is the assumption of prominent organizations being reliable evaluators and capable of discerning quality differences among potential partners (Stuart 1998). If there is a perceived association between prominence and evaluative ability, then third parties will interpret a connection to a prominent organization as an endorsement of the initiatives of a young venture. Because prominent organizations are viewed as experts at the due diligence process (at least in the domain in which they have garnered recognition), the fact that one of them has determined that a new venture is of sufficient quality to merit transacting with it is, in and of itself, a valuable endorsement. Unlike the mechanism linked to the reputational capital of the partner, however, this process does not depend on the assumption that the reputational capital of prominent organizations is at stake in each of their associations. It is not necessary to assume that an occasional, low-quality exchange partner will meaningfully damage an organization's reputation.

In corporate venture capital setting, I argue that the more prominent the corporate investor, the stronger the expected capability to evaluate the quality of potential ventures. Therefore, the more prominent the corporate investor, the higher the endorsement benefits.

Fourth, I argue that associations with more prominent partners lead to more *publicity.* Included in the argumentation in Stuart *et al.* (1999:319) is the idea of the importance of the visibility of the partner and the following visibility created for the focal company when establishing a tie with this partner. Prominence of the partner has been argued to be an important factor influencing the endorsement effects because of high visibility stemming from the relationships (Stuart *et al.* 1999, Stuart 2000). The role of prominence in the perspective of the dissemination of the signal to the environment is also discussed and supported in the study of Swaminathan *et al.* (2001).

In corporate venture capital setting, I argue that the more prominent the corporate investor, the closer will its actions be followed by the public. Therefore, the more prominent the corporate investor, the more fully will endorsement be disseminated to the population of actors potential new partners. Consequently, the more prominent the corporate investor, the higher the endorsement benefits.

Fifth, I argue that *the cost of creating the relationship* with a prominent corporate investor is higher than establishing a relationship with a less prominent corporate investor. From the perspective of economics, there are more stringent conditions for what economics calls signaling (Allen & Faulhaber 1989, Spence 1973, Grinblatt & Hwang 1989). Distinguished from observable, unalterable measures of the true quality of an actor, signals are observable characteristics that the actor can manipulate. In financial economics, the management's decision regarding retention of their ownership in initial public offerings is signaled to inform insiders of the future prospects of the company (Allen & Faulhaber 1989, Grinblatt & Hwang 1989, Keloharju & Kulp 1996, Leland & Pyle 1977). A critical condition for signaling to work is that it is costly (Allen & Faulhaber 1989, Grinblatt & Hwang 1989, Leland & Pyle 1977). Considering signaling from the equilibrium perspective, it needs to be costly in order to be credible, because otherwise everyone would invest in getting favorable signals. An interesting example of the influence of the cost of signaling is Lee (2001) who demonstrated that companies that changed their names to '.com' during the Internet fever, and simultaneously made strategic changes, experienced higher abnormal returns than those who just changed their names. Interestingly, companies who only changed their names, and did nothing else, also experienced some abnormal returns.

In corporate venture capital and venture capital settings, the more prominent the corporate investor, the stronger is the negotiating power of the investor. The higher the negotiation power, the lower the valuation given at investment. Therefore, the more prominent the corporate investor, the more costly it is to create the relationship just for signaling purposes. The higher the cost of signaling, the more credible are the signals. Consequently, the more prominent the corporate investor, the higher the endorsement benefits.

Summing up the previous five arguments, I hypothesize that the prominence of the corporate investor is positively related to the endorsement benefits. Therefore:

Hypothesis 10: The higher the investor prominence, the stronger the endorsement benefit resulting from the association with the corporate investor.

3.3.2 Relationship Between the Corporate Investor and the Venture Influencing Endorsement

Resource acquisition influencing endorsement. Building on extant research (Stuart *et al.* 1999, Kelley & Spinelli 2001), I argue that the strength of the tie between the venture and the corporate investor is likely to influence the endorsement benefits. More specifically, I hypothesize that the level of resource acquisition by the venture from the corporate investor will be positively associated with the endorsement benefits. I identify two reasons for this relationship.

First, I argue that resource acquisition (relationship where the venture accesses concrete resources of the parent corporation) increases the *visibility of the relationship.* The stronger the tie between the corporate investor and the venture, the greater is the visibility of the relationship for outsiders. Following this logic, the development of the investor relationship to include sharing of concrete resources should result in higher endorsement benefits compared to a pure financial relationship. Providing some support for the idea of increased endorsement benefits following increasing collaboration, Kelley and Spinelli (2001) found that corporate venture capital backed firms with business relationships with their corporate venture capital investors formed higher number of alliances with other firms.

Second, I argue that relationships involving resource acquisition require stronger commitment from the corporate partner and thus are *more credible signals.* The stronger the ties, the more difficult it is to create just for signaling purposes. Therefore, stronger tie should result in higher endorsement benefits. Following this logic, the development of the investor relationship to include sharing of concrete resources should be result in higher endorsement benefits compared to pure financial relationship.

Summarizing the two above arguments, resource acquisition by ventures from their corporate investors is likely to create increased attention and be taken as a more serious signal of the quality of the venture than the original corporate venture capital investment. Therefore:

Hypothesis 11a: The greater the acquisition of production-related resources, the greater the endorsement benefit resulting from the association with a corporate investor.

Hypothesis 11b: The greater the acquisition of distribution-related resources, the greater the endorsement benefit resulting from the association with a corporate investor.

Resource acquisition mediating the influence of complementarities on endorsement. I also hypothesize that complementarities are valuable for endorsement but that effect is mediated by resource acquisition. I argue that complementarities influence the quality assessment capability and the goal alignment of the corporate investor but suggest that these gain more weight accompanied with resource acquisition.

First, I argue that complementarities influence the *quality assessment capability* of the corporate investor. As discussed in the context of Hypothesis 10, the expected quality assessment capability of the partner influences the endorsement benefits of the focal actor (Stuart *et al.* 1999). In the context of corporate venture capital, I argue that the greater the complementarities between the corporate investor and the focal venture, the more competitive the corporate investor can be assumed to be in evaluating the quality of the venture. An existence of complementarities between the corporate investor and the venture indicates that these firms understand each other's businesses. Therefore, the greater the complementarities, the higher can the quality assessment capability of the corporate investor be expected to be. This suggests a positive relationship between complementarities and endorsement benefits.

Second, complementarities are likely to be positively related to *goal alignment with the corporate investor.* As suggested by Stuart *et al.* (1999) in their discussion for further research, the alignment of objectives between the partners is likely to have an impact on the endorsement benefits. For instance, the theoretical work of Hellmann (2001) on corporate venture capital relationships suggests that the complementarity (versus cannibalism) influences dramatically the sensibility of taking corporate venture capital investors. However, it is not always possible to choose whom one gets to partner with, so there are investments accepted and alliances created that are not fully optimal for one of the stakeholders. The complementarities and alignment of goals observed by outsiders is therefore likely to influence the endorsement benefits.

In corporate venture capital context, I argue that the greater the complementarities between the partner and the focal venture, the higher the likely benefits from the relationship between the venture and the investor. The higher the expected benefits, the higher the expected performance of the focal venture.

However, while complementarities are argued to be positively related to endorsement benefits, I argue that resource acquisition largely mediates this relationship. The role of resource acquisition is to realize the potential benefits stemming from the complementarities by making the complementarities visible for the outsiders.

Summarizing the above arguments, complementarities are argued to increase the quality assessment capability and goal alignment of the corporate venture, thus improving the value of the endorsement. It is suggested that these benefits are mediated by resource acquisition. Therefore:

> *Hypothesis 12a: Acquisition of production-related resources mediates the positive relationship between complementarities and endorsement*

Hypothesis 12b: Acquisition of production-related resources mediates the positive relationship between complementarities and endorsement

3.3.3 Characteristics of the Venture Influencing Endorsement

Characteristics of the focal venture are likely to influence the value of the endorsement benefits. Following previous research, uncertainty of the focal venture is identified as a key factor.

Venture age influencing endorsement. I argue that characteristics of the focal venture, especially uncertainty, are likely to influence the value of the endorsement benefits. This argument is well grounded in the asymmetric information theory (Akerlof 1970) and signaling theory (Spence 1973) as well as the endorsement arguments of Podolny (1993, 1994) and Stuart *et al.* (1999) and Stuart (2000).

The role of uncertainty, commonly proxied with venture age, on signaling effects has been demonstrated in research on asymmetric information. Similarly, research examining legitimizing endorsement benefits from sociological perspectives has similarly focused on the uncertainty measured as the age of the venture (Stuart *et al.* 1999, Stuart 2000).

I argue that the same logic applies to corporate venture capital setting. Following previous research, age of the focal venture is identified as a key factor influencing the endorsement benefits. The younger the venture, the higher the uncertainty regarding the true quality of the focal venture, and the more weight will be given to the role of its affiliates when determining the quality of the focal venture. Therefore:

Hypothesis 13: The younger the venture, the stronger the endorsement benefit resulting from the association with a corporate investor.

Customer switching costs influencing endorsement. Transaction cost economics highlight one further important aspect influencing the value of endorsements: the magnitude of risk related to the exchange relationship. In addition to uncertainty and opportunism, transaction cost economics highlight the importance of the stakes that would be at risk in transactions as a factor driving the need for safeguarding the transactions. According to transaction cost economics, asset specificity is an important factor influencing the risk in an exchange relationship (Williamson 1979, 1981, 1985). Switching costs related to changing a supplier or a partner influence the need to safeguard transactions. Transaction cost economics posit that when asset specificity and switching costs are high, there is a high need for safeguards against opportunism and uncertainty in exchange relationships. Considering prominent partners as certifiers against opportunism and other risks, the value of interorganizational endorsements is likely to be higher when there are high transaction costs between the start-up company and its potential customers and partners (Swaminathan *et al.* 2001).

Therefore, I argue that the higher the risk a potential partner or customer has to assume in forming a business relationship with the focal venture, the more it will give

weight to all signals of the quality, including endorsement. As a specific form of risk for customers and partners, I recognize high switching costs increasing the risk in selecting a partner, supplier or employer of uncertain quality. Because the long-term success of a venture is largely determined by the willingness of the potential customers to adopt the products of the venture, also potential partners and employees should be interested in the likelihood of potential customers to adopt the products of the venture. Therefore, high customer switching costs are likely to increase the value of endorsement not only in attracting potential customers, but also in attracting potential partners and employees.

Supporting these arguments, Singh (1997) has shown that the technological complexity of the products moderated the influence of interorganizational alliances on the likelihood of the survival of firms in the hospital software systems industry. Similarly, Swaminathan *et al.* (2001) demonstrated that suppliers of architectural goods (higher switching costs) benefit more from high-status customers than suppliers of modular goods (lower switching costs). Therefore,

> *Hypothesis 14: The greater the customer switching costs, the stronger the endorsement benefit resulting from the association with a corporate investor.*

3.4   Summary of the Hypotheses

In order to examine closer the factors driving the value-added benefits, a model of the value added mechanisms and the factors influencing the value-added mechanisms was developed based on received theories and previous research. There are three main sub-models in the model. The first sub-model focuses on the value-added mechanisms.

Model of the Value-added Mechanisms

Three main forms of value-added were identified
- Resource acquisition
- Knowledge acquisition
- Endorsement

Resource acquisition refers to concrete resources of the parent corporation that the portfolio company gets access to through the investor relationship. Resource acquisition is further divided in acquisition of resources related to production and technology and acquisition of resources related to marketing and distribution of the products. Resource acquisition was hypothesized to be positively related to the perceived value-added.

Knowledge acquisition refers to learning benefits for the portfolio company in the investment relationship. Start-up companies may learn from their corporate investor for instance about markets, customer needs, competition, and technological issues. Knowledge acquisition was hypothesized to be positively related to the perceived value-added.

Endorsement refers to the help the association with a large corporation brings in the form of increased legitimacy when attracting new investors, employees, partners, and customers. Endorsement was hypothesized to be positively related to the perceived value-added.

Resource and knowledge acquisition Model

The second sub-model examines factors influencing the resource acquisition and knowledge acquisition. One of the key success factors in the model was hypothesized to be complementarities between the start-up company and the parent company of the corporate investor.

Complementarities refer to the complementarities between the parent of the corporate investor and the start-up. Complementarities were hypothesized to increase the incentives for cooperation and thus increase the social interaction in the investment relationship.

Social interaction was hypothesized to be a key factor facilitating knowledge acquisition by the start-up company from the corporate investor and thus mediating the complementarity benefits to knowledge acquisition. Social interaction was also hypothesized to facilitate the identification of opportunities for sharing resources with the corporate investor and thus mediate the complementarity benefits to resource acquisition.

Complementarities were also hypothesized to influence resource acquisition directly because resource complementarity is a prerequisite for resource sharing. Finally, resource acquisition was hypothesized to influence knowledge acquisition because of the increased opportunities for transferring knowledge when sharing concrete resources such as distribution channels or production facilities.

Endorsement model

The third sub-model examines factors influencing the endorsement benefits. Endorsement benefits were hypothesized to be positively influenced by the prominence of the parent of the corporate investor. The more influential the investor, the higher the endorsement effect. The age of the venture was hypothesized to be negatively related to the endorsement benefits from associations with corporate investors. Furthermore, the endorsement was hypothesized to be more valuable the more risky it is for the customers to buy from the start-up. Customer switching costs were therefore hypothesized to be positively related to the endorsement benefits. Finally, resource acquisition was hypothesized to increase the endorsement benefits, thus mediating the complementarity benefits to endorsement. The endorsement is more beneficial, the more complementary the two companies are. However, complementarities may be invisible for outsiders, unless there is concrete resource sharing that proves the complementarities for outsiders.

The summary of the hypotheses is presented in Table 3-1.

Table 3-1   Summary of the hypotheses

Hypothesis	
Model on the value-added mechanisms	
H1a	Acquisition of production-related resources positively related to value-added
H1b	Acquisition of distribution-related resources positively related to value-added
H2	Knowledge acquisition positively related to value-added
H3	Endorsement positively related to value-added
Resource and knowledge acquisition model	
H4	Complementarities positively related to social interaction
H5a	Complementarities positively related to acquisition of production-related resources
H5b	Complementarities positively related to acquisition of distribution-related resources
H6a	Social interaction positively related to acquisition of production-related resources
H6b	Social interaction positively related to acquisition of distribution-related resources
H7	Social interaction positively related to knowledge acquisition
H8	Social interaction mediating the positive relationship between complementarities and knowledge acquisition
H9a	Acquisition of production-related resources positively related to knowledge acquisition
H9b	Acquisition of distribution-related resources positively related to knowledge acquisition
Endorsement model	
H10	Investor prominence positively related to endorsement
H11a	Acquisition of production-related resources positively related to endorsement
H11b	Acquisition of distribution-related resources positively related to endorsement
H12a	Acquisition of production-related resources mediating the positive relationship between complementarities and endorsement
H12b	Acquisition of distribution-related resources mediating the positive relationship between complementarities and endorsement
H13	Venture age negatively related to endorsement
H14	Customer switching costs positively related to endorsement

The sub-models together comprise an integrated model of the value-added mechanisms and the factors influencing those value-mechanisms in relationships between technology-based new firms and their corporate venture capital investors. Figure 3-4 illustrates the integrated model.
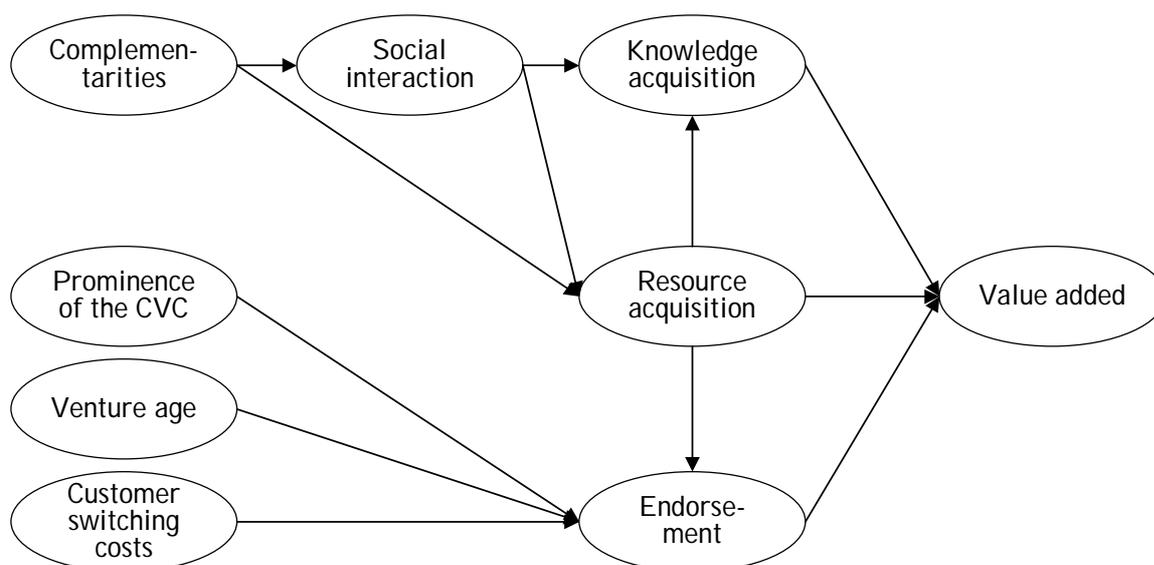
Figure 3-4   Integrated model

4   METHODS

This chapter discusses the methodology used in the present study. First, the sources of secondary data and the survey are discussed. Then, the statistical methodology used in the present study is discussed. Thereafter, the operationalization of constructs is discussed. Finally, the chapter discusses the various elements or reliability, validity, and generalizability and how those elements have taken into account in the present study.

4.1   Population and Sample

The sample companies were identified from the Venture Economics database. This extensive source has been used widely in earlier research on venture capital and corporate venture capital (e.g. Bygrave 1987, 1988, 1989, Gompers 1995, Gompers & Lerner 1998, Kelley & Spinelli 2001, Kortum & Lerner 2000, Lerner 1994, and Sorenson & Stuart 2001). Venture Economics is widely recognized as the leading source of U.S. venture capital investment data (Gompers & Lerner 1999b, NVCA 2001). The database has been argued to have a good coverage of the U.S. venture capital industry (Gompers & Lerner 1999b). The database contains currently information on over 150,000 private equity investments from 1969 to present. Venture Economics gathers venture capital investment data using for instance annual reports of venture capital funds, personal contacts to funds' personnel, initial public offering prospectuses, and deals announced in the media.

The sample frame was derived from Venture Economics database using following selection criteria

- Portfolio company was founded in 1995 or later (six year maximum age for technology-based new firms)
- Portfolio company operates in high tech industry. The high tech industries in Venture Economics database include the following subcategories: biotechnology, medical/health science, internet specific, communications, computer software and services, computer hardware, or semiconductors/other electronics
- Portfolio company was privately held and actively operating
- Portfolio company had received funding from at least one corporate venture capital investor and at least one independent venture capital investor
- Portfolio company had received at least one round of investments within the last two years

In total, 856 companies fulfilling this inclusion criteria were identified from Venture Economics Database in December 2000. A questionnaire was sent to CEOs, chairmen of the boards, or founders of all these companies in December 2000.

4.2   Survey

The primary source of data in this research is a mail survey administered to the CEOs, chairmen or founders of the whole population of the identified technology-based new firms fulfilling the selection criteria discussed in the previous chapter. The survey is described in the following sections.

4.2.1 Questionnaire

The survey instrument used in the present study was a four page questionnaire with a section covering background information, value-added provided by the most important corporate venture capital investor and the most important independent venture capital investor, relationship with these investors, more specific questions on the relationship with the corporate venture capital investor, and a company profile. The questionnaire was pre-tested with several CEOs (Fowler 1993:100-102, Spector 1992:8). The relevance and clarity of the questions were also checked with several corporate venture capital investors and researchers familiar with the topic area. Because of the need to connect the data to other data, the names of the respondent and investor firms were asked in the questionnaire. This could have reduced the willingness of some potential respondents to answer the questionnaire. However, confidentiality was assured and the interviewed CEOs did not consider asking whether the names would cause a problem. Answering was encouraged by promising a summary of the results in return.

4.2.2 Mailing Process and Response Pattern

There were altogether three mailings administered to the CEOs of the sample companies in the first survey of the present study. First, a mailing consisting of a cover letter, the four-page questionnaire, and an information sheet were sent to the 856 CEOs in the sample frame. A week later, reminder cards were sent as suggested by Dillman (1978). Four weeks later, the final third mailing was sent to non-respondents. This mailing included a new questionnaire.

The total number of firms to which the questionnaire was sent was 856. Of these firms, 46 could not be located or the named recipient was not employed by the company anymore. Therefore, the effective maximum sample was 810 companies. Of these 810 firms, 135 returned the filled questionnaire. This translates to a response rate of 17 %. This response rate can be considered acceptable, given that it was requested that the four-page questionnaires were completed by the CEOs. Management time is a critically scarce resource for this group and therefore Gaedeke and Tootelian (1976) forecasted a 20 percent response rate from surveys of top executives. McDougall & Robinson (1990) and McDougall *et al.* (1994) had a response rate of 11% in their study of technology-based new ventures.

Illustrating the challenging situation of the sample firms, the average age of the firms is just over three years, with an average of $55 million dollars having been invested collectively by at least one corporate venture capital and one independent venture capital investor. With average revenues of less than $5 million per year, the CEOs of these companies were likely to be under strong investor pressure to grow their business rapidly (and not to spend their busy time answering any surveys). At the time of this survey in December 2000, the general investment climate for technology-based new firms had become markedly less favorable. This had an immediate and adverse economic impact on valuations of initial public offerings and investors' confidence in the venture capital market. These extreme conditions may have had an adverse effect on the willingness of CEOs to participate in any survey research.

Extensive analyses were carried out to detect potential non-response biases. These tests are analyses are reported in Chapter 4.2.3. No differences between respondents and non-respondents were found.

Of the 135 returned questionnaires, six companies were excluded from the analysis because the respondents indicated their companies were older than six years. Because the present study is interested in providing understanding of the factors influencing the value-added received by ventures from their corporate venture capital investors, it was important to exclude ventures that were spin-offs from the corporations. Eight companies were excluded because the ventures were not independent start-ups but spin-offs from the corporations currently acting as minority investors. Eight further companies were excluded because they had been acquired (6) or gone public (2). Finally, 17 companies were excluded because the respondent had not provided sufficient information on the corporate investor. The final number of ventures included in the analyses is 91. Table 4-1 presents the response pattern of the survey.

Table 4-1   Response pattern in the survey

Category	Number of companies	Percentage
Total numbers of companies	856	
Not received or not working in the company anymore	41	
Potential sample size	810	100%
Total number of questionnaires returned	135	17%
Venture is older than 6 years old	6	
Venture is a spin-off or joint venture of the CVC investor	9	
Venture has been acquired before returning the questionnaire	6	
Venture has gone public before returning the questionnaire	2	
Corporate investor is not a non-financial corporation	4	
Information on CVC investor missing or incomplete	15	
Final sample	91	

Because the survey was answered by a single key informant, it is important that the respondent is knowledgeable as to the operations of the firm (John & Reve 1982). The survey was sent primarily to the CEOs of the focal companies. In the absence of the contact information of the CEO, the survey was sent to the chairman or founder of the

company. The great majority of the respondents were CEOs of the sample companies (Table 4-2).

Table 4-2   Respondents' positions in the sample firms

Highest position	Number of respondents	Percentage
President and/or CEO	75	82 %
Chairman	3	3 %
Other (founders, managers, directors)	13	14 %
Total	91	100 %

4.2.3 Non-Response Analysis

I conducted several tests to assess the representativeness of the sample. First, I compared the age of the respondent and non-respondent companies. The mean age for both groups was close to three years with no statistical difference between respondents and non-respondents (Table 4-3).

Table 4-3   Test of difference in firm age between respondents and non-respondents

	Respondents Mean (std. dev.)		Non-responses Mean (std. dev.)		T	Df	Sig. (2-tail)
Firm age (years from founding)	3.08	(1.352)	3.17	(1.440)	-.68	199.70	.50

Second, I compared the locations of the respondent and non-respondent companies. I determined the location based on the states where the companies were incorporated. I selected the seven most frequent states, which covered 81% of the companies (Table 4-4). I compared the location distributions of respondents and non-respondents using a chi-square test. Again, no statistically significant difference could be found between respondents and non-respondents (Table 4-5).

Table 4-4   Distribution of respondents and non-respondents according to location

	Respondents		Non-Respondents	
California	70	18 %	326	82 %
Colorado	5	19 %	22	81 %
Massachusetts	10	13 %	70	88 %
New York	6	13 %	41	87 %
Pennsylvania	6	23 %	20	77 %
Texas	12	27 %	32	73 %
Washington	1	3 %	34	97 %
Other	25	16 %	130	84 %
Total	135	17 %	675	83 %

Table 4-5   Test of difference in location between respondents and non-respondents

	Chi-square	Df	Sig. (2-tail)
Location (state)	11.04	7	.14

Thirdly, I compared the distribution of respondents and non-respondents according to their industry sector. For the eight sectors included, the share of respondents varied between 13% and 28% when the sample response rate was 17% (Table 4-6). I

compared the industry sector distributions of respondents and non-respondents using the chi-square test. Again, no statistically significant difference could be found between respondents and non-respondents (Table 4-7).

Table 4-6   Distribution of respondents and non-respondents according to industry sector

	Respondents		Non-Respondents	
Biotechnology	2	14 %	12	86 %
Medical/Health	7	25 %	21	75 %
Internet Specific	68	15 %	373	85 %
Communications	21	21 %	79	79 %
Computer Software and Services	21	13 %	136	87 %
Computer Hardware	3	13 %	21	88 %
Semiconductors/Other Elect.	13	28 %	33	72 %
Total	135	17 %	675	83 %

Table 4-7   Test of difference in industry sector between respondents and non-respondents

	Chi-square	Df	Sig. (2-tail)
Industry sector (Venture Economics)	9.28	6	.16

As the fourth test of non-respondent bias, I compared early and late respondents. This test should provide additional evidence of the potential non-response bias because late respondents have been argued to be more representative of those in the sample who did not respond than are early respondents (Armstrong & Overton 1977). I tested the difference in the number of employees and revenues between early (first 60) and late (last 60) respondents (Table 4-8). Again, no statistical difference could be found between early and late respondents.

Table 4-8   Test of difference in the number of employees and revenues between early (first 60) and late (last 60) respondents

	Early respondents Mean (std. dev.)		Late respondents Mean (std. dev.)		T	Df	Sig. (2-tail)
Employees (2000)	104.78	(92.91)	121.25	(108.24)	-0.87	111.76	.38
Revenue (2000, $ Millions)	6.60	(15.01)	8.01	(19.22)	-0.40	84.98	.69

Furthermore, it is important to note that the purpose of this study was to examine interrelations between variables rather than describe accurately the population of corporate venture capital backed companies. In this kind if setting the potential non-response bias has been argued to be lower. For instance, Krosnick (1999) reviewed research on nonresponse biases and concluded that having a low response rate does not necessarily mean that a survey suffers from a large amount of nonresponse error.

4.2.4 Missing Value Analysis

There were very few missing values in the data (2.29% of all used measurement items). I analyzed the missing values and did not find any significant patterns of missing values. The influence of missing data appeared to be insignificant. Mean substitution

was used to replace the missing values. I tested the effect of this and noted that this choice did not influence the results in this study.

4.2.5 Analysis of Common Method Variance

Because there are no close proxies or external measures available for many of the critical variables examined in the present study (such as knowledge acquisition from a specific investor relationship) I had to rely on the self-reported assessment of CEOs of the sample companies on these variables. Because of this approach, it is important to ensure that common method variance is not causing the relationships between variables (Avolio *et al.* 1991, Podsakoff & Organ 1986). In order to ensure common method variance does not undermine the results, I used earlier validated measures as much as possible (Spector 1987). I also examined the possibility of common method variance using Harman's single factor test as suggested by Podsakoff & Organ (1986). Inclusion of all the items used in the multi-item scales yielded 8 factors with an eigenvalue of over 1.00. The first factor explained 33% of the variance. Based on this analysis, it appears that common method variance is not a serious threat to the validity of this study.

4.2.6 Follow-Up Survey

In order to ensure the reliability and stability of the measures, I administered a follow-up survey six months after the original survey in June 2001 (Carmines & Zeller 1979:37-40, Litwin1995:8-13, Nunnally 1978:233-236). The follow-up survey was administered to the sample companies' CEOs that answered in the original survey. An e-mail questionnaire was sent to the addresses of the CEOs that they had provided in their survey answers. The purpose of the survey was to re-test some of the key dependent variables measured in the original survey. The follow-up survey included summary questions measuring the dependent variables of the present study.

The e-mail questionnaire was sent to the 91 CEOs and senior executives that were included in the study from the original survey. An analysis of the non-respondents indicated that at least five companies had been acquired, three companies were not in operation anymore, and four CEOs were not employed by the sample company anymore. Therefore, there were a maximum of 79 respondents working in operating companies that could have answered to the follow-up survey. Of these, 31 CEOs and senior executives did answer to the follow-up survey. This responds to 39%, which can be considered as a fairly good response rate in this kind of target population.

It is important to note that, in this study, the follow-up has an additional importance because of the time frame of the study. The sample companies had all received corporate venture capital funding during 1999-2000. The radical developments (rise and fall) in the venture capital markets during the recent years obviously raised a concern regarding the generalizability of the results over other periods of time. Because

the nature of the research questions demanded of primary data, it was not possible to use longitudinal setting employing archival data. The need to focus on recent investments was further determined by the relatively small number of corporate venture capital investments before the end of 1990's. In this study, the reliability and the stability of the dependent variables were ensured by the re-test procedure of sending a follow-up survey for the original respondents after six months from the original survey. These six months are important, because the amount of venture capital and corporate venture capital investments decreased dramatically during the first half of 2001. The answers to the follow-up questions were strongly and significantly correlated with the original constructs supporting the reliability and generalizability of the results over the specific period of time.

4.3 Statistical Methods

In order to test the hypotheses developed in the study, the present study employed four main statistical methods. First, confirmatory factor analysis was employed in testing the validity of the constructs. Second, multiple regression analysis was used in testing the paths between constructs. Third, an application of the multiple regression analysis was used to test the mediation effects. Fourth, structural equation modeling was employed to test simultaneously the paths in the integrated model. These methods, their assumptions, and the interpretation of the results are explained in the following sections.

4.3.1 Confirmatory Factor Analysis

In the present study, factor analysis was used to confirm that the observed measurement items define latent theoretical constructs as expected, on the basis of theoretical grounds. This method, known as confirmatory factor analysis (CFA) is used to test that the number of factors and the loadings of measurement items on them conform to what is expected on the basis of pre-established theory. Measurement items are selected on the basis of prior theory and factor analysis is used to see whether they load as predicted on the expected number of factors. Confirmatory factor analysis thereby complements the use of Cronbach's alpha coefficients in evaluating the reliability and validity of constructs.

Confirmatory factor analysis assumes that a number of a priori defined factors explain the majority of the covariation among the observed variables. The variance of each observed variable consists of the proportion of variance determined by a linear combination of the common factors and the proportion determined by a specific component unique to the variable. The coefficients, which define the linear combination of factors for each variable, are called factor loadings. A factor loading can be interpreted as a standardized partial correlation coefficient between the variable and the factor while controlling for the other factors (Schumacker & Lomax 1996)

Eigenvalues represent the amount of variance accounted for by a factor. They are commonly used as the basis of extracting factors in factor analysis. The common guideline is that any factor with an eigenvalue of less than 1.00 should not be used because such factors explain less variance than a single variable (Hair *et al.* 1998). In the present study, this eigenvalue criterion was used to confirm that the number of factors that emerge from the data corresponds to the number of factors determined a priori on the basis of theoretical grounds.

Besides confirming the correct number of factors, the factor analysis was used to confirm that the measurement items loaded on correct factors. In confirmatory factor analysis, a common rule of thumb is that only items with factor loadings of .60 or higher on the primary factor and loadings of .40 or lower on any other factor are retained. These guidelines were employed in the present study.

There are two primary alternative methods available for extracting factors: component analysis and common factor analysis. In component analysis, factors are based on the total variance (common, specific, and error variance) whereas in common factor analysis factors are based on a reduced correlation matrix excluding the specific and error variance (Hair *et al.* 1998). Principal component analysis is the method used in most of the similar studies. Principal component analysis was also used in the present study for extracting factors.

Factor rotation is an important part of factor analysis and is needed to make the factor solution interpretable. There are various alternative methods for factor rotation of which Varimax rotation is most often used. Being an orthogonal rotation algorithm, Varimax rotation creates a factor solution consisting of factors that are uncorrelated with each other. Varimax rotation aims at finding a factor solution where a variable loads highly on one particular factor and loads as low as possible on the other factors. In the present study, Varimax rotation algorithm was used whenever a factor solution consisted of more than one factor.

4.3.2 Multiple Linear Regression Analysis

In the present study, multiple regression analysis was used as the main statistical method to test the hypotheses. Multiple linear regression analysis is a statistical method used to explain the past variation or predict the future variation in one dependent variable by estimating the influence of several independent variables on the dependent variable. The general form of the multiple linear regression equation is $y_j = b_0 + b_1 x_{1j} + b_2 x_{2j} + \ldots + b_n x_{nj} + e_j$, where y_j represents the values of the dependent variable that is explained in the regression, x_{1j} - x_{nj} are the observations of the independent variables, b_0 is the constant, b_1 - b_n are the regression coefficients for x_{1j} - x_{nj}, and e_j is the error term representing observed residuals from fitting the regression line to the set of observations.

Of the various regression analysis methods, ordinary least squares regression (OLS) is the most common regression analysis method. In the ordinary least squares

regression, the sum of squared residual vertical distances between the data points and associated points in the regression line are minimized. The present study employs OLS regression.

Assumptions in Multiple Regression Analysis

Multiple linear regression is based on several assumptions concerning the quality of the data and the nature of the phenomenon analyzed. The most important assumptions are (1) metric data; (2) linearity of the phenomenon; (3) constant variance of the error term; (4) independence of the error terms; (5) normality of the error term distribution; (6) low multicollinearity and (7) sufficient sample size. These assumptions and their implications for the present study are discussed below.

Metric data. The data has to be metric or transformed appropriately (Hair *et al.* 1998). In this study, the statistical properties of the variables are examined in order to identify any violations. In this study, the categorical variables such as industry sector are included as dummy variables (Hair *et al.* 1998).

Linear relationships. The relationships between the dependent and independent variables should be linear. The linearity of the relationship between dependent and independent variables represents the degree to which the change in the dependent variable (the regression coefficient) is constant across the range of value for the independent variable. Linearity can be detected using residual plots. Any curvilinear pattern indicates a non-linearity. Non-linearity of a relationship can be overcome using data transformation techniques (Hair *et al.* 1998). In the present study, data transformations are used when the analyses indicate nonlinear relationships.

Dependent variable normally distributed. The dependent variable should be normally distributed. The normality of the variables can be tested using normal probability plots in which standardized residuals are compared with the normal distribution. Some normality issues can be dealt with by transformations such as logarithmic transformation in the case of lognormal distribution (Hair *et al.* 1998). In this study, the normality of the dependent variable and non-dummy independent variables were examined using the Normal P-P plot. In the Normal P-P plot, the cumulative proportion for a single numeric variable is plotted against the cumulative proportion expected if the sample were from a normal distribution. If the sample is from a normal distribution, points will cluster around a straight line. In the present study, the variables are transformed to achieve normality when necessary.

Constant variance of the error term. The variance of the error term should be constant. The presence of unequal variance in the error term (heteroscedasticicity) violates the assumptions of OLS regression. Heteroscedasticity can be detected for instance by using the Levane test for homogeneity of variance, which measures the equality variances for a single pair of variables. In case heteroscedasticity is present, it can be dealt with appropriate transformations, or if the violation can be attributed to a single independent variable, the procedure of weighted least squares can be employed

(Hair *et al.* 1998). An effective method for dealing with heteroscedasticicity is to use the White (1980) correction for heteroscedasticity. In this study, the presence heteroscedasticicity was tested. In the present study, transformations were employed in order to homogenize the variance when needed.

Independent error terms. The error terms should be independent. The predicted values should not be sequenced by any variable. Possible violations of this assumption can be detected by plotting the residuals against any possible sequencing variable. If the residuals are independent, the pattern should appear random. Violations occur when basic model conditions change but are not included in the model. Data transformations such as first differences in a time series model, or specially formulated indicator variables can be used to deal with this violation. In the present study, several control variables were used in order to take the potential differences in the basic conditions into account.

Low multicollinearity. The independent variables that are included in a model should not be multicollinear. Multicollinearity means that independent variables are highly correlated and makes it difficult to determine the contribution of each independent variable because the impact is mixed. High correlations among the independent variables, 0.90 and above, indicate substantial multicollinearity (Hair *et al.* 1998:191). However, lack of high correlation values does not ensure a lack of collinearity. Thus, better indicators of multicollinearity are the tolerance value and variance inflation factor (VIF), which tell the degree to which each independent variable is explained by other independent variables. Tolerance is the amount of variability of the selected independent variable not explained by the other independent variables. Thus, very small tolerance values (and high VIF values) denote high collinearity. A common cut-off threshold is a tolerance value of .10, which corresponds to VIF values above 10 (Hair *et al.* 1998). In case multicollinearity is detected, it can be dealt with by (1) omitting one or more highly correlated predictor variables and identifying other, better predictor variables; (2) using the model only for prediction and making no attempt to interpret the regression coefficients; (3) using simple correlations between each predictor and dependent variable to understand the predictor-dependent variable relationship; and/or (4) use a more sophisticated method of analysis such as Bayesian regression or regression on principal components to obtain a model that clearly reflects the simple effects of the predictors (Hair *et al.* 1998). In this study, the existence of potential multicollinearity is examined on the basis of correlation matrices and variance inflation factors.

Sufficient sample size. Sample size has a strong impact on the explanatory power of multiple regression analysis. Hair *et al.* (1998) have suggested a minimum of 5 times as many observations as there are independent variables in the model to avoid an over fitting of the model and enabling generalizability. However, too large samples may cause the regression analysis to become overly sensitive (Hair *et al.* 1998). In the present study, the sample size is in line with the above recommendations.

Interpretation of the Results in Multiple Regressions

The statistical significance of each regression coefficient b_j is tested with a *t*-test. The *t*-value indicates how many standard error measures the coefficient is from zero, and the probability value *p* indicates the significance of the test that b_j is different from zero. A common threshold value for the regression coefficients to be considered as significant is .05. Unstandardized regression coefficients have a clear interpretation and can be used to build forecasting models. Standardized regression coefficients are needed when comparing the explanatory power of several regression coefficients in the same equation. In the present study standardized coefficients are reported to allow comparison between independent variables.

When comparing regression models, the most common standard used is overall predictive fit measured as the coefficient of determination (R^2). However, the drawback of this measure is that when adding new explanatory variables, the measure can never decrease. Thus, inclusion of all independent variables would give the maximum R^2, even if the same level had achieved using fewer variables. In order to take into account the number of explanatory variables, the adjusted R^2 can be used. Adjusted R^2 is also useful in comparing models between different data sets because it compensates for the different sample sizes. In the present study, both adjusted and unadjusted R^2 are reported.

The statistical significance of the overall model is indicated by the *F*-test of the analysis of variance. The overall model can be considered significant when the significance level of the *F*-statistic is below .05. In the present study, *F*-statistics are also reported in the analyses.

4.3.3 Testing of Mediating Effects by Using Multiple Regression

In addition to testing relationships with a single dependent variable and a number of independent variables, the multiple regression method can be extended to the analysis of paths of relationships (e.g. Aguinis & Pierce 1999, Baron & Kenny 1986, Cohen & Cohen 1975). In this study, multiple regression analysis is used to test mediation effects. A variable may be considered a mediator to the extent to which it carries the influence of a given independent variable to a given dependent variable (Baron & Kenny 1986). Illustration of mediation is presented in Figure 4-1.
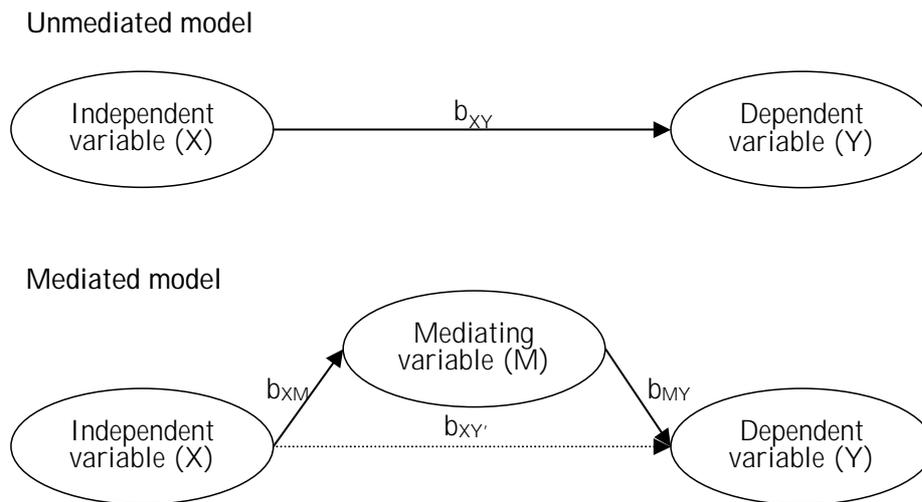
Figure 4-1   Illustration of mediation effect

Steps in Establishing Mediation

Baron and Kenny (1986) have presented four steps in establishing mediation. This study follows these steps in testing mediation hypotheses. The steps are presented below for variable M mediating the relationship between independent variable X and dependent variable Y as illustrated in Figure 4-1.

Step 1. Show that the independent variable is correlated with the outcome variable ($b_{XY} > 0$). Use Y as the criterion variable in a regression equation and X as a predictor. This step demonstrates that there is an effect that can be mediated.

Step 2. Show that the independent variable is correlated with the mediator ($b_{XM} > 0$). Use M as the criterion variable in the regression equation and X as a predictor. This step essentially involves treating the mediator as if it were an outcome variable.

Step 3. Show that the mediator affects the outcome variable ($b_{MY} > 0$). Use Y as the criterion variable in a regression equation and X and M as predictors (estimate both b_{MY} and $b_{XY'}$ in same the model). It is not sufficient just to correlate the mediator with the outcome; the mediator and the outcome may be correlated because they are both caused by the independent variable X. Thus, the independent variable must be controlled in establishing the effect of the mediator on the outcome.

Step 4. To establish that M *completely mediates* the X→Y relationship, the effect of X on Y controlling for M should be zero ($b_{XY'} = 0$). The effects in both Steps 3 and 4 are estimated in the same regression equation.

If all four of these steps are met, then the data are consistent with the hypothesis that variable M *completely mediates* the X→Y relationship. However, if the first three steps are met but Step 4 is not, then *partial mediation* is indicated. Moreover, Step 1 is not necessarily required for establishing mediation, because a path from the independent variable to the outcome variable is implied if Steps 2 and 3 are met. If $b_{XY'}$ is opposite in sign to $b_{XM} * b_{MY}$, then it could be the case that Step 1 is not met, but there is still

mediation. In this case, the mediator acts like a suppressor variable. Therefore, the essential steps in establishing mediation are Steps 2 and 3.

The amount of mediation is defined as the reduction of the effect of the initial independent variable on the dependent variable between the unmediated and mediated model. This difference in coefficients can be shown to equal exactly the product of the effect of X on M times the effect of M on Y ($b_{XM} * b_{MY} = b_{XY} - b_{XY'}$). The exact equality holds for multiple regression and structural equation modeling without latent variables, but it holds only approximately for structural equation model with latent variables. The amount of reduction in the effect of X on Y is not equivalent to either the change in variance explained or the change in an inferential statistic such as F or a p value. It is possible for the F from the independent variable to the outcome to decrease dramatically even when the mediator has no effect on the outcome.

Test of Mediation

If Step 2 (the test of $b_{XM} > 0$) and Step 3 (the test $b_{MY} > 0$) are met, it follows that there necessarily is a reduction in the effect of X on Y in the mediated model. An indirect and approximate test that $b_{XM} * b_{MY} = 0$ is to test that both b_{XM} and b_{MY} are zero (Steps 2 and 3).

Baron and Kenny (1986) provided a direct test of $b_{XM} * b_{MY}$ which is a modification of a test originally proposed by Sobel (1982). It requires the standard error of b_{XM} or s_{XM} (which equals b_{XM}/t_{XM} where t_{XM} is the t-test of coefficient b_{XM}) and the standard error of b_{MY} or s_{MY}. Following Goodman (1960), the standard error of $b_{XM} * b_{MY}$ can be shown to equal

$$\text{Goodman I test: standard error } = \sqrt{b_{MY}^2 * s_{XM}^2 + b_{XM}^2 * s_{MY}^2 + s_{XY}^2 * s_{MY}^2} \qquad (1)$$

The test of the indirect effect is given by dividing $b_{XM} * b_{MY}$ by the above standard error and treating the ratio as a Z test (i.e., larger than 1.96 in absolute value is significant at the .05 level).

However, different versions of the above standard error have been published (Baron & Kenny 1986, Goodman 1960, MacKinnon *et al.* 1995, Sobel 1982). The above formula (Goodman I) is a population formula (Baron and Kenny 1986, Goodman 1960). In the Goodman II version of the test the third term is subtracted for an unbiased estimate of the variance of the mediated effect, which can sometimes have the unfortunate effect of yielding a negative variance estimate. Sobel (1982) presented an approximation of the above formula without the last term. The formulas only differ in the last term and its size is usually trivial in that it depends on sample size squared whereas the other terms depend only on sample size. Baron and Kenny (1986) recommended using the Goodman I version of the Sobel test because it does not make an unnecessary assumption that the product of s_{XM} and s_{MY} would be negligible small. MacKinnon *et al.* (1995) analyzed these tests using simulation and concluded that the Sobel test and the Goodman I test performed best in their analysis and converged

closely with sample sizes greater than 50. In this dissertation, the first version (Goodman I) of the mediation test is used (Baron & Kenny 1986, Goodman 1960). The formula is

$$Goodman\ I\ test:\ Z\ value = \frac{b_{XM}{}^2 * b_{MY}{}^2}{\sqrt{b_{MY}{}^2 * s_{XM}{}^2 + b_{XM}{}^2 * s_{MY}{}^2 + s_{XY}{}^2 * s_{MY}{}^2}} \qquad (2)$$

4.3.4 Structural Equation Modeling

Structural equation modeling is a multivariate method that can be used to examine a set of regression equations simultaneously (Bollen 1989, Hair *et al.* 1998:584). Structural equation modeling may be used as a more powerful alternative for instance to multiple regression, path analysis, factor analysis, time series analysis, and analysis of covariance. These procedures can be viewed as special cases of structural equation modeling which is an extension of the general linear model.

Structural equation modeling has some advantages compared to multiple regression including for instance more flexible assumptions, use of confirmatory factor analysis to reduce measurement error by having multiple indicators per latent variable, overall testing of the model fit rather than coefficients individually, the ability to test models with multiple dependent variables, the ability to model mediating variables, the ability to model error terms.

Structural equation modeling is normally viewed as a confirmatory rather than exploratory procedure (Byrne 2001:3). Structural equation modeling uses goodness-of-fit tests to determine if the pattern of variances and covariances in the data is consistent with the hypothesized structural model specified a priori. Structural equation modeling can also be used to test two or more causal models to determine which has the best fit (Loehlin 1987). Because structural equation modeling cannot itself draw causal arrows in models or resolve causal ambiguities, theoretical insight and judgment by the researcher is critically important.

Interpretation of the Results in Structural Equation Modeling

The fit of a structural equation model is a multidimensional concept and should therefore be examined from a variety of perspectives. The examination of model fit includes the assessment of the parameter estimates and the model as a whole. The procedures used to examine the model fit in the present study are discussed below in more detail.

Parameter estimates. Byrne (2001:75) summarizes three areas of assessment on parameter estimates: (1) the feasibility of the parameter estimates, (2) the appropriateness of standard errors, and (3) the statistical significance of the parameter estimates.

The first step when assessing the model fit on the parameter estimate level is the examination of the *feasibility of the parameter estimates*. Parameters should have the

correct sign and size according to the underlying theory. Clear examples of unreasonable estimates include correlations >1.00, negative variances, and covariance or correlation matrices that are not positively definite (Byrne 2001).

The second step in the determination of the model fit on the parameter estimate level is the assessment of the appropriateness of the standard errors. Standard errors that are either excessively large or small are indicative of poor model fit (Byrne 2001). However, this assessment is subjective because the magnitude of standard errors is dependent on the unit of measurement and the parameter estimates.

The third step in the assessment of the model fit on the parameter estimate level is the examination of the statistical significance of the parameter estimates. Non-significant parameter estimates, with the exception of error variances, can be considered unimportant for the model. However, it should be noted that sample size influences the significance of the parameters (Byrne 2001).

These three steps were followed in the analyses carried out in the present study.

The model as a whole. When examining the fit of the model as a whole, multiple indices are typically used to determine the model fit. Table 4-9 describes the goodness-of-fit measures used in this study.

Table 4-9 Goodness-of-fit criteria in structural equation modeling used in this study

Criterion	Description	Interpretation
Chi-square	Calculation of difference between observe and estimated covariance matrices	p>.05 for model to be acceptable; sensitivity to sample size
Normed Chi-square	Chi-square adjusted for degrees of freedom	Recommendation between 1.0 and 2.0
Goodness of fit index (GFI)	Predicted squared residuals compared with obtained residuals, not adjusted by degrees of freedom	Range between 0 (no fit) to 1.0 (perfect fit); recommendation above .90
Non-Normed fit index (NNFI) (= Tucker and Lewis' index / TLI)	Proposed model compared with the null model, adjusted by degrees of freedom	Range between 0 (no fit) to 1.0 (perfect fit); recommendation above .90
Comparative fit index (CFI)	Proposed model compared with the null model, adjusted by degrees of freedom	Range between 0 (no fit) to 1.0 (perfect fit); recommendation above .95
Akaike information criterion (AIC)	Compares models with different number of constructs	Values closer to zero indicate better fit and greater parsimony
Root mean square error of approximation (RMSEA)	Discrepancy per degree of freedom	Values below .08 are acceptable

One of the commonly used measures of model fit is the chi-square test where the predicted covariance matrix is tested for statistical difference from the original covariance matrix. If the difference is statistically insignificant, the model fit is considered to be good.

Besides the chi-square test, there are many other indices used in the testing of model fit. *Normed chi-square* adjusts the chi-square by the degrees of freedom. Values between 1.0-2.0 are considered to indicate a good fit (Hair *et al.* 1998).

Goodness of fit index (GFI) is calculated by comparing the predicted squared residuals with the obtained residuals. This measure is for absolute fit, and not adjusted by degrees of freedom. The range of this index is between 0 (no fit) and 1.0 (perfect fit). Models with GFI is above .90 are considered to have a good fit. This index has been argued to be insufficient because, for example, it is overly influenced by sample size (Fan *et al.* 1999).

Non-normed fit index (NNFI) compares the proposed model with a null model. This index is also called Tucker and Lewis' index (TLI). NNFI is adjusted by degrees of freedom and ranges between 0 (no fit) and 1.0 (perfect fit). Models with NNFI above .90 have traditionally been considered to have a good fit. However, it should be noted that when the sample size is small, the NNFI tends to reject correct models too easily (Hu and Bentler 1999).

Comparative fit index (CFI) compares the proposed model to the null model. This index is also adjusted by the degrees of freedom. Also CFI ranges between 0 (no fit) and 1.0 (perfect fit) Models with CFI above .90 are considered to have a good fit (Bentler 1992). However, the recent research recommends higher cut-off value close to .95 (Hu & Bentler 1999).

Akaike information criterion (AIC) compares models with different number of constructs. AIC is based on information theory. Values closer to zero indicate better fit and greater parsimony. When comparing different models, the model with the lowest AIC is considered to have the best fit (Akaike 1987).

Root mean square error of approximation (RMSEA) measures the discrepancy per degree of freedom. Values less than .05 are considered to be good and values ranging from .05-.08 are considered to be acceptable (Browne & Cudeck 1993:144, MacCallum *et al.* 1996). However, Hu and Bentler (1999) cautioned that when the sample size is small, the RMSEA tends to reject correct models too easily.

Model misspecification. Finally, after the assessment of the model on the parameter estimate level and the model as a whole, the potential model misspecification is examined. The residual covariance matrix is the discrepancy between the restricted hypothesized model and the sample covariance matrix. Each residual represents the difference between the observed and hypothesized parameter estimate. Large residuals indicate potential misfit in the model. Because the magnitude of residuals is dependent on the measurement units, standardized residuals are typically used in this analysis. Standardized residuals, being defined as fitted residuals divided by their asymptotical standard errors, are analogous to Z scores (Byrne 2001). Jöreskog and Sorbom (1988) suggested a cut-off value of 2.58 residuals to be considered large. In order to identify signs of potential misspecification, residuals are examined in the present study following the above guideline.

Structural equation model is often used to combine confirmatory factor analysis and path analysis. Various processes have been proposed for doing this (Anderson & Gerbing 1988, Mulaik & Millsap 2000). In the present study, a relatively small sample

size prevents the use of these techniques. Instead, path analysis was carried out using separately validated summated scales employing structural equation modeling.

In line with some other recent studies (e.g. Zahra *et al.* 2000a), the present study used multiple regression analysis with summated scales as the primary analytical method. However, the multiple regression analyses were supplemented with path analyses carried out using structural equation modeling in order to test all the hypotheses simultaneously and to test that there are no other important paths in the model. Path analysis using structural equation model thereby enables a test of the whole model and thereby adds to the multiple regression analyses. The use of two methods to carry out the analyses increases the robustness of the results and conclusions.

4.4   Construct Operationalizations

This section discusses the operationalization of the constructs of the three sub-models tested in this dissertation. The section discusses the selection of the measurement items, inter-item reliability, results of the confirmatory factor analyses and descriptive statistics.

Whenever an objective measure was not available, constructs were operationalized as multi-item scales (Spector 1992). Whenever possible these constructs and their measurement items were derived from existing research. All statement-style items were measured on a scale from 1 (strongly disagree) to 7 (strongly agree). Confirmatory factor analysis and Cronbach's alpha tests were used to test the unidimensionality and inter-item reliability of the measures. Furthermore, the reliabilities of the key dependent variables were measured through test-retest analysis.

The variables in the model of value-added mechanisms and the dependent variables in the resource and knowledge acquisition model and in the endorsement model are
- Perceived value-added
- Resource acquisition
- Knowledge acquisition
- Endorsement
- Controls: firm age, firm size, industry sub-sector

The independent variables in the resource and knowledge acquisition model are
- Complementarities
- Social interaction
- Controls: firm age, firm size, industry sub-sector

The independent variables in the endorsement model are
- Complementarities (discussed in the resource and knowledge acquisition model)
- Investor prominence
- Customer switching costs
- Venture age

- Controls: firm size, industry sub-sector

4.4.1 Variables in the Model of Value-added Mechanisms

Value-added

There is little research examining the value-added provided by corporate venture capitalists for their portfolio companies. Some of the few studies (Gompers & Lerner 1998, Maula & Murray 2000a) examine the relationship between the existence of specific types of corporate venture capitalists and the probability of making an initial public offering or market valuation at the initial public offering. However, the starting point for this study was the general finding in the above mentioned previous studies that co-existence of corporate venture capital investors in addition to independent venture capitalists was in general associated with improved performance. The purpose of this study is to create a deeper understanding of the value-adding mechanisms and the factors influencing them. Creating this understanding while relying on secondary data would be difficult because of the lack of suitable data and measures for many of the important constructs (Das & Teng 2000). The research strategy was to rely on primary data collected from key informants, CEOs of technology-based new firms (John & Reve 1982).

In the model of value-added mechanisms, the dependent variable is the value-added perceived by the CEOs of the sample companies. The use of survey-based measures has recently been warranted (Das & Teng 2000:53). While reliance on dependent variables operationalized using perceptual data may introduce problems, perceptual measures have been argued to be well-suited to the measurement of the performance and value creation of interorganizational relationships. Providing empirical support for the reliability of perceptual measures in measuring the value-added provided by venture capitalists, Sapienza (1992), and Sapienza and Gupta (1994) demonstrated high correlation between perceptual value-added measures and venture performance validated by later objective measures and high inter-rater reliability between venture capitalists and entrepreneurs on both sides of the dyads. Similarly, the reliability of perceptual measures has been argued and shown to be good in many of the studies examining analogous situations such as performance of strategic alliances (Bucklin & Sengupta 1993, Saxton 1997, Weaver & Dickson 1998), joint ventures (Geringer & Hebert 1989, 1991, Lyles & Salk 1996), and performance in vertical supplier-customer relationships (Anderson & Narus 1990, Heide & John 1990, Mohr & Spekman 1994, Yli-Renko *et al.* 2001a). The use of perceptual measures in many of the studies has been based on the notion that success is determined, in part, by how well the partnership achieves the performance expectations set by the partners (Anderson & Narus 1990, Mohr & Spekman 1994, Saxton 1997, Weaver & Dickson 1998).

Following the traditions in research on the performance implications of interorganizational relationships, I measured the overall value-added using a multi-

item scale measuring the overall satisfaction of the key informants. The value-added construct measures the value-added provided by the corporate venture capital investors as perceived by the start-up CEOs. The construct was operationalized using three measurement items. The measurement items and factor loadings are presented in Table 4-10. The factor loadings are all above .83. The Cronbach's alpha inter-item reliability coefficient for this construct is .87.

Table 4-10   Measurement items and factor loadings for the value-added construct

Measurement item	Loading
This investor has provided us valuable value-adding support in addition to the financing	.93
The value-adding support provided by this investor has been critical for our success	.91
We are very happy about having this investor	.83

Principal Component analysis, Unrotated

The descriptive statistics of the dependent variable in the model of value-added mechanisms is presented in Table 4-11.

Table 4-11   Descriptive statistics of the dependent variable in the model of value-added mechanisms

	Mean	Median	Std.Dev.	Min	Max	N
Perceived value-added	4.67	5.00	1.66	1.00	7.00	91

To ensure the reliability of the construct a follow-up survey was administered for the original respondents six months after the original survey. The original value-added construct and the 6 months lagged construct were highly correlated ($r = .576$, $p \leq .001$) suggesting good reliability for this construct. Furthermore, a one-way ANOVA, using firm identity as the independent variable, revealed that between firm-variance was significantly greater than within-firm variance ($p \leq .001$), indicating significant agreement between the original and the lagged ratings (Amason 1996, Autio *et al.* 2000). Together, these tests provided additional evidence of construct validity.

Constructs Measuring the Value-added Mechanisms

In the model of value-added mechanisms, the independent variables are resource acquisition, knowledge acquisition, and endorsement. The control variables are age, size, and the industry sector indicators. The descriptive statistics of the independent variables in the model of value-added mechanisms are presented in Table 4-12.

Table 4-12   Descriptive statistics of the independent variables in the model of value-added mechanisms

	Mean	Median	Std.Dev.	Min	Max	N
Resource acquisition (production)	3.08	2.75	1.69	1.00	7.00	88
Resource acquisition (distribution)	3.56	3.50	1.93	1.00	7.00	87
Knowledge acquisition	4.30	4.40	1.63	1.00	7.00	91
Endorsement	5.32	5.50	1.42	1.50	7.00	90
Venture age	2.93	2.76	1.33	0.67	6.00	91
Venture size (employees), logarithm	4.46	4.41	0.79	2.48	6.40	88

The confirmatory factor analysis was conducted simultaneously for all the value-added mechanisms. The factor analysis identified the correct number of factors with lambdas above one. The included measurement items loaded higher that .60 in the primary factor and lower or equal than .40 on any other factor except for two measurement items. These two measurement items were measures of the acquisition of production related resources and loaded above .40 on the distribution type resource acquisition construct (.43 and .48). Table 4-13 presents the measurement items and factor loadings for all the value-added mechanisms.

Table 4-13 Measurement items and factor loadings for the resource acquisition, knowledge acquisition, and endorsement constructs

Measurement Item	Resource acquisition (production)	Resource acquisition (distribution)	Knowledge acquisition	Endorsement
Acquisition of production-related resources				
This corporate investor has been valuable in opening access to their production facilities	.62	.48	.23	.09
This corporate investor has been valuable in letting us use their technology	.87	.07	.18	.17
This corporate investor has been valuable in opening access to their R&D	.84	-.06	.28	.14
This corporate investor has been valuable in helping us acquire their products/services at a lower cost	.74	.43	-.01	.18
Acquisition of distribution-related resources				
This corporate investor has been valuable in opening access to sell to their customers	.17	.72	.32	.33
This corporate investor has been valuable in opening access to their distribution channels	.14	.88	.22	.19
Knowledge acquisition				
From this investor, we have obtained valuable market knowledge	.08	.14	.87	.19
From this investor, we have obtained valuable information on competition	.20	.15	.79	.09
This investor has been an important source of information/know how for us on customer needs and trends	.16	.07	.84	.17
This investor has been an important source of information/know how for us on competition in our field	.07	.20	.85	.14
We have learnt or acquired some new or important information from this investor	.24	.16	.73	.30
Endorsement				
We have actively used the name of this investor in order to be more credible when raising money from other investors	.10	.10	.10	.74
We have actively used the name of this investor in order to be more credible when recruiting new employees	-.02	.13	.20	.88
We have actively used the name of this investor in order to be more credible when trying to attract new partners/suppliers	.30	.18	.22	.80
We have actively used the name of this investor in order to be more credible when trying to attract new domestic customers	.25	.20	.23	.79

Principal Component analysis with Varimax Rotation

Resource Acquisition

Resource acquisition refers to the concrete resources the start-up company has acquired or got access to through the investment relationship. Resource acquisition is further divided into resources related to production and technology and resources related to marketing and distribution of the products.

Acquisition of production-related resources. The measurement items covered resources including production facilities, technology, R&D and the possibility of acquiring products or services at a lower cost. The measurement items and factor loadings are presented in Table 4-13. All items loaded on the factor with factor loadings higher than .62 suggesting a good convergent validity. The Cronbach's alpha inter-item reliability coefficient for this construct is .86.

The reliability of the construct was also tested by a follow-up survey administered to the original respondents six months after the original survey. The original acquisition of production-related resources construct and the lagged item measuring resource acquisition were highly correlated ($r = .527$, $p \leq .01$), suggesting good reliability for this construct. Furthermore, a one-way ANOVA, using firm identity as the independent variable, revealed that between-firm variance was significantly greater than within-firm variance ($p \leq .001$), indicating significant agreement between the original and the lagged ratings and providing additional evidence of construct validity.

Acquisition of distribution-related resources The measurement items covered resources such as distribution channels. The measurement items and factor loadings are presented in Table 4-13. All items loaded on the correct factor with factor loadings higher than .72 suggesting a good convergent validity. The Cronbach's alpha inter-item reliability coefficient for this construct is .83.

The reliability of the construct was also tested by a follow-up survey administered for the original respondents six months after the original survey. The original acquisition of distribution-related resources construct and the lagged item measuring resource acquisition were highly correlated ($r = .611$, $p \leq .001$), suggesting good reliability for this construct. Furthermore, a one-way ANOVA, using firm identity as the independent variable, revealed that between-firm variance was significantly greater than within-firm variance ($p \leq .001$), indicating significant agreement between the original and the lagged ratings and providing additional evidence of construct validity.

Knowledge Acquisition

In contrast to resource acquisition, which refers to accessing concrete resources of the corporate investor through the investor relationship, knowledge acquisition refers to the learning benefits realized in the investor relationship. Start-up companies may learn from their corporate investor about markets, for instance, and customer needs, competition, and technological issues.

The knowledge acquisition construct was defined using five indicators. The items were adopted from Yli-Renko *et al.* (2001a) and Kale *et al.* (2000) and modified slightly to fit the context of the present study. The knowledge acquisition construct is in line with Huber's (1991:97) 'grafting' process of organizational learning. The measures of the knowledge acquisition construct cover acquisition of knowledge on market trends, customer needs, and competition.

The measurement items and factor loadings are presented in Table 4-13. All items loaded on the correct factor with factor loadings higher than .73, suggesting a good convergent validity. The Cronbach's alpha inter-item reliability coefficient for this construct is .91.

The reliability of the construct was also tested by a follow-up survey administered for the original respondents six months after the original survey. The correlation between the summated scale of original responses and the follow-up measurement-item was high ($r = .626$ $p \leq .001$), suggesting good reliability for this construct. Furthermore, a one-way ANOVA, using firm identity as the independent variable, revealed that between-firm variance was significantly greater than within-firm variance ($p \leq .001$), indicating significant agreement between the original and the lagged ratings and providing additional evidence of construct validity.

Endorsement

Endorsement refers to the help the association with a large corporation brings in the form of increased legitimacy when attracting new investors, employees, partners, and customers. Endorsement was operationalized using four items measuring the reputational benefits the start-up company has received from the association with the investor.

Endorsement benefits were operationalized using four measurement items. The measurement items and factor loadings are presented in Table 4-13. All the measurement items loaded on the correct factor and had factor loadings of .74 or higher. The Cronbach's alpha inter-item reliability coefficient for this construct is .88.

The reliability of the construct was tested by a follow-up survey administered for the original respondents six months after the original survey. The correlation between the summated scale of original responses and the follow-up measurement-item was high ($r = .572$, $p \leq .001$), suggesting good reliability for this construct. Furthermore, a one-way ANOVA, using firm identity as the independent variable, revealed that between-firm variance was significantly greater than within-firm variance ($p \leq .001$), indicating significant agreement between the original and the lagged ratings and providing additional evidence of construct validity.

4.4.2 Independent Variables in the Resource and Knowledge Acquisition Model

In the resource and knowledge acquisition model, the independent variables are complementarities and social interaction. The control variables are age, size, and industry sector indicators. The descriptive statistics of the independent variables in the resource and knowledge acquisition model are presented in Table 4-14.

Table 4-14   *Descriptive statistics of the independent variables in the resource and knowledge acquisition model*

	Mean	Median	Std.Dev.	Min	Max	N
Complementarities	4.94	5.33	1.67	1.00	7.00	88
Social interaction	4.09	4.33	1.77	1.00	7.00	90
Venture age	2.93	2.76	1.33	0.67	6.00	91
Venture size (employees), logarithm	4.46	4.41	0.79	2.48	6.40	88

Complementarities

Literature espousing the resource-based view stresses the strategic importance of exploiting complementarities in resources and capabilities. In addition to resources and capabilities, complementarities can also stem from the product or service offerings of two companies (Amit and Zott 2001, Brandenburger & Nalebuff 1996). Amit and Zott (2001) argued that complementarities are present whenever having a bundle of goods together provides more value than the total value of having each of the goods separately. Similarly, Brandenburger and Nalebuff (1996) stated that, "a player is your complementor if customers value your product more when they also have the other player's product than when they have your product alone" (1996:18). Complementors are players from whom customers buy complementary products or to whom suppliers sell complementary resources (Brandenburger & Nalebuff 1995). As an example, hardware and software companies are classic complementors. Faster hardware increases users' willingness to pay for more powerful software. More powerful software, such as the latest Microsoft Office, increases the users willingness to pay for faster hardware (Brandenburger & Nalebuff 1995). In this research, complementarities are examined both in resources and capabilities as well as in the products and services offered to customers.

In order to capture the wide range of complementarities, the construct was defined using six indicators covering complementarities both in resources and/or capabilities and in products and/or services. Only one factor with lambda over 1.0 emerged in the factor analysis indicating good construct validity. The factor loadings were all above .70 for this construct. The measurement items and factor loadings of this construct are presented in Table 4-15. The Cronbach's alpha inter-item reliability coefficient for this construct is .88.

Table 4-15   Measurement items and factor loadings for the complementarities construct

Measurement item	Loading
Our products/services facilitate the use of the products/services for our largest corporate investor	.80
Our products/services complete a solution set that the customers of our largest corporate investor are demanding	.79
Increase in the demand for our products/services increases the demand for the corporate investor's products/services	.75
Our products/services are highly complementary with the products/services of our largest corporate investor	.87
Our capabilities/skills are highly complementary with the capabilities/skills of our largest corporate investor	.87
We have superior capabilities/skills in some areas compared to our largest corporate investor	.70

Principal Component analysis, Unrotated

Social Interaction

Social interaction was defined using four indicators measuring various facets of the social interaction between the venture and the corporate venture capital investor. The measurement items and factor loadings of this construct are presented in Table 4-16.

Table 4-16   Measurement items and factor loadings for the social interaction construct

Measurement item	Loading
How often you are in contact with this investor? (Seven-point scale from "every day" to "less often than once a quarter")	.68
We know this investor's people on a personal level	.84
We maintain close social relationships with this investor	.90
We often meet this investor's people informally	.89

Principal Component analysis, Unrotated

The first item, frequency of interaction, was adopted from Sapienza (1992) and Sapienza and Gupta (1994). The three other items (knowledge of investor's people on personal level, closeness of the relationship, and informal meetings) have earlier been used by Tsai and Ghoshal (1998) and Yli-Renko *et al.* (2001a) in measuring social interaction in organizational relationships building on Nahapiet and Ghoshal (1998). The factor loadings were all above .68 in this construct. The Cronbach's alpha inter-item reliability coefficient for this construct is .85.

Control Variables

Firm age was measured in years since founding on the basis of information provided by the respondents.

Firm size was measured as number of employees at the end of 2000 according to the information provided by the respondents. Number of employees was used instead of revenues because many of the young (mean age 2.93 years) firms did not have revenues. The logarithm of the number of employees was used in the modeling.

Firm industry sector. Industry effects were controlled in the multiple regression analyses by including dummy variables in the analyses.

4.4.3 Independent Variables in the Endorsement Model

In the endorsement model, the independent variables are investor prominence, resource acquisition, venture age, customer-switching costs, while the control variables are size, and the industry sector indicators. The descriptive statistics of the independent variables in the endorsement model are presented in Table 4-17.

Table 4-17   Descriptive statistics of the independent variables in the endorsement model

	Mean	Median	Std.Dev.	Min	Max	N
Investor prominence (corporate sales 2000, logarithm)	8.96	9.39	2.06	3.06	12.13	91
Resource acquisition (production)	3.08	2.75	1.69	1.00	7.00	88
Resource acquisition (distribution)	3.56	3.50	1.93	1.00	7.00	87
Venture age	2.93	2.76	1.33	0.67	6.00	91
Customer switching costs	5.39	5.67	1.27	1.67	7.00	88
Venture size (employees), logarithm	4.46	4.41	0.79	2.48	6.40	88

Investor Prominence

Investor prominence is operationalized as the size of the corporate investor. The size of the parent corporation (measured in the logarithm of revenue in 2000) is considered to be a proxy of the influence the parent corporation has in the industry in which it operates (Mitchell & Singh 1992, Stuart 2000).

In some research, other operationalizations of partner prominence have also been used. For instance, some earlier studies have used Fortune Magazine reputation measures. However, researchers have later discouraged their use because of lack of underlying theory (Deephouse 2000, Fombrun & Shanley 1990, Saxton 1997). Some other alternative measures have included market share. However, market share data is hard to come by and is not suitable for multi-industry studies. In the present study, a further difficulty stems from the fact that some of the corporate investors are global or foreign, which makes it difficult to gather comparable figures for more fine-grained measures than revenues.

There is a long tradition using corporate revenues as a measure of prominence and industry strength (Mitchell & Singh 1992, Stuart 2000). For the purposes of the present study, revenue of the parent corporation was seen as the best measure of the prominence and industry strength. Revenues were available for all corporations. Following Mitchell & Singh (1992), the logarithm of total corporate sales was used in the final operationalization.

Resource Acquisition

Resource acquisition was explained above in the discussion of the constructs of the model of the value-added mechanisms and is therefore not discussed here.

Firm Age

Firm age was measured in years since founding on the basis of information provided by the respondents. I measured the age of the company as a proxy for uncertainty according to the asymmetric information literature. The younger the company is, the more uncertain are the prospects of the company. In empirical studies examining the impact of asymmetric information and endorsement on the initial returns, age has been found to be negatively correlated with gross spreads and initial returns. This measure is also in line with the social capital literature definition of *liability of newness* (Stinchcombe 1965, Freeman *et al.* 1983, Aldrich & Auster 1986). Age has also been used in the other analogous studies that have examined endorsement as a proxy for uncertainty (Stuart *et al.* 1999, Stuart 2000).

Customer Switching Costs

The nature of the business has been argued to be an important determinant of the easiness for potential customers to adopt the product from an alternative supplier. The ideas advocated in the present study is that the higher the switching costs and the importance of the product, the higher the risks for potential customers to select a technology-based new firm as a supplier, and the more difficult it is therefore for these ventures to attract partners and customers. Endorsement by prominent corporations is seen as a mechanism making potential customers and partners to accept the risks. Swaminathan *et al.* (2001) examined the U.S. automotive industry between 1918-1942 and found that suppliers of architectural goods (lower switching costs) benefited more from high-status customers than suppliers of modular goods (lower switching costs).

In the present study, customer-switching costs were defined using four indicators. The factor loadings were all above .63 for this construct. The measurement items and factor loadings of this construct are presented in Table 4-18. The Cronbach's alpha inter-item reliability coefficient for this construct is .77.

Table 4-18   Measurement items and factor loadings for the customer switching costs construct

Measurement item	Loading
Buying our products/services is a major decision for our customers	.90
Our products/services are very important for the customers	.80
It is expensive for customers to switch to or from using our products/services	.63
Face-to-face discussions with customers are important when selling our product/service	.80

Principal Component analysis, Unrotated

Control Variables

Firm size was measured as employees at the end of 2000 according to the information provided by the respondents. Number of employees was used instead of revenues because many of the young (mean age 2.93 years) firms did not have revenues. The logarithm of the number of employees was used in the modeling.

Firm industry sector. Industry effects were controlled in the multiple regression analyses by including dummy variables in the analyses.

4.5 Reliability and Validity Analysis

In the dissertation, a considerable amount of attention has been given for ensuring the reliability and validity of the results. The hypotheses have been developed based on received theories. Related earlier research has been used when developing the constructs and measurement items. Most reliable available data sources have been used, and the primary data collected in this research has been validated both through external validation and by re-testing some measures. Statistical methods have been carefully selected and employed after ensuring fulfillment of the assumptions. Finally, results and conclusions have been carefully analyzed to ensure their feasibility. In the following section, the various elements of reliability and validity are reviewed in more detail (Carmines & Zeller 1979, Litwin 1995, Nunnally 1978, Venkatraman & Grant 1986). A summary of the elements is presented in Table 4-19. In the following sections, how each of these elements has been taken into account in the research is discussed.

Table 4-19   Elements of reliability, validity, and generalizability

Reliability	• Reliability of data sources
	• Reliability of measures
Validity	• Face validity: construct conforms to common understanding of the concept
	• Content validity: construct covers all relevant facets of the concept
	• Construct validity: construct theoretically reflects the phenomenon under study
	• Convergent validity: different measures of the same construct are correlated
	• Discriminant validity: constructs of the study are conceptually distinct
	• Criterion-related validity: results are in consonance with theory and previous results
	• Concurrent validity: measure is associated with previously validated measure
	• Predictive validity: measure predicts another measure as predicted in theory
Generalizability (external validity)	• Representativeness
	• Generalizability to other contexts

4.5.1 Reliability

Reliability refers to the extent the results of the measurement can be replicated. Reliable measurement values are close to their "true" values with little measurement error. In survey studies, repeated measures are not common. However, in the present study, a follow-up survey was carried out six months after the previous first one. In addition to this test-retest procedure, several other methods were used to ensure the reliability. Two dimensions of reliability are explicitly discussed in the next chapters (1) reliability of the empirical data, and (2) reliability of the constructs.

Reliability of the Empirical Data

Reliability of the empirical data refers to the extent how reproducible the measurement is (Litwin 1995:6). The analyses in the present study are primarily based on primary data collected from the CEOs of technology-based new firms because of the lack available secondary data covering the measures of interest of this study. Several steps were taken to ensure the reliability of the single-respondent, self-reported data.

First, in order to maximize the reliability of the data colleted by survey, the surveys were administered to key informants (John & Reve 1982), CEOs of the firms, who can be considered to be knowledgeable of investment relationships of their firms. In new ventures, the CEO has typically the closest working relationship with the equity investors. No other person in new ventures can be expected to be equally knowledgeable of the investor relationships and their influences on firm performance.

Second, the questionnaire instrument was carefully designed with several rounds of revisions. The questionnaire was tested with several CEOs and also with several corporate venture capital investors and researchers familiar with the research questions (Fowler 1993:100-102, Spector 1992). Several interviews and the pre-testing of the questionnaire gave confidence to expect that the respondents would not have problems understanding the questions and that they would be knowledgeable about the issues covered by the questionnaire.

Third, the quality of the data appeared to be good. There were very few missing values in the data (only 2.29% of the measurement items used in the present study). The influence of missing values appeared to be insignificant.

Fourth, a follow-up survey was carried out six months after the original survey (Carmines & Zeller 1979:37-40, Litwin1995:8-13, Nunnally 1978:233-236). The responses were compared both by correlation analysis and ANOVA analyses. The correlations were all significant. The one-way ANOVA analyses also provided further evidence of the reliability.

Fifth, the reliability of the data was also improved by complementing the primary data with various complementary sources of data and testing the reliability of the data whenever possible. For instance, the correlation between the age reported by the Venture Economics database and the respondents was very high ($r = .77$, $p \leq .001$). Furthermore, a one-way ANOVA, using firm identity as the independent variable, revealed that between-firm variance was significantly greater than within-firm variance ($p \leq .001$), indicating significant agreement between the self reported figures and the Venture Economics data base.

Reliability of the Constructs

Reliability of the constructs refers to the extent the measurement of the constructs can be considered as reliable. Multi-item scales were used to measure most of the constructs (Spector 1992). Two main methods were used to examine the reliability of

the measurement of the constructs: (1) inter-item reliability of the constructs and (2) test-retest reliability of the constructs.

Inter-item reliability of the constructs refers to the extent measurement items in multi-item scales are correlated with each other. It reflects the degree to which the items represent a common latent unobserved construct. The inter-item reliabilities of the multi-item constructs were tested using the Cronbach's alpha measure. These measures were .77 or more for all constructs in the analysis. The common threshold value for Cronbach's alpha is .70 (Nunnally 1978). Therefore, all the multi-item constructs appear on the basis of this analysis to be highly reliable. The results of the confirmatory factor analyses and Cronbach's alphas of the constructs were reported in Chapter 4.4. The constructs are summarized in Table 4-20.

Table 4-20   Summary of the constructs

Construct	Number of measurement items	Cronbach's alpha	N
Perceived value-added	3	.87	91
Resource acquisition (production)	4	.86	88
Resource acquisition (distribution)	2	.83	87
Knowledge acquisition	5	.91	91
Endorsement	4	.88	90
Social interaction	4	.85	90
Complementarities	6	.88	88
Investor prominence (corporate sales, logarithm)	1	-	91
Customer switching costs	4	.77	88
Firm age (years)	1	--	91
Firm size (employees)	1	--	88

Test - re-test reliability of the constructs refers to the extent the constructs are reliable in two or more independent tests. In this study, the key dependent variables were re-tested in a follow-up survey six months later (Carmines & Zeller 1979:37-40, Litwin1995:8-13, Nunnally 1978:233-236). For all test - re-test verifications, the correlations were high and significant. Furthermore, one-way ANOVA tests, using firm identity as the independent variable, revealed that between-firm variances were significantly greater than within-firm variances for all tested variables, indicating significant agreement between the original and the lagged ratings and providing additional evidence of the construct reliabilities.

4.5.2 Validity

Validity refers to the extent a measurement instrument does what it is intended to do (Nunnally 1978:86). In the present study, previously validated measures have been used when possible in order to improve the validity of the study. In the following, the validity of the constructs is discussed in detail divided into four dimensions: face validity, content validity, construct validity, and criterion related validity (Carmines & Zeller 1979, Litwin 1995, Nunnally 1978).

Face Validity

Face validity refers to the extent a construct conforms to the common understanding of the related concept. Face validity was ensured in several ways. First, an extensive review of the literature was carried out in order to understand the relevant concepts both in theory and in practice. Second, the constructs and measurement items were developed on the basis of previous research as far as was possible. Third, the questionnaire was developed and pre-tested with CEOs in the target group, investors, and academics with experience in the relevant fields of research. The measures are I line with common understanding of the concepts and previous literature. Therefore, the constructs should have good face validity.

Content Validity

Content validity refers to the extent "to which an empirical measurement reflects a specific domain of content" (Carmines & Zeller 1979:20, Venkatraman & Grant 1986). Construct should cover all relevant facets of the concept. In this study, several methods were used to ensure and test content validity. First, extensive literature reviews were carried out in order to understand the phenomena and to identify the most important facets of the constructs. The constructs were developed based on previous research and discussions with entrepreneurs and investors. Second, most of the constructs were operationalized using multiple measurement items in order to improve content validity. Content validity was kept in mind when developing the constructs and items measuring the constructs. Third, the questionnaires were also pre-tested with several CEOs of technology-based new firms, investors, and researchers familiar with the research questions. The content validity and the comprehensiveness of the measurement items in measuring the constructs are discussed in more detail in the chapters discussing the construct operationalization.

Construct Validity

Construct validity refers to the extent to which an operationalization measures the concept it is supposed to measure (Bagozzi *et al.* 1991). Construct validity can be assessed employing confirmatory factor analysis (Bagozzi *et al.* 1991, Spector 1992). In this study, confirmatory factor analysis was employed to confirm the unidimensionality of the multi-item constructs. Confirmatory factor analysis indicated that only one factor was represented in each set of items measuring a construct and that items measuring different constructs did not load on a common factor. In a more in-depth analysis, construct validity can be divided in two dimensions that are tested separately: (1) convergent validity and (2) discriminant validity.

Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement (Bagozzi *et al.* 1991, Venkatraman & Grant 1986). Two or more measures of the same concept should covary highly if they are valid measures of the concept (Bagozzi *et al.* 1991). In this study, several methods were used to ensure

and test convergent validity. First, earlier validated constructs and measurement items were used whenever possible. Second, new constructs and measurement items were developed on the basis of theory and earlier related research. Third, measurement item level correlation matrices were examined in order to identify potentially low correlations among measurement items belonging to the same constructs. Within-factor measurement item correlations were found to be high, with 79% of the within factor inter-item correlations above .50, and all of them exceeding the recommended cut-off value of .30 (Hair *et al.* 1998:118). Fourth, confirmatory factor analysis was carried out. All the remaining measurement items load .62 or higher on their primary factor, clearly exceeding the common threshold value of .50 (Hair *et al.* 1998:111).

Discriminant validity is the degree to which measures of different constructs are distinct (Bagozzi *et al.* 1991, Venkatraman & Grant 1986). If two or more concepts are unique, then valid measures of each should not correlate too highly (Bagozzi *et al.* 1991). In this study, several methods were used to ensure and test discriminant validity. First, earlier validated constructs and measurement items were used whenever possible. Second, new constructs and measurement items were developed based on theory and earlier related research. Third, measurement item level correlation matrices were examined in order to identify potentially high correlations among measurement items belonging to different constructs. Inter-factor measurement item correlations were found to be low (94% were below .50). Fourth, confirmatory factor analysis was carried out. All the included measurement items loaded .40 or below on other factors than their primary factor, except for two items of the construct measuring the acquisition of production related resources loaded.43 and .48 on the factor measuring acquisition of distribution related resources. The common threshold value acceptable for loadings on other than primary factors is .40 or lower.

Furthermore, in order to ensure common method variance (Avolio *et al.* 1991, (Podsakoff & Organ 1986) does not undermine the results, I also examined the possibility of common method variance using Harman's single factor test as suggested by Podsakoff & Organ (1986). Inclusion of all the items used in the multi-item scales yielded 8 factors with an eigenvalue of over 1.00. The first factor explained 33% of the variance. Based on this analysis, it appears that common method variance is not a serious threat to the validity of this study.

Criterion-Related Validity

Criterion-related validity refers to the extent results are in consonance with theory and previous results. Criterion-related validity can be divided in two dimensions: (1) concurrent validity, and (2) predictive validity.

Concurrent validity refers to the extent the measure is associated with previously validated measures (Litwin 1995:37). There are some earlier validated measures in the study that can be used to determine the concurrent validity. In the measure of social interaction, two of the measures had been validated by Yli-Renko *et al.* (2001a) and

Tsai and Ghoshal (1998). These measures correlated significantly in the present study, indicating concurrent validity. Similarly, measures of knowledge acquisition were adopted from previously validated constructs and correlated significantly in the present study providing further evidence of the concurrent validity.

Predictive validity refers to the extent the measure predicts another measure as predicted in theory. Predictive validity is demonstrated in the results of the tests of the hypotheses. Results on the hypothesis testing are discussed in Chapter 5.

4.5.3 Generalizability

Generalizability refers to the extent the results of the study represent the whole population (representativeness) and the extent the results can be generalized to other contexts. The representativeness and the generalizability of the study to other contexts are discussed in detail in Chapter 6.4.1 'Limitations'.

5 RESULTS

This chapter presents the empirical results from the analyses. First, descriptive analyses of the sample companies are reported. The objective is to create a clear picture of the nature of the companies included in the analyses. Second, results from the statistical analyses are presented. The analyses are presented in three groups according to the models developed in Chapter 3: (1) model of value-added mechanisms, (2) resource and knowledge acquisition model, and (3) endorsement model. For each set of hypotheses, the correlation structure is first analyzed followed by a multiple regression analysis and mediation tests. Thereafter, an integrated model is tested using structural equation modeling.

5.1 Descriptive Analysis

The descriptive analysis is based on the survey and database variables using non-missing values. The purpose of the descriptive analysis is to give an overview of the sample firms. In this section, characteristics discussed include age, number of employees, revenues, location, industry sector, internationalization, goals, and the ownership of the sample firms.

5.1.1 Description of the Sample Firms

Age of the Sample Firms

Technology-based new firms were defined to be less than six years old. This age limit was used in the sample selection. The mean age of the sample companies is 2.9 years. 50% of the sample companies were between 1.8 to 4.1 years old at the time of the survey in the end of year 2000 (Table 5-1).

Table 5-1   Age of sample companies

Years since founding	Number of firms	Percent of non-missing
0.00-0.99	2	2 %
1.00-1.99	23	25 %
2.00-2.99	26	29 %
3.00-3.99	15	16 %
4.00-4.99	17	19 %
5.00-6.00	8	9 %
Total	91	100 %

Mean	Median	Std.Dev.	Min	Max	N
2.93	2.76	1.33	0.67	6.00	91

Size of the Sample Firms

The size of the sample firms was measured both in terms of the number of employees and revenues. The companies were small. On average, the sample companies had 117

employees, with half of the companies having less than 80 employees, and the biggest firm having 600 (Table 5-2).

Table 5-2   Number of employees of the sample companies

Number of full-time employees	Number of firms	Percent of non-missing
0 to 19	2	2.3 %
20 to 39	10	11.4 %
40 to 59	16	18.2 %
60 to 99	21	23.9 %
100 to 199	24	27.3 %
200 to 399	12	13.6 %
Over 400	3	3.4 %
Total	88	100.0 %

Mean	Median	Std.Dev.	Min	Max	N
117.55	82.00	102.06	12.00	600.00	88

The size of the sample companies was also measured in revenues. Although revenues is generally a preferred way to measure size of technology-based companies, revenues measurement was somewhat problematic in this case because many of the early-stage companies did not have revenues and some of the companies did not want to disclose their revenues. The companies that did disclose their revenues had on average 4.78 million dollars revenues in 2000. Half of the firms had $2 million or less revenue, with the highest revenue being $50 million (Table 5-3).

Table 5-3   Revenues of the sample companies

Revenue in 2000 (USD Million)	Number of firms	Percent of non-missing
No revenue	16	21.6 %
0.01 to 4.99	35	47.3 %
5 to 9.99	11	14.9 %
10 to 19.99	8	10.8 %
20 to 39.99	3	4.1 %
Over 40	1	1.4 %
Total	74	100.0 %

Mean	Median	Std.Dev.	Min	Max	N
4.78	2.00	8.38	0.00	50.00	74

Location of the Sample Firms

The geographical location of the sample companies was clustered in several key areas following the general geographical distribution of technology-based new firms in the United States. California was the most common state, with 56% of the sample companies being located there. Massachusetts was the second most common state, with 10% of the sample companies (Table 5-4).

Table 5-4   Distribution of the locations of the sample companies

State	Number of Firms	Percent of Non-Missing
California	51	56 %
Colorado	4	4 %
Connecticut	1	1 %
Georgia	1	1 %
Illinois	3	3 %
Maryland	1	1 %
Massachusetts	9	10 %
Minnesota	1	1 %
New Jersey	2	2 %
New York	5	5 %
Ohio	1	1 %
Pennsylvania	2	2 %
Texas	6	7 %
Utah	2	2 %
Washington	1	1 %
Virginia	1	1 %
Total	91	100 %

Industries of the Sample Firms

As specified earlier, the sample of technology-based new firms was drawn from the Venture Economics database, but included only companies classified as operating in high technology sectors. These high technology sectors are, on a lower level, divided in to seven categories: Biotechnology, Communications, Computer Hardware, Computer Software and Services, Internet Specific, and Medical/Health. Almost half of the sample companies operated in Internet specific sector (Table 5-5).

Table 5-5   Distribution of the industries of the sample companies

Industry Sector	Number of Firms	Percent of Non-Missing
Biotechnology	2	2 %
Communications	11	12 %
Computer Hardware	3	3 %
Computer Software and Services	16	18 %
Internet Specific	45	49 %
Medical/Health	4	4 %
Semiconductors/Other Elect.	10	11 %
Total	91	100 %

Goals of the Sample Firms

Regarding the goals of the companies, CEOs were asked to allocate 100 points across three goals: developing technology/product, maximizing sales growth, and maximizing profitability to indicate how important the goals are for their company. The three goals ranked almost equally high, with somewhat higher scores for maximizing growth than for the other goals (Table 5-6).

Table 5-6   Goals of the sample companies

Goal	Mean	Median	Std.Dev.	Min	Max	N
Developing technology/product	34.24	30.00	21.33	0.00	100.00	87
Maximizing sales growth	37.18	40.00	17.88	0.00	80.00	87
Maximizing profitability	28.67	25.00	19.56	0.00	100.00	87
Total	100.00					

However, showing the importance of growth, 54% of the CEOs agreed (17% agreeing strongly) with the statement: "Growing as fast as possible is currently the most important goal of our company." (In these descriptive analyses, the term "agree" refers to answering with a score of between 5 and 7 in statement-style questions measured on a scale from 1= strongly disagree to 7= strongly agree.)

Internationalization of the Sample Firms

At this stage of the development of the ventures, internationalization did not appear to be a key priority. A majority (55.6%) of the companies had no sales abroad. Only 30.8% of the sample companies had sales in two or more foreign countries, and 8.6% of the companies had sales in ten or more foreign countries (Table 5-7).

Table 5-7   Number of foreign countries where sample companies have sales

Number of foreign countries	Number of firms	Percent of non-missing
0	45	55.6 %
1	11	13.6 %
2	9	11.1 %
3-4	4	4.9 %
5-9	5	6.2 %
10 or more	7	8.6 %
Total	81	100.0 %

Mean	Median	Std.Dev.	Min	Max	N
2.78	0.00	9.35	0.00	80.00	81

The share of employees (full-time equivalents) based outside the U.S. further reveals the impact of the large home market of U.S. start-ups. The majority of the companies did not have any employees abroad. Only 9.5% of the ventures had 20 percent, or more, of their staff located abroad, with 64.7% having no employees abroad (Table 5-8).

Table 5-8   Share of employees of sample companies working abroad

Share of employees working abroad	Number of firms	Percent of non-missing
0%	55	64.7 %
0.01 to 4.99%	11	12.9 %
5 to 9.99%	5	5.9 %
10 to 19.99%	6	7.1 %
20 to 49.99%	6	7.1 %
50% or more	2	2.4 %
Total	85	100.0 %

Mean	Median	Std.Dev.	Min	Max	N
5.44	0.00	13.29	0.00	86.54	85

The question regarding the prioritization of internationalization as an objective produced similar results. With the scale 1-7 (1= "Strongly disagree", 7="Strongly agree") CEOs indicated that internationalization was not one of their major priorities at the time of the survey. Only 22% agreed with the statement: "Rapid internationalization is one of our major priorities at the moment". Over 25% of the CEOs strongly disagreed with this statement (Table 5-9).

Table 5-9   Internationalization of the sample companies

	Mean	Median	Std.Dev.	Min	Max	N
Rapid internationalization is one of our major priorities at the moment	3.02	3.00	1.81	1.00	7.00	87

External Equity Financing of the Sample Firms

According to Venture Economics data, these companies had received, on average, $55 million external investments by the end of 2000 (Table 5-10). On average, companies had 8.7 external professional investors. Of these, on average, 5.0 were independent venture capitalists, 2.2 corporate venture capitalists, and 1.5 were others.

Table 5-10   Cumulative amount of external equity financing

Cumulative external equity investments by 31.12.2000 (USD Million)	Number of firms	Percent of non-missing
0 to 9	5	5.5 %
10 to 19	13	14.3 %
20 to 39	27	29.7 %
40 to 59	14	15.4 %
60 to 99	18	19.8 %
100 to 149	11	12.1 %
Over 150	3	3.3 %
Total	91	100%

Mean	Median	Std.Dev.	Min	Max	N
55.18	43.00	47.08	3.50	268.34	91

5.1.2 Relationships with Corporate Venture Capital Investors

Ownership Shares of Corporate Venture Capital Investors

It was specified in the sample inclusion criteria that the sample companies should have at least one corporate venture capital investor and one independent venture capital investor. Typically, these companies had several investors. The questionnaire focused primarily on the most important corporate venture capital measured in the ownership share.

On average, the most important corporate investor (measured in ownership share) owned 9.6% of the shares of the portfolio company. In half of the sample companies the ownership share was 7% or less with the maximum being 43%. Table 5-11 presents the distribution of the ownership by the most important corporate venture capital investor.

Table 5-11   Ownership share of the largest corporate venture capital investor

Ownership share by largest corporate investor (%)	Number of firms	Percent of non-missing
0% to 1%	5	5.6 %
2% to 4%	22	24.7 %
5% to 9%	24	27.0 %
10% to 14%	16	18.0 %
15% to 19%	12	13.5 %
20% to 29%	6	6.7 %
Over 30%	4	4.5 %
Total	89	100.0 %

Mean	Median	Std.Dev.	Min	Max	N
9.63	7.00	8.10	1.00	43.00	89

Board Representation

Corporate investors have varying strategies in relation to taking board seats in their portfolio companies. A board seat gives control and enables a higher level of social interaction. However, at the same time, it exposes confidential issues to the corporate

investor and may cause legal problems for the parent corporation in case the start-up later claims that the corporate has taken unfair advantage of the knowledge learned in the board meetings. Many corporate investors prefer not to have board seats in their portfolio companies in order to avoid legal liabilities. In this sample, 31% of the start-up companies had a representative of their largest corporate investor as a board member. In 40% of the cases, corporate investor did not have a board seat but had observer rights instead. In 30%, the corporate investor had no representation on the board of their portfolio company (Table 5-12).

Table 5-12   Board representation by the largest corporate venture capital investor

Board representation	Number of Firms	Percent of Non-Missing
Board seat	28	31 %
Observer seat but no board seat	36	40 %
No representation on board	27	30 %
Total	91	100 %

Communication Frequency

On average, the respondent CEOs communicated with their corporate investors once or twice a month. 15% of the respondents communicated once a week or more often. Close to 30% of the respondents communicated once a quarter or less often with their corporate investors. Table 5-13 presents the distribution of the communication frequency between the corporate investor and the CEO of the portfolio company.

Table 5-13   Frequency of communication with the largest corporate venture capital investors

Frequency of communication	Number of firms	Percent of non-missing
Every day	2	2.2 %
Twice a week	2	2.2 %
Once a week	10	11.0 %
Twice a month	25	27.5 %
Once a month	25	27.5 %
Once a quarter	23	25.3 %
Less often	4	4.4 %
Total	91	100.0 %

Mean	Median	Std.Dev.	Min	Max	N
3.31	3.00	1.27	1.00	7.00	91

Value-added Mechanisms

Resource acquisition. A considerable share of the respondents indicated that they had received access to some concrete resources of the corporate investor. A large share of the respondents agreed with statements asking whether the largest corporate investor had been valuable in opening access to sell to their customers (41%); opening access to their distribution channels (33%); opening access to their production facilities (18%); letting start-ups use their technology (32%); opening access to their R&D (30%); and helping start-ups acquire their products/services at a lower cost (22%)

Knowledge acquisition. A large share of the respondents agreed they had received some form of learning benefits from the corporate investor. For instance, 65% of the respondents acknowledged that they had obtained valuable market knowledge from their largest corporate investor. A considerable share of the respondents also agreed that the largest corporate investor had been an important source of information/know-how as to competition in their field (52%), customer needs and trends (42%), and developing their technology (37%).

Endorsement. Perhaps the most important benefits from the corporate investor relationship have been the endorsement effect from the investor relationship with a large corporation. A clear majority of the respondents had observed these benefits. A majority of the responding CEOs agreed with the statements that they had actively used the name of the largest corporate investor in order to be more credible when raising money from other investors (84%), recruiting new employees (72%), trying to attract new partners/suppliers (76%), and trying to attract new domestic customers (61%).

Problems Experienced

At the same time, some companies agreed they had experienced some problems in their relationship with the largest corporate investor, including the corporate investor transferring ideas or intellectual property to its parent corporation (9%); becoming a competitor (15%); reducing autonomy (10%); making decisions slowly, thus slowing down development (30%); actively preventing cooperation with their competitors (22%); reducing, by its association with the company, the willingness of some potential strategic alliance partners or customers to do business with them (19%).

Overall Satisfaction and Perceived Value-added

Despite the above mentioned problems, most of the respondent CEOs were very satisfied with the investor relationship with the very significant share of respondent CEOs agreeing that the corporate investor had provided them with valuable value adding support in addition to the financing (53%), value-adding support provided by this investor having been critical for their success (43%), and CEO being very happy about having that investor (74%). The share of respondent CEOs not being happy about having the investor was small (13%).

Other Findings on the Relationships with Corporate Venture Capital Investors

Taking multiple corporate investors. In line with the results of Maula & Murray (2000a), the results of the survey indicate that by taking multiple corporate investors, start-up company may reduce the potential for conflicts of interests with corporate investors. Of the companies that had more than one corporate investor, 48% agreed with the statement: "Having multiple corporate investors reduces the potential for conflicts of interests with corporate investors compared to if we had only one corporate investor." Having multiple corporate investors may help because multiple corporate

investors often have an incentive to watch that one of them is not exploiting the start-up company (Maula & Murray 2000a).

Multiple investors have also argued to increase the endorsement benefits (Maula & Murray 2000a). The results of the survey support this view. Of the companies that had more than one corporate investor, 88% agreed with the statement: "Having multiple corporate investors makes us more credible in the marketplace compared to if we had only one corporate investors."

Finally, multiple investors may help when trying to set new standards of creating dominant technologies (Maula & Murray 2000a). This idea receives also some support from the survey respondents. Of the companies that had more than one corporate investor, 46% agreed with the statement: "Having multiple corporate investors makes us more influential over the technological development in our industry compared to if we had only one corporate investor."

While these descriptive results provide additional evidence for the benefits of having multiple investors (Maula & Murray 2000a), it is important to keep in mind that additional investors demand additional communication and relationship management. It was also noted that when trying to get two competing customer corporations as investors to balance each other, the worst outcome would be getting only one of them, which might subsequently lead to credibility problems with other customers.

Considerate sharing of technical information. Another aspect explored in the survey were the strategies entrepreneurs use to manage the relationships with their corporate investors. One of the strategies used by some respondent start-ups was to limit the amount of information revealed for their corporate investors. Revealing only the necessary technological information for the corporate investor helps in reducing the risk of exploitation of the corporate partner. Furthermore, securing the core competencies from being learned too quickly by corporate investor retains the incentives of the corporation for continuing collaboration with the portfolio company.

Support in globalization. One further area of interest in the descriptive analysis was the extent to which corporate investors support their portfolio companies in internationalization. Because most of the sample firms operated only in the United States, there were little information on the support for internationalization. However, there were some firms in the sample that had started to expand into foreign markets, for instance to Asia. From the answers of these companies, it could be concluded that global corporations (or locally significant players in the target market) might be important facilitators in the globalization process. For instance in Asia, big local companies seemed to have an important role in opening doors in their markets. However, the benefits may not come without a cost. Dealing with foreign corporations as investors may be challenging and time-consuming.

Company characteristics. To summarize the analysis of the characteristics of the sample firms, it can be said that the sample companies were very young and small and had high growth aspirations. With several venture capital and corporate venture capital investors having invested significant amounts of money in these companies, they have high pressures to grow and become profitable. Because of the young age and large home market in the United States, a very small percentage of the companies had internationalization as a major priority.

Relationships with most important corporate venture capital investors. The key finding in the descriptive analysis of the relationships between technology-based new firms and their corporate venture capital investors was that there is a large variance in the level of value-added received by portfolio companies from their investors. Most of the companies had received value-added benefits while simultaneously claiming that some problems had taken place in their investment relationship. The factors influencing the value-added will be examined in the next chapters reporting the results of the statistical analyses of the hypothesized models.

In this summary of descriptive results it is worth noting the few things that came up in the descriptive analysis as typical mechanisms in managing the investment relationship. First, the majority of the companies that had several corporate investors reported benefits in having two or more corporate investors instead of only one corporate investor. These benefits include decreased risk for conflicts of interest, higher endorsement effects, and increased influence over technological development in the industry. Many companies also reported that they are considerate in sharing their technological knowledge with the corporation in order to prevent the corporation from misusing the information. Finally, from the answers of companies that operated globally and had global corporate investors, it could be noted that corporations may help in opening doors in foreign markets.

5.2   Model on the Value-added Mechanisms

This section reports the results of analyses testing the model on the value-added mechanisms.

5.2.1 Correlations Among Variables

Table 5-14 presents the correlations among variables in the model on the value-added mechanisms. Correlations indicated that knowledge acquisition, both forms of resource acquisition, and endorsement were all highly correlated with the perceived value-added, as hypothesized.

Table 5-14 *Correlations among variables in the model on the value-added mechanisms*

Variable	1	2	3	4	5	6	7
1 Value-added	-						
2 Acquisition of production-related resources	.52 **	-					
3 Acquisition of distribution-related resources	.47 **	.49 **	-				
4 Knowledge acquisition	.70 **	.42 **	.49 **	-			
5 Endorsement	.54 **	.43 **	.49 **	.47 **	-		
6 Firm age (years)	-.14	-.15	-.11	-.22 *	-.16	-	
7 Firm size (employees, log)	.06	-.06	.19 +	.06	.17	.00	-
8 Biotechnology (dummy)	.17	.14	.00	.04	-.07	.02	-.04
9 Medical/Health (dummy)	-.02	-.05	-.08	.10	-.18 +	.21 *	-.32 **
10 Internet Specific (dummy)	-.19 +	-.06	.21 *	-.22 *	-.12	-.16	.17
11 Communications (dummy)	-.06	-.06	-.17 +	.02	.05	-.09	.11
12 Computer Software and Services (dummy)	.12	.13	.06	.07	.20 +	.10	.02
13 Computer Hardware (dummy)	-.06	-.07	.11	-.10	.03	.07	.08
14 Semiconductors/Other Elect. (dummy)	.19 +	.01	-.24 *	.22 *	.02	.04	-.23 *

** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, two-tailed.

5.2.2 Multiple Regression Analysis of Hypotheses

Multiple regression analysis was used to test the hypotheses in the model on the value-added mechanisms. After confirmatory factor analysis, summated scales were used in testing the hypothesized relationships between the variables.

Regression Tests of Hypotheses 1-3: Resource Acquisition, Knowledge Acquisition, and Endorsement Influencing Value-added

Table 5-15 presents the results of the regression analyses for Hypotheses 1-3. In the table, standardized beta coefficients are presented for independent variables and control variables. For the hypothesized paths, the significance tests are one-tailed. For the control variables, the significance tests are two-tailed. All variables were entered simultaneously. In the regression analysis, variance inflation factors were examined to detect potential problems from multicollinearity. All VIF-statistics were 2.47 or lower indicating that multicollinearity should not cause problems in the regression analysis.

Table 5-15   Regression tests of Hypotheses 1-3: resource acquisition, knowledge acquisition, and endorsement influencing value-added

	Predicted direction	Dependent variable: Value-added
Independent variables		
Hypothesis 1a: Acquisition of production-related resources	+	.179 *
Hypothesis 1b: Acquisition of distribution-related resources	+	.074
Hypothesis 2: Knowledge acquisition	+	.454 ***
Hypothesis 3: Endorsement	+	.216 *
Control variables		
Firm age		.017
Firm size (Log of employees)		.032
Biotechnology		.148 *
Medical / health science		.009
Communications		-.028
Computer software and services		.046
Computer hardware		-.009
Semiconductors / other electronics		.123
Model indices		
R^2		.620
Adjusted R^2		.561
F		10.589 ***
N		91

*** $p \le .001$, ** $p \le .01$, * $p \le .05$, + $p \le .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients.

Hypothesis 1a and 1b predicted positive relationships between the two types of resource acquisition and the perceived value-added. Hypothesis 1a received support from the data. The resource acquisition related to production and technology related resources is significantly positively related to value-added ($\beta = .179$, $p \le .05$). However, resource acquisition related to distribution channels is not significantly positively related to value-added. Weakly supporting the hypothesis, the beta is positive, but the coefficient is not statistically significant ($\beta = .074$, n.s.). This result will be discussed in the discussion of results in Chapter 6.1.1.

Hypothesis 2 predicted a positive relationship between knowledge acquisition and the perceived value-added. This hypothesis received strong support from the regression analysis presented in Table 5-15. Knowledge acquisition is significantly positively related to value-added ($\beta = .454$, $p \le .001$).

Hypothesis 3 predicted a positive relationship between endorsement and value-added. This hypothesis received support from the regression analysis. Endorsement is significantly positively related to value-added ($\beta = .216$, $p \le .05$).

Of the control variables, only the dummy variable indicating the biotechnology sector was significant ($\beta = .148$, $p \le .05$) indicating that biotechnology companies had, on average, received higher value-added from their corporate venture capital investors than companies in other industries.

5.3 Resource and Knowledge Acquisition Model

This section reports the results on analyses testing the resource and knowledge acquisition model.

5.3.1 Correlations Among Variables

Table 5-16 presents the correlations among variables in the resource and knowledge acquisition model and provides initial support for the hypotheses. Correlations indicate that complementarities are highly related to social interaction and acquisition of both types of resources. Social interaction is highly related to knowledge acquisition and both forms of resource acquisition. Both types of resource acquisition are related to knowledge acquisition. The two types of resource acquisition (distribution and production) were also highly correlated.

Table 5-16 *Correlations among variables in the resource and knowledge acquisition model*

Variable	1	2	3	4	5	6	7
1 Acquisition of production-related resources	-						
2 Acquisition of distribution-related resources	.49 **	-					
3 Knowledge acquisition	.42 **	.49 **	-				
4 Social interaction	.42 **	.55 **	.55 **	-			
5 Complementarities	.33 **	.48 **	.31 **	.42 **	-		
6 Firm age (years)	-.15	-.11	-.22 *	-.24 *	-.12	-	
7 Firm size (employees, log)	-.06	.19 +	.06	.03	.04	.00	-
8 Biotechnology (dummy)	.14	.00	.04	.14	.10	.02	-.04
9 Medical/Health (dummy)	-.05	-.08	.10	-.12	-.21 *	.21 *	-.32 **
10 Internet Specific (dummy)	-.06	.21 *	-.22 *	-.07	-.01	-.16	.17
11 Communications (dummy)	-.06	-.17 +	.02	.08	.13	-.09	.11
12 Computer Software and Services (dummy)	.13	.06	.07	.01	-.06	.10	.02
13 Computer Hardware (dummy)	-.07	.11	-.10	-.02	.03	.07	.08
14 Semiconductors/Other Elect. (dummy)	.01	-.24 *	.22 *	.04	.02	.04	-.23 *

** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, two-tailed.

5.3.2 Multiple Regression Analysis of Hypotheses

Multiple regression analysis was used to test the hypotheses in the model on the value-added mechanisms. After confirmatory factor analysis, summated scales were used in testing the hypothesized relationships between the variables.

Regression Test of Hypothesis 4: Complementarities Influencing Social Interaction

Table 5-17 presents the results of the regression analyses testing the hypothesis of complementarities influencing social interaction. In the table, standardized beta coefficients are presented for independent variables and control variables. For the hypothesized paths, the significance tests are one-tailed. For the control variables, the significance tests are two-tailed. All variables were entered simultaneously. All VIF-

statistics were 1.30 or lower indicating that multicollinearity should not cause problems in the regression analysis.

Table 5-17   Regression test of Hypothesis 4: complementarities influencing social interaction

	Predicted direction	*Dependent variable:* Social interaction
Independent variables		
Hypothesis 4: Complementarities	+	.388 ***
Control variables		
Firm age		-.209 *
Firm size (Log of employees)		.045
Biotechnology		.114
Medical / health science		.039
Communications		.038
Computer software and services		.084
Computer hardware		-.002
Semiconductors / other electronics		.084
Model indices		
R^2		.232
Adjusted R^2		.146
F		2.713 **

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients

Hypothesis 4 states that complementarities are positively related to social interaction. Hypothesis received support from the regression analysis presented in Table 5-17. Complementarities are significantly positively related to social interaction between the venture and the corporate venture capital investor ($\beta = .388$, $p \leq .001$). Of the control variables, only age is significant ($\beta = -.209$, $p \leq .05$) indicating that younger companies tend to have closer relationships with their corporate investors.

Regression Tests of Hypotheses 5 and 6: Complementarities and Social Interaction Influencing Resource Acquisition

Table 5-18 presents the results of the regression analyses testing Hypotheses 5 and 6. In the table, standardized beta coefficients are presented for independent variables and control variables. For the hypothesized paths, the significance tests are one-tailed. For the control variables, the significance tests are two-tailed. All variables were entered simultaneously. All VIF-statistics were 1.30 or lower in the both models indicating that multicollinearity should not cause problems in the regression analyses.

Table 5-18   *Regression tests of Hypotheses 5 and 6: complementarities and social interaction influencing resource acquisition*

	Predicted direction	*Dependent variable:* Resource acquisition (production)	*Dependent variable:* Resource acquisition (distribution)
Independent variables			
Hypothesis 5a&5b: Complementarities	+	.217 *	.340 ***
Hypothesis 6a&6b: Social Interaction	+	.310 **	.467 ***
Control variables			
Firm age		-.080	.023
Firm size (Log of employees)		-.060	.132
Biotechnology		.083	-.129 +
Medical / health science		.038	.036
Communications		-.085	-.311 ***
Computer software and services		.139	-.029
Computer hardware		-.046	.051
Semiconductors / other electronics		-.006	-.287 ***
Model indices			
R^2		.255	.566
Adjusted R^2		.162	.511
F		2.744 **	10.415 ***

*** $p \le .001$, ** $p \le .01$, * $p \le .05$, + $p \le .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients.

In the analysis of factors influencing the acquisition of production-related resources, Hypothesis 5a received support from the regression analysis presented in the first model in Table 5-18. Complementarities are significantly positively related to acquisition of production-related resources ($\beta = .217$, $p \le .05$).

This model also provides support for Hypothesis 6a. Social interaction is significantly positively related to acquisition of production-related resources ($\beta = .310$, $p \le .01$). In this model, none of the control variables were statistically significant.

In the analysis of factors influencing the acquisition of distribution-related resources, Hypothesis 5b received support from the regression analysis presented in the second model in Table 5-18. Complementarities are significantly positively related to acquisition of distribution-related resources ($\beta = .340$, $p \le .001$). This model provides also support for Hypothesis 6b. Social interaction is significantly positively related to acquisition of distribution-related resources ($\beta = .467$, $p \le .001$).

Of the control variables in this model, it can be noted that in several industries, benefits from acquisition of distribution-related resources were significantly lower than for the base group (Internet specific). Industries that enjoyed lower benefits from acquiring distribution-related resources are biotechnology ($\beta = -.129$, $p \le .10$), communications ($\beta = -.311$, $p \le .001$), and semiconductors and other electronics ($\beta = -.287$, $p \le .001$).

Regression Tests of Hypotheses 7 and 9: Social Interaction and Resource Acquisition Influencing Knowledge Acquisition

Table 5-19 presents the results of Hypotheses 7 and 9. In the table, standardized beta coefficients are presented for independent variables and control variables. For the hypothesized paths, the significance tests are one-tailed. For the control variables, the significance tests are two-tailed. All variables were entered simultaneously. All VIF-statistics were 2.28 or lower indicating that multicollinearity should not cause problems in the regression analysis.

Table 5-19   Regression tests of Hypotheses 7 and 9: social interaction and resource acquisition influencing knowledge acquisition

	Predicted direction	Dependent variable: Knowledge acquisition
Independent variables		
Hypothesis 9: Social interaction	+	.236 **
Hypothesis 7a: Acquisition of production-related resources	+	.086
Hypothesis 7b: Acquisition of distribution-related resources	+	.414 ***
Control variables		
Firm age		-.197 *
Firm size (Log of employees)		.170 *
Biotechnology		.054
Medical / health science		.321 ***
Communications		.149 +
Computer software and services		.168 *
Computer hardware		-.070
Semiconductors / other electronics		.428 ***
Model indices		
R^2		.571
Adjusted R^2		.512
F		9.572 ***

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients.

Hypothesis 7 states that social interaction is positively related to knowledge acquisition. This hypothesis received support from the regression analysis presented in Table 5-19. Social interaction is significantly positively related to knowledge acquisition ($\beta = .236$, $p \leq .01$).

Hypotheses 9a and 9b state that resource acquisition is positively related to knowledge acquisition. However, Hypothesis 9a (acquisition of production related resources) does not receive strong support from the regression analysis. The beta is positive as predicted ($\beta = .086$) but not statistically significant. However, Hypothesis 9b (acquisition of distribution-related resources) does receive support from the regression analysis. Acquisition of distribution-related resources is significantly positively related to knowledge acquisition ($\beta = .236$, $p \leq .01$).

Of the control variables, firm age is negatively related to knowledge acquisition ($\beta = -.197$, $p \leq .05$). The younger the company, the higher the knowledge acquisition. On

the other hand, firm size is positively related to knowledge acquisition (β = .170, $p \leq$ .05). The larger the company, the higher the knowledge acquisition. In several industries, knowledge acquisition benefits were significantly higher compared to the base group (Internet specific companies). Industries that enjoyed high knowledge acquisition benefits are medical/health science (β = .321, $p \leq$ .001), communications (β = .149, $p \leq$ .10), computer software and service (β = .168, $p \leq$ .05), and semiconductors and other electronics (β = .428, $p \leq$ .001).

5.3.3 Multiple Regression Analysis of Mediation Effects

Regression Test of Hypothesis 8: Social Interaction Mediating Complementary Benefits to Knowledge Acquisition

Table 5-20 presents the results of the four steps in testing the mediating effects of social interaction mediating the complementarity benefits to knowledge acquisition. In Step 1, complementarities (independent variable) are shown to be significantly related to knowledge acquisition (dependent variable). This is shown in the first model in Table 5-20 (β = .344, $p \leq$ .001). In the second step, complementarities (independent variable) are shown to be significantly related to social interaction (mediator variable). This is shown in the second model in Table 5-20 (β = .388, $p \leq$ .001). In Step 3, social interaction (mediator variable) is shown to be significantly related to knowledge acquisition (dependent variable). This is shown in the third model in Table 5-20 (β = .452, $p \leq$ .001) In this third regression model, both the independent variable and the mediator variable are included in the analysis simultaneously. In Step 4, it is shown that inclusion of social interaction (mediator variable) in the regression with complementarities (independent variable) reduces the influence of complementarities on knowledge acquisition. In order to be able to claim complete mediation in this testing sequence, the effect of the independent variable should be zero when the mediator is included. In this analysis, however, complementarities remain weakly significant after the inclusion of the mediator. Therefore, these results indicate that social interaction mediates the relationship between complementarities and knowledge acquisition, but, on the basis of this testing sequence, it cannot be claimed that the mediation would be complete.

Table 5-20   Regression test of Hypothesis 8: social interaction mediating complementary benefits to knowledge acquisition

	Dependent variable: Knowledge acquisition	Dependent variable: Social interaction	Dependent variable: Knowledge acquisition
Independent variables			
Social interaction			.452 ***
Complementarities	.344 ***	.388 ***	.168 *
Control variables			
Firm age	-.289 **	-.209 *	-.195 *
Firm size (Log of employees)	.241 *	.045	.220 *
Biotechnology	.059	.114	.007
Medical / health science	.358 ***	.039	.340 ***
Communications	.029	.038	.012
Computer software and services	.206 *	.084	.168 +
Computer hardware	-.054	-.002	-.054
Semiconductors / other electronics	.347 ***	.084	.309 ***
Model indices			
R^2	.322	.232	.479
Adjusted R^2	.247	.146	.414
F	4.282 ***	2.713 **	7.364 ***

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients

A more formal test of mediation developed by Goodman (1960), Sobel (1982), and others was introduced in the methods section (Chapter 4.3.3). The results of the Sobel's test of mediation are presented in Table 5-21. The Sobel's test indicates statistically significant mediation effects ($p \leq .01$).

Table 5-21   Sobel test of social interaction mediating the positive relationship between complementarities and knowledge acquisition

	Dependent variable: Social interaction		Dependent variable: Knowledge acquisition	
Independent variables	β	Standard Error	*B*	Standard Error
Social interaction			.418	.085
Complementarities	.415	.109	.166	.090
			Z	*p* (2-tail)
Sobel test of mediation			2.978	.003

5.4   Endorsement Model

This section reports the results of analyses testing the endorsement model.

5.4.1 Correlations Among Variables

Table 5-22 presents the correlations among variables in the endorsement model. Correlations indicate that both types of resource acquisition, complementarities,

customer switching costs, and investor prominence are all highly correlated with endorsement as hypothesized.

Table 5-22   Correlations among variables in the endorsement model

Variable	1	2	3	4	5	6	7	8
1 Endorsement	-							
2 Acquisition of production-related resources	.43 **	-						
3 Acquisition of distribution-related resources	.49 **	.49 **	-					
4 Complementarities	.40 **	.33 **	.48 **	-				
5 Customer switching costs	.39 **	.10	.22 *	.40 **	-			
6 Investor prominence	.21 *	-.01	-.04	-.12	.02	-		
7 Firm age (years)	-.16	-.15	-.11	-.12	.13	-.03	-	
8 Firm size (employees, log)	.17	-.06	.19 +	.04	.06	-.01	.00	-
9 Biotechnology (dummy)	-.07	.14	.00	.10	.04	-.15	.02	-.04
10 Medical/Health (dummy)	-.18 +	-.05	-.08	-.21 *	-.03	-.02	.21 *	-.32 **
11 Internet Specific (dummy)	-.12	-.06	.21 *	-.01	-.29 **	-.18 +	-.16	.17
12 Communications (dummy)	.05	-.06	-.17 +	.13	.21 +	.09	-.09	.11
13 Computer Software and Services (dummy)	.20 +	.13	.06	-.06	.02	.07	.10	.02
14 Computer Hardware (dummy)	.03	-.07	.11	.03	.15	.13	.07	.08
15 Semiconductors/Other Elect. (dummy)	.02	.01	-.24 *	.02	.13	.11	.04	-.23 *

** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, two-tailed.

5.4.2 Multiple Regression Analysis of Hypotheses

Multiple regression analysis was used to test the hypotheses in the model on the value-added mechanisms. After confirmatory factor analysis, summated scales were used in testing the hypothesized relationships between the variables.

Regression Tests of Hypotheses 10, 11, 13, 14: Investor Prominence, Resource Acquisition, Venture Age and Customer Switching Costs Influencing Endorsement

Table 5-23 presents the results of the regression analyses testing the hypotheses on factors influencing endorsement benefits. In the table, standardized beta coefficients are presented for independent variables and control variables. For the hypothesized paths, the significance tests are one-tailed. For the control variables, the significance tests are two-tailed. All variables were entered simultaneously. In the regression analysis, variance inflation factors were examined to detect potential problems from multicollinearity. All VIF-statistics were 1.83 or lower indicating that multicollinearity should not cause problems in the regression analysis.

Table 5-23   Regression tests of Hypotheses 10, 11, 13, 14: investor prominence, resource acquisition, venture age, and customer switching costs influencing endorsement

	Predicted direction	Dependent variable: Endorsement
Independent variables		
Hypothesis 10: Investor prominence	+	.182 *
Hypothesis 11a: Acquisition of production-related resources	+	.225 *
Hypothesis 11b: Acquisition of distribution-related resources	+	.315 **
Hypothesis 13: Venture age	-	-.123 +
Hypothesis 14: Customer switching-costs	+	.282 **
Control variables		
Firm size (Log of employees)		.109
Biotechnology		-.065
Medical / health science		-.046
Communications		.054
Computer software and services		.158 +
Computer hardware		-.031
Semiconductors / other electronics		.089
Model indices		
R^2		.485
Adjusted R^2		.405
F		6.115 ***

*** $p \le .001$, ** $p \le .01$, * $p \le .05$, + $p \le .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients

Hypothesis 10 predicted a positive relationship between the prominence of the corporate investor and endorsement. This hypothesis received support from the regression analysis presented in Table 5-23. Investor prominence is significantly positively related to endorsement ($\beta = .182$, $p \le .05$).

Hypothesis 11a predicted a positive relationship between acquisition of production-related resources and endorsement. This hypothesis received support from the regression analysis. Acquisition of production-related resources is significantly positively related to endorsement ($\beta = .225$, $p \le .05$). Similarly, Hypothesis 11b predicted positive relationship between acquisition of distribution-related resources and endorsement. Also this hypothesis received support from the regression analysis. Acquisition of distribution-related resources is also significantly positively related to endorsement ($\beta = .315$, $p \le .01$).

Hypothesis 13 predicted a negative relationship between firm age and the value of endorsement. This hypothesis received support from the regression analysis ($\beta = -.123$, $p \le .10$).

Hypothesis 14 predicted a positive relationship between the customer switching-costs and the value of endorsement. Supporting this hypothesis, customer-switching costs are significantly positively related to endorsement ($\beta = .282$, $p \le .01$).

Of the control variables, only the dummy variable indicating computer software or service company was at all significant ($\beta = .158$, $p \leq .10$)

5.4.3 Multiple Regression Analysis of Mediation Effects

Regression Test of Hypothesis 12a: Acquisition of Production-related Resources Mediating Complementarity Benefits to Endorsement

Table 5-24 presents the results of the four steps in testing the mediating effects of social interaction mediating the complementarity benefits to knowledge acquisition. In step 1, complementarities (independent variable) are shown to be significantly related to endorsement (dependent variable). This is shown in the first model in Table 5-24 ($\beta = .402$, $p \leq .001$). In the second step, complementarities (independent variable) are shown to be significantly related to acquisition of production resources (mediator variable). This is shown in the second model in Table 5-24 ($\beta = .521$, $p \leq .001$). In step 3, resource acquisition (mediator variable) is shown to be significantly related to endorsement (dependent variable). This is shown in the third model in Table 5-26 ($\beta = .438$, $p \leq .001$) In this third regression model, both the independent variable and the mediator variable are included in the analysis simultaneously. In step four, it is shown that inclusion of resource acquisition (mediator variable) in the regression with complementarities (independent variable) reduces the influence of complementarities on endorsement. In order to be able to claim complete mediation in this testing sequence, the effect of the independent variable should be zero when the mediator is included. In this analysis, however, complementarities remain weakly significant after the inclusion of the mediator. Therefore, these results indicate that acquisition of production-related resources mediates the relationship between complementarities and endorsement but based on this testing sequence, it cannot be claimed that the mediation would be complete.

Table 5-24   Regression test of Hypothesis 12a: acquisition of production-related resources mediating complementary benefits to endorsement

	Dependent variable: Endorsement	Dependent variable: Resource acquisition (production)	Dependent variable: Endorsement
Independent variables			
Acquisition of production-related resources			.326 ***
Complementarities	.402 ***	.337 ***	.292 **
Control variables			
Firm age	-.146 +	-.145	-.099
Firm size (Log of employees)	.175 +	-.046	.190 +
Biotechnology	-.076	.118	-.114
Medical / health science	.030	.050	.014
Communications	.029	-.074	.053
Computer software and services	.261 *	.165	.207 *
Computer hardware	.049	-.046	.064
Semiconductors / other electronics	.103	.020	.097
Model indices			
R^2	.274	.181	.361
Adjusted R^2	.193	.090	.281
F	3.391 ***	1.995 *	4.512 ***

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, hypothesized paths one-tailed tests, controls two-tailed.

The results of the Sobel's test of mediation are presented in Table 5-25. The Sobel's test indicates statistically significant mediation effects ($p \leq .05$).

Table 5-25   Sobel test of acquisition of production-related resources mediating the positive relationship between complementarities and endorsement

	Dependent variable: Resource acquisition (production)		Dependent variable: Endorsement	
Independent variables	β	Standard Error	β	Standard Error
Acquisition of production-related resources			.276	.084
Complementarities	.341	.106	.250	.085
			Z	p (2-tail)
Sobel test of mediation			2.253	.024

Regression Test of Hypothesis 12b: Acquisition of Distribution-related Resources Mediating Complementarity Benefits to Endorsement

Table 5-26 presents the results of the four steps in testing the mediating effects of social interaction mediating the complementarity benefits to knowledge acquisition. In step 1, complementarities (independent variable) is shown to be significantly related to endorsement (dependent variable). This is shown in the first model in Table 5-26 ($\beta = .402$, $p \leq .001$). In the second step, complementarities (independent variable) are shown to be significantly related to acquisition of distribution resources (mediator

variable). This is shown in the second model in Table 5-26 ($\beta = .521$, $p \leq .001$). In step 3, resource acquisition (mediator variable) is shown to be significantly related to endorsement (dependent variable). This is shown in the third model in Table 5-26 ($\beta = .438$, $p \leq .001$) In this third regression model, both the independent variable and the mediator variable are included in the analysis simultaneously. In step four, it is shown that inclusion of resource acquisition (mediator variable) in the regression with complementarities (independent variable) reduces the influence of complementarities on endorsement. The results indicate that acquisition of distribution-related resources mediates the relationship between complementarities and endorsement, but, based on this testing sequence, it cannot be claimed that the mediation would me complete.

Table 5-26   *Regression test of Hypothesis 12b: acquisition of distribution-related resources mediating complementary benefits to endorsement*

	Dependent variable: Endorsement	Dependent variable: Resource acquisition (distribution)	Dependent variable: Endorsement
Independent variables			
Acquisition of distribution-related resources			.438 ***
Complementarities	.402 ***	.521 ***	.174 +
Control variables			
Firm age	-.146 +	-.075	-.114
Firm size (Log of employees)	.175 +	.153	.108
Biotechnology	-.076	-.076	-.043
Medical / health science	.030	.054	.006
Communications	.029	-.293 **	.157
Computer software and services	.261 *	.010	.257 **
Computer hardware	.049	.050	.027
Semiconductors / other electronics	.103	-.248 **	.212 *
Model indices			
R^2	.274	.398	.389
Adjusted R^2	.193	.331	.312
F	3.391 ***	5.957 ***	5.089 ***

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, hypothesized paths one-tailed tests, controls two-tailed. Standardized coefficients

The results of the Sobel's test of mediation are presented in Table 5-27. The Sobel's test indicates statistically significant mediation effects ($p \leq .001$).

Table 5-27   Sobel test of acquisition of distribution-related resources mediating the positive relationship between complementarities and endorsement

Independent variables	Dependent variable: Resource acquisition (distribution)		Dependent variable: Endorsement	
	β	Standard Error	β	Standard Error
Acquisition of distribution-related resources			.327	.084
Complementarities	.597	.103	.149	.093
			Z	p (2-tail)
Sobel test of mediation			3.194	.001

5.5   Integrated Structural Equation Model

This section presents the results from the test of the model integrating the previously tested sub-models. Path analysis is carried out using structural equation modeling.

5.5.1 Model Fit and Nested Model Testing

Following the procedure outlined in Chapter 4.3.4 describing the use of structural equation modeling in this study, I first examined the feasibility of the parameter estimates. The parameter-level examination indicates a good model fit. No correlations above 1.00, or negative variances were found (Byrne 2001:75). The covariance matrix was also positive definite. Standard errors were also reasonable and the direction and significance of the parameters were according to the underlying theories and hypotheses in sixteen out of seventeen hypothesized parameters, also suggesting good fit of the model. These analyses should reveal potential severe violations in the model fit. Based on these analyses, the model appears to behave well. The parameter estimates are further discussed in later sections discussing the results of hypotheses testing.

The next phase of the analysis is the examination of the model as a whole. As Table 5-28 demonstrates, the overall fit of the hypothesized model is good. The Chi-square test indicates a non-significant difference between the hypothesized and observed covariance matrices ($p \geq .10$), thus suggesting a good fit of the model. The Normed Chi-square statistic for the hypothesized model is 1.38, well within the recommended range 1.0-2.0 (Hair *et al.* 1998). Values close to or above .90 on the goodness-of-fit index and non-normed fit index are desirable. The hypothesized model exceeds these limits. The comparative fit index value .970 exceeds the new strict criteria of .950 thus indicating a good fit (Hu & Bentler 1999). Also root mean square error of approximation was within the recommended limits for acceptable fit of .08 (Browne & Cudeck 1993, MacCallum *et al.* 1996). Overall, the hypothesized model appears to fit well in the observed data.

Model	χ^2	df	p	Normed χ^2	GFI	NNFI	CFI	AIC	RMSEA
1. Null model	312.91	45	.000	6.95	.469	.000	.000	332.91	.257
2. Hypothesized model	29.05	21	.113	1.38	.944	.936	.970	97.05	.065
3. Partial mediation model 1 (Direct path added between complementarities and knowledge acquisition)	29.03	20	.087	1.45	.944	.924	.966	99.03	.071
4. Partial mediation model 2 (Direct path added between complementarities and endorsement)	27.86	20	.113	1.39	.946	.934	.971	97.86	.066

Normed Chi-square = Chi-square adjusted by degrees of freedom, GFI = Jöreskog and Sörbom's goodness-of-fit index, compares predicted squared residuals with obtained residuals, not adjusted by degrees of freedom; NNFI = Non-Normed Fit Index (Tucker and Lewis' index) compares proposed model to null model, adjusted by degrees of freedom; and CFI = compares proposed model to null model, adjusted by degrees of freedom; AIC = Akaike information criterion; RMSEA = Root Mean Square Error of Approximation.

Nested model tests (Loehlin 1987:62-67) were employed to assess the fit of the hypothesized model and to test its robustness by comparing it to other alternative models. Nested model tests are a means of internally validating a hypothesized model by comparing the Chi-squares of models that differ in the number of paths hypothesized. Nested models can be derived from each other by adding or deleting paths. A significant difference in Chi-square indicates that the more complex model provides a better fit with the data (Steiger *et al.* 1985: 254).

I compared models 1 through 4 in Table 5-28 by using sequential Chi-square difference tests to obtain successive fit assessments (Steiger *et al.* 1985). Following a series of hierarchical tests, the validity of the hypothesized model was tested by showing that it is the best fitting of the theoretically meaningful models.

The four nested models compared in the analysis are: (1) a null model, in which no relationships are posited; (2) the hypothesized model; (3) a partial mediation model in which a direct path is added to the hypothesized model between complementarities and knowledge acquisition; and (4) a partial mediation model in which a direct path is added to the hypothesized model between complementarities and endorsement. Table 5-29 summarizes the testing sequence employed.

Table 5-29   Nested model testing sequence and difference tests

More Parsimonious Model		Less Parsimonious Model	$\Delta\chi^2$	Δdf	P	Preferred
1. Null model	vs.	2. Hypothesized model	283.86	24	<.005	Model 2
2. Hypothesized model	vs.	3. Partial mediation model 1	0.01	1	>.100	Model 2
2. Hypothesized model	vs.	4. Partial mediation model 2	1.18	1	>.100	Model 2

In the testing sequence, the first comparison is the comparison between the hypothesized model and the null model. The goodness-of-fit statistics (Table 5-28) and the Chi-square difference test (Table 5-29) indicate that the hypothesized model provides a better fit than the null model.

The second comparison is a robustness test testing the strength of the mediation effect of social interaction mediating the complementarity effects to knowledge

acquisition. In this comparison, the hypothesized model was compared to the partial mediation model in which a direct path was added to the hypothesized model between complementarities and knowledge acquisition. The difference in Chi-square is not significant (second row in Table 5-29), indicating that the more parsimonious, hypothesized model provides a better fit with the data than the partial mediation model.

The third comparison is a robustness test testing the strength of the mediation effect of resource acquisition mediating the complementarity effects to endorsement. In this comparison, the hypothesized model was compared to the partial mediation model in which a direct path was added to the hypothesized model between complementarities and endorsement. The difference in Chi-square is not significant (third row in Table 5-29), indicating that the more parsimonious, hypothesized model provides a better fit with the data than the partial mediation model.

Having tested all the relevant model alternatives, I conclude that the hypothesized model (Model 2) provides the best fit and terminate the model testing. Figure 5-1 presents the diagram of the hypothesized model tested using structural equation modeling.
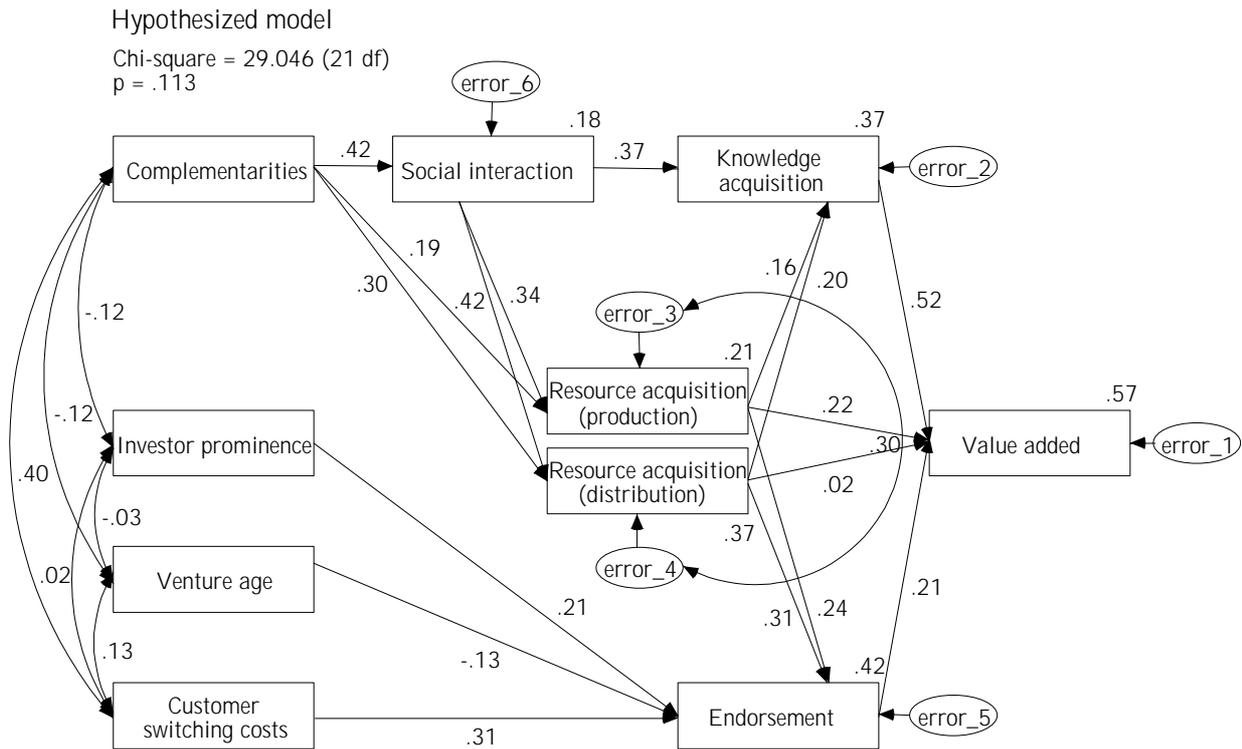
Figure 5-1   Structural equation-modeling results of the hypothesized integrated model

5.5.2 Path Analyses

Testing the fit of the hypothesized model and finding no signs of misspecification allowed testing of the hypotheses made in the hypothesized model. Table 5-30 presents the standardized maximum likelihood parameter estimates and their statistical significance levels for the hypothesized path model. In the hypothesized model, 17 relationships are tested. Sixteen out of seventeen hypotheses received at least weak support from the empirical data.

Table 5-30   Structural equation modeling tests of hypotheses

Hypothesis	Description of Path			Coefficient	
Model on the value-added mechanisms					
H1a	Acquisition of production-related resources	→ (+)	Value-added	.22	**
H1b	Acquisition of distribution-related resources	→ (+)	Value-added	.02	
H2	Knowledge acquisition	→ (+)	Value-added	.52	***
H3	Endorsement	→ (+)	Value-added	.21	**
Resource and knowledge acquisition model					
H4	Complementarities	→ (+)	Social interaction	.42	***
H5a	Complementarities	→ (+)	Acquisition of production-related resources	.19	*
H5b	Complementarities	→ (+)	Acquisition of distribution-related resources	.30	***
H6a	Social interaction	→ (+)	Acquisition of production-related resources	.34	***
H6b	Social interaction	→ (+)	Acquisition of distribution-related resources	.42	***
H7	Social interaction	→ (+)	Knowledge acquisition	.37	***
H9a	Acquisition of production-related resources	→ (+)	Knowledge acquisition	.16	*
H9b	Acquisition of distribution-related resources	→ (+)	Knowledge acquisition	.20	*
Endorsement model					
H10	Investor prominence	→ (+)	Endorsement	.21	**
H11b	Acquisition of production-related resources	→ (+)	Endorsement	.24	**
H11a	Acquisition of distribution-related resources	→ (+)	Endorsement	.31	***
H13	Venture age	→ (-)	Endorsement	-.13	+
H14	Customer switching costs	→ (+)	Endorsement	.31	***

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, + $p \leq .10$, hypothesized paths one-tailed tests

Model on the Value-added Mechanisms

The first set of hypotheses predicts the mechanisms through which corporate venture capital investments may add value to portfolio companies. The first hypothesis (Hypothesis 1) predicts the influences of two different types of resource acquisition. Hypothesis 1a, which states that acquisition of production-related resources is positively related to value-added, received strong support from the data ($\beta = .22$, $p \leq .01$). Hypothesis 1b states that acquisition of distribution-related resources is positively related to value-added. In this data acquisition of distribution-related resources was not significantly related to value-added ($\beta = .02$, n.s.). I will discuss potential reasons for this surprising result in the discussion of the results in Chapter 6.1.1. Hypothesis 2 states that that knowledge acquisition is positively related to value-added. This hypothesis received strong support from the data ($\beta = .52$, $p \leq .001$). The last hypothesis in this set of hypotheses (Hypothesis 3) states that endorsement is positively related to value-added. This hypothesis also received strong support from the data ($\beta = .21$, $p \leq$ .01). Overall, all the three main mechanisms of value-added (knowledge acquisition,

resource acquisition, and endorsement) were positively related to the perceived value-added.

Resource and Knowledge Acquisition Model

The second set of hypotheses concerns the factors affecting resource and knowledge acquisition by portfolio companies from their corporate investors. The first hypothesis in this set of hypotheses (Hypothesis 4) states that complementarities between the venture and the corporate investor is positively related to social interaction. This hypothesis received strong support from the data ($\beta = .42$, $p \leq .001$).

The next four hypotheses predict the factors influencing acquisition of two types of resources. Hypothesis 5a states that complementarities are positively related to acquisition of production-related resources. This hypothesis received strong support from the data ($\beta = .19$, $p \leq .05$). Similarly, Hypothesis 5b states that complementarities are positively related to acquisition of distribution-related resources. Also this hypothesis received strong support from the data ($\beta = .30$, $p \leq .001$). Hypothesis 6a states that social interaction is positively related to acquisition of production-related resources. This hypothesis received strong support from the data ($\beta = .34$, $p \leq .001$). Finally, Hypothesis 6b states that social interaction is positively related to acquisition of distribution-related resources. Also this hypothesis received strong support from the data ($\beta = .42$, $p \leq .001$).

The next three hypotheses predict the roles of factors influencing knowledge acquisition. Hypothesis 7 states that social interaction is positively related to knowledge acquisition. This hypothesis received strong support from the data ($\beta = .37$, $p \leq .001$). Predicting the role of resource acquisition influencing knowledge acquisition, Hypothesis 9a states that acquisition of production-related resources is positively related to knowledge acquisition. This hypothesis received strong support from the data ($\beta = .16$, $p \leq .05$). Similarly, Hypothesis 8b states that acquisition of distribution-related resources is positively related to knowledge acquisition. This hypothesis also received strong support from the data ($\beta = .20$, $p \leq .05$).

Endorsement Model

The third set of hypotheses concerns the factors affecting endorsement benefits received by portfolio companies from their association with their corporate investors. Predicting the role of corporate investor characteristics, Hypothesis 10 states that investor prominence is positively related to endorsement. This hypothesis received strong support from the data ($\beta = .21$, $p \leq .01$). Predicting the role of strength of tie influencing the credibility of the endorsement, Hypothesis 11a states that acquisition of production-related resources is positively related to endorsement. This hypothesis received strong support from the data ($\beta = .24$, $p \leq .01$). Similarly, Hypothesis 11b states that acquisition of distribution-related resources is positively related to endorsement. Also this hypothesis received strong support from the data ($\beta = .31$, $p \leq .001$). Predicting the role of uncertainty of the quality of the venture influencing the

value of the endorsement, Hypothesis 13 states that venture age is negatively related to the endorsement. This hypothesis received weak support from the data (β = -.13, $p \leq$ .10). Predicting the role of customer risks influencing the value of endorsements, Hypothesis 14 states that customer switching costs is positively related to endorsement. This hypothesis received strong support from the data (β = .31, $p \leq$ .001).

Mediation Effects

Hypothesis 8 predicts that social interaction mediates the influence of complementarities on knowledge acquisition. I tested this hypothesis by first examining the results of the nested model tests and then analyzing the specific relationships between the constructs. In the nested model tests (Table 5-29), the hypothesized mediation model (Model 2) provided a better fit than the alternative partial mediation model in which a direct path was added to the hypothesized model between complementarities and knowledge acquisition (Model 3). This result provides evidence in support of a mediating role of social interaction in mediating the effects of complementarities. To demonstrate mediation for specific relationships, I followed the four steps discussed in the methods section for establishing mediation (Chapter 4.3.3). The statistical results are presented in Table 5-31. First, the independent variable (complementarities) was shown to be related to the mediator (social interaction). Second, the mediator was shown to be related to the dependent variable (knowledge acquisition). Third, the relationship between the independent variable (complementarities) and the dependent variable (knowledge acquisition) was shown to be insignificant when the mediator is accounted for. Thus, it appears that social interaction mediates the relationship between complementarities and knowledge acquisition.

Table 5-31   Test of Hypothesis 8: social interaction mediating complementarity benefits to knowledge acquisition

Path description			Model 2 Hypothesized model	Model 3 Direct path added between complementarities and knowledge acquisition
Complementarities	→ (+)	Social interaction	.42 ***	.42 ***
Social interaction	→ (+)	Knowledge acquisition	.37 ***	.37 ***
Complementarities	→ (+)	Knowledge acquisition		.01

*** $p \leq$ .001, ** $p \leq$ .01, * $p \leq$ .05, + $p \leq$ .10, hypothesized paths one-tailed tests

Hypothesis 12 predicts that resource acquisition mediates the influence of complementarities on endorsement. I tested also this hypothesis by first examining the results of the nested model tests and thereafter analyzing the specific relationships between the constructs. In the nested model tests (Table 5-29), the hypothesized mediation model (Model 2) provided a better fit than the alternative partial mediation model in which a direct path was added to the hypothesized model between complementarities and endorsement (Model 4). This result provides evidence in support of a mediating role of resource acquisition in mediating the effects of

complementarities. To demonstrate mediation for specific relationships, I followed again the same four steps discussed earlier. The results are presented in Table 5-32. First, the independent variable (complementarities) was shown to be related to the mediators (both types of resource acquisition). Second, the mediators were shown to be related to the dependent variable (endorsement). Third, the relationship between the independent variable (complementarities) and the dependent variable (endorsement) was shown to be insignificant when the mediators are accounted for. Thus, it appears that social interaction mediates the relationship between complementarities and knowledge acquisition.

Table 5-32   Test of Hypotheses 12a and 12b: resource acquisition mediating complementarity benefits to endorsement

Path description			Model 2 Hypothesized model	Model 4 Direct path added between complementarities and endorsement
Complementarities	→ (+)	Acquisition of production-related resources	.19 *	.19 *
Complementarities	→ (+)	Acquisition of distribution-related resources	.30 ***	.30 ***
Acquisition of production-related resources	→ (+)	Endorsement	.24 **	.23 **
Acquisition of distribution-related resources	→ (+)	Endorsement	.31 ***	.27 **
Complementarities	→ (+)	Endorsement		.11

*** $p \le .001$, ** $p \le .01$, * $p \le .05$, + $p \le .10$, hypothesized paths one-tailed tests

Table 5-33 provides further evidence of the critical role of complementarities. In this table, the indirect effects of complementarities on all endogenous variables are estimated on the basis of the structural equation model results for the hypothesized model. The coefficients are relatively high (above .14) for all endogenous variables. The indirect effects of complementarities on knowledge acquisition were high (.31) as was predicted in Hypothesis 8. Also indirect effects of complementarities on endorsement are quite high (.29) as predicted in Hypothesis 12.

Table 5-33   *The critical role of complementarities: indirect effects of*
              complementarities on endogenous variables

Path description				Model 2 Hypothesized model
Complementarities	→	(+)	Acquisition of production-related resources	.14
Complementarities	→	(+)	Acquisition of distribution-related resources	.20
Complementarities	→	(+)	Knowledge acquisition	.30
Complementarities	→	(+)	Endorsement	.19
Complementarities	→	(+)	Value-added	.28

Standardized estimates of indirect effects

5.6   Summary of the Results

Table 5-34 provides a summary of the statistical results of both regression analyses and structural equation modeling. All but two hypotheses are supported in both sets of analyses.

Table 5-34   Summary of the results

Hypothesis		Multiple regression analysis	Structural equation modeling
Model on the value-added mechanisms			
H1a	Acquisition of production-related resources positively related to value-added	Supported	Supported
H1b	Acquisition of distribution-related resources positively related to value-added	Not significant	Not significant
H2	Knowledge acquisition positively related to value-added	Supported	Supported
H3	Endorsement positively related to value-added	Supported	Supported
Resource and knowledge acquisition model			
H4	Complementarities positively related to social interaction	Supported	Supported
H5a	Complementarities positively related to acquisition of production-related resources	Supported	Supported
H5b	Complementarities positively related to acquisition of distribution-related resources	Supported	Supported
H6a	Social interaction positively related to acquisition of production-related resources	Supported	Supported
H6b	Social interaction positively related to acquisition of distribution-related resources	Supported	Supported
H7	Social interaction positively related to knowledge acquisition	Supported	Supported
H8	Social interaction mediating the positive relationship between complementarities and knowledge acquisition	Supported	Supported
H9a	Acquisition of production-related resources positively related to knowledge acquisition	Not significant	Supported
H9b	Acquisition of distribution-related resources positively related to knowledge acquisition	Supported	Supported
Endorsement model			
H10	Investor prominence positively related to endorsement	Supported	Supported
H11a	Acquisition of production-related resources positively related to endorsement	Supported	Supported
H11b	Acquisition of distribution-related resources positively related to endorsement	Supported	Supported
H12a	Acquisition of production-related resources mediating the positive relationship between complementarities and endorsement	Supported	Supported
H12b	Acquisition of distribution-related resources mediating the positive relationship between complementarities and endorsement	Supported	Supported
H13	Venture age negatively related to endorsement	Supported	Supported
H14	Customer switching costs positively related to endorsement	Supported	Supported

6   DISCUSSION AND CONCLUSIONS

6.1   Discussion of the Results

This dissertation set out to analyze the relationship between corporate venture capital investors and their portfolio companies from the portfolio company perspective with the objective of identifying the primary value added mechanisms and the factors influencing those mechanisms (Chapter 1.2). In order to identify these value-added mechanisms and the factors influencing those mechanisms, earlier research on relationships between ventures and their corporate venture capital investors was reviewed. Because it was recognized that there is very little earlier research focusing on this topic, the literature review was expanded to cover other related and partly analogous types of interorganizational relationships. The expanded literature review covered research on the value-added provided by independent venture capital investors for their portfolio companies, research on the benefits for ventures from alliances with large firms, and research on relationships between ventures and parent corporations in internal corporate venturing. Review of earlier research on the research topic and several related fields of empirical research and identification of commonalities in these literatures provided a solid basis for hypothesis development.

In addition to review of empirical research on the research topic and related fields, the most relevant theoretical approaches were reviewed. These reviewed theoretical approaches included resource-based view, knowledge-based view, asocial capital theory, resource dependence perspective, asymmetric information and signaling theory, agency theory, and transaction economics. These theories were summarized, their related empirical applications were reviewed, and the critique of these theories was discussed. Finally, these theories were compared and their applicability to the present study was assessed. Extensive review of both empirical and theoretical literature related to the research topic gave a solid basis for hypothesis development.

Building on these reviews of earlier empirical research and relevant theoretical approaches, theoretical models were built focusing on (1) various forms of value-added provided by corporate venture capital investors; (2) factors influencing resource and knowledge acquisition; and (3) factors influencing the endorsement effects. Together these three sub-models comprise an integrated model of the value-added mechanisms and the factors influencing those mechanisms in relationships between technology-based new firms and their corporate venture capital investors.

These models were validated employing contemporary survey data collected from the CEOs of U.S. technology-based new firms. The models were tested using factor analysis and regression analysis. These models are the first theory-based, empirically validated models that examine the relationships between entrepreneurs and their corporate investors. Finally, an integrated model consisting of all the sub-models was

tested using structural equation modeling. In the following chapters, the three sub-models are discussed.

The research answers the two first research questions posed in Chapter 1.2 by identifying the key value-added mechanisms and the factors influencing those mechanisms. The mechanisms are further discussed in the next chapter in the discussion of the model on the value-added mechanisms. The factors influencing the value-added mechanisms are discussed in Chapters 6.1.2 and 6.1.3.

Based on the model of these value-added mechanisms and the factors influencing those mechanisms, the present study answers to the two latter questions posed in Chapter 1.2 concerning how to select corporate venture capital investors and how to manage relationships with corporate venture capital investors. These normative recommendations are discussed in Chapter 6.3 Managerial Implications.

6.1.1 Model on the Value-added Mechanisms

The model of the value-added mechanisms posits that portfolio companies receive value-added from their corporate investors primarily through three main mechanisms: resource acquisition, knowledge acquisition, and endorsement. *Resource acquisition* refers to concrete resources such as distribution channels and production facilities that the portfolio company can access through the relationship with the corporate investor. *Knowledge acquisition* refers to the organizational learning by the technology-based new firm enabled by interaction with the corporate venture capital investor and access to their knowledge base. *Endorsement* refers to the reputational benefits the portfolio company receives from being associated with a corporate investor. These value-added mechanisms were in general shown to be associated with the perceived value-added.

While all the other hypotheses in the present study received support from the analyses, the path between the acquisition of distribution-related resources and the perceived value-added was not statistically significant. One potential reason for this surprising result is that distribution agreements have not performed as well as have been hoped when making the agreements. The value-added construct, which measures the satisfaction of the CEO on the relationship, takes into account potential problems that have occurred in the relationship. It is possible that leaving the distribution for a large corporate partner may not always lead to satisfactory results. Another potential reason for this nonsignificant path is that a large share of the companies (21.6%) did not have any revenues at the time of the survey (page 135, Table 5-3).

In post hoc analyses, I also identified one further potential explanation for the non-significant path between distribution-related resources and value-added. While the zero-order correlation between the acquisition of distribution-related resources and the value-added was high and statistically significant, the introduction of knowledge acquisition in the model in the regression analyses reduced the coefficient of the acquisition of distribution-related resources to a non-significant level. Closer examination of the path analysis in structural equation modeling suggests that some of

the resource acquisition benefits are mediated by knowledge acquisition. The indirect effects from the acquisition of distribution-related resources mediated by knowledge acquisition are .145. This suggests that some of the benefits from the access to distribution-related resources might realize through learning. However, this explanation is based on explorative post hoc analysis and the explanation is therefore speculative. This relationship was the only hypothesized relationship, which was not found statistically significant in the data.

Overall, the development of a consistent and theoretically grounded framework is a valuable contribution for the understanding of the potential benefits from corporate venture capital because most of the literature touching on the issue has provided mainly descriptive lists of potential benefits without properly connecting them to theory (McNally 1997). A consistent theory-based framework allows a better understanding of the value-added benefits because it enables theoretical explanations when and how these value-added mechanisms work.

6.1.2 Resource and Knowledge Acquisition Model

Contributing to a deeper understanding of the value-added in corporate venture capital, the resource and knowledge acquisition model explains the factors influencing resource acquisition and knowledge acquisition in relationships between technology-based new firms and their corporate investors.

Recognizing organizations as economic actors (although embedded in social context), the economic motivation is an important factor influencing the willingness to collaborate (Amit & Zott 2001, Brandenburg & Nalebuff 1996). Complementarities were argued to be related to economic benefits and therefore create an incentive for collaboration. Supporting this hypothesis, complementarities between the corporate investor and the portfolio company were significantly positively related to social interaction and resource acquisition.

Building on the resource-based view, this model demonstrates the role of complementarities as enablers of value creation through resource sharing (Rothaermel & Deeds 2001, Rothwell 1989, Rothwell & Zegweld 1982, Teece 1986). Similarly, building on the knowledge-based view (Lane & Lubatkin 1998), the model also demonstrates the role of complementarities influencing knowledge acquisition. These relationships were found significant but mediated by social interaction between the venture and the corporate investor.

Recognizing the problems in transferring knowledge over organizational boundaries and creating unique resource combinations by combining complementary resources, the model drew from social capital theory (Nahapiet & Ghoshal 1998, Tsai & Ghoshal, and Yli-Renko *et al.* 2001a) and demonstrated the role of social interaction facilitating interorganizational learning and resource combination. Social interaction was strongly positively related to resource acquisition and knowledge acquisition from the investor relationship. Providing support for the hypotheses, social interaction was shown to

mediate the influence of complementarities on resource acquisition and knowledge acquisition. Finally, supporting the theories on stronger ties enabling a more efficient transfer of tacit knowledge (Bresman *et al.* 1999, Kogut & Zander 1992, Steensma & Lyles 2000, Steensma 1996), resource acquisition was found to influence positively knowledge acquisition.

6.1.3 Endorsement Model

The endorsement model builds on earlier research on interorganizational endorsements (Podolny 1993, 1994, Stuart *et al.* 1999, Stuart 2000). From this work, the endorsement model assumed the roles of partner prominence and venture uncertainty as drivers of the endorsement benefits. The model also assumed the underlying idea of this line of research that the coupling between the status (stemming from the association with prominent partners) and the quality of the venture could be loose. In other words, there could be value from associations with prominent partners even if they did not directly reflect the true quality of the venture. As suggested by Podolny (1993, 1994), Stuart *et al.* (1999) and Stuart (2000), endorsements could help to access critical resources and lead to better performance and quality, thus blurring the causality between status and quality. Supporting the hypotheses of Podolny (1993, 1994), Stuart *et al.* (1999) and Stuart (2000), it was shown that the greater the prominence of the corporate investor, the greater the endorsement benefits. Similarly, it was shown that the younger the venture, the greater the endorsement benefits.

Extending the framework of Stuart *et al.* (1999) on social mechanisms facilitating the implicit status transfer from prominent partners, the endorsement model integrated ideas from research on asymmetric information (Akerlof 1970) and signaling theory (Spence 1973) linking to a wide body of literature that has examined the role of prestigious underwriters (Beatty & Ritter 1986, Booth & Smith 1986, Carter & Manaster 1990, Carter *et al.* 1998), auditors (Beatty 1989, Michaely & Shaw 1995, Titman & Trueman 1986), and venture capitalists (Barry *et al.* 1990, Brav & Gompers 1997, Megginson & Weiss 1991) in certifying the quality of the ventures going public and reducing the problems caused by asymmetric information (Akerlof 1970) between insiders and outside investors. From this line of research, the model assumed the role of signaling costs making endorsement more credible. It was shown that the stronger the relationship between the corporate investor and the venture, the higher the endorsement benefits.

Further extending the framework of Stuart *et al.* (1999), the endorsement model assumed from transaction cost economics (Williamson 1975, 1979, 1981, 1985) the idea of risk (switching costs) increasing the weight that potential customers and partners give to signals of the quality of the venture (Swaminathan *et al.* 2001). It was shown that the higher the switching costs for potential customers, the higher the value of endorsement for the venture.

Responding to the call for future research by Stuart *et al.* (1999:346), the present study has examined the endorsement in types of associations other than those examined by Stuart *et al.* (1999). The present study has demonstrated that endorsement is also an important value creation mechanism in the relationships between corporate venture capitalists and technology-based new firms. Further, partly responding to another call for future research by Stuart *et al.* (1999:347), the present study has demonstrated the importance of complementarities as an important factor influencing the endorsement benefits (mediated by resource acquisition), thus suggesting that aligned incentives are likely to improve endorsement benefits.

Overall, the endorsement model has extended the understanding of the factors influencing endorsement benefits. The model integrates complementary theoretical bases and predicts how various mechanisms are influenced by characteristics of the endorsing partner, the focal venture, the potential customers and partners as well as how the characteristics of the relationships between these constituents influence the strength and value of endorsement.

6.2   Theoretical and Empirical Contributions of the Dissertation

The present study makes several theoretical and empirical contributions to the literature on corporate venture capital and interorganizational relationships in general. In the following, these contributions are briefly discussed first from the perspective of contributions to corporate venture capital research and secondly from the perspective of contributions to research on interorganizational relationships more generally.

6.2.1 Contributions to the Literature on Corporate Venture Capital

1) First rigorous empirical analysis of relationships with corporate venture capitalists from the perspective of technology-based new firms. One of the key contributions of the present study relates to the observation made earlier that there has been an important research gap in the rigorous empirical research focusing on the relationships between corporate venture capital investors and their portfolio companies. The few studies (Gompers & Lerner 1998, Kelley & Spinelli 2001, and Maula & Murray 2000a, 2000b) have relied on secondary data and have therefore had limitations in creating a more thorough understanding of the dynamics of these relationships. By building a theoretically grounded model of the value-added mechanisms and the factors affecting these value-added mechanisms in these relationships, collecting primary data from the CEOs of corporate venture capital backed companies, and statistically testing the hypotheses, the present study has contributed to the deeper understanding of relationships of start-up CEOs with their corporate venture capital investors.

2) Comprehensive analysis of value-adding mechanisms and the factors influencing them. The present study builds on the earlier research on corporate venture capital providing theory-based and empirically tested explanations for earlier results that have

suggested potential value-added benefits for start-up companies from corporate venture capital investors (Gompers & Lerner 1998, Maula & Murray 2000a). Employing primary data collected from CEOs of corporate venture capital backed companies, the present study has been able to get inside the 'black box' of how corporate venture capital may influence the performance of technology-based new firms. Employing this primary data, the present study has been able to test the roles of different value-adding mechanisms and the factors influencing the value-added mechanisms, thus creating increased understanding of the value-added processes in corporate venture capital from the perspective of portfolio companies.

6.2.2 Contributions to the Literature on Interorganizational Relationships

In addition to contributing to the scarce literature on corporate venture capital, the present study makes more general contributions to the wide body of literature on interorganizational relationships.

3) Multi-theoretic framework of the mechanisms of value creation in interorganizational relationships. The study contributes to the research on interorganizational relationships by developing a multi-theoretic framework of the value creation mechanisms in interorganizational relationships and the factors influencing those mechanisms. Interorganizational relationships have been researched from many different theoretical perspectives. While focus on one theory would help in understanding how that specific theory works, a multi-theoretic approach is required to understand the complex phenomena related to interorganizational relationships (Gulati 1998, Lado *et al.* 1997, Osborn & Hagedoorn 1997, Park *et al.* 2001, Smith *et al.* 1995). One of the underlying bases of the present study is the resource-based view (Barney 1991, Penrose 1959, Peteraf 1993). This perspective predicts that resource complementarities are an important factor influencing value creation in interorganizational alliances (Das & Teng 2000, Hitt *et al.* 2000, Teece 1986). The resource-based view and resource dependence perspective predict that *resource acquisition* via interorganizational relationships is important for new ventures (Das & Teng 1998, Jarillo 1989, Park *et al.* 2001, Pfeffer & Salancik 1978). Knowledge-based view predicts the importance of *knowledge acquisition* as one of the value creating mechanisms in interorganizational relationships (Lane & Lubatkin 1998). On the other hand, knowledge-based views also recognize the problems of transferring knowledge (especially tacit knowledge) over organizational boundaries. Social capital (and especially social interaction) has been found to be an important facilitator of resource and knowledge exchange (Nahapiet & Ghoshal 1998, Tsai & Ghoshal 1998, Yli-Renko *et al.* 2001a).

In addition to resource acquisition and knowledge acquisition benefits, sociological research on interorganizational *endorsement* (Podolny 1993, 1994, Stuart *et al.* 1999, Stuart 2000) and economic research on asymmetric information and signaling (Beatty & Ritter 1986, Megginson & Weiss 1991) predict positive influence from associations

with prominent affiliates, especially when the focal company is new and unknown. Transaction cost economics predict the influence of customer switching costs as increasing the need for customers to safeguard their transactions and thus influence the value of interorganizational endorsements (Swaminathan *et al.* 2001, Williamson 1979, 1981, 1985)

The present study has developed a multi-theoretic framework of the value creation mechanisms and the factors influencing these mechanisms in interorganizational relationships between small and large firms and tested it in the context of relationships between technology-based new firms and corporate venture capital investors. Despite a specific empirical context of corporate venture capital, the predicted relationships are likely to apply to some extent to other types of interorganizational relationships because the model has been built on theories tested in multiple contexts and combined after examination of commonalities and differences between theories in predicted relationships. The result of this work is a comprehensive framework explaining value creation in interorganizational relationships, particularly in relationships with technology-based new firms and their corporate venture capital investors, but which is also likely to be applicable to other contexts involving interorganizational relationships between small and large firms.

4) Contributions to the literature on interorganizational endorsements. As discussed earlier, the present study validates and extends the recent research on interorganizational endorsements by Stuart *et al.* (1999) and Stuart (2000). The present research provides new support for the roles of uncertainty and partner prominence for interorganizational endorsement. Extending the research of Stuart *et al.* (1999) as suggested by the authors (Stuart *et al.* 1999:346), the present study has validated the influence of those factors on interorganizational endorsement in the context of different types of relationships: relationships between technology-based new firms and their corporate venture capital investors. Further, replying to the other call for future research by Stuart *et al.* (1999:347), this research has extended the body of literature on interorganizational endorsement by integrating relationship characteristics with partner characteristics and venture characteristics and arguing theoretically and demonstrating empirically the influence of complementarities and the strength of ties with the endorsing partner on the effectiveness of interorganizational endorsement. The present study has also demonstrates that the characteristics of exchange relationships with potential partners and customers (customer switching costs) further influence the value of endorsements for the focal company. The model developed and tested in the present study integrates different theoretical bases and predicts how interorganizational endorsement is influenced by characteristics of the endorsing partner, the focal venture, the potential customers and partners as well as how the characteristics of the relationships between these constituents influence the strength and value of endorsement.

5) Contributions to the literature on resource and knowledge acquisition in interorganizational relationships. Contributing to the research on resource and knowledge acquisition in interorganizational relationships, the present study integrates the resource-based view arguments concerning the importance of complementary assets for value created in the interorganizational relationship with other relevant perspectives. From organizational economics, the present study adopted the role of potential economic benefits influencing the motivation for collaboration. This combination of the resource-based view with other theories has been advocated in recent research on interorganizational relationships (Das & Teng 2000:55).

6) Contributions to the literature on social capital. From the social capital perspective, the resource and knowledge sharing model adopted the idea of social interaction as a facilitator of resource and knowledge sharing. In so doing, the present study contributes to the existing literature on social capital and interorganizational knowledge transfer by providing further empirical validation for the recent research suggesting the importance of social interaction influencing resource and knowledge acquisition (Nahapiet & Ghoshal 1998, Tsai and Ghoshal 1998, Yli-Renko *et al.* 2001a). As an important contribution to the literature on social capital, the present study has also demonstrated that social capital is not exogenous but instead endogenous and driven by the incentives and motivation to collaborate. By arguing theoretically and demonstrating empirically the importance of complementarities as a prerequisite for the successful build-up of social capital and subsequent knowledge and resource sharing, the present study extends the previous understanding and applicability of social capital and its link to other theoretical frameworks.

7) Contributions to the literature on value creation mechanisms in interorganizational relationships. The present study contributes to the literature examining the role of different mechanisms on value creation in interorganizational relationships. The present research responds to the call for future research by Das and Teng (1998:39) who found that small alliance partners benefited most from interorganizational alliances when measured in stock market reactions. As for future research, they suggested that it would be valuable to examine the comparative role of resource acquisition and reputational benefits in relation to these differential benefits from alliances. The present study responds to this suggestion by using primary data collected from the CEOs of U.S. technology-based new firms and examining and comparing the roles of resource acquisition, knowledge acquisition, and endorsement in value creation in interorganizational relationships between small and large firms. The answer to this question is that resource and reputational benefits appear to be complementary and relatively highly correlated. In examining simultaneously resource acquisition, knowledge acquisition, and endorsement benefits, the present study also extends the research by Stuart *et al.* (1999) and Stuart (2000) who, using proxy measures derived from archival data, were able to separate endorsement effects from other benefits, but did not separate learning benefits from resource sharing benefits. Contributing to the

empirical testing of the hypotheses, the present study has operationalized and validated constructs and tested the predicted relationships using primary data. This strategy has been warranted in earlier research because of the difficulties involved in operationalizing measures like complementarities on the basis of secondary data. As recommended by Das & Teng (2000:53), the present study has employed survey methodology and collected primary data directly from the executives of focal companies.

8) Contributions to empirical testing of theories in interorganizational relationships. Much of the recent research on the influence of interorganizational relationships on the performance of new ventures has employed primarily count-measures with relatively few focusing on the characteristics of partners and relationships (DeCarolis & Deeds 1999, Deeds & Hill 1996, Rothaermel & Deeds 2001, Shan *et al.* 1994, Wang *et al.* 2001). However, some authors have recently argued that the characteristics of the partners and relationships may be much more important than the mere numbers of partners (Stuart *et al.* 1999, Stuart 2000). Some recent research has suggested that focusing on dyadic level on the relationships with the most important constituencies of the new firms would help to create a better understanding of the influence the role of interorganizational relationships on their performance (Galunic & Moran 2000, Lane & Lubatkin 1998, Stuart 2000, Yli-Renko *et al.* 2001a).

Employing this strategy, the present study has been able to gather rich data from the CEOs of U.S. technology-based new firms concerning relationships with their most important corporate venture capital investors. The present study has extended the understanding on the role of interorganizational relationships in the domain of relationships with corporate venture capital investors by arguing and demonstrating the influence of the characteristics of the venture, partner, and their relationship on resource acquisition, knowledge acquisition, and endorsement benefits in these relationships.

6.3 Managerial Implications

The findings of the present study have several implications for entrepreneurs either selecting investors or managing an existing investor relationship, corporate venture capitalists, and independent venture capitalists. These implications are briefly discussed in the following chapters.

6.3.1 Implications for Entrepreneurs

Importance of investor selection. The empirical data demonstrated that there are significant differences in the value-added received by ventures from their corporate venture capital investors. The findings of the present study imply that complementarities between the businesses of the corporate investor and the portfolio company are a crucially important success factor. Because complementarities are

largely exogenous, a clear implication for entrepreneurs considering corporate venture capital investors is that careful investor selection is extremely important for start-up CEOs. Fortunately, start-ups often do have some choice in this matter. Depending of the specific array of needs of the start-up company, an optimal 'value-added portfolio' may be constructed by specifically selecting both corporate venture capitalists and independent venture capital investors on the basis of their ability to provide complementary support and advice in their respective areas of strength.

Understanding of the forms of value-added provided by corporate venture capital investors. The present study has identified three important classes of benefits available in varying degrees for the portfolio companies from their relationships with corporate venture capitalists. While there are numerous ways to classify different potential benefits from the relationships, it helps entrepreneurs to have a coherent understanding of the major classes of benefits. The present study identified three theoretically and empirically grounded classes of value-added benefits: (1) *resource acquisition*, (2) *knowledge acquisition* (3) and *endorsement* benefits. Understanding the nature of these benefits and the factors influencing them helps entrepreneurs in approaching suitable corporate investors.

Importance of complementarities as a success factor. As one of the key factors important for ventures when selecting investors, the present study identified complementarities as a key determinant of value creation in relationships between ventures and their corporate venture capital investors. The finding of the major role of complementarities between the parent of the corporate venture capital investor and the portfolio company has important implications both for the portfolio companies and corporate investors. Given that complementarities were found to be an important structural factor influencing the benefits available from the relationship, complementarities should always be considered by the entrepreneur when considering accepting an investment from a corporate venture capital investor.

Role of social interaction in the management of the investor relationship. As one factor important for entrepreneurs in managing the relationships with corporate venture capital investors, the present study identified social interaction as a key facilitator of resource and knowledge acquisition. The finding that social interaction mediates the benefits from complementarities and greatly facilitates resource and knowledge acquisition from corporate investors has implications for entrepreneurs managing the relationships with corporate venture capitalists. This finding suggests that social interaction is an important lever that the entrepreneurs can use to obtain greater benefits from their relationships with corporate investors. While it was shown that the complementarities have a significant catalyzing role for social interaction, it is up to the management to interact with the corporate investors and reap the benefits from the association. Therefore, active relationship management is recommended for the entrepreneurs.

Factors influencing endorsement benefits. Endorsement effect may be a particularly important benefit from having a corporate investor particularly if the products of the venture are critical for the business of the customers so that the customers or partners would have high switching costs. A small start-up may not be a credible enough supplier alone. Investment by an industry-leading corporation may improve the credibility and visibility of the venture as a supplier and enhance the impression that the product is reliable and fits potential standards and road maps in the industry. The more prominent the investor, the higher the endorsement benefits for the venture. When selecting corporate venture capital investors, the prominence of the investor is an important consideration.

In addition to the investor prominence and customer switching costs, the present study identified the young age of the venture as a factor that influence the value of endorsements. The younger the venture, the more potential partners and customers will pay attention to the existing partners including corporate venture capital investors. The younger and more uncertain the venture is, the more it can benefit from endorsements by prominent investors.

Further, the characteristics of the relationship between the venture and the corporate investor were found to influence the endorsement. The closer the relationship is the stronger the endorsement effects in the eyes of outsiders. In addition to facilitating resource and knowledge acquisition, investments in relationship building can therefore have indirect benefits through increased endorsement effects.

For entrepreneurs, a short summary list of the research-based recommendations is presented in Table 6-1.

Table 6-1   Ten research-based recommendations for technology-based new firms on corporate venture capital

	Recommendation
1	Select your investors very carefully. Just as investors conduct due diligence on potential investment targets, it pays off for start-ups to conduct due diligence on their potential investors.
2	Build a portfolio of investors that fits your needs. It may be beneficial to have different types of investors bringing different value-added benefits.
3	Pay a considerable amount of attention to the complementarities between your firm and the parent firm of the potential corporate investor. Complementarities are critical for cooperation.
4	Use social interaction to facilitate knowledge acquisition from corporate investors and enable identification of opportunities for cooperation.
5	Consider the potential for acquiring critical resources from the parent of the corporate investor when selecting investors. Complementarities are a key enabler for resource sharing, but social interaction helps in identifying opportunities for cooperation. However, keep in mind that investor relationship does not always give preferential access to corporate resources.
6	Consider the potential learning benefits when selecting corporate investors. Start-up companies may learn a lot from large global corporations regarding markets, customer needs, competition, and technological issues. Social interaction facilitates knowledge acquisition.
7	Consider the potential endorsement benefits when selecting corporate investors. The more influential the corporation, the more valuable the endorsement. Uncertainty and high switching costs for customers make endorsement more valuable. Complementarities improve the value of endorsements and concrete resource sharing makes complementarities more visible.
8	Consider taking multiple instead of only one corporate investor. Multiple investors may increase the endorsement and balance each other reducing the risks for conflicts of interest.
9	Do not reveal more technical documentation to the corporate investor than is necessary for the investment relationship and good cooperation. Revealing too much increases the risk of exploitation and reduces the incentives for continued cooperation.
10	Consider the potential help from taking corporate investors when entering foreign markets. Global corporations (or significant local players in foreign markets) may help to open doors in foreign markets.

6.3.2 Implications for Corporate Venture Capital Investors

For corporate venture capitalists, it is naturally important to understand how they can add value. The findings imply that complementarities are a key determinant of the potential economic value of their portfolio firms. The existence and extent of complementarities, therefore, should be explicitly studied during the due diligence process.

Furthermore, social interaction is an important factor facilitating value creation. While social interaction helps ventures to get more out from the relationship through learning and identification of opportunities for resource sharing, closer collaboration also helps corporate venture capitalists to learn more from the venture (Keil 2000).

6.3.3 Implications for Independent Venture Capital Investors

The findings of the present study are also important for independent venture capitalists. Because the number of deals syndicated between independent venture capitalists and corporate venture capitalists has grown high (LeClair *et al.* 2000), it is important for independent venture capitalists to understand what corporate venture capitalists can

bring to syndicates. Further, it is important for venture capitalists to understand the conditions under which corporate venture capital investors can add value to syndicates.

The findings of the present study indicate that complementarities between the ventures are an important determinant of value-added provided by corporate venture capital investors for their portfolio companies. Independent venture capitalists are therefore advised to examine the complementarities when considering inviting a corporate venture capital investor in the syndicate.

When the venture needs endorsements for commercializing the products, co-investment by prominent corporate venture capitalists can often do the trick. The prominence of the corporate investor is an important factor to consider when seeking endorsement benefits for the venture. Industry-leading corporations are more influential in this respect compared to smaller corporations. The endorsement by large corporations may be particularly valuable when the venture operates in a systemic business environment offering products that are critical for the business of the customers.

6.4 Limitations of the Study and Directions for Future Research

6.4.1 Limitations of the Study

There are no studies without limitations. Some of the limitations of the present study and the implications of these limitations are discussed in this chapter.

Cross-sectional nature of the study. Even though this study combines both survey data and secondary data collected at different times, the nature of the study is essentially cross sectional. This design limits the opportunities for claiming causalities in the identified relationships purely on the basis of empirical findings. However, the hypotheses were developed on the basis of received theories and empirical research, thus improving the validity of the results. Despite the simultaneous data collection for many of the variables, some of these variables are such that causalities are fairly clear (such as social interaction influencing knowledge acquisition and not vice versa).

Limited geographical focus. The present study focused on U.S. technology-based new firms. This focus was chosen because of the small number of corporate venture capital backed ventures and the low availability of information on them elsewhere.

Focus on dyadic relationships. This study focused on the dyadic relationships between the technology-based new firm and its most important corporate venture capital investor measured in terms of ownership. In reality, corporate venture capital backed technology-based new ventures often have multiple investors. However, this focus on a single relationship is justified by the lack of in-depth studies focusing on relationship qualities (Hansen *et al.* 1999, Yli-Renko 1999). Several authors have argued for the need to focus on the characteristics of relationships with key constituencies in order to gain a richer understanding of the factors influencing the

value and management of interorganizational relationships (Galunic & Moran 2000, Lane & Lubatkin 1998, Stuart 2000, Yli-Renko *et al.* 2001a).

Focus on one side of the dyad. In this study, the dyadic relationships were examined only from the entrepreneur perspective. Simultaneous research of the relationships from both the entrepreneur and corporate investor perspectives would provide additional insights, or at least additional factors to be considered. However, the practical implementation of such a study would have been difficult or impossible because of the inherent reduction in the sample size and increase in time and costs (Mohr & Spekman 1994, Yli-Renko *et al.* 2001a). Providing validity for the measurement from one side of the dyad, Sapienza (1992) and Sapienza and Gupta (1994) demonstrated a very high similarity in answers regarding value-added provided by venture capitalists from both venture capitalists and entrepreneurs.

Use of primarily perceptual measures. One of the limitations of this study is that it employs primarily perceptual measures. However, this strategy has been intentionally chosen in order to examine issues where objective measures are not available. The use of survey-based measures has recently been warranted (Das & Teng 2000:53). The reliability of perceptual measures in has been shown to be good in many of the studies examining analogous situations such as value-added in venture capital (Sapienza 1992, Sapienza & Gupta 1994), performance of joint ventures (Geringer & Hebert 1989, 1991, Lyles & Salk 1996), and performance in vertical supplier-customer relationships (Anderson & Narus 1990, Heide & John 1990, Mohr & Spekman 1994, Yli-Renko *et al.* 2001a). The use of perceptual measures in many of the studies has been based on the notion that success is determined, in part, by how well the partnership achieves the performance expectations set by the partners (Anderson & Narus 1990, Mohr & Spekman 1994).

Increasing the reliability and validity of the perceptual measures in the present study, the constructs have been operationalized using theoretically based and, in many cases, previously validated multi-item scales, and tested for inter-item reliability (Nunnally 1978), and convergence and divergence validity using confirmatory factor analysis. Furthermore, the reliabilities of the dependent variables were ensured by a follow-up survey for the original respondents with the results demonstrating good reliability (Carmines & Zeller 1979:37-40, Litwin1995:8-13, Nunnally 1978:233-236).

The use of perceptual measures has also clear benefits in research examining the performance implications of certain types of interorganizational relationships. Separating performance implications resulting from specific interorganizational relationships is difficult without primary data focusing on those relationships. Use of secondary data might be problematic because performance differences in cross-sectional studies are always subject to unobserved heterogeneity and selection bias. Unobserved heterogeneity refers to the potential unobserved factors influencing the performance differences between firms. Selection bias refers to the potential problem that higher potential ventures are likely to attract better partners. The use of primary

data focusing on the processes occurring in specific dyads is likely to suffer less from the above-mentioned problems.

Limited time frame of the study. The sample companies had all received corporate venture capital funding during 1999-2000. Given the exceptional developments in the financial markets during recent years, there is always a concern for the generalizability of the results over other periods of time. Because of the nature of the research questions demanded for primary data, it was not possible to use a longitudinal setting based on archival data. The need to focus on recent investments was further determined by the relatively small number of corporate venture capital investments before the end of 1990's. In this study, the reliability and the stability of the dependent variables were ensured by test - re-test procedure by sending a follow-up survey for the original respondents six months after the original survey (Carmines & Zeller 1979:37-40, Litwin1995:8-13, Nunnally 1978:233-236). This six-month period is important, because the amount of venture capital and corporate venture capital investments decreased dramatically during the first half of 2001. The results in the follow-up questions were strongly correlated with the original responses supporting the reliability and generalizability of the results over the specific period of time.

6.4.2 Directions for Future Research

In its attempt to answer the research questions outlined in the Introduction (Chapter 1.2), the present study has pinpointed some areas of potential future research. In the following, some possible avenues for future research are discussed.

Longitudinal analysis of the impact of corporate venture capital on the performance of technology-based new firms. One of the limitations of this research is that the analyses are primarily based on cross-sectional data. A longitudinal research setting could help to create further understanding of the value-added benefits from corporate venture capital investments because some of the benefits discussed in the present study may be only short-term benefits. For instance, examining strategic alliances of new ventures, Stuart *et al.* (1999:347) suggested that it is possible that the initial advantage of a connection with a prominent actor might be followed by sub-par performance in a case when endorsement benefits were not tightly coupled with the true quality of the venture. Longitudinal research designs and lagged performance variables would be valuable in future research on the performance effects of the value-added provided by corporate venture capitalists.

The impact of corporate venture capital on the internationalization of technology-based new firms. There is some existing research suggesting that interorganizational relationships may be valuable for the internationalization of technology-based new firms (Artz *et al.* 1999, Autio *et al.* 1997, Lu & Beamish 2001, Zacharakis 1997, Zahra *et al.* 2000b). However, the role of corporate venture capital in supporting internationalization has not been examined in the previous literature. The present study considered this idea, but because of the large home-market of the U.S. based

sample companies, few of the very young companies in the sample had prioritized internationalization very high. However, some of the companies that were attempting to internationalize rapidly, and had foreign corporate investors (e.g. in Asia), suggested that these foreign corporate investors were valuable in entering the foreign market. It would be interesting to examine the role of corporate investors in the internationalization of start-ups based in smaller home markets because in this setting the potential help in internationalization could be better measured.

The impact of the experience and external venturing capability of the corporations on the corporate venture capital performance. This study examined corporate venture capital from the start-up perspective. While this perspective was justified by the lack of research from this perspective, there are also gaps in research on corporate venture capital from the corporate perspective. One interesting perspective would be to examine the influences of structure, experience, and external venturing capability of corporations (Keil 2000) on their performance in corporate venture capital. These factors are also likely to affect the relationship with portfolio companies.

Overall, the present dissertation is the first study to develop and empirically validate a comprehensive model on the value-added mechanisms and the factors influencing these mechanisms in the relationships between technology-based new firms and their corporate venture capital investors. In addition to contributing to the emerging literature on corporate venture capital, the present study also contributes to a wider body of literature on interorganizational relationships between small and large firms and has implications both for researchers and practitioners regarding value creation in interorganizational relationships.

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