

INTERNAL RESOURCES AND EXTERNAL NETWORKS DRIVING FIRM PERFORMANCE

A study on the network of IT companies in The Netherlands

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Abstract

This study examined the influence of internal resources and external networks on firm performance. The rents that accrue to firms are partly the result of their own resource endowments but partly derived from the network of relationships in which they are embedded, and therefore both have to be taken into account. Firm internal resources were operationalized by technological, marketing and financial resources. Firm external networks were captured by centrality and structural autonomy of the firm in the network. Return on assets, market share and sales growth indicated the firm's performance. Data was collected from databases for 50 companies of the network of IT industry in The Netherlands. Regression results showed that among internal resources indicators, marketing and financial resources are important predictors of a firm's performance. Among external networks, neither centrality nor structural autonomy predicted the firm's performance. Interaction terms between internal resources and external networks did not have either a statistically significant influence on performance. Implications and directions for future research were discussed.

Executive summary

This study examines the influence of internal resources and external networks on firm performance. Strategy scholars have considered firm's internal resources as sources of value creation. Besides, nowadays we are in a world in which firms are embedded in networks of social, economic and exchange relationships with other organizational actors, and as the economic environment is becoming more and more competitive, those networks in which firms are situated assume enhanced strategic importance toward understanding firm strategy and performance.

Those arguments lead to urgency to investigate both aspects of the firm, internal resources and external networks, in explaining firm performance. This is a topic that has not been researched yet and is what we address in this research. To do so, we combine two theories that are considered central in the explanation of firm: RBV and social capital. RBV theory regards the firm as a bundle of resources and suggests that they significantly affect the performance; whereas social capital theory captures the beneficial effect of social networks on organizational performance and claim that firm's external networks form a major contributor to firm performance.

In this research we have found that internal resources are key determinants of firm performance, unlike firm external networks that do not influence firm performance. The results suggest that firm performance is much better explained by RBV than by social capital theory.

Therefore, in order to succeed the managers should focus on the accumulation of intangible resources. In particular, in this research we found of key importance marketing and financial resources. Marketing efforts are needed as complementary resources that promote the production of the most suitable products and services according to the current state of the market, and for the delivering of those products and services. The financial resources of a company allow the accumulation of larger stock of key resources than other companies that lack such financial resources.

In contrast, social capital does not have a significant influence on firm performance compared to the influence of internal resources. In particular in this research, neither centrality nor structural autonomy of a firm, which facilitate quick and more, and varied and exclusive information and resources respectively, seems to contribute in firm performance compared to internal resources.

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1. INTRODUCTION

1.1 Research topic, research objective and research question

A key question in strategy research is why firms differ in their conduct and profitability. In order to address this question, in the literature the firms have been seen as autonomous entities trying to achieve competitive advantage from external industry sources (e.g., Porter, 1980) or from internal resources and capabilities (e.g., Barney, 1991). However, the idea of individual actors competing for profits against each other in an impersonal marketplace is becoming less appropriate in a world in which firms are embedded in networks of social, professional, and exchange relationships with other organizational actors (Granovetter, 1985; Gulati, 1998; Galaskiewicz and Zaheer, 1999). Such networks are defined by Gulati, Nohria and Zaheer (2000) as a firm's set of relationships, both horizontal and vertical, with other organizations—be they suppliers, customers, competitors, or other entities— including relationships across industries and countries. The interorganizational ties that compose strategic networks are enduring, of strategic significance for the firms entering them, and include strategic alliances, joint ventures, long-term buyer-supplier partnerships, and a host of similar ties. By adopting a relational approach rather than an individual approach we can deepen our understanding of the sources of differences in firm conduct and profitability.

Moreover, nowadays we are in an economic environment that is becoming more and more competitive. In such context, the networks in which firms are situated assume enhanced strategic importance, and awareness about them becomes a central exercise toward understanding firm strategy and performance. Deny the existence of strategic networks could lead to an incomplete understanding of firm behavior and performance (Gulati, Nohria and Zaheer, 2000). Strategic networks potentially provide a firm with access to information, resources, markets, and technologies; with advantages from learning, scale, and scope economies; and allow firms to achieve strategic objectives such as share risks and outsource value-chain stages and organizational functions. On the other hand, networks also have potential disadvantages: they may lock firms into unproductive relationships or exclude partnering with other viable firms. Thereby, the network of relationships in which firms are embedded is a source of both opportunities and constraints; and by examining it, the firm's conduct and performance can be more fully understood.

To help in the development of network strategy, in this research we attempt to uncover the role of strategies within networks in the value creation process. The network strategy literature is replete with arguments that in explaining firm performance, internal resources and external networks independently matter (Zaheer and Bell, 2005). On one hand, strategy scholars tend to consider firm's internal resources as sources of value creation. On the other hand, network scholars tend to focus attention on the value of the network structure. Besides, there are authors that claim for the joint consideration of internal resources and external networks as

respective contributors to firm performance. For instance, Gulati, Nohria and Zaheer (2000) highlight that the rents that accrue to firms is partly the result of their own unique resource endowments, but partly derived from the structure of the network to which they belong. It is claimed that a comprehensive view of a firm's rent-generating resources not only include elements such as brands, technological resources, management talent, and so forth, but would also include the network resources or social capital of the firms. However, there is not yet research that bridges the gap between the role of internal firm resources and external networks as respective contributors to firm performance (Zaheer and Usai, 2004).

The aim of this research is to gain insight into such scientific gap. We consider the role of internal firm resources and firm external networks as respective contributors to firm performance. Thus, we can formulate our *research objective* as follows:

Investigate the firm- performance implications of building internal resources and of developing external networks.

The investigation of the research objective is an explorative research in which we have tentatively formulated the influence of internal resources and external networks in firm performance. Specifically, our *research question* is:

What is the relationship between the internal resources and external networks of a firm, and its performance?

To answer this question we need to address the following sub-questions:

1. *What is firm performance?*
2. *What are firm internal resources?*
3. *What is the relationship between firm internal resources and firm performance?*
4. *What are firm external networks?*
5. *What is the relationship between firm external networks and firm performance?*

In order to illustrate the basis of this research, the *research model* is shown in figure 1.

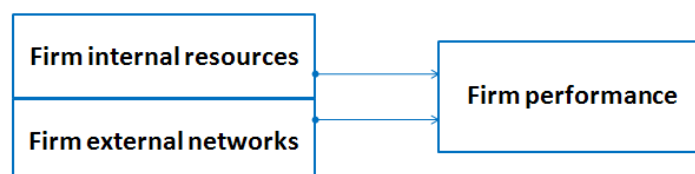


Figure 1: Research model

In order to answer the research question we are going to study companies in the network of the IT industry in The Netherlands. We study their internal resources, external networks and performance. In this research internal resources will be defined as "all resources (without including capabilities and processes) controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency". In order to account for the value creation of internal resources we use the resource based view of the firm (thereafter RBV). External networks will be view from a structural perspective which is focused on the informational role of the position a company occupies in the network (Gulati, 1998). Within this perspective position is view as the function of the actor's relational pattern in the network (Gulati 1998). In order to account for the value creation of external networks we use social capital theory.

1.2 Methodology

This explorative study is mainly based on literature search. The exploration would be carried when we find the relationship between internal resources and external network of a firm and its performance. We would like to obtain generally valid conclusions.

A conceptualization of firm's external networks and internal capabilities is developed and the expected relationships between them and performance are presented as hypotheses. We operationalize internal resources, external networks and performance by a number of variables in order to establish a link between the set of independent variables (internal resources and external networks variables) and dependent variable (performance variables). This link is analyzed in order to test the hypothesis.

The scope of this research is the network of IT companies in The Netherlands. IT is an heterogeneous industry defined as firms that either manufacture or sell computer hardware, software, and peripherals. Our sample is composed by 50 firms based on the companies with largest number of relationships within a subgroup of firms that first, are a member in the Dutch IT industry and second, are part of a strategic relationship with another member of that industry.

In this research we conduct a quantitative research so the data is numerical in nature. We use this type of data because we want to test specific hypothesis and thereof we know beforehand what data we require (Van der Velde, Jansen and Anderson, 2004).

In order to collect data we had to decide beforehand what research strategies we were going to use. We had to take into account first that we collect quantitative data, second that as a researcher we did not aim to intervene with the research units (firms), and third that we wanted to make generally valid conclusions. Thus, according to Van der Velde, Jansen and Anderson (2004) we should use either questionnaires or review of existing material. We also had to take into account certain research limits such as limits on time, funding, or the availability of people. If we restrict our research to those limits, the most suitable data collection method is review of existing material since it

allows studying a large group of companies in a short time and implying low cost. Therefore, according to the theoretical suggestions, the research strategy we developed was the review of existing material.

We measure the firm-level variables according to measures developed by other authors in the extant literature that are meaningful for our research. The last step is the analysis of the collected data. Based on the results we test the study's hypothesis and draw conclusions and discussions for our proposed research model.

1.3 Relevance

This research is of scientific relevance because it will extend our knowledge of network strategies developed with the aim of obtaining the best results. Specifically, we are going to fill the scientific gap of the joint consideration of firm's external networks and firm internal capabilities in explaining firm performance (Zaheer and Usai, 2004).

Doing business and competing in an interconnected network requires decision-makers to consider many factors in deciding which actions are appropriate and what the impact on their performance will be. This research is of managerial relevance because it will contribute to managers' knowledge in the field of firm external networks and internal capabilities and how this contributes to firm performance.

1.4 Report structure

The second chapter address the extant research about first, firm performance; second, firm internal resources and their relationship with performance based on RBV; third, firm external networks and their relationship with performance based on social capital theory; and finally, the relationship between internal resources and external network. Through this literature review the hypotheses that link the research's independent constructs with firm performance are proposed. The third chapter describe the sample, data collection method, measures of the research's construct, and the analytic techniques used to test the hypotheses. The fourth chapter present the results of the statistical analysis. The fifth chapter include the conclusions, weaknesses and recommendations. Sixth and seventh chapter include the appendixes and references respectively.

2. Internal resources and external networks driving firm performance: THEORETICAL CONSIDERATIONS

In this theoretical chapter we extensively discuss the relevant literature with regard to our research objective: investigate the firm-performance implications of building internal resources and of developing external networks. In order to account for the variation in value creation among firms we use two guiding firm-level theories: the resource-based view of the firm (RBV) and social capital theory. Figure 2 schematizes the research.

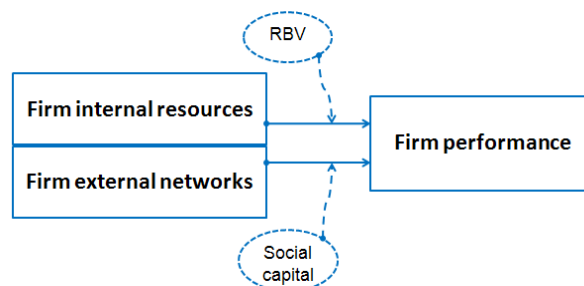


Figure 2

This chapter is structured in a way that sequentially answers the sub-research questions. The first section deals with firm performance. The second section deals with firm internal resources and their relationship with firm performance from the point of view of RBV. The third section deals with firm external networks and their relationship with firm performance from the point of view of social capital theory. The fourth section studies the relationship between firm internal resources and external networks.

2.1 Firm performance

In this research we study the performance implications of the strategy of accumulating internal resources and developing external networks. Therefore, we have to address the research sub-question “What is firm performance?” This is what this section is about. A review of the extant literature on the operationalization of firm performance is put forward in the coming paragraphs, followed by the operationalization we choose. Figure 3 schematizes what this section deals with.

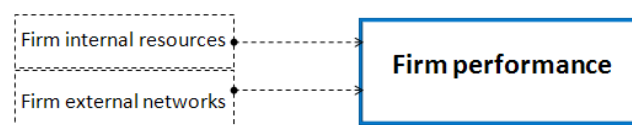


Figure 3

According to Das and Teng (2003), in this study the interorganizational relationships that compose a network are viewed as separate entities where the *performance* is the success of these separate entities.

2.1.1 Operationalization

In the operationalization of performance we find a debate in the academic community on issues of terminology, levels of analysis, and conceptual basis (Ford and Schellenberg 1982 in: Venkatraman and Ramanujam (1986)). Indeed, some researchers have expressed frustration with the lack of agreement on basic terminology and definition (Kantar and Brinkerhoff 1981; Cameron & Whetten, 1983a; Steers, 1975 in: Venkatraman and Ramanujam (1986)). Nevertheless, most strategy studies have identified two dimensions in firm performance that Venkatraman and Ramanujam (1986) named financial and organizational performance.

Financial performance is centred on the use of simple outcome-based financial indicators that are assumed to reflect the fulfilment of the economic goals of the firm. The exclusive use of this dimension to evaluate firm performance has been the dominant model in empirical strategy research. Typical indicators of this approach are sales growth, profitability (reflected by ratios such as return on investment, return on sale, and return on equity), earnings per share, and so forth.

However, this approach assumes the dominance and legitimacy of financial goals in a firm's system of goals. Moreover, these measures can be volatile and no reliable, and they reflect an outcome, not the process of achieving the outcome (Hafeez, Zhanga and Malakb, 2002). Thus, because of the disadvantage of the accounting measures, Venkatraman and Ramanujam (1986) suggest a broader conceptualization of firm performance that emphasizes, in addition to indicators of financial performance, indicators of *operational performance* (i.e., nonfinancial). The inclusion of operational performance indicators extend the "black box" approach that seems to characterize the exclusive use of financial indicators and focuses on those key operational success factors that might lead to financial performance. Under this framework there are measures such as market-share, new product introduction, product quality, marketing effectiveness, manufacturing value-added, and other measures of technological efficiency.

If we review the business network literatures that operationalize performance, we find that financial and/or operational performance measures are commonly used. As general examples of business network literatures we find Gupta and Somers (1996) who used the two dimensions identified by Venkatraman (1989) to measure organizational performance: growth performance and financial performance. They adapted the multiple items scale devolved by Gupta and Govindarajan (1984) that measure financial performance by: operating profits, profit to sale ratio, cash flow from operations and return on investment; and growth performance by: sales growth rate and market share. Hafeez, Zhanga, Malakb (2002) used common financial and non-financial performance measures: operating profit, return on capital employed,

market share, customer satisfaction and new product introduction. Baum, Calabrese and Silverman (2000) take into account the following performance dimensions: economic resource acquisition, human capital recruitment, investment in innovation, and intellectual property development. In order to measure them they use revenue growth, employment growth, R&D spending growth, and patenting success. Wang and Ahmed (2007) use what they called "key performance indicators" which include market and financial indicators. They compare them with the main competitors or industry average. Other authors have used as measures of firm's performance: firm's innovativeness (Zaheer and Bell, 2005), return on assets (Gulati and Gargiulo 1999; Rowley et.al, 2000), innovation and profitability rate (Tsai 2001), firm's likelihood of failure (Uzzi, 1997) or innovation output (i.e. number of patents) (Ahuja, 2000).

If we restrict the literature review to the specific cases related to our research question, it is, the literature that measure the effect of firm internal resources and external networks on firm performance, we also find the financial and operational dimensions of firm performance. In the literature where the effect of firm's internal resources on performance is focused upon, we find for instance Combs And Ketchen (1999) that use return on assets as financial performance to measure the efficiency of business operations (Hill et al., 1992 in: Combs And Ketchen 1999); and market-to-book value as market performance to approximate the stock market's perception of the value of the firm's present and future income and growth potential (Montgomery, Thomas, and Kamath, 1984). Caloghirou et al. (2004) esteem firm profitability relative to competition with three perceptual items: profit margin, return on assets, and net profits.

If we turn to the literature that test the relationship between firm's external networks and firm's performance, the financial and operational dimensions of organizational performance are once again identified. For instance, Batjargal (2003) uses sales growth, operating profit margin and return on assets. Baum, Calabrese and Silverman (2000) measure five dimensions of firms' performance: revenue and R&D spending growth, two different performance measures of employment growth, and the patenting rate. Lavie (2004) combines operational and financial measured by using market return, revenue growth and return on assets. Sarkar, Chambadi and Harrison (2001) use market share, sales growth, market development, and product development. Stuart (2000) also uses sales growth as a measure of performance. Zaheer and Bell (2005) use market share.

In order to choose the most suitable constructs for our research, we restrict such choice to four constraints. These four constraints are used throughout this research when we choose the constructs by which measure the study's variables. The first constraint is that the constructs should be measures at firm-level since this is a starting point of our research. The second is that they should be commonly studied and have sufficient theoretical and empirical support in the literature. This constraint is because by using existing instruments, it gives more confidence in the reliability and validity of the measurement and increases the comparability of the research results in case we want to compare. The third is that the constructs should be theoretically interesting for our research context. The fourth constraint is that the constructs should be able to

be measured with the information we have available in the collection data sources we can use in this study (they are detailed in 3.2 Data collection). This fourth constraint restricts to a large extent the measures that can be used. Moreover, for the measurement of firm performance, we add a requirement: we want to use not only financial measures because as we have explained they have some weaknesses, we also want to also use operational measures.

Basing our decision on the former constraints, we decide to operationalize firm performance by: market share, sales growth and return on assets. These three constructs are applicable as firm-level measures, so they meet the first constraint. They are commonly studied and have sufficient support in the literature as we can see in the theoretical review about performance operationalization that we have conducted above. So they meet the second constraint. Regard to the fourth constraint, the data we need to measure those constructs is available through the databases we have available for this research. Regard to the requirement to include operational as well as financial measures, market share is an operational indicator, while revenue growth and return on assets are financial indicators. Finally, in order to argument that these constructs are also theoretically interesting for our research, we study them more in depth in the next paragraphs.

Market share

Market share allow us measure how the internal resources and external networks contribute to the market power of a firm in the IT industry. Moreover, it is recognized that this measure takes into account corporate objectives and strategies (Hafeez, Zhanga, Malakb, 2002), so market share is recommended to test our strategy of building internal resources and developing external networks. Moreover, due to its operational character, the main advantage is that market share abstracts from industry-wide macroenvironmental variables such as the state of the economy, political ups and downs, any disaster, or changes in tax policy. Changes in the industry will be reflected in the market share ratio of the companies.

Market share is a measure of the percentage or proportion of the total market that is being serviced by a company (Maclachlan, 2001).

Revenue growth

We use revenue growth because it will permit us to assess the economic resource acquisition of a firm (Baum, Calabrese and Silverman, 2000) due to the development of internal resources and external networks. The increase in the firm's net sales analyze the effect that accumulating internal resources and developing external networks cause in the firm market reach and in the generation of firm additional revenues.

We use sales growth rather than sales figures because the sample consists of mixed large, medium and small firms.

Return on assets (ROA)

We use ROA because it is a conventional accounting measure that will tell us how profitable a company is. Moreover, our research deals with resources that will be specifically represented in ROA because it measured as the ratio of firm's net income to its total assets (tangible and intangible assets). The resources that we want to test in this research will be included in the total assets, thus permitting us a direct test of their effects.

By means of ROA we will measure the efficiency of business operations and it will provide an evaluation of firm performance (Hill et al., 1992 in: Combs And Ketchen 1999). Moreover, it is commonly used to compare companies in the same industry that is what we do in this research.

It is calculated as the ratio of a firm's net income to its total assets (tangible and intangible assets).

Figure 4 shows and illustrative summary of the operationalization of firm performance.

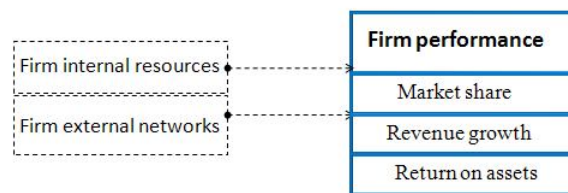


Figure 4

2.2 Internal resources

In this section we investigate the performance implications of accumulating internal resources. We address the research sub-questions "What are firm internal resources?" and "What is the relationship between firm internal resources and firm performance?" We use the resource based view of the firm (RBV) to study how internal resources explain differences in firm performance. First of all, we put forward the definition of internal resources we use in this research and after we turn to explain how internal resources drive firm performance. The last subsection is the operationalization of internal resources. Figure 5 schematizes what we deal with in this section.

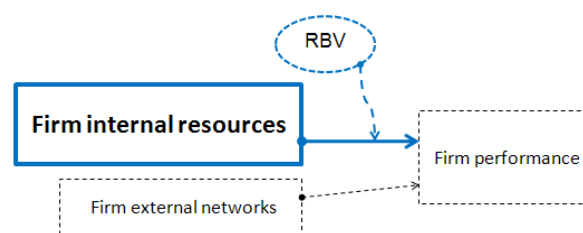


Figure 5

2.2.1 Definition

In the literature there are different definitions of firm internal resources. For instance, early studies on the RBV define resources as which 'include 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' (Barney, 1991: 101). This definition includes resources as well as capabilities and processes unlike other scholars who distinguish resources from capabilities and/or processes (Amit and Schoemaker, 1993; Helfat and Lieberman, 2002; Helfat and Peteraf, 2003 in: Lee (2008)). For instance, Helfat and Peteraf (2003) define resource as "an asset or input to production (tangible or intangible) that an organization owns, controls, or has access to on a semi-permanent basis", and with organizational capability refers to "the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result". Other scholars emphasize a capability as one or more routines, processes, or activities for producing outputs of a particular type (Eisenhardt and Martin, 2000; Winter, 2000; Zollo and Winter, 2002 in: Lee (2008)), so as to avoid the tautology of defining capabilities as an ability or capacity.

In this study we focus on resources, being resources different from capabilities. Capabilities use resources and therefore are more dynamic and complex entity and should be treated separately (Hafeez, Zhanga, Malakb 2002). We do not study both resources and capabilities due to time constraints; this would be a more extensive study out of the scope of this research. We focus on resources instead on capabilities because RBV –the theory we use in this research-, while extremely successful in explaining a number of phenomena, also imply a significant criticism for conceptualization and measurement of capabilities (Dutta, Narasimhan and Rajiv, 2005). For instance, Porter (1994), and Williamson (1999) in Dutta, Narasimhan and Rajiv (2005) criticize extant operationalizations of capabilities as being tautological: most extant studies identify critical resources/capabilities by comparing successful firms with unsuccessful ones, and then test if the resources/capabilities thus identified are indeed critical. Not surprisingly, the answer to this question is always a yes, making the theory unfalsifiable. Since we use RBV and we do not want to undertake the problems that the use of this theory implies when it deals with capabilities, we decide to focus on resources and thereby overcome this drawback.

Before putting forward the definition of internal resources we are going to use in this research, we have to tackle another specification: the literature differences "tangible" resources from "intangible" resources. The conceptualization of resources is very often found out to be difficult (see Hoskisson et al., 1999; Robins and Wiersema, 1995 in: Dutta, Narasimhan and Rajiv, 2005), particularly when one needs to estimate the effect of a possibly large set of "intangible" resources with all manner of possible complementarities and interactions among them, on a possibly large set of firm performance measures. Therefore, many quantitative RBV studies has only employed the 'tangible' elements of resources (e.g., facilities, raw materials, equipment) to explain variations in firm performance (Dutta, Narasimhan and Rajiv, 2005).

However, in this research, in spite of the difficulty that characterizes the conceptualization of intangible resources, we are going to consider them. The reason is that the 'intangible' elements (e.g., culture, communication, and knowledge) have an important role in creating an organization's value: 'as the industrial society becomes a services society, where knowledge and information are the mainstays of business growth, the importance of intangible resources are coming increasingly to the forefront' (Canals, 2000: 118 in: Dutta, Narasimhan and Rajiv, 2005). This fact is especially important for our research because we focus on the IT industry, which is a knowledge-based industry, in which the knowledge and information above commented is the stressed importance. Moreover, in the IT industry economies of scale are high -the marginal cost of each unit of additional software or hardware is insignificant compared to the value addition that results from it- and economies of scale arise mainly from intangible resources such as technical, marketing, and production know-how (Yeoh and Roth, 1999). Therefore, it is especially interesting for our research to consider intangible resources. Thus, we operationalize resources by considering both, tangible as well as intangible resources.

After all this considerations, we define internal resources as done by Hafeez, Zhanga, Malakb (2002) and Carmeli and Tishler (2004): resources are anything 'tangible' as well as 'intangible' owned by a firm.

2.2.2 Internal resources driving firm performance: RBV

Understanding sources of sustained competitive advantage for firms has become a major area of research in the field of strategic management (Porter, 1985; Rumelt, 1984 in: Combs and Ketchen, 1999). In this research we use the resource based view of the firm (RBV) to study how internal resources explain differences in firm performance.

RBV is a theory that seeks to explain how organizations maintain competitive advantage using firm-specific resources (Wernerfelt, 1984; Katila and Shane, 2005; Barney, 1991 in: Combs and Ketchen, 1999). RBV regards the firm as a bundle of resources and suggests that they significantly affect the firm's competitive advantage and, by implication, its performance (Barney, 1986, 1991; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984; Katila and Shane, 2005 in: Lee, Lee and Pennings, 2001). RBV emphasizes firm idiosyncratic resources, especially those that reside within organizations and are valuable, scarce, imperfectly tradable, and hard to imitate (Dierickx and Cool, 1989; Peteraf, 1993; Reed and DeFillippi, 1990 in: Barney, 1991). Thereby, RBV suggests that firms should pursue strategies that focus on the accumulation of resources to improve its performance (Lee, Lee and Pennings, 2001).

According to RBV, to be a source of sustained above-average performance, resources must meet three criteria. They must be: (1) valuable, meaning buyers are willing to purchase the resources' outputs at prices significantly above their costs; (2) rare, so that buyers cannot turn to competitors with the same or substitute resources; and (3) imperfectly imitable, meaning it is difficult for competitors to either imitate or purchase the resources (Barney, 1991). Further, the ability of a resource to meet these

criteria depends on industry characteristics that affect a resource's value (brand name reputation, for example, may be more valuable in experiential service industries than in industries where quality can be determined prior to purchase (Nayyar, 1990 in: Combs and Ketchen, 1999). Resources that are rare, difficult to imitate, and create value in a given industry are labelled 'strategic resources' (Chi, 1994 in: Combs and Ketchen, 1999). The literature is replete with examples of such valuable, rare, imperfectly imitable and not perfectly substitutable firm resources that enhance performance. Those examples include trade contacts, machinery, capital, corporate culture or firm's reputation among suppliers (Barney, 1986b, 1991); items of capital equipment, skills of individual employees, patents, and finance (Grant, 1991), or a brilliant Nobel prize-winning scientist as an employee (Peteraf, 1993). Applied to famous firms, examples are Sony's capacity to miniaturize, Phillip's optical-media expertise, Casio's ability to harmonize streams of technology (Prahalad and Hamel, 1990).

How resources affect organizational action and the specific processes through which resources affect performance have had considerable research attention (e.g., Argyres, 1996; Bergh, 1995; Mahoney and Pandian, 1992; Peteraf, 1993; Wernerfelt, 1984 in: Barney, 1991;). RBV argues that resource-based differences among firms can help in explaining performance differences because the outputs that can efficiently emerge from any unique configuration of resources are themselves unique. Firms are heterogeneous with respect to their resources because they are endowed with unique and idiosyncratic abilities to accumulate, develop, and deploy those assets to formulate and implement value creating strategies (Amit and Schoemaker, 1993; Peteraf, 1993 in: Barney, 1991). When resources enable a firm to establish either a lower cost structure or demand a price premium for its products or services, performance differences emerge (Wernerfelt, 1984; Porter, 1980; Combs and Ketchen, 1999). Moreover, the sustainability of these differences that produce superior profits depend on the difficulty competitors have in accessing similar resources (Barney, 1991; Dierickx and Cool, 1989; Peteraf, 1993). Hence, firm resources can form the basis of competitive advantage and thereby explain performance differences, if characterized by the properties of heterogeneous distribution among industry participants, imperfect mobility and protection from competition (Barney, 1991). Caloghirou et al. (2004) provided evidence that differences in the configuration of strategic resources better predict performance differences than do industry or market characteristics.

Another reason to explain how, according to RBV, resource endowments help in explaining performance differences is that resources are also '*sticky*': at least in the short run, firms are to some degree stuck with what they have and may have to live with what they lack. Teece et al. (1997) argue that this stickiness arises for three reasons. First, business as well as capability development is an extremely complex process, because firms lack the capacity to develop new competencies quickly (Dierickx and Cool, 1989). Second, some assets are not readily tradable, as is the case with tacit know-how (Teece, 1976, 1980), or reputation (Dierickx and Cool, 1989). Thus, resource endowments cannot equilibrate through factor input markets. Finally, even in the case where an asset can be purchased in a strategic factor market, the price the firm will have to pay will fully capitalize the rents stemming from its

utilization (Barney, 1986). As a result, unique firm assets exhibit inherently differentiated levels of 'efficiency', in the sense that they are superior to others (Teece et al., 1997). Sustained profits then, are ultimately a return to firm's assets (Caloghirou, et al., 2004).

RBV also especially stress the role of intangible resources in firm performance. As we said before, they have an important role in creating an organization's value because knowledge and information are key resources in the current society. Moreover, economies of scale arise mainly from intangible resources such as technical, marketing, and production know-how (Yeoh and Roth, 1999). Teece (2000) also suggests that a firm's superior performance depends on its ability to defend and use the intangible assets it creates (e.g., knowledge). In comparison with tangible elements, intangible elements such as organizational culture are less flexible (Chatterjee and Wernerfelt, 1991 in: Carmeli and Tishler, 2004), hard to accumulate, and not easily transferred, they can affect multiple uses at the same time, serve simultaneously as inputs and outputs of corporate activities (Itami with Roehl, 1987), and are not consumed when in use (Collis and Montgomery, 1998 in: Carmeli and Tishler, 2004). According to Hitt et al. (2001: 14) 'intangible resources are more likely than tangible resources to produce a competitive advantage.'

So far we have put forward the arguments given by RBV about how and why firm resources can explain differences in firm performance. In the next section we conceptualize firm resources by a number of constructs, and based on the theory we have developed in the paragraphs above and in the specific characteristics of the IT industry, we will hypothesize the sign of the relationship between internal resources and firm performance.

2.2.3 Operationalization

In order to conceptualize internal resources, we first look into extant literature to find out what have already been done. We find that Teece et al. (1997) identifies 8 variables for the measurement of firm resources: technological, financial, marketing, reputational, structural and institutional assets, and market (structure) and organizational boundaries. Yeoh and Roth (1999) focus on technological and marketing resources. Lee, Lee and Pennings (2001) use technological and financial resources, and also entrepreneurial orientation. Hafeez, Zhanga and Malakb (2002) classify resources of a manufacturing company into three sub categories: physical assets (location, buildings), marketing assets (brand name, reputation), and cultural assets (working ethics). Caloghirou et al. (2004) include measures of technological, financial, marketing and production competencies. Lavie (2004) identifies aspects that he argues may impact performance: technological, financial and marketing resources. Kumar (2009) uses tangible resources such as plant and equipment but also intangible resources such as technical and marketing resources and production know-how.

In order to choose the most suitable constructs for our research, we again restrict such choice to four constraints. The first is that the constructs should be measures at firm-

level since this is a starting point of our research. The second is that they should be commonly studied and have sufficient theoretical and empirical support in the literature, in order to assure the reliability and validity of the measurement and to increase the comparability of the research results in case we want to compare. The third is that the constructs should be theoretically interesting for our research context. The fourth constraint is that the constructs should be able to be measured with the information we have available in the collection data sources we have available for this study (they are detailed in 3.2 Data collection). This fourth constraint restricts to a large extent the possible measures we can use.

Basing our decision on the former constraints, we decide to operationalize firm internal resources by: technological, marketing and financial resources. These three constructs are applicable as firm-level measures, so they meet the first constraint. They are commonly studied and have sufficient support in the literature as we can see in the theoretical review about firm resources operationalization that we have conducted above. We see that the three chosen figures appear in almost all the literatures formerly reviewed. Thus, they meet the second constraint. Regard to the fourth construct, as we will see in the section 3.2 Data collection, we can measure these constructs by indicators we can find available through the databases we use in this research. Finally, in order to argument that this constructs are also theoretically interesting for our research, we study them more in depth in the next paragraphs.

Before we study the three chosen resources independently more in depth, we would like to point out a common theme: they are measures of intangible resources. As we have explained before, the intangible resources are of key importance in the IT industry.

Technological resources

Technological resources are a key indicator in the IT industry, the target of this research, because it is a knowledge-based industry which is noted for its technological intensity. Therefore, competitive advantage is tied to knowledge or technology development (Yeoh and Roth, 1999), which makes technological resources an appropriate measure of internal resources of a firm in the IT industry. As Lavie (2004) argues, the ownership and utilization of technological resources are clearly key differentiators among firms, especially in high-technology firms like the IT industry. Moreover, according to RBV, technological resources define the roots of a firm's sustainable competitive advantage: technological resources comprise many aspects such as technological knowledge, patents, or other technology-specific intellectual capital that are valuable and difficult to imitate by competitors, thereby being a sources of competitive advantage (Dollinger, 1995).

Based on these arguments that explain why technological resources are of key importance in IT industry and are a base of competitive advantage, we propose the following hypothesis:

Hypothesis 1: Firm technological resources are positively associated with firm performance

Marketing resources

Marketing efforts have been observed to be important in the IT industry. As we said before, technological resources are a key resource for IT industry. The fact is that besides, technological innovations also require the use of certain related assets to produce and deliver products and services. For instance, prior commercialization activities such as information collection about emerging customer needs are required to more likely ensure successful differentiation within the industry. Therefore, marketing resource is an interesting indicator to take into account in our research.

Studies from the product development literature have generally found a strong relationship between marketing orientation and product success (e.g., Cooper and Kleinschmidt, 1990). Marketing resources serves a potentially critical role in gathering market-based information and providing direction throughout the value creation process. Thus, even before the prelaunch stage, marketing efforts are necessary to create awareness about and interest in promising products and services. Moreover, by conditioning the target audience about them, firms attempt to influence preferences rather than merely respond to them. Therefore, marketing efforts are expected to influence approval success of products and services directly.

In the IT industry, the role of marketing resources is even more important in order to succeed: it is a global, highly competitive, and extremely dynamic industry in which the rate of change in consumer preferences among other aspects, by far exceeds that of other industries. As a result, quick and effective research and response to the changing customer needs to be able to gain the market and are critical for success in this industry.

Moreover, from the point of view of RBV, marketing are mainly experience based resources what makes these skills difficult to imitate and then be a source of competitive advantage.

Based on the former arguments that explain the advantage that entail marketing resources in firm success, we propose the following hypothesis:

Hypothesis 2: Firm marketing resources are positively associated with firm performance

Financial resources

The financial capital a firm possesses is the liquid assets or credit lines that a firm can invest in product and market development, technology development, marketing research, advertising, recruit of valuable human capital, etc. Therefore, financial resources are important for every type of company, but especially in the IT industry where firms have to make large investments. The more financial capital a firm is

endowed with, the more advantages it will be able to enjoy, and thus it is more likely to perform better.

From the point of view of RBV, financial resources are not considered to provide sustainable competitive advantage since such resources are neither rare, nor imitable, nor tradable. However, financial resources can be a source of sustainable competitive advantage since the firms that have more financial resources are likely to accumulate a larger stock of strategic assets than others that lack such financial resources (Dierickx and Cool, 1989 in: Lee, Lee and Pennings, 2001).

Thus, based on the former arguments that explain the advantage that entail the financial resources in firm success, we propose the following hypothesis:

Hypothesis 3: Firm financial resources are positively associated with firm performance

Figure 6 is an illustrative summary of the operationalization and the sign of the hypothesized relationships we have put forward in this section.

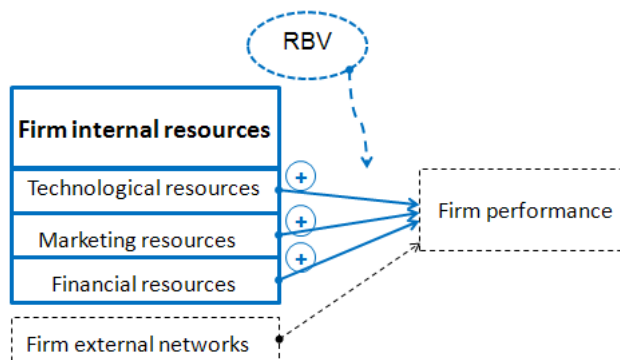


Figure 6

2.3 External networks

In this section we investigate the performance implications of developing external networks. We address the research sub-questions “What are firm external networks” and “What is the relationship between firm external networks and firm performance?” We use social capital theory to study how external networks explain differences in firm performance. First of all, we put forward the definition of external networks we use in this research, and after that we turn to explain how external networks drive firm performance. The last subsection is the operationalization of external networks. Figure 7 schematizes what we deal with in this section.

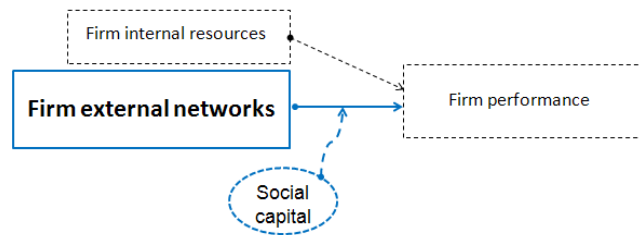


Figure 7

2.3.1 Definition

Organizations cover only part of their value chain and depend critically on their environment. Firms are truncated in their resource endowment, and a way to overcome those resource scarcities is to transact with other economic actors having complementary assets. Thereby, firms are interconnected with other firms through a wide array of social and economical relationship constituting a social network (Erramilli and Rao, 1990; Ingham and Thompson, 1994 in: Lee, Lee and Pennings, 2001).

These networks include supplier relationships, resource flows, trade association memberships, relationships among individual behaviours and prior strategic alliances. Through these networks a firm access key resources from its environment such as information, access, capital, goods, services, etc, what have the potential to maintain or enhance a firm's competitive advantage (Baum, Calabrese and Silverman, 2000; Gulati, 1998).

Since firms are interconnected with other firms in social networks, we cannot make the same mistake as much of the research on alliances and represent an undersocialized account of firm behaviour (Gulati, 1998). Rather, we have to take into account the actions of other firms or the relationships in which they themselves are already embedded. This is why a number of researchers have explicitly incorporated the idea of "embeddedness" of firms in social networks with other business actors into our understanding of strategic questions relating to the behavior and performance of firms (see, for example, Granovetter, 1985; Burt, 1992; Uzzi, 1996; Gulati, Nohria, and Zaheer, 2000; Rowley, Behrens, and Krackhardt, 2000). It is generally admitted that embeddedness has relational as well as structural dimension (Gulati, 1998). In the present paper structural embeddedness is focused upon. In the paragraphs below we argue this choice.

Underlying embeddedness is the quest for information to reduce uncertainty. It is a quest that has been identified as one of the main drivers of organizational action (Granovetter, 1985). Networks of contact between actors can be important sources of information for the participants, and what can matter is not only the identity of the members of a network but also the pattern of ties among them. Thus, networks may provide informational benefits through two mechanisms (Granovetter, 1992). First, *relational embeddedness* or cohesion perspectives on networks stress the role of direct cohesive ties as a mechanism for gaining fine-grained information. Actors who share direct connections with each other are likely to possess more common information

and knowledge of each other. Second, *structural embeddedness* or positional perspectives on networks go beyond the immediate ties of firms and emphasize the informational value of the structural position these partners occupy in the network. This shifts the analytical approach from the dyad to the system. Information travels not only through proximate ties in networks, but through the structure of the network itself. Thereby, structural embeddedness highlights the advantage a firm can derive from its position in the network unlike relational embeddedness that highlights the advantage from information exchange in individual relationships (Granovetter, 1992; Gulati, 1998; Rowley et al., 2000). Both approaches represent the structure and quality of ties among firms which shape economic actions by creating unique opportunities and access to those opportunities (Uzzi, 1997).

We focus upon structural embeddedness because it reflects the advantages a firm can enjoy from the resource flow through the whole structure of the network of relationships -which is what we want to study in this paper- unlike relational embeddedness that only highlights advantages from proximate ties.

Therefore, in this research we study firm external networks from a point of view that suggest that embedded ties provide the greatest access to the benefits circulating in the network: because of the high level of information exchange, trust, and joint problem-solving arrangements that characterize embedded ties, firms can most rapidly gain entry into, and capitalize on, the opportunities afforded by the network (Gnyawali et al. 2006).

2.3.2 External networks driving firm performance: social capital theory

A way to understand the performance consequences of social networks for firms embedded within them, is to think of social networks as bestowing firms with 'social capital' (Gulati, 1998) that can become an important basis for competitive advantage (Burt, 1997)¹.

Social capital captures the beneficial effect of social networks on organizational performance (e.g., Pennings et al., 1998). Social capital is defined by Gabbay and Leenders (1999) as: 'the set of resources, tangible or virtual, that accrue to a corporate player through the player's social relationships, facilitating the attainment of goals'. Therefore, social capital suggests that a firm's external networks form a major contributor to firm performance (Leenders and Gabbay, 1999), which imply that firms should pursue strategies focusing on the development of valuable networks with external parties in order to succeed.

¹ While the notion that actors possess social capital has been most developed for individuals and their interpersonal networks, the idea can easily be extended to organizations and their interorganizational networks (Gulati, 1997).

Social capital can also be defined as resources embedded in a social structure which are accessed and/or mobilized in purposive actions (Lin, 1999). According to Uzzi (1996) "embeddedness refers to the fact that exchanges within a network... have an ongoing social structure [that], . . . by constraining the set of actions available to the individual actors² and by changing the dispositions of those actors toward the actions they may take . . . affects economic performance in ways that some orthodox and neoinstitutional economic schemes do not address". The key embeddedness argument is therefore that actors' purposeful actions are embedded in concrete and enduring strategic relationships that impact those actions and their outcomes (Granovetter, 1985). Hence, the strategic network perspective avers that the embeddedness of firms in networks of external relationships with other organizations holds significant implications for firm performance (Gulati, Nohria, and Zaheer, 2000; Zaheer and Bell, 2005).

Although there is a great variety in the conceptualization of network embeddedness, (for an overview, see Dacin, Ventresca, and Beal, 1999), a common theme is that network embeddedness can be looked upon as a strategic resource in itself influencing the firm's future capability and expected performance. Thereby, performance may vary between firms because of differences in network embeddedness. Network embeddedness can be looked as a strategic resource because, as it is commonly thought, an organization's performance is contingent on its ability to obtain resources from its environment (Andersson, Forsgren and Holm, 2002), and through the social network the firm gets access to resources outside the organization -resources such as capital, goods, services, innovations, etc. The network is created through a path-dependent process and is, therefore, idiosyncratic and difficult to imitate. Consequently, the resources which are accessible through the network are also relatively inimitable and nonsubstitutable (Gulati, 1999; Gulati et al., 2000).

There are scholars that have found many other positive effects of interorganizational relationships on performance. For instance Uzzi (1997) demonstrated that organizational performance increases with the use of embedded ties with network partners. It has been suggested that lower uncertainty in close relationships will lead to better inventory control and lower inventory costs on both sides (Trevelen, 1987; Landeros and Monenczka, 1989 in: Uzzi 1997). Close relationships mean a better understanding of a supplier's ability and therefore more efficient marketing (purchasing) activities. Furthermore, actors in long-term relationships have a much better knowledge of the counterparts' resource heterogeneity. This knowledge will increase the possibility of value creation through combining the resources and activities on both sides that goes beyond the simple pooling of resources, and consequently an increased 'opportunity space' (Blankenburg Holm, Eriksson, and Johanson, 1996). Superior performance has also been related more directly to the ability to absorb new knowledge from the environment through that network of specific interorganizational relationships.

² In this study the actor is the firm.

As we explained in the section above, in this research we specifically focus on the structural dimension of network embeddedness. This positional perspective goes beyond the immediate ties of firms and emphasizes the value of the structural position the firms occupy in the whole network. The positive effect on performance of superior network positions has also been extensively documented in the network literature (Portes, 1998; Reagans and Zuckerman, 2001; Tsai, 2002 in: Gulati et al., 2000). For instance, Powell and Smith-Doerr (1994) in their wide-ranging review of the network literature found numerous mechanisms through which network position enhances firm performance, including quick access to resources (see also Uzzi, 1997), rapid dissemination of information regarding opportunities and threats, and receipt of information about the quality of exchange partners. The location of firms in interfirm networks is also important in explaining differences in firm profitability by means of competition. Competition is more intense among actors who occupy a similar location relative to others but is mitigated if actors are tied to each other (Zaheer and Zaheer, 1999; Gulati, Nohria and Zaheer, 2000). Gnyawali et al. (2006) explain that firms that achieve superior network positions in a co-opetitive network are better able to develop their competitive capabilities through a network of ties and increase its competitive advantage. Nevertheless, the most commonly tested arguments are related to the debate between Burt's (1992) structural hole and Coleman's (1988) closure forms of social capital. They illustrates that different types of structural embeddedness can be beneficial: Coleman (1988) argues that a dense network promotes trust and cooperation among its members. In contrast, Burt (1992) suggests that firms embedded in sparsely connected networks will enjoy efficiency and brokerage advantages based on the ability to arbitrage nonredundant information exchanges.

The benefits of developing external relationships in of stressed importance in the IT industry. IT is the industry in which most strategic partnerships have been developed. The reason is that this industry requires a wide requires a wide application of a range of technological capabilities which may not be implemented on the grounds of the firm's individual competencies and therefore strategic partnerships are needed.

So far we have put forward the arguments given by social about how and why firm relationships can explain differences in firm performance. In the next section we conceptualize firm external networks by a number of constructs, and based on the theory we have developed and in our research context, we will hypothesize the sign of the relationship between firm networks and firm performance.

2.3.3 Operationalization

In order to conceptualize firm networks, specifically from a structural embeddedness perspective, we first look into extant literature to find out what have already been done in this theme.

Most researches identify embeddedness as a multilevel phenomenon (i.e. Granovetter (1985)); actually, the embeddedness literature has largely focused on the firm and network levels as well as in pair-level interactions (Wasserman & Faust, 1994). According to the multilevel perspective of embeddedness, the most used construct in explaining structural embeddedness are the following: centrality (firm-level structural property), structural autonomy (an index of how many “structural holes” are in the firm’s network) (firm-level structural property), structural equivalence (pair-level structural property), and density (or network closure) (network-level structural property).

In order to choose the most suitable constructs for our research, we again restrict such choice to the four constraints. The first is that the constructs should be measures at firm-level since this is a starting point of our research. The second is that they should be commonly studied and have sufficient theoretical and empirical support in the literature in order to ensure the reliability and validity of the measurement and to increase the comparability of the research results in case we want to compare. The third is that the constructs should be theoretically interesting for our research context. The fourth constraint is that the constructs should be able to be measured with the information we have available in the collection data sources we can use in this study (they are detailed in the Methods chapter, in the subsection Data collection). Specifically for network measures, we use information contained in the database of companies in the Dutch IT industry. In this database there is a list with the name of the partners every company has that operate in this same Dutch IT industry, so we have the networks on relationship in the industry and we can perform many network measures. Therefore, this fourth constraint is not a big restriction in the measures to be used for network measures unlike for performance and internal resources measures. Besides these four constraints, in order to measure firm external networks according to the focus of this research, we have to use structural properties. As we explained before, we focus this research in the structural characteristics of firms embedded in networks.

Taking into account the former constraint, in this research we are going to measure firm external networks by centrality and structural autonomy. As we can see in the literature review paragraph, they are firm-level structural measures –so we meet the first and the last constraint- and they are identified as the two most used firm-level constructs in explaining structural embeddedness –so we meet the second constraint. Regarding the fourth constraint, we can calculate those measures with the information we have available. Finally, in order to argue why these constructs are also theoretically interesting for our research, in the coming sections we study both construct more in depth.

Centrality

Centrality, which refers to the position of an individual actor in the network, denotes the extent to which the focal actor occupies a strategic position in the network by virtue of being involved in many significant ties (Wasserman & Faust, 1994). It is interesting to measure firm centrality because this measure let us know an index of

how well positioned the firm is in the network and thereby the firm's ability to access and acquire network resources (Gnyawali et al. 2006). Differences in such abilities create network-based resource asymmetries among firms, and so influencing firm's performance. So the measure of centrality is of key importance for the better understanding of differences in firm profitability.

Gnyawali and Madhavan (2001) among others propose that high centrality leads to higher volume and speed of asset, information, and status flows since network ties are conduits for all three resources. Regard to assets, a central actor has greater access to external assets, such as technology, money, and management skills, from connected actors. Regard to information, being at the confluence of a larger number of information sources through their ties, central actors are likely to receive new information sooner than less central actors (Rogers, 1995 in: Gnyawali and Madhavan 2001), as well as to enjoy earlier access to important new developments (Valente, 1995 in: Gnyawali and Madhavan 2001). Regard to status, high centrality implies higher status and power (Wasserman & Faust, 1994), because an actor who is the recipient of many ties is considered to be a prestigious actor (Brass and Burkhardt, 1992 in: Gnyawali and Madhavan 2001). Thus, firms whose relationships allow them to occupy a more central place in the strategic networks enjoy superior returns than those firms that are more peripheral because the access to better information, resources and opportunities lead them to a positive resource asymmetry and therefore to differences in competitive behaviour and performance (Gulati, Nohria and Zaheer, 2000).

Centrality may also have two negative consequences as well: the central firm is highly dependent upon its network by virtue of being involved in a large number of ties, and the central firm may also be at a disadvantage since each network tie is not only an opportunity to gain information but also a potential "leakage point" (Harrigan, 1986 in: Gnyawali and Madhavan 2001). However, it is argued that the central firm still has the advantage, on balance, for three key reasons. First, high centrality implies that the actor who is the object of many relations has something of value to others, suggesting that it will retain "bargaining power" (Burt, 1991). Second, although dependency does flow in both directions within the tie, the central firm's dependency is diffused across many more ties. Third, with respect to information leakage, disjointed information elements held by different actors in isolation may be less valuable than the integrated information set held by the central firm.

Considering the above arguments about the effects of centrality on performance, we propose the following hypothesis:

Hypothesis 4: As the centrality of a focal firm relative to others in the network increases, the firm performance will increase

Structural autonomy

Structural autonomy is a measure that allows the assessment of firm's ability to control the potential flow of resources to rivals. It is important to investigate that because by controlling the flow of resources to rivals the firm creates network-based resource asymmetries among firms that may influence firm's performance (Gnyawali et al. 2006).

Drawn from Burt's (1992) influential work on structural holes, a structurally autonomous firm has structural holes between the firms it is connected to but is free of structural holes at its own end. In other words, structural autonomy refers to the extent to which a firm enjoys structural holes in its network of relationships; it is an index of how many "structural holes" are in the firm's network (Burt, 1992).

Structural holes: if actor A has ties to both B and C but B and C are not tied directly to each other—that is, B and C can reach each other only through A—a structural hole exists between B and C, which can be exploited by A. In other words, structural holes exist when two industry trading partners are connected only through the focal industry (Gulati, Nohria and Zaheer, 2000). (See illustrative example in figure 8)

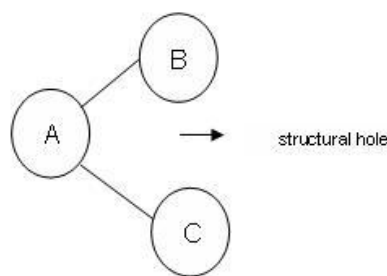


Figure 8-Structural hole

Structural holes enhance information benefits in several ways and thereby have an important role on performance. For instance Burt (1992 and 2000) or McEvily and Zaheer (1999) argue that actors in a network rich in structural holes will be able to access novel information from remote parts of the network, and exploit that information to their advantage (Burt, 1992). Additionally, firms bridging structural holes may be able to access resources from unique parts of their network, may hear about impending threats and opportunities more quickly than others not so positioned, and may find out about the quality of possible exchange partners and potential allies (Powell and Smith-Doerr, 1994; Uzzi, 1996). Because knowledge is developed partially through firm interaction, actors who bridge structural holes will be able to develop new understandings, especially regarding emergent threats and opportunities not possible to those who do not bridge holes. Moreover, because maintaining ties to many other actors is costly, firms that eliminate redundant ties to others will be more efficient in their use of scarce management attention (Burt, 1997; Gnyawali and Madhavan, 2001). Writers like Zaheer and Bell (2005) found support for Burt (1992), McEvily and Zaheer (1999) and others approach that firms that bridge

structural holes will be well positioned to efficiently and quickly learn about and develop responses to industry trends. Consequently, they posit that superior network position, defined as access to structural holes, exerts a multiplicity of positive influences on firm performance, including enhanced efficiency, better access to resources (including information or knowledge), and better identification of and responses to emerging threats and opportunities.

While structural holes are the underlying phenomena, structural autonomy is the network property of actors who have "relationships free of structural holes at their own end and rich in structural holes at the other end" (Burt 1992: 45). Thus, our discussion hinges on the structural autonomy construct.

Because of the structural hole advantage above described, a structurally autonomous firm enjoys more effective and efficient flows of assets, information, and status from its network, and these translate into a positive resource asymmetry and provide competitive advantage and by implication better performance. Further, structural autonomy provides control benefits: the competitor with structural holes can play its less autonomous partners against one another (Burt, 1992). The relative lack of redundancy in network contacts implies that the structurally autonomous firm has a richer and more varied set of assets and information. Structural autonomy also implies that the focal firm is depended upon (by the actors with whom it has ties) to a greater degree than vice versa, leading to greater status and power. The bridging role implicit in structural autonomy means that connected firms depend on the bridging tie not only for resources from the focal firm but also for indirect contact with (and resources from) each other-in effect, according the bridging firm significant status and power. Given that the structurally autonomous firm enjoys a stronger asset base, early information access, greater status, and control over resource flows, it is more likely to undertake competitive actions and thus enhance performance than less autonomous firms.

Considering the above arguments about the advantages of firms enjoying structural autonomy, we propose the following hypothesis:

Hypothesis 5: As the structural autonomy of a focal firm relative to others in the network increases, the firm performance will increase

Figure 9 is an illustrative summary of the operationalization and the sign of the hypothesized relationships we have put forward in this section.

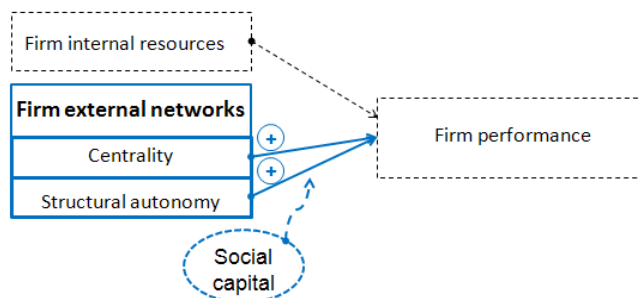


Figure 10

In order to have an overall picture of the operationalization of the study's variables, we include figure 10.

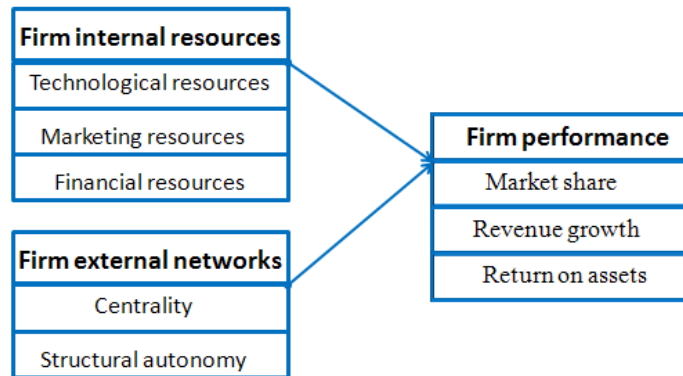


Figure 11

2.4 The relationship between internal resources and external networks driving firm performance

In the two previous sections we have addressed first the sub-questions “What are firm internal resources?”, and “what is the relationship between firm internal resources and firm performance?” from the point of view of RBV. Second, we have addressed the sub-questions “What are firm external networks?”, and “What is the relationship between firm external networks and firm performance?” from the point of view of social capital. We have stated that internal resources and external networks independently matter in explaining firm performance. Strategy scholars tend to consider the firm’s internal resources as sources of value creation; while network scholars tend to focus attention on the value of the network structure.

However, as many researches claim (i.e., Gulati, Nohria and Zaheer, 2000) the rents that accrue to firms is partly the result of their own unique resource endowments, but partly derived from the structure of the network to which they belong. They claim that a comprehensive view of a firm’s rent-generating resources would not only include elements such as brands, technological resources, management talent, and so forth, but would also include the network resources or social capital of the firms. This is a topic that has not been researched yet at the level of a firm what led us to the main research question “What is the relationship between the internal resources and external networks of a firm and its performance?” (See figure 1 for an illustrative scheme).

The joint consideration of internal resources and external networks in explaining firm performance is of special interest in the IT industry. It is an industry that places great importance on resources, because they are necessary to develop the high-technologies that comprises the industry; but also places great importance on external networks because due to the large range of technological resources that are required, the firm may not be capable to implement them on the grounds of its individual competencies.

In this study we use RBV and social capital. Both theories have divergent concerns with the roots of value creation with RBV stressing the internally accumulated resources while social capital theory underscores its relational characteristics with external entities. However, both theories ought to be synthesized. If we gain insight into RBV and social capital, we observe that both approaches claim the urgency of research that deals with the joint consideration of internal resource and external networks as respective contributors to firm performance. Specifically, both perspectives claim the consideration of the other theory for this aim, which is what we are doing in this research.

RBV perspective, it sets great store by internal resources but has mostly ignored external resources available through the firm's network (Gulati, 1999). RBV has emphasized the notion that resources owned or controlled by the firm have the potential to provide enduring competitive advantage when they are inimitable and not readily substitutable (Peteraf, 1993). Typically, scholars looked within the firm for these valuable and inimitable resources (Barney, 1991); it was generally assumed that firms 'somehow' develop such resources internally. Search for the source of value-creating resources beyond the boundaries of the firm was a novel perspective for the RBV. According to this new perspective, Gulati, Nohria and Zaheer (2000) stated that a firm's network can be thought of as creating inimitable and nonsubstitutable value (and/or constraint) as an inimitable resource by itself and as a means to access inimitable resource. Gulati (1999) referred to these as "network resources". However, "network resources" as studied by Gulati (1999) it is not a concept developed for understanding individual networks: "it inheres not so much within the firm but in the interfirm networks in which firms are located". Gulati, Nohria and Zaheer (2000) explain that in order to examine the acknowledge role of firm's external networks in the value creation process from the perspective of RBV we have to use the theory of social capital (which is concept akin to "network resources" but has been developed for understanding individual networks). Therefore, RBV acknowledge that a source of creation of inimitable value-generating resources lies in a firm's network of relationships, but RBV have not examined it yet in a firm-level, and suggest to turn to social capital theory.

Regard to *Social capital*, this concept captures the beneficial effect of social networks on organizational performance (e.g., Pennings *et al.*, 1998). This theory places firm's external networks as a major contributor to firm's performance (Leenders and Gabbay, 1999). By means of social network analysis is possible to provide deep insights and explanations of many aspects of firm behaviour by examining the networks in which firms are embedded (Zaheer and Usai, 2005). However, it is also argued by authors in this theory (i.e. Zaheer and Usai, 2005; Zaheer and Bell, 2005) that adopting a purely network structuralist approach and ignoring focal firm resources is likely to overlook an important source of variance in firm performance. They state that incorporating organization resources into network explanatory models in addition to structural and relational characteristics is important in interfirm research, since ties and structure may impose only limited constraints on action, or provide limited opportunities for enhancing performance outcomes. Another argument to include firm resources in network studies draws on the complexity and size of organizations, in particular

relative to individuals: only a small part of the organization may be connected to the network, with consequently limited effects on the organization as a whole. Therefore, as networks authors argue, trying to explain an outcome like firm performance only using network structure would lead to a seriously underspecified model (Zaheer and Usai, 2005; Zaheer and Bell, 2005). Thus, in social network research is pointed “a need to go beyond a structuralist view and account for firm attributes which, as predicted by the RBV, exert an influence on firm performance” (Zaheer and Bell, 2005). (i.e. Stuart (2000) and Gulati and Wang (2003)). However, they have not done it yet.

In the last two paragraphs we have put forward evidence from RBV as well as from social capital that a comprehensive view of a firm’s rent-generating resources would not only include elements such as brands, technological resources, management talent, and so forth, but would also include the network resources or social capital of the firms. In line with these arguments it is also interesting to investigate the performance consequences of the interactions between internal resources and external networks. Interaction occurs when the effect of internal resources and external networks in firm performance is not simply additive, but has an effect upon one another. This is investigated more in depth in the next subsection.

Interactions

Internal resources help firms accumulate social capital, as potential partners are more willing to collaborate with the firms having a higher level of internal resources. Similarly, social capital helps firms accumulate internal resources as social capital provides access to information, technology, and, at times, human and financial capital that are needed for the accumulation of internal resources (Burt, 1992).

Furthermore, internal resources and social capital are complementary in creating value. The value of *internal resources* to a firm is *contingent on its social capital* (cf. Burt, 1997). To create more value from internal resources at hand, firms should mobilize complementary external resources in which to apply the resources and have to dispose of produced outputs. Organizations with more social capital receive higher returns to their internal resources because they are positioned to identify and develop more rewarding opportunities (Burt, 1992), to acquire complementary external resources (Teece, 1997), and to dispose their technological production with better terms. Likewise, when organizations have less social capital, their internal resources are bound to generate fewer rents and the market to value them to be much lower.

Similarly, the value of *social capital* to a firm is *contingent on its internal resources*. Internal resources help firms better use the complementary external resources that can be obtained on the basis of their social capital. A higher level of internal resources and thus higher level of absorptive capacity help firms learn more from their networks and create more value from the opportunities provided by their networks. Lacking internal resources, firms experience difficulty in generating value from their social capital.

In sum, internal resources and external networks are complementary in creating value for firms. We hypothesize this idea as follows:

Hypothesis 6: Internal resources and external networks have a positive interaction effect on firm performance

Figure 11 is an illustrative summary of the sign of the hypothesized relationship we have put forward in this section.

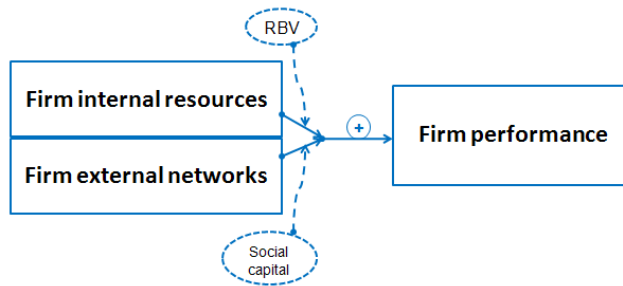


Figure 12

3. METHODS

3.1 Sample

In this research we look at the firm's set of relationships with other organizations that facilitate the achievement of a common goal (Provan et.al 2007). We focus on the network within information technology (IT) industry. IT is a heterogeneous industry that includes software development, hardware, and services as well as everything from computer systems, to the design, implementation, study and development of IT and management systems. IT companies includes telecommunications, hardware and electronics, and software and computer services companies.

We focus on IT industry because it provides many characteristics that make this industry appropriate to analyze our research objective: investigate the performance implications of strategies for building internal capabilities and for developing external networks. The characteristics that make IT industry appropriate for our research are the following. 1) This industry is the area where most of the worldwide strategic partnerships are developed. IT requires a wide application of a range of technological capabilities which may not be implemented on the grounds of the firm's individual competencies. Therefore, this industry has a rich network thereby enhancing the meaningfulness, reliability and variance of networks variables. 2) This industry requires a heterogeneous and large range of resources. Therefore, this will allow us study a wide range of firm internal resources. 3) This an industry that shows successive waves of transformation resulted in significant changes in this industry, but the overall structure, productivity, and diversity have been unhurt, and its main players have persisted (Iansiti and Levien 2004b). Therefore, it is appropriated for studies over a period of time (longitudinal study). 4) This is a fast-paced industry with frequent innovations, but its product lifecycle is not too long. Therefore, this industry enables observation. 5) This is an industry in particular featured a high proportion of publicly traded firms. Therefore, it ensures the accessibility of financial information and reducing potential size- and age-related biases (Lavie, 2004).

The scope of this research is the network of IT companies in The Netherlands. The worldwide network of IT companies would be a large population whose research would be an expensive and too time-consuming task (Van der Velde, Jansen and Anderson, 2004). Moreover, we also have to consider the availability of data, which for the case of IT companies in The Netherlands, we can find available.

The network of IT companies in The Netherlands if composed by about 9500 companies. In order to have an idea of the size of the companies, out of the 9500 that form the industry, only 2 companies have more than 10000 employees, 40 companies have between 10000 and 1000 employees, and 100 companies have between 1000 and 300 employees. In order to have an idea of the level of networking in this industry, in the database from which we collect the data there is a rank of the 70 companies

with the largest number of ties. The number of ties of the company ranked in first position is 890, while the number of ties of the firm ranked in the 70th position is 15. The rest of the 9500 companies have less than 15 ties. According to the data we can find in the available in this database, in this research ties are the relationships a company has with other companies that also operate within the network of IT industry in The Netherlands.

Knoke (1994) summarized three decision rules used for constructing networks for empirical examination and defining boundaries: attributes of actors (such as membership in an industry), types of relations between actors (such as strategic alliances), and participation in a set of events or issues (such as proposed plans to deregulate a highly regulated industry). According to those decision rules our sample is designed based on two criteria: membership in the Dutch IT industry and be part of a strategic relationship with another member of that industry.

The IT industry in The Netherlands is composed by about 9500 companies. We leave out of the sample the companies that are not part of a strategic relationship with any other member in that industry because they are not part of the network. We choose the companies for our sample among the companies with largest number of ties. We make the selection based on the largest number of ties because those companies are the most active and dynamic in the networking context, so they are representative for the network research variables. Moreover, some of the companies with largest number of ties are among the biggest companies in the industry –not all the companies with largest number of ties are also the biggest ones, this happens only for some of the companies-, where size is measured by the number of employees. This is an added value because company size is also a representative attribute for internal resources variables: the larger the firm's size, the greater the resources (Bonaccorsi, 1999). Moreover, the largest firms constitute the core of an industry and ensure the availability and reliability of data. Indeed, past network studies have used the strategy of focusing on the leading firms in an industry to conduct the analysis (Gulati, 1995; Gulati and Garguilo, 1999; Ahuja, 2000).

We first picked a group of 70 companies with largest number of ties to include them in the research sample. In order to include a company in the research sample we had to find specific financial data of the Dutch subsidiary for the years 2004-2007, as well as the annual reports of the global company for the year 2006 (in the section 3.2 Data collection it is explained why this information is needed). In some cases the financial information for the Dutch subsidiary was not available, or was not available for the required years. In other cases the unavailable information was the annual reports of the global company, or the published reports were summaries with no enough information, or were not for the required year. Thus, out of the sample of 70 companies with largest number of ties we could include only 40 in our research sample.

We wanted more companies for our research sample so we picked another group of companies to try to include them in our sample: we picked the 55 biggest firms of the network of Dutch IT industry. We chose the companies based on their size because of

the arguments we already stated the paragraph above (they are representative for internal resources variables and are more likely to have available data, which has been the problem we encountered with the previous group of companies). By choosing this new group we hoped not to have problems due to the unavailability of data. Within this new group of the 55 biggest companies, some of them had already been assessed in the former step (as we explained before, some of the companies with largest number of ties were among the biggest companies as well) so they were dropped out of the analysis. For the rest of companies we followed the same procedure we followed with the previous group: we had to find specific financial data of the Dutch subsidiary for the years 2004-2007, as well as the annual reports of the global company for the year 2006. After dropping out the firms that had already been assessed in the former step and the firms for which we could not find all the required financial data, we obtained 10 companies more. Thus, we came up with a sample of 50 companies.

In order to evaluate whether this sample size is big enough to discover significant correlations, we have to take into account that the necessary size depends on the analysis we conduct. A general rule for statistic analysis is that a sufficient sample contains about 10 times research units as explanatory (independent) variables are in the research model (Verde and Anderson, 2004). In order to test frequency distribution of this study's variables, at least 20 research units are needed. When normal distribution of variables is not achieved, it is not a serious concern if the sample has more than 30 research units. Therefore, we consider the sample of 50 firms that we have obtained to be sufficient for this research.

We tried to include more research units into our sample. The problem was that most of the rest of companies of the network of Dutch IT industry are either small and/or they are not required to report financial figures by SEC regulations (Lavie, 2004). This means that the information we had to collect was unavailable and therefore we could not include them in the sample.

3.2 Data collection

In this research we conduct a quantitative research so the data is numerical in nature. According to the theoretical suggestions put forward in the section 1.2 Methodology, the research strategy we develop is the review of existing material.

In this research we adopt a one-year lagged dependent variable model to examine the relationship between the independent and dependent variables. In other words, independent and control variables are indicators for the year 2005 and dependent variable is collected for the year 2006. It is reasonable to assume that the internal resources and social capital in 2005 in technological companies affect performance in year 2006 (i.e. Lee, Lee and Pennings, 2004). Figure 12 illustrate this lag. The lagged dependent variable model would be a more rigorous test of the effects of firm characteristics on firm performance (Mosakowski, 1993). Moreover, at least one-year

lag is necessary in order to allow for the causal interpretation of the findings (Stuart 2000).

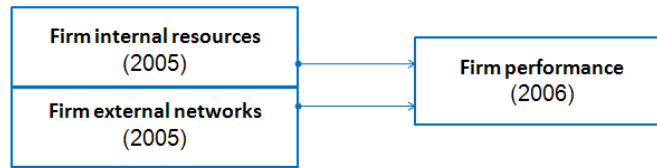


Figure 13

We wanted to use data for more than 1 year for all the study's variables because this helps us build confidence in the results. However, we could not do it because of unavailability of data. The source of data for the network variables contains information only for the year 2005, so we cannot use more than 1 year for the independent variables. Regarding the performance variables, we wanted to compute data for the years 2007 and 2008 in addition to the data for 2006. However, data for 2008 was unavailable for most of the companies, and data for 2007 was also unavailable in many cases. For instance, out of the 50 companies of our sample, we could collect data for 2007 for only 29 cases.

The rest of this section is organized in four subsections: internal resources data, network data, performance data, and control variables data. In every section it is detailed the data sources, the specific information coded from each source, and the drawbacks encountered in the collection process. Moreover, we would like to point that since this research is conducted in a firm-level, all the collected data is for the ego-firm.

Internal resources data

Data for the operationalization of firm's internal resources were collected from LexisNexis Company database and SEC filings. Internal resources are measured for the year 2005, so all the information is collected for such year.

LexisNexis Company Dashboard contains data from Dutch-language news resources such as more than 70 prominent publications: Het Financieele Dagblad, De Volkskrant, NRC Handelsblad, Elsevier, Fem Business, De Telegraaf en Algemeen Dagblad. You can search in this database for Dutch Business Companies information which contains more than 1,5 million companies, including 300.000 companies with extended financial information. Figure 13 shows the appearance of LexisNexis database.

From that database we wanted to code all the information needed to operationalize firm internal resources: revenue, cash, long-term debt, and R&D, marketing and financial expenditures. However, the R&D, marketing and financial expenditures, and

sometimes long-term debt were unavailable in LexisNexis database or in any other documents I could access by archival research³.

LexisNexis[®] Company Dashboard [Help](#)

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1 van 2

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[Financiële gegevens >>](#)

Winst & verliesrekening

Begindatum	2007-01-01	2006-01-01	2005-01-01	2004-01-01
Einddatum	2007-12-31	2006-12-31	2005-12-31	2004-12-31
	dz EUR	dz EUR	dz EUR	dz EUR
Bedrijfsopbrengsten	64.755	77.775	78.379	71.081
- w.v. netto-omzet	1.623	1.355	1.064	2.222
- w.v. ovg. bedrijfsopbrengsten	486	788	1.069	1.063
- w.v. commissieopbrengsten	62.646	75.632	76.246	67.796
Bedrijfslasten	61.071	75.780	74.243	70.662
- w.v. personeelskosten	34.462	39.794	36.949	38.444
- w.v. afschr. immat. v. act.	21	356	121	nb.
- w.v. afschr. mat. v. act.	727	706	710	nb.
- w.v. inkoopw. omzet	342	620	357	1.066
- w.v. ovg. bedrijfsfst.	25.519	34.304	36.106	nb.
- w.v. niet gespecificeerd	nb.	nb.	nb.	31.152
Bedrijfsresultaat	3.684	1.995	4.136	419
Fin. baten	14.606	31.791	2.054	27.963
- w.v. opr. fin. v.a.	13.000	30.000	0	26.000
- w.v. ontv. interest	1.606	1.791	1.542	996

Figure 14-LexisNexis database

To overcome such problem we use SEC's EDGAR database. It is a collection of submitted forms and reports from every domestic public company to the US Securities and Exchange Commission (SEC). Among such forms we can sometimes find annual reports with internal company-specific data. Figure 15 shows the appearance of SEC's EDGAR database.

However, this data is for the global company not for the Dutch subsidiary, which is the level of analysis of this study. Since making approximations over financial data is a common practice in research (i.e. Ahuja, 2000; Yeoh & Roth, 1999), we used global-company data and approximate them for the Dutch subsidiary (in the next section 3.3 measures there are detailed the approximation we made). The global-company data we coded from SEC's EDGAR database were R&D expenses, selling, general and administrative expenses, financial expenses, long-term debt and revenue.

In some cases the global-company information was not in SEC's EDGAR database either, so we searched in internet for the annual reports of those companies in order to obtain the information above described.

³ The unavailability of information is usual among firms which are not required to report these figures by SEC regulations (Lavie, 2004), as is the case of the subsidiaries of big companies, which are the targeted companies of this research: the Dutch subsidiaries.

SUN MICROSYSTEMS, INC.
 CONSOLIDATED STATEMENTS OF OPERATIONS
 (in millions, except per share amounts)

	Fiscal Years Ended June 30	
	2007	2006
Net revenues:		
Products	\$ 8,771	\$ 8,371
Services	5,102	4,697
Total net revenues	13,873	13,068
Cost of sales:		
Cost of sales-products, including stock-based compensation expense of \$13 in 2007 and \$10 in 2006	4,811	4,827
Cost of sales-services, including stock-based compensation expense of \$31 in 2007 and \$29 in 2006	2,797	2,612
Total cost of sales	7,608	7,439
Gross margin	6,265	5,629
Operating expenses:		
Research and development, including stock-based compensation expense of \$64 in 2007 and \$74 in 2006	2,008	2,046
Selling, general and administrative, including stock-based compensation expense of \$106 in 2007 and \$112 in 2006	3,851	4,039
Restructuring charges and related impairment of long-lived assets	97	284
Impairment of goodwill and other intangible assets	—	70
Purchased in-process research and development	—	60
Total operating expenses	5,956	6,499
Operating income (loss)	309	(870)
Gain on equity investments, net	6	27
Interest and other income, net	214	114
Settlement income	54	54
Income (loss) before income taxes	583	(675)
Provision for (benefit from) income taxes	110	189
Net income (loss)	\$ 473	\$ (864)
Net income (loss) per common share-basic	\$ 0.13	\$ (0.25)
Net income (loss) per common share-diluted	\$ 0.13	\$ (0.25)
Shares used in the calculation of net income (loss) per common share-basic	3,531	3,437
Shares used in the calculation of net income (loss) per common share-diluted	3,606	3,437

Figure 16-SEC's EDGAR database

Network data

In order to obtain data for the operationalization of firm's external networks variables we conducted desk research in a database that contains information about companies that operate in the Dutch IT industry –there are collected more than 9500 companies-. The only available information about how this database was made is that it was bought to Marketons who collected the data from newspapers and articles in business journal for specific brands. Marketons is an internet portal for IT-industry and e-business, publisher of a cd-rom database with company profiles and market information dedicated to the Dutch IT-industry.

This database we have used to collect network data contains companies' information for the year 2005. For every company there is recorded contact information –including address, telephone numbers, website and email-, number of employees, turnover, year of the collected turnover, a list of its company partners that operate in the Dutch IT industry as well, establishment year, mother company, type of activities they perform and the places of their establishments. There is also a rank with the 70 companies with largest number of ties⁴ and an edge list of the relationships of companies that operate in the Dutch IT industry. Figure 15 shows the appearance of this database.

⁴ In this database ties are relationship with other companies that are also included in the database. It is, relationships with companies that also operate in the network of IT industry in The Netherlands.

From every company, the information collected from this database is the list with its partners that also operate in the Dutch IT industry. More specifically, we used the edge list of the relationships of companies that operate in the Dutch IT industry.

N32												9 (>500 medewerkers)
A	B	C	D	E	F	G	H	I	J	K	L	
{ID}	{Bedrijf}	{Kantooradr}	{Postac}	{Postcc}	{Plaats}	{telefo}	{fax}	{email}	{website}	{Mutatiebron}	{Medewerkers}	
1	5078 KPN Telecom B.V.	Maanplein 32	Postbus 312500	GA	Den Haag	070-34343	070-3434575		www.kpn.com		18.500	
4	3614 Getronics PinkRocccade Nederland	Marconibaan 5	Marconiba	3439 MR	Nieuwegei	030-66366	030-66366	info.algemeen@geti	www.getronics.com/nl		10.000	
5	794 Atos Origin Nederland B.V.	Papendorpsewe	Papendorp	3528 BJ	Utrecht	030-29944	030-29954	info.nl@atosorigin.c	www.nl.atosorigin.com		9.000	
6	1541 Capgemini	Papendorpsewe	Postbus 213500	GN	Utrecht	030-68989	030-68999	info@cgey.nl	www.nl.capgemini.com		6.080	
7	6751 PinkRocccade nv	Plein van de Vei	Postbus 9:2700	AB	Zoetermee	079-34713	079-34713	receptie@pinkrocce	www.pinkrocce.nl		5.946	
8	5296 LogicaCMG Nederland B.V.	Professor E. M.	Postbus 111180	AD	Amstelvee	020-50330	020-50330	info@logicacmg.nl	www.logicacmg.nl		5.700	
9	4098 IBM Nederland NV	Johan Huizingal	Postbus 911006	CE	Amsterdam	020-51351	020-51457	ibm4you@nl.ibm.cc	www.nl.ibm.com		5500	
10	3611 Getronics Infrastructure Solutions	Gyroscoopweg 1	Postbus 211000	CW	Amsterdam	020-58795	020-5879400		www.nl.getronics.com		5000	
11	3603 Getronics NV	Amstelplein 1	Amstelplei	1056 HA	Amsterdam	020-58614	020-58615	info.algemeen@geti	www.getronics.com		4.500	
12	6346 Océ N.V.	St. Urbanusweg	Postbus 115900	MA	Venlo	077-35922	077-35447	info@oce.nl	www.oce.com		3922	
13	4101 IBM Global Services	Johan Huizingal	Postbus 911066	VH	Amsterdam	020-51351	020-51368	ibm_4you@nl.ibm.c	www.ibm.com/services		3.800	
14	6481 Ordina N.V.	Ringwade 1	Postbus 73430	JC	Nieuwegei	030-66370	030-66370	info@holding.ordina	www.ordina.nl		3.600	
15	9096 Vodafone B.V.	Avenue Ceramic	Postbus 116201	BM	Maastricht	043-35555	043-35555	info@vodafone.nl	www.vodafone.nl		3190	
16	7721 Siemens Nederland NV	Prinses Beatrixd	Postbus 112500	BB	Den Haag	070-33331	070-33329	info@siemens.nl	www.siemens.nl		3.069	
17	1666 Centric Holding B.V.	Doesburgweg 7	Postbus 7:2800	AT	Gouda	0182-5629	0182-5628	info@centric.nl	www.centric.nl		2850	
18	5072 KPN EnterCom Solutions B.V.	Koningin Wilheli	Postbus 8:3503	RE	Utrecht	030-25560	030-2555988		www.kpn.com		2.750	
19	730 ASM Lithografy B.V.	de Run 1110	Postbus 3:5500	AH	Veldhoven	040-23030	040-25803	info@asml.com	www.asml.com		2.711	
20	3899 Hewlett-Packard Nederland B.V.	Orteliuslaan 10C	Postbus 913506	GB	Utrecht	030-22220	030-2225000		www.hp.nl		2700	
21	2419 Defensie Telematica Organisatie DTO	Van der Burchla	Postbus 912509	LV	Den Haag	070-31662	070-31685	dto-info@mindef.nl	www.mindef.nl		2050	
22	7901 Sogeti Nederland B.V.	Wildenborch 3	Postbus 211110	AG	Diemen	020-66066	020-69814	info@sogeti.nl	www.sogeti.nl		2000	
23	2928 EDS Nederland B.V.	Rivium Boulevard	Postbus 3:2900	AH	Capelle aa	0181-5021	0181-5023	info-nl@eds.com	www.eds.nl		1946	
24	9104 Volker Wessels Netwerk Bouw B.V.	Modemweg 33	Postbus 1:3800	BJ	Amersfoort	030-25561	030-29879	netwerkbouw@vwt	www.vwnetwerkbouw.nl		1.600	
25	8218 T-Mobile Netherlands B.V.	Waldorpstraat 6	Postbus 112500	BG	Den Haag	070-30550	070-30550	info@t-mobile.nl	www.t-mobile.nl		1560	
26	176 Accenture	Apolloalaan 150	Postbus 7:1070	AT	Amsterdam	020-49383	020-49380	info@accenture.nl	www.accenture.nl		1515	
27	6311 NRG Group Benelux B.V.	Utopialaan 25	Postbus 9:5203	MB	Den Bosch	073-64511	073-64518	info@nashuatec.co	www.nashuatec.nl		1.500	
28	1379 BT Nederland N.V.	Hoogoorddreef 1	Postbus 1:1100	AA	Amsterdam	020-20380	020-20370	info@bt.nl	www.bt.nl		1500	
29	6760 PinkRocccade IT Management bv	Bredewater 16	Postbus 2:2700	AA	Zoetermee	079-32077	079-32077	info.itm@pinkrocce	www.pinkrocce.nl/itmanagem		1400	
30	6759 PinkRocccade Infrastructure Services	Paalbergweg 1	Postbus 2:1105	AG	Amsterdam	020-57047	020-57047	infrastructure@pink	www.pinkrocce.nl		1.300	
31	6463 Orange Nederland N.V.	Groenhovenstra	Groenhove	2596 HT	Den Haag	06-489990	06-48998000		www.orange.nl		1300	
32	3120 Ericsson Telecommunicatie B.V.	Ericssonstraat 2	Postbus 8:5120	AA	Rijen	0161-2499	0161-249922		www.ericsson.nl		1250	

Figure 17-Database of IT industry in The Netherlands

Performance data

Data for the operationalization of firm performance was collected from LexisNexis Company database (described above), and from the organisation for economic co-operation and development (OECD). Performance is measured for the year 2006. Since one measure of firm performance consist of the revenue growth of the year 2006 compared to 2005, we collected revenue data for 2005 as well.

OECD is an organization whose mission is to bring together the governments of countries committed to democracy and the market economy from around the world to support sustainable economic growth, boost employment, raise living standards, maintain financial stability, assist other countries' economic development, and contribute to growth in world trade. For more than 40 years, OECD has been one of the world's largest and most reliable sources of comparable statistics and economic and social data. As well as collecting data, OECD monitors trends, analyses and forecasts economic developments and researches social changes or evolving patterns in trade, environment, agriculture, technology, taxation and more. Moreover, OECD is one of the world's largest publishers in the fields of economics and public policy. From OECD we extracted IT global-market⁵ revenue.

From LexisNexis database we coded net income, total assets and revenue.

⁵ The worldwide market revenue

Control variables data

The data for the measurement of control variables was obtained from the database of IT companies in the Dutch IT industry that we also used for the collection of network data. The information was collected for the year 2005 and consists of firm's age and number of employees.

3.3 Measures

This research is conducted in a firm-level so all the collected data is for the ego-firm. Therefore, when we name the data for instance "revenue", it is a substitution of "firm's revenue", and so forth with the rest of variables.

When we chose the construct by which we wanted to operationalize performance, internal resources and external networks, we took into account that the information required to measure such construct had to be available in the collection data sources we have available for this study. In this section, in the cases in which we still have to make choices about what indicator to use, once again we have to take into account that this data have to be available in the data sources we have can find accessible.

Table 1 is a summary of the study's variables, their measurement, and their sources of data collection.

3.3.1 Dependent variable

Measurement of firm performance

We measure firm performance by indicators of the year 2006. We thought that the growth of these indicators from 2005 to 2006 could raise more interesting and significant results (we also thought that would be scientifically interesting the growth from 2006 to 2007, or from 2007 to 2008, or the growth of a longer period as for example from 2005 to 2008, but as we have already explained the data for such years is not available). We calculated these growth figures from 2005 to 2006 and run the analysis but we did not obtain significant results. Therefore, we present only the analysis for the figures in 2006 -not for the figures of growth from 2005 to 2006- (but for revenue growth that it is a measure of growth in itself) and based the conclusions on those results.

Return on assets (ROA)

As we put forward in the section 2.1 Firm performance, ROA is a conventional accounting measure of how profitable a company is. It is calculated as the ratio of a firm's net income to its total assets (sum of tangible and intangible assets). It is calculated for the year 2006.

$$\text{ROA} = \text{Net income} / \text{total assets}$$

Total assets are calculated as a sum of intangible fixed assets, tangible fixed assets, financial assets and current assets.

Net income is calculated as total revenue minus costs and expenses.

Table 1-Study variables' measurement and sources of data collection

Variables	Operationalization	Data sources
<i>Performance</i>		
Return on assets (ROA)	Net income/ Total assets	LexisNexis Database
Revenue growth	$\frac{(\text{Revenue}_t - \text{Revenue}_{t-1})}{\text{Revenue}_{t-1}}$	LexisNexis Database
Market share	Revenue/Market revenue	LexisNexis Database OECD
<i>Internal firm resources</i>		
Technological resources	R&D expenses/log(1+revenue)	LexisNexis Database, Annual Reports
Marketing resources	Marketing expenses/log(1+revenue)	LexisNexis Database, Annual Reports
Financial resources	Cash/log(1+longTermDebt)	LexisNexis Database, Annual Reports
<i>Firm's external networks</i>		
Centrality	Degree centrality (as implemented by UCINET)	Database of companies in the IT Dutch industry
Structural autonomy	Reversed sign of Constraint (as implemented by UCINET)	Database of companies in the IT Dutch industry
<i>Control variables</i>		
Size	Number of employees	Database of companies in the IT Dutch industry
Age	(2005 – Company incorporation year)	Database of companies in the IT Dutch industry

Sales growth

The rate of increase in the firm's net sales measures the success of the firm in expanding its market reach and generating additional revenues (Lavie, 2004). Sales growth is calculated as the proportion the revenue has increased regard to the year before.

$$\text{Revenue growth} = \frac{(\text{Revenue}_t - \text{Revenue}_{t-1})}{\text{Revenue}_{t-1}} \quad (\text{Ec. 1})$$

In order to clarify, we show the equation 2 that detail how sales growth for the year 2006 is calculated:

$$\text{Revenue growth}_{2006} = \frac{(\text{Revenue}_{2006} - \text{Revenue}_{2005})}{\text{Revenue}_{2005}} \quad (\text{Ec. 2})$$

Market share

It is a factor used to measure market power of a firm (Hafeez, Zhanga and Malakb, 2002). It is the percentage or proportion of the total available market that is being serviced by a company. It is calculated as a company's sales revenue (in the targeted market) divided by the total sales revenue available in that market, as shown in equation 3.

$$\text{Market share} = \text{Revenue}_{(\text{in the targeted market})} / \text{Market revenue} \quad (\text{Ec. 3})$$

Market share is calculated for the year 2006.

Since this study is focused on one industry, there is only one value for market revenue: the market revenue of ICT market. This figure is used for the calculation of the market share of all the companies. Regarding firm revenue in the ICT market, we have to point out that all the firm revenues we have collected in this study are from the ICT market. We picked the companies to be included in our research sample from the database of companies in the network of Dutch IT industry. A company can have revenues from different markets. However, the companies included in the database of the Dutch IT industry are the subsidiaries that operate in the Dutch IT market. Other subsidiaries that could operate in other markets are not included in the database and thereby have not been analyzed in this study.

3.3.2 Independent variables

Measurement of internal resources

Technological resources

Technological resources are widely studied in the literature. Examples of by which indicators technological resources are measured are for instance Yeoh and Roth (1999) who measured technological resources as R&D expenditures. Lavie (2004) as R&D intensity. Caloghirou et al. (2004) used items such as effective R&D department, cooperation with universities and/or other entities in order to acquire know-how. Lee, Lee and Pennings (2004) used the number of technologies that were internally developed including the number of patents obtained or submitted, and the number of utility models and designs that were registered to Patents. The common practice we observe is that all of them stress the R&D department.

In order to choose the most suitable indicator for the measurement of technological resources, we have to take into account the specific case of the IT industry. It is an industry noted for its technological intensity, and in these cases there are studies that suggest that research and development (R&D) is an important source of advantage (Henderson and Cockburn, 1994). Moreover, it is a fast changing industry in which firms must continually revise their design and range of products. To accomplish this task R&D it is needed.

Also from the RBV perspective it is argued that technological resources of high-technology firms are very well represented by aspects like R&D among others (Dollinger, 1995).

Taking into account the data we can find availability and the scientific interest for our research context, the most suitable indicator to measure technological capabilities is R&D resources, an indicator of intellectual property development. We measure R&D resources as R&D intensity because it is assumed that the propensity of a firm to invest in R&D indicates its R&D resources. This measure has already been used in extant literature (i.e. Lavie, 2004) and is shown in the equation 4.

$$\text{R\&D resources} = \text{R\&D intensity} = \text{R\&D expenses/revenue} \quad (\text{Ec. 4})$$

However, this measure produce disproportionally high values for firms with limited revenue figures. Therefore, we adjusted the measure for revenue as equation 5 shows.

$$\text{R\&D resources} = \text{R\&D expenses} / \log(1+\text{Revenue}) \quad (\text{Ec. 5})$$

As we commented on the section “data collection”, R&D expenses are not available for the Dutch subsidiary of the companies. Therefore, we had to approximate this figure by using the R&D expenses of the global company, which were indeed available. We calculated the percentage of the global-company’s revenue that corresponds to the Dutch subsidiary. Then, we multiplied the global-company R&D expenses by the percentage that the Dutch subsidiary represents for the global company. It is shown in the equation 6.

$$\text{R\&D expenses}_{\text{NL}} = (\text{Revenue}_{\text{NL}}/\text{Revenue}_{\text{global company}}) * \text{R\&D expenses}_{\text{global company}} \quad (\text{Ec. 6})$$

Marketing resources

Marketing resources are also widely studied in the extant literature. For instance, they are measured by Yeoh and Roth (1999) as marketing expenditures, by Lavie (2004) as marketing intensity, or by Caloghirou et al. (2004) as reputation for product/service quality, brand name image, and well-organized marketing department.

For measures like brand name image or well-organized marketing department we cannot obtain data. Our data collection process is based on review of existing material which is mainly tied to financial data. By means of this data we cannot have a reliable measure of brand name image for instance. Therefore, if we restrict our measures to those that we can calculate with data we have available, the most suitable choice is measure marketing resources as marketing intensity. This is based on the assumption that marketing efforts of firms reflect their marketing resources. This is a measure that has already been used in extant literature (i.e. Lavie, 2004). It is shown in the equation 7.

$$\text{Marketing resources} = \text{Marketing intensity} = \text{Marketing expenses/revenue} \quad (\text{Ec. 7})$$

We find again the problem that this measure produce disproportionately high values for firms with limited revenue figures. Therefore, we again adjusted the measure for revenue. See equation 8.

$$\text{Marketing resources} = \text{Marketing expenses} / \log(1+\text{Revenue}) \quad (\text{Ec. 8})$$

As we commented on the section "data collection", marketing expenses are not available for the Dutch subsidiary of the companies. We again tried to approximate this figure by using data of the global-company obtained through annual reports. We looked for marketing expenses of the global company. However, this indicator was neither available. Marketing expenses are included in Selling, General and Administrative expenses (SGA), which are indeed available. Therefore, the approximation we make for marketing expenses of the Dutch subsidiary is the same way we made for R&D expenses but using SGA expenses of the global company. It is shown in the equation 9.

$$\text{Marketing expenses}_{\text{NL}} = (\text{Revenue}_{\text{NL}}/\text{Revenue}_{\text{global company}}) * \text{SGA}_{\text{global company}} \quad (\text{Ec. 9})$$

Financial resources

Financial resources are also widely studied in the literature. Examples are Caloghirou et al. (2004) who measured financial resources by three items: effective cash management, the availability of own capital to finance new investments and borrowing capacity; or Lee, Lee and Pennings (2004) who used the total costs and expenses accrued after organizational founding.

Since IT companies have to make large investments, we find solvency as the most appropriate measure of financial resources because solvency is considered a proxy for the capacity of firms to finance their operations.

Solvency is calculated as cash divided by a logarithmic function of long-term debt as done by Lavie (2004). It is shown in the equation 10.

$$\text{Financial resources} = \text{Cash}/\log(1+\text{LongTermDebt}) \quad (\text{Ec. 10})$$

For some companies, long-term debt was also unavailable for the Dutch subsidiary. For those cases, we made the same approximation than for R&D and marketing expenses, based on available data of the global company. Thus, we proximate long-term debt of the Dutch subsidiary by using the long term debt of the global-company. It is shown in the equation 11.

$$\text{LongTermDebt}_{\text{NL}} = (\text{Revenue}_{\text{NL}}/\text{Revenue}_{\text{global company}}) * \text{LongTermDebt}_{\text{global company}} \quad (\text{Ec. 11})$$

Measurement of firm external networks

Centrality

Centrality measures are commonly described as indices of prestige, prominence, importance, and power -the four Ps. There are many different measures of centrality which capture different aspects. In this research we operationalize centrality as the firm "degree" centrality score, as described in modern form by Freeman (1979): the number of ties that a given node has. We chose degree centrality because it is an index of exposure to what is flowing through the network. It is interpreted as opportunity to influence and/or be influenced directly. The more ties an actor has, the more choices/alternatives, and the more power they may have⁶. Figure 16 shows an illustrative example.

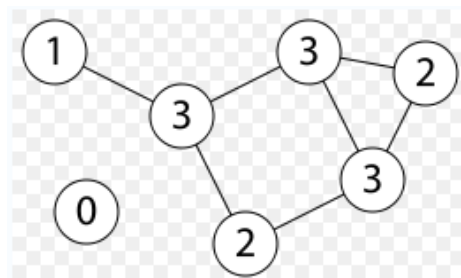


Figure 16-Vertices labelled by its degree centrality

⁶ We also measured eigenvector centrality. Eigenvector centrality is best understood as a variant of simple degree, but is less used in by authors in literature. It is calculated based on the idea that the centrality of a node is proportional to the sum of centralities of the nodes it is connected to. Hence, an actor that is connected to many actors who are themselves well-connected is assigned a high score by this measure, but an actor who is connected only to near isolates is not assigned a high score, even if she has high degree. The result of the analysis reported the same results than using degree centrality. Therefore, in this research we kept the analysis that uses degree centrality.

We measured degree centrality using UCINET program. UCINET is software for social network analysis and cultural domain analysis. It provides a package for the analysis of social network data as well as other 1-mode and 2-mode data. Social network analysis methods include centrality measures, subgroup identification, role analysis, elementary graph theory, and permutation-based statistical analysis.

In order to use UCINET, the information must have been coded in the format this program requires. We created a file with all the ties that every company in the network of Dutch IT companies has with other members in such network of Dutch IT companies. This file was created in the format that UCINET requires in order to be able to run the analysis. Figure 17 shows the format of this data.

```

DL n=2972
format = nodelist1
labels embedded:
data:
7      3899
8      8132
8      8119
8      5741
8      5192
8      3899
8      1750
9      3899
11     8119
11     3899
11     1746
12     4098
13     5741
14     5741
15     8018
15     7522
15     5741
15     3899
15     1746
18     8165
18     6283
18     5741
18     4875
18     3899
18     1750
18     1746
18     588
18     39
21     8119
  
```

Figure 17-Data format required by UCINET

In UCINET all data are described as matrices; all UCINET data are ultimately stored and described as collections of matrices. Therefore, the input shown in Figure 18 is converted in a matrix which is also symmetrised (symmetrising means that if cell *ij* contains a '1,' so too will cell *ji*). The matrix obtained from UCINET program in is shown in figure 18.

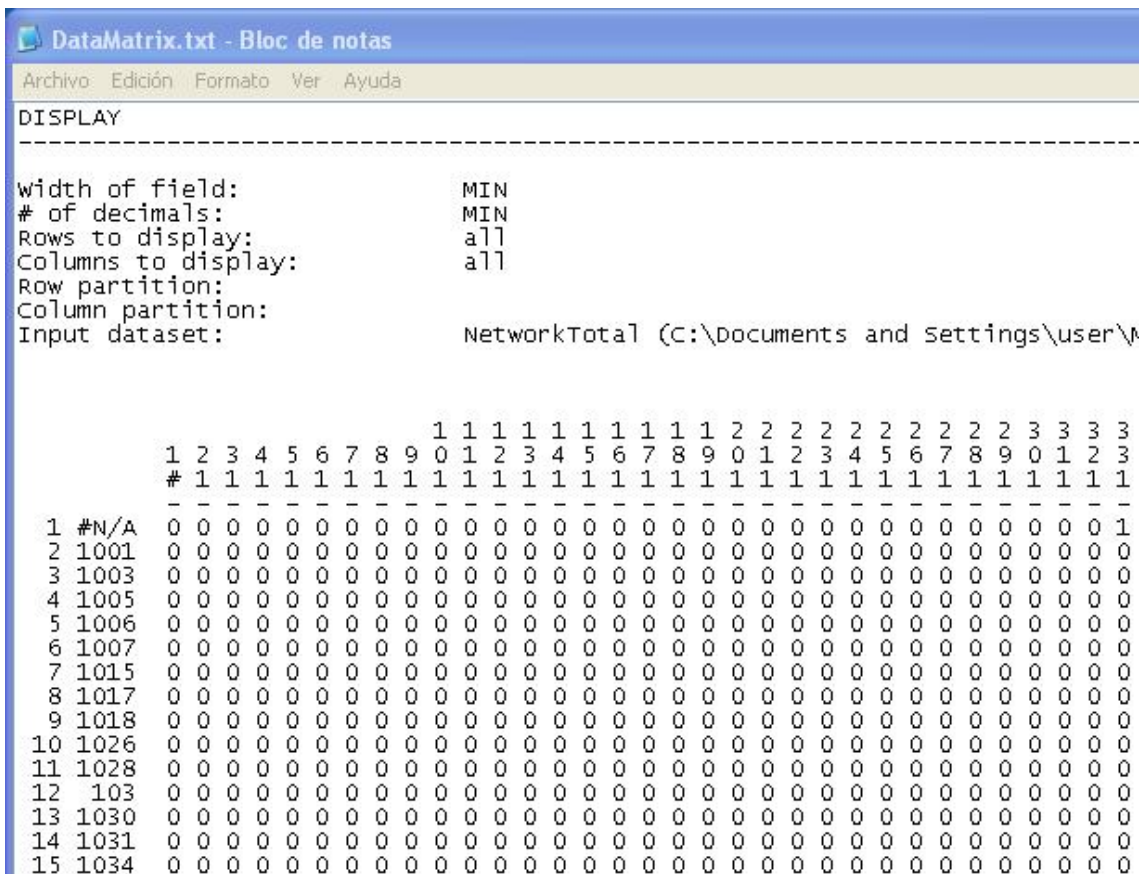


Figure 18-Data matrix

At that time we were able to run the analysis in UCINET. We measured degree centrality using the 'Network . . . Centrality . . . Degree' routine (Borgatti, Everett, and Freeman, 2002). We obtained an output with the degree centrality score of every company as well as the normalized degree centrality score. The normalized degree centrality is the degree divided by the maximum possible degree expressed as a percentage. We used the normalized value because this is recommended (Borgatti, Everett, and Freeman, 2002) when you use binary⁷ data, which is our case. The output given by UCINET is shown in the figure 19.

Structural autonomy

We operationalize structural autonomy by reversing the sign of the "constraint" measure described by Burt (1992: 55). This operationalization of structural autonomy by reversing the sign of the constraint represents standard practice among network analysts, for instance Gnyawali et al. (2006), or Zaheer and Bell (2005).

⁷ Binary data is used when the existence of tie is scored with 1, and the non existence is scored with 0. It means that the ties are not valued.


```

DegreeCentrality.txt - Bloc de notas
Archivo Edición Formato Ver Ayuda
FREEMAN'S DEGREE CENTRALITY MEASURES:
-----
Diagonal valid?      NO
Model:              SYMMETRIC
Input dataset:      NetworkTotal (C:\Documents and Settings
-----
          1          2          3
          Degree   NrmDegree   Share
-----
1650 5741      877.000      29.519      0.059
 993 3899      802.000      26.994      0.054
1066 4098      489.000      16.459      0.033
1895 6460      322.000      10.838      0.022
 266 1746      242.000       8.145      0.016
 771 3219      235.000       7.910      0.016
1829 6295      178.000       5.991      0.012
2482 8119      150.000       5.049      0.010
 267 1750      134.000       4.510      0.009
 994   39      133.000       4.477      0.009
2291 7522      128.000       4.308      0.009
2637 8569      121.000       4.073      0.008
1719  597      112.000       3.770      0.008
1405 5078       87.000       2.928      0.006
 866 3488       81.000       2.726      0.005
2078 6977       76.000       2.558      0.005
2356 7722       75.000       2.524      0.005
 761  316       70.000       2.356      0.005
 307  188       67.000       2.255      0.005
 337  195       64.000       2.154      0.004
-----

```

Figure 19-Degree centrality output

According to Burt, network constraint effectively measures a firm's *lack* of access to structural holes (Burt, 1992). "Constraint" is an index that measures the extent to which a person's contacts are redundant. As well as connection is the key to redundant benefits; dependence is the key to constrained benefits more generally. "Constraint" measures the lack of structural holes with which you could negotiate demands from other. Your opportunities are constrained to the extent that you have invested the bulk of your network time and energy in relationships that lead back to a single contact.

We measured constraint using UCINET program. We use the same file we created to run UCINET for the calculation of centrality. This file was created in the format UCINET required and included all the ties that every company in the network of Dutch software companies has with other members in such network of Dutch software companies.

We measured constraint using the 'Network . . . Ego Network . . . Structural Holes' routine in UCINET (Borgatti, Everett, and Freeman, 2002). In this routine, constraint is calculated base on the equation 12.

$$c_{ij} = p_{ij} + \sum_q p_{iq} m_{qj}, \quad q \neq i, j \quad (\text{Ec. 12})$$

M_{jq} = j 's interaction with q divided by j 's strongest relationship with anyone
 So this is always 1 if j has tie to q and 0 otherwise
 P_{iq} = proportion of i 's energy invested in relationship with q
 So this is a constant $1/N$ where N is network size

We obtained an output containing, among other things, the constraint score of every company. It is shown in figure 19.

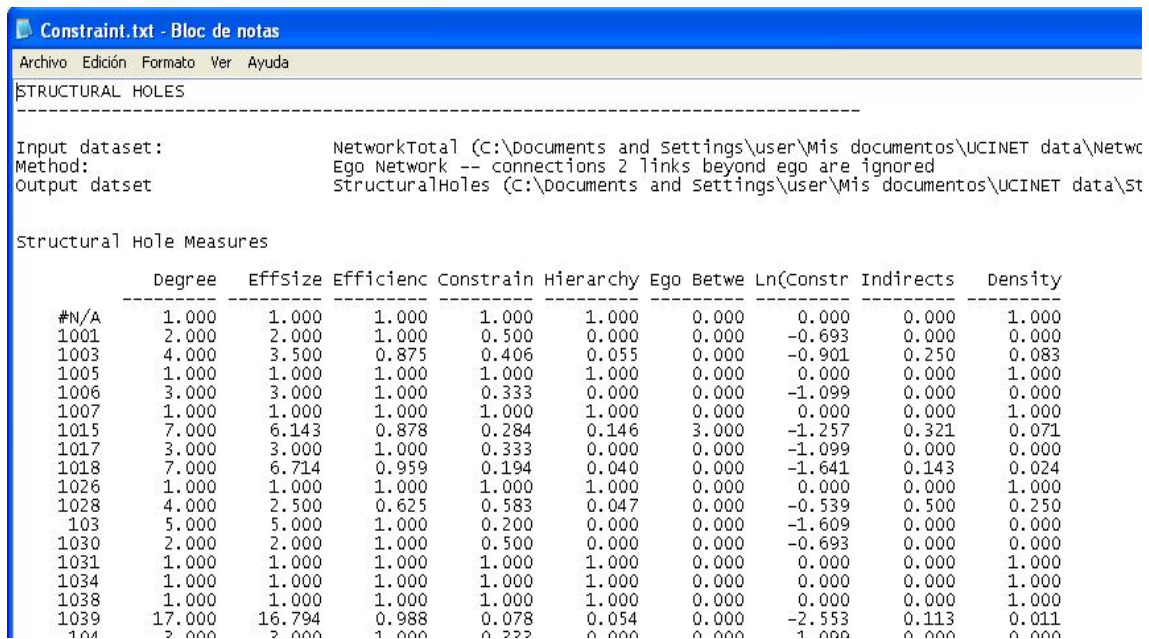


Figure 200-Constraint output

We calculated Structural autonomy as one minus the firm's constraint score (in cases where constraint was non-zero) and zero for all other cases, because a score of zero arise only when the firm was unconnected to others, so has no access to structural autonomy. We made this measure as done by Zaheer and Bell (2005).

3.3.3 Control variables

There are variables that may cause effects on the results, but we do not want to attribute the results to the effects of these variables. The solution is to control such variables (Van der Velde, Jansen and Anderson, 2004). In this study we control firm age and firm size.

In general, it is conventional to control for *firm's size* effects because it has been found to impact firm's performance (i.e. Yeoh and Roth, 1999; Rowley, Beherens and Krackhardt 2000). We measure the size of the firm by its number of employees, a widely used measure of firm size (Yeoh and Roth, 1999). In the case of the IT industry, it is especially recommended to control the number of employees. IT industry, mainly due to software sector, is human resources intensive. It is a knowledge-based industry

that requires the utilization of skilled labour forces. Therefore, the number of employees is likely to influence firm performance.

Regard to *firm age*, we want to control this effect because firms that have been in existence longer are likely to have greater market share since they have had more time to develop their reputation and put their names out to the public, develop relationship with sales representatives, and so on (Zaheer and Bell, 2005). We calculated firm age as 2005 (the year of the data gathering) minus the year when the company was incorporated.

3.4 Analysis

3.4.1 Descriptive statistics

We start the analysis by calculating the means and standard deviations of the study's variables. They are shown in table 2. Potential outliers for every variable have been coded as missing values.

Table 2-Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	50	3	128	28,98	30,080
Employees	50	6	18500	1185,40	2803,284
NormalizedCentrality	47	,06700	29,51900	2,4942766	4,99375671
Structural Autonomy	47	,500	,995	,90445	,105709
Technological resources	49	,2126	184277,2589	8576,258776	2,8874898E4
Marketing resources	50	5,7003	315079,7203	2,088548E4	5,1353155E4
Financial resources	50	7,3092	184090,4056	1,223150E4	3,3734782E4
Return on Assets	49	-,1342	,4764	,075751	,1233846
Revenue growth	49	-,7220	1,7857	,078689	,3375472
Market share	50	,000000856	,038687626	,00307475847	,008181430151

In the table 2 of descriptive statistics we observe that for some variables there is a big difference between the minimum and maximum values. Because of that, we again looked at the original data in their respective sources to check whether coding errors had been made. Nevertheless, the data were correct. In the next paragraphs we explain the striking facts we observe in the table.

There is a great difference between the minimum and maximum *number of employees*. This is not striking. As we explained in the section 3.1 Sample, we based

our firm sample on the companies with largest number of ties. In some cases those companies are also the biggest and therefore have a large number of employees, but in some other cases they are not big and have a low number of employees.

Regard to the difference between the minimum and maximum values of *centrality*, we again look at the firms that form our sample to find the explanation. As we detailed in the section 2.1 Sample, in the network of companies in the Dutch IT industry there is a rank of the 70 companies with the largest number of ties. The company ranked in first position has 890 ties, while the firm ranked in the 70th position has 15. What we want to clarify with this data is that among the companies with higher number of ties there is a great difference in such number of ties. Moreover, there are 10 companies in our sample that do not come from this rank, so they have a lower number of ties. Since our measure of centrality is the firm's number of ties (we use its normalized value), it is therefore meaningful that we encounter a great difference between the maximum and minimum values of centrality.

Regard to the *internal resource variables*: technological, financial and marketing resources we also find a great difference between maximum and minimum values. This is not strange if we take into account two factors. First, we again look at the sample in which there are big as well as small companies. It is understandable that the biggest companies have more resources than the smaller. Second, IT is a heterogeneous industry. It comprises software, hardware and services. This heterogeneity explains the differences in firm resources. As an illustrative example we can put forward the fact that a great percentage of the budget of IT is dedicated to software. Therefore, the companies more focused on software are more likely to have more resources than the companies focused on the other sectors of the IT industry.

As also shown by Table 2, we observe that *Return on Assets* is always lower than zero. This means that the net income is always lower than the sum of all the assets the company has. This is understandable since the IT industry has a lot of assets: the hardware sector of the industry has a lot of tangible assets (computer devices, etc) and the software sector has a lot intangible assets (computer programs, etc). The sign minus means that the net income is negative (more costs and expenses than revenues).

The values of *market share* are expected since in the sample are big as well as small companies. The biggest companies are expected to have more market share than the smallest companies.

3.4.2 Frequencies

Next step was the calculation of the frequencies of the study's variables. We found that none of them were normally distributed. Therefore, we tried to log-transform the variables in order to obtain normal distributions. The coming paragraphs detail in which cases we succeed and in which cases we do not.

For *internal resources* variables, after log-transform the three variables we obtained normal distributions. Significances of Kolmogorov-Smirnov tests were: (sig=0,167) for Technological resources; (sig= 0,200) for marketing resources and (sig= 0,200) for financial resources. Since all of those significance values are higher than (sig= 0,05), the variables are normally distributed.

For *network variables*, we obtained normal distribution for centrality (Kolmogorov-Smirnov test sig= 0, 058) but not for structural autonomy. In another attempt to obtain normal distribution for structural autonomy we calculated its square root, but we did not succeed. Then we removed outliers, but we neither obtained normal distribution. We also calculated the square value of structural autonomy but any normal distribution was achieved. We also removed again potential outliers but once again did not succeed. Thus, we leave structural autonomy values in their original way (Kolmogorov-Smirnov test sig=0, 000).

For *performance variables* we could not log-transform all the variables. For negatives values logarithmic functions cannot be calculated. Thus, we only log-transformed market share and obtained normal distribution (Kolmogorov-Smirnov test sig=0,200), but we could not do it for ROA and revenue growth. For those two variables the square root could not have been calculated either for the same reason: negatives values. Moreover, if we decide to calculate the square value instead, we would always obtain positives values, which would make our analysis wrong. Thus, we cubed the variables – by this way the original sign is remained- but we obtained not only non-normally distributed values, but even worst distributions. Thus, we left the original values of those two variables. Significances of Kolmogorov-Smirnov tests were for ROA (sig=0,000) and for revenue growth (sig=0,003).

For *control variables* we log-transformed the variables and obtained normal distributions. Significances of Kolmogorov-Smirnov tests were for firm age (sig=0,200) and for number of employees (sig=0,200).

Though we did not obtain normal distributions for all the study's variables, when the number of observation is larger than 30, the normal distribution is not a strict requirement so we could have gone on with the analysis of our data.

3.4.3 Correlations

Next step was the calculation of Pearson Correlations. The output is shown in Table 3.

Table 3-Correlations

	Age	Employee	Centrality	Structural Autonomy	Techn	Marketi	Financ	Market Share	ROA	Revenue Growth
Age	1,000	,455**	,185	,121	,210	,152	,188	,120	-,016	,027
		,001	,212	,418	,152	,293	,190	,408	,912	,856
	50	50	47	47	48	50	50	50	49	48
Employee	,455**	1,000	,134	-,038	,432**	,460**	,228	,502**	-,268*	-,083
	,001		,371	,802	,002	,001	,111	,000	,062	,577
	50	50	47	47	48	50	50	50	49	48
Centrality	,185	,134	1,000	,745**	,120	,043	,112	,037	,262*	,102
	,212	,371		,000	,431	,777	,453	,807	,078	,504
	47	47	47	47	45	47	47	47	46	45
Structural Autonomy	,121	-,038	,745**	1,000	-,050	-,195	-,129	-,235	,290*	,007
	,418	,802	,000		,743	,189	,387	,112	,050	,964
	47	47	47	47	45	47	47	47	46	45
Technological	,210	,432**	,120	-,050	1,000	,871**	,651**	,714**	-,250*	-,185
	,152	,002	,431	,743		,000	,000	,000	,090	,219
	48	48	45	45	48	48	48	48	47	46
Marketing	,152	,460**	,043	-,195	,871**	1,000	,602**	,755**	-,298*	-,147
	,293	,001	,777	,189	,000		,000	,000	,038	,320
	50	50	47	47	48	50	50	50	49	48
Financ	,188	,228	,112	-,129	,651**	,602**	1,000	,691**	-,190	-,086
	,190	,111	,453	,387	,000	,000		,000	,191	,561
	50	50	47	47	48	50	50	50	49	48
Market Share	,120	,502**	,037	-,235	,714**	,755**	,691**	1,000	-,268*	,057
	,408	,000	,807	,112	,000	,000	,000		,063	,703
	50	50	47	47	48	50	50	50	49	48
ROA	-,016	-,268*	,262*	,290*	-,250*	-,298*	-,190	-,268*	1,000	,323*
	,912	,062	,078	,050	,090	,038	,191	,063		,027
	49	49	46	46	47	49	49	49	49	47
Revenue Growth	,027	-,083	,102	,007	-,185	-,147	-,086	,057	,323*	1,000
	,856	,577	,504	,964	,219	,320	,561	,703	,027	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

(No asterisk). Correlation is significant at the 0.1 level (2-tailed).

In the correlation results shown in table 3 we find significant correlations among internal resources variables ($p < 0.01$) as well as among external networks variables ($p < 0.01$). In theory, in order to avoid multicollinearity, we should apply factor analysis to the groups of independent variables correlated with each other and create new composed variables. However, it is not possible because the hypotheses of this research, every one test the relationship of one of this variables and performance. Therefore, we cannot aggregate any of the independent variables because they separately are needed to test the hypotheses⁸. Moreover, when we calculated regression analysis we also conducted collinearity diagnostics where we observed that the variance inflation factors (VIF) of the variables were considerably lower than the critical value of (VIF=10) (Lavie, 2004) –the maximum VIF we observed in our analysis was (VIF=4.5) -. Thus, we concluded that collinearity was not a significant concern in this study (Besley, 1991 in: Zaheer and Bell, 2005).

In the table we also observe that resource variables are positive and highly correlated with market share so we expect a positive effect on internal resources in the market share of the firms. We also find a significant correlation between resources and ROA, however, this correlation is negative. This negative relationship is usual among companies and has been studied in the literature and called “organizational slack”. Organizational slack is defined by Gulaty, Nohria and Zaheer (1996) “as the pool of resources in an organization that in is excess of the minimum necessary to produce a given level of organizational output. These resources include surplus of employees, unexploited opportunities to increase outputs, etc”. Therefore, slack are the resources that a company owns but are not helping to create profits at a current moment. They can be resources they used in the past (i.e. machinery) but they are not using any longer. Since they are assets the company owns, they have to be included in the total assets of the companies. ROA is measured as the ratio net income by total assets. The slack makes the total assets increase, but as those assets are not creating value, the net income is lower in relation to those total assets. Therefore, ROA is negatively correlated with resources. In fact, Litschert & Bonham (1978) defined slack as “the variation from the average among comparable organizations on: ROA, ROTA and Gross Profit as a percent of Sales”.

Regard to the control variables we observe that number of employees is correlated with performance measures, unlike firm age. Therefore, we do not expect meaningful results from firm age. Moreover, both control variables are significantly correlated ($p < 0.1$) what could produce multicollinearity. We run the analysis (the analysis will be explained in the coming section Analytic techniques) and as expected, firm age was not significant in any of the models. Moreover, the full model lost one significant coefficient in comparison with the analysis that did not include firm age. Based on those arguments, we decided to leave firm age out of the analysis.

⁸ We calculated factor analysis but the explanation was lower. Since we cannot distinguish what variables significantly contribute to firm performance and what variables do not, we have less information.

3.4.4 Analytic techniques

The next step is the analysis of relations between variables. Since we want to study the effects of independent variables on dependent variables, the analysis we should conduct is regression analysis. By means of this analysis we investigate the extent to which the data support our hypotheses.

In order to examine the additive effects of different variables we run models using hierarchical regression equations. The models use ROA, market share and revenue growth separately as measures of performance. In Model 1 we model performance solely as a function of the control variable: number of employees. This is a basic model and it is a benchmark against which to test the effects of other variables on firm performance. In the Model 2 we add internal resources variables to Model 1 in order to test their additive effect. In Model 3 we add external networks variables to Model 1 in order to test their additive effect on performance. Thus, Model 2 and 3 are the partial models. In Model 4 we introduce all the variables. This is the full model that allows for the assessment of the relative significance of the various effects. Therefore, the testing of the hypothesis 1 to 5 is primarily based on the results of Model 4.

We also want to test the interaction effects of internal resources and external networks on performance. For that we produced 6 interaction terms (three internal resource variables X two external networks variables), and added each interaction term to Model 4. Those are the Models from 5 to 10. We did not run all interaction variables in a single model because of two reasons. First, correlations between interaction terms are too high (correlations among variables including interaction variables are shown in the appendix 2) and introducing all them in one model may produce multicollinearity problems. Second, our sample size is not large enough to allow the analysis of all those variables in a single model. The hypothesis concerning interaction between internal resources and external variables is tested based on those models (Models 5 to 10).

4. Internal resources and external networks driving firm performance: RESULTS

In this chapter we present the results of the analysis we have conducted. We interpret those results and thereby we test the hypothesis.

The chapter starts with a brief recapitulation of the research model and then we proceed to interpret the results. We first describe the results of the control variables in explaining firm performance. Secondly we describe the results of internal resources driving firm performance. Thirdly we describe the results of external networks driving firm performance. Finally we describe the results of internal resources and external networks driving firm performance. Within that section there are also included the results of the interactions and the global tests that compare successive models.

4.1 The model

In this research we want to investigate firm-performance implications of building internal resources and of developing external networks. In the theoretical chapter we have dealt with this research objective from a theoretical point of view. On the basis of the theory we have derived 6 hypotheses. All of them positively relate with firm performance: internal resources (hypothesis 1, 2 and 3) (see figure 6), external networks (hypothesis 3 and 4) (see figure 6), and their interaction (hypothesis 9) (see figure 11). These hypotheses are going to be tested in this chapter. As we explained in the section 3.4.4 Analytic techniques, we based the testing of the hypothesis 1 to 5 on the Model 4 (full model which includes all the study's variables). The testing of the hypothesis 6 is based on the models 5 to 10 (models which include each of them one of the 6 interaction terms).

In every section we present the tables with the result of the models related to the hypotheses that are tested in each of those sections. The significant beta coefficients are in bold, italic and colour red.

4.2 Control variables

In this Model performance is solely modelled as a function of the control variable number of employees.

The number of employees is negatively and significantly associated with ROA in Model 1 ($\beta=-0,039$; ($p <0. 1$)). The negative sign is expected because of the "organizational slack" explained in the section 3.4.3 Correlations. The significant effect only persisted in Model 3 of table 6 ($\beta=-0,042$; ($p <0. 1$)) where network variables are added, but neither in Model 2 nor Model 4 where internal resources variables are included. This means that the effect of number of employees in ROA is outweighed by the effect of internal resources on ROA but not by the effect of external networks.

Table 4

Model 1 - Basic Model			
Variable	ROA	Market Share	Revenue Growth
Number of employees	-0,039	0,605	-0,022
Sig.	0,075	0,000	0,590
Technological resources			
Sig.			
Marketing resources			
Sig.			
Financial resources			
Sig.			
Centrality			
Sig.			
Structural autonomy			
Sig.			
Adjusted R square	0,050	0,234	-0,016
Sig. F test	0,075	0,000	0,590

When the performance variable is market share, the number of employees is positively associated with it in Model 1 ($\beta=0,605$; ($p < 0. 01$)) of table 4, and this effect persisted through the Model 3 ($\beta=0,533$; ($p < 0. 01$)) and Model 4 ($\beta=0,262$; ($p < 0. 05$)) of table 6. This result suggests that the bigger the company, the larger the market share.

4.3 Internal resources driving firm performance

In Model 2 there are resource variables added to Model 1 in order to test their additive effect. In Model 4 there are all the variables and this is the model based on which we are going to test the hypotheses 1, 2 and 3.

Hypotheses 1 predict that technological resources are positively associated with firm performance. In the Models above, technological resources do not provide any significant result. These results suggest that the intellectual property development do not contribute to firm performance. Therefore, hypothesis 1 does not obtain support from the data. The no effect of technological resources in performance is understandable because R&D need more than 1 year (our lagged period) to cause effect in the performance of a company (as we explained in the section 3.2 Data collection, we do not use more lagged periods because we do not have data for that).

Hypothesis 2 predicts that marketing resources are positively associated with firm performance. This variable have a positive and statistically significant effect on market share in Model 2 ($\beta=0,374$; ($p < 0. 05$)). This effect persists significant when the networks variables are added in Model 4 ($\beta=0,306$; ($p < 0. 1$)). These results suggest that the marketing intensity of a firm contribute to enhance the market power of a firm in

Table 5

Variable	Model 2 - Partial model Internal resources			Model 4 - Full model		
	ROA	Market Share	Revenue Growth	ROA	Market Share	Revenue Growth
Number of employees	-0,025	0,265	-0,001	-0,031	0,262	-0,011
Sig.	0,312	0,032	0,977	0,207	0,038	0,826
Technological resources	0,010	0,002	-0,054	-0,001	0,065	-0,045
Sig.	0,789	0,992	0,433	0,976	0,722	0,535
Marketing resources	-0,029	0,374	0,011	-0,017	0,306	0,001
Sig.	0,397	0,026	0,870	0,629	0,085	0,987
Financial resources	-0,006	0,397	0,013	-0,008	0,372	0,000
Sig.	0,814	0,002	0,787	0,733	0,005	0,994
Centrality				0,066	0,111	0,135
Sig.				0,237	0,688	0,230
Structural autonomy				0,037	-1,478	-0,512
Sig.				0,895	0,306	0,375
Adjusted R square	0,024	0,665	-0,059	0,077	0,661	-0,073
Sig. F test	0,297	0,000	0,819	0,171	0,000	0,803
R square change-Model 1 to Model 2	0,041	0,444	0,030			
Sig. F change	0,610	0,000	0,742			
R square change-Model 2 to Model 4				0,090	0,011	0,036
Sig. F change				0,132	0,485	0,480

the IT industry. For ROA and for revenue growth there are no statistically significant effects. Hence, marketing resources partially contribute to firm performance. Therefore, hypothesis 2 gains partial support from the data.

Hypothesis 3 predicts that financial resources are positively associated with firm performance. This variable has a positive and statistically significant effect on market share in model 2 ($\beta=0,397$; ($p < 0. 01$)). This effect persists when the networks variables are added in Model 4 ($\beta=0,372$; ($p < 0. 01$)). These results suggest that the financial resources a firm is endowed with contribute to enhance the market power of a firm in the IT industry. For ROA and for revenue growth we do not observe any statistically significant effect. Hence, financial resources contribute partially to firm performance. Therefore, hypothesis 3 gains partial support from the data.

4.4 External networks driving firm performance

Table 6

Variable	Model 3 - Partial model External networks			Model 4 - Full model		
	ROA	Market Share	Revenue Growth	ROA	Market Share	Revenue Growth
Number of employees	-0,042	0,533	-0,034	-0,031	0,262	-0,011
Sig.	0,054	0,002	0,434	0,207	0,038	0,826
Technological resources				-0,001	0,065	-0,045
Sig.				0,976	0,722	0,535
Marketing resources				-0,017	0,306	0,001
Sig.				0,629	0,085	0,987
Financial resources				-0,008	0,372	0,000
Sig.				0,733	0,005	0,994
Centrality	0,049	0,610	0,115	0,066	0,111	0,135
Sig.	0,346	0,115	0,273	0,237	0,688	0,230
Structural autonomy	0,144	-4,391	-0,423	0,037	-1,478	-0,512
Sig.	0,575	0,025	0,414	0,895	0,306	0,375
Adjusted R square	0,108	0,292	-0,035	0,077	0,661	-0,073
Sig. F test	0,053	0,000	0,678	0,171	0,000	0,803
R square change-Model 1 to Model 3	0,097	0,089	0,029			
Sig. F change	0,104	0,076	0,544			
R square change-Model 3 to Model 4				0,034	0,367	0,037
Sig. F change				0,662	0,000	0,677

In Model 3 there are network variables added to Model 1 in order to test their additive effect. In Model 4 there are all the variables and is the model based on which we are going to test the hypotheses 4 and 5.

Hypothesis 4 suggests that the more centrality of a firm is positively associated with firm performance. Centrality in none of the models is significantly associated with any of the performance measures. These results suggests that although a company is connected with many others companies in the network, and through this strategic position has access to higher volume and speed of asset, information, and status flows, this is not contributing to firm performance. Therefore, Hypothesis 4 does not gain support from the data.

Hypothesis 5 suggests that the more structural autonomy of a firm is positively associated with firm performance. We observe that structural autonomy is significant and negatively associated with market share in Model 3 ($\beta=-4,391$; ($p < 0. 05$)). This means that structural autonomy has a negative effect on market share. However, this significant result does not persist in Model 4 when internal resources variables are

added, meaning that the effect of structural autonomy is outweighed by the effect of internal resources on market share. For ROA and for revenue growth we do not observe any statistically significant effect. Since in Model 4 structural autonomy does not contribute to firm performance, hypothesis 5 does not gain support from the data.

If we reflect on the advantages that structural autonomy provides, we see that they are related with the exploratory side of the firms. A structural autonomy company has ties with remote and unique parts of the network what provides access to new knowledge, new understandings, efficiently and quickly information about threats and industry trends, etc. Structural autonomy provides varied and exclusive resources, information and opportunities. However, our measures of performance weakly reflect the exploratory art of the firm. Therefore, it is understandable that structural autonomy does not influence our measures of performance.

These results also lead us to think that network resources may take longer than 1 year (our lagged period) to significantly affect firm performance, and this is why we do not find significant effect. As we explained in the section 3.2 Data collection, we do not have data to test the effects in more lagged periods and then check whether this is the reason.

4.5 Internal resources and external networks driving firm performance

In the previous sections we have seen that marketing and financial resources positively contribute to market share. We have also seen that structural autonomy has a negative effect on market share in the model that only includes control and network variables. However, this significance disappears in the full model. This means that although external networks influence market share, their effect is outweighed by the effect that internal resources has on market share. This suggests that the explanation of firm performance is attributed to internal resources but not to external networks. If we specify within internal resources, the explanation of firm performance is attributed to marketing resources ($\beta=0,306$) and even more to financial resources ($\beta=0,372$).

In order to extend the general picture we have obtained from the former results, we turn to analyze the effects of the interactions in firm performance.

Interactions

By means of the Models 5 to 10 we can test the interaction effect between internal resources and external networks on firm performance. Therefore, we test the hypothesis 6.

The effects of interaction are all negatively associated with performance. Out of 6 interaction terms per performance variable, we find 4 of them negatively influencing ROA, and 1 negatively influencing market share. The rest are not statistically significant. This suggests that the combined effect of developing external networks and

Table 7

Variable	Model 5 - Interaction Technological resources * Centrality			Model 6 - Interaction Technological resources * Structural autonomy		
	ROA	Market Share	Revenue Growth	ROA	Market Share	Revenue Growth
Number of employees	-0,032	0,262	-0,012	-0,026	0,262	-0,003
Sig.	0,176	0,040	0,813	0,289	0,042	0,949
Technological resources	0,004	0,063	-0,039	-0,011	0,063	-0,059
Sig.	0,918	0,734	0,594	0,761	0,733	0,431
Marketing resources	-0,007	0,301	0,013	-0,013	0,306	0,006
Sig.	0,840	0,096	0,850	0,693	0,089	0,935
Financial resources	-0,028	0,380	-0,024	-0,021	0,371	-0,019
Sig.	0,273	0,007	0,654	0,410	0,007	0,727
Centrality	0,146	0,077	0,234	0,085	0,114	0,163
Sig.	0,024	0,817	0,088	0,130	0,693	0,165
Structural autonomy	-0,255	-1,354	-0,873	-0,091	-1,492	-0,698
Sig.	0,396	0,398	0,178	0,755	0,324	0,254
Technological resources * Centrality	-0,086	0,036	-0,106			
Sig.	0,023	0,852	0,179			
Technological resources * Structural autonomy				-0,452	-0,049	-0,653
Sig.				0,086	0,970	0,229
Adjusted R square	0,177	0,652	-0,055	0,123	0,652	-0,066
Sig. F test	0,046	0,000	0,683	0,105	0,000	0,730
R square change-Model 4 to Model X	0,109	0,000	0,047	0,063	0,000	0,038
Sig. F change	0,023	0,852	0,179	0,086	0,970	0,229

accumulating internal resources negatively affect firm performance. Therefore, hypothesis 6 does not gain support from the data.

The results obtained in the interaction models that differ from those obtained in Model 4 are detailed as follows. When performance is measured by market share, most of models including interactions do not change regard to Model 4. There are only two changes. First, the statistically significant effect of marketing resources disappears when its interaction with structural autonomy is included. It is expected because both variables are significantly correlated and multicollinearity may occur (see appendix 6.1 Correlations of study variables including interactions variables). By contrast, although financial resources and its interaction with structural autonomy are significantly correlated, the main effect of financial resources does not disappear in the model where both variables are introduced. Second, the interaction of financial resources with structural autonomy has a statistically significant and negative effect.

Table 8

Variable	Model 7 - Interaction Marketing resources * Centrality			Model 8 - Interaction Marketing resources * Structural autonomy		
	ROA	Market Share	Revenue Growth	ROA	Market Share	Revenue Growth
Number of employees	-0,032	0,261	-0,012	-0,032	0,259	-0,012
Sig.	0,163	0,041	0,802	0,163	0,041	0,806
Technological resources	0,020	0,073	-0,019	0,009	0,086	-0,036
Sig.	0,557	0,701	0,797	0,799	0,640	0,620
Marketing resources	-0,025	0,302	-0,009	-0,033	0,270	-0,014
Sig.	0,442	0,094	0,897	0,322	0,135	0,848
Financial resources	-0,023	0,367	-0,018	-0,018	0,351	-0,009
Sig.	0,343	0,007	0,727	0,438	0,008	0,854
Centrality	0,151	0,143	0,237	0,094	0,173	0,160
Sig.	0,018	0,669	0,074	0,083	0,545	0,165
Structural autonomy	-0,172	-1,556	-0,766	0,055	-1,440	-0,496
Sig.	0,538	0,309	0,200	0,838	0,319	0,390
Marketing resources * Centrality	-0,096	-0,036	-0,117			
Sig.	0,014	0,860	0,150			
Marketing resources * Structural autonomy				-0,592	-1,275	-0,530
Sig.				0,023	0,343	0,324
Adjusted R square	0,195	0,652	-0,041	0,178	0,660	-0,073
Sig. F test	0,031	0,000	0,631	0,043	0,000	0,773
R square change-Model 4 to Model X	0,121	0,000	0,051	0,106	0,007	0,024
Sig. F change	0,014	0,860	0,150	0,023	0,343	0,324

The explanation that this effect adds to the previous model (Model 4) is very low (2,6%). Moreover, this negative effect of the interaction term on market share does not support the theory. We think the reason is related with our data set. The data we use is from IT industry that is a heterogeneous industry and therefore produces diversity in the data set. According to Yeoh and Roth (1999), if the resource accumulation process is not sufficiently similar across the firms studied, the results lose confidence (Yeoh and Roth, 1999). Therefore, the data could be the problem in this case. Once again, we should analyze data for more years in order to test whether the problem is in the data set. But as we have explained in the section 3.2 Data collection, we cannot obtain data for more years.

Therefore, we are not going to take into account the effect of this interaction term in firm performance. The rest of the Models do not change anything compare to Model 4. Therefore, neither network variables nor their interaction with resource variables contribute to the explanation of market share.

Table 9

Variable	Model 9 - Interaction Financial resources * Centrality			Model 10 - Interaction Financial resources * Structural autonomy		
	ROA	Market Share	Revenue Growth	ROA	Market Share	Revenue Growth
Number of employees	-0,028	0,298	-0,008	-0,030	0,348	-0,014
Sig.	0,269	0,023	0,879	0,265	0,009	0,790
Technological resources	-0,003	0,038	-0,047	-0,002	0,019	-0,043
Sig.	0,934	0,835	0,525	0,961	0,914	0,560
Marketing resources	-0,014	0,349	0,005	-0,016	0,378	-0,002
Sig.	0,706	0,055	0,948	0,664	0,033	0,981
Financial resources	-0,012	0,326	-0,004	-0,010	0,247	0,005
Sig.	0,655	0,017	0,938	0,718	0,077	0,936
Centrality	0,071	0,182	0,140	0,065	0,037	0,138
Sig.	0,219	0,522	0,228	0,256	0,892	0,231
Structural autonomy	0,052	-1,277	-0,496	0,057	-0,207	-0,562
Sig.	0,858	0,378	0,400	0,860	0,893	0,386
Financial resources * Centrality	-0,017	-0,226	-0,019			
Sig.	0,688	0,270	0,822			
Financial resources * Structural autonomy				-0,023	-1,509	0,060
Sig.				0,891	0,063	0,857
Adjusted R square	0,056	0,663	-0,100	0,052	0,733	-0,101
Sig. F test	0,246	0,000	0,879	0,257	0,000	0,881
R square change-Model 4 to Model X	0,004	0,010	0,001	0,000	0,026	0,001
Sig. F change	0,688	0,270	0,822	0,891	0,063	0,857

When performance is measured by ROA, a statistically significant and positive value of centrality appears when there are included the interactions of centrality with technological and marketing resources, and the interactions of structural autonomy with marketing resources. Besides, the interactions between centrality and technological and marketing resources, and the interactions between structural autonomy and technological and marketing resources, have a negative and significant effect on ROA.

We think we should not base our conclusions on these negative interaction effects if we want to give meaningful explanations to our research. In order to obtain meaningful explanations we should look at ROA not only 1 year lagged from the independent variables, but also some years later. It is because for instance, it is common that companies lower their prices in order to get larger market share. Because of the lower prizes, they obtain fewer benefits, thus making ROA decrease (ROA is a measure of profitability). They obtain market share and the benefits (ROA) will come later. As stated by Spanos and Lioukas (2001), "firm resources act upon

accomplishments in the market arena (i.e., market performance), and via the latter, to profitability”.

This is what seems that is happening in our results. We observe how internal resources contribute positively to market share. However, in the interaction models they are found contributing negatively to the profitability what may mean that revenues will come later. It can be also explained from the point of view of “organizational slack” we put forward in the section 3.4.3 Correlations. The explanation is as follows. We saw negative correlations between technological and marketing resources and ROA. This may be caused because these resources may take more than one year to cause effect on profitability. One year later (the year we are studying), the resources have not caused yet effect on performance, so profitability is low, but they must be included in the total assets of the company making the ratio ROA decrease. Therefore, it was expected that internal resources decrease ROA in the year of our study.

More specifically, in the hypothesis testing we saw that technological resources do not influence market share and marketing resources influences with a significance of only ($p < 0.1$). This suggests that technological and marketing resources take more than 1 year to cause effect on market share -and market share is indeed obtained quicker than ROA-. As expected from the hypothesis, the interactions that negatively influence ROA are indeed those of technological and marketing resources (because of the organizational slack). Therefore, in order to get meaningful conclusions from the interaction models we should look at ROA in more lagged periods than the 1-year lag we use in this research, and thereby we should not draw conclusions based on the profitability results we have obtained with this 1-year lag.

In the interactions between centrality and technological and marketing resources, centrality is positively associated with ROA, but the interactions are negative. This suggests that the positive effect of centrality is not strong enough to outweigh the negative effect of resources. In the interaction between structural autonomy and technological and marketing resources, structural autonomy is not significant, so we do not know its sing of contribution to ROA. Therefore, we assume that it is again the negative effect of marketing and technological resources what cause the negative interaction effect. Anyway, the explanatory power of those models is very low as shown in the R square of the Models 5 to 10.

In sum, we cannot take into account the results obtained from the interaction Models because we should first analyze them through longer periods. At first glance of what is happening is that there is always present the negative effect of “organizational slack” due to technological and marketing resources, which overcome the contribution of networks variables. But as we have said, we are not going to base the conclusions on the interaction models.

A summary of what the interactions between resources and network variables contribute to firm performance is as follows. Interactions do not improve the explanation of variance in market share. The models explaining ROA are not going to be taken into account in this research because with the data we have available we

cannot provide meaningful conclusions. The introduction of interactions in the Models with revenue growth does not produce any significant result.

4.5.1 Global tests

In the bottom of all the Models there are also a series of global test that compare the successive Models by using incremental F-test. In these tests R square indicates the percentage of variance of the dependent variable that is explained by the independent variables in the Model. R square change indicates the improvement of R square regard to the previous Model.

According to *R square change* in model 2, which includes internal resources as well as control variables, it explains variance in market share 44,4% better ($p < 0.01$) than the model 1 that only includes control variables. This large R square change means that the introduction of internal resources variables improve the explanation power of the model in a 44,4%. Therefore, internal resources are good predictors of market share.

According to R square change in model 3, which includes external networks as well as control variables, it explains variance in market share only 8,9% better ($p < 0.1$) than the model 1 that only includes control variables. This means that the introduction of external network improve the explanatory power of the model only a 8,9%. Therefore, external networks are not good predictors of market share.

Model 4 includes internal resources, external networks and control variables. According to the significant R square change we find in this table, the full model explains variance in market share 36,7% better ($p < 0.01$) than the model 3 which only includes external networks and control variables. It was expected due to the high prediction power of internal resources observed in model 3.

Now we turn to analyze the absolute explanatory power of the models by looking at the significant values of adjusted *R square*. R square indicates the percentage of variance of the dependent variable that is explained by the independent variables.

We see in model 1 that the control variable explains the 5% of variance of ROA and the 23,4% of variance on market share. In Model 2, we see that internal resources and control variables explain the 66,5% of variance on market share. In Model 3 we see that external networks and control variables explain only the 29,2% of variance on market share. It is expected according to the low explanation that network variables provide. In fact, the Model with only control variables has proximately the same explanatory power that the Model that also includes networks variables.

In model 4 we see that the full model explain the 66,1% of variance on market share. Therefore, the explanatory power of model 4 is proximately the same than the explanatory power of model 2. This means that external networks do not predict market share. Obviously, the explanatory power of model 4 is larger than the explanatory power of model 3.

Regard to the interactions, if we leave out of the explanation the cases we discuss before, we observe that they do not modify any of the R square or R square change comparing to Model 4. Therefore, neither the network variables nor their interaction with internal resources explain variance in firm performance.

In general, this suggests that in order to understand the performance of firms in the IT industry we have to consider only the effect of internal resources.

5. CONCLUSIONS AND DISCUSSION

In this study we investigated the effects of internal resources and external network on the performance of firms within the network of companies of the Dutch IT industry. It is widely accepted that the rents that accrue to firms is partly the result of their own resource endowments, but partly derived from the network in which they are embedded. Therefore, a comprehensive view of a firm's rent-generating resources would not only include internal resources but would also include the network resources of the firms (i.e. Gulati, Nohria and Zaheer, 2000). This joint consideration of firm resources and external networks in affecting firm performance is what we investigated in this research.

The results confirmed our hypothesis that marketing and financial resources drive firm performance and did not support the expectation that technological resources positively influence firm performance. Besides, the results did not support any of the hypothesis that positively related centrality and structural autonomy with firm performance. Regard to the hypothesis that internal resources and external networks have a positive interaction effect on firm performance, the results did not support this expectation either. Therefore, the results suggest that firm internal resources are key determinants of firm performance, unlike firm external networks that do not influence firm performance.

We believe that this study can significantly contribute to our knowledge of wealth creation. We explored the importance of internal resources and external networks in the performance of firms in the IT industry by combining RBV and social capital theory. They have been considered central in the explanation of firm performance. On one hand, RBV regards the firm as a bundle of resources and suggests that they significantly affect the firm's competitive advantage and, by implication, its performance (Barney, 1986, 1991; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984; Katila and Shane, 2005 in: Lee, Lee and Pennings, 2001). On the other hand, social capital, that emerged out of theories on social networks, shifted the attention away from the RBV-inspired question of 'what you know' to 'who you know,' by taking stock of a the set of resources, tangible or virtual, that accrue to a corporate player through the player's social relationships that facilitate the attainment of goals (Pennings *et al.*, 1998).

Our results suggest that firm performance is better explained by RBV than by social capital theory. In the results we saw significant effects of social capital on firm performance that disappear when internal resources are also taken into account. This means that social capital does not explain enough variance of firm performance compared to the variance explained by RBV. Thus, in explaining firm performance RBV is better than social capital theory. We also theoretically argued that the interaction effects of RBV and social capital theory needed to be considered to better account for firm wealth creation. Our results indicated however, that again it is only RBV what explains differences in firm performance.

In light of these theories our results suggest that the wealth creation attributed to the resources accumulated by a company is much higher than the wealth creation attributed to the external resources obtained through social capital.

According to RBV, this research suggests that organizations obtain competitive advantage using firm-specific resources, especially strategic resources (they are resources that are first, valuable, meaning that buyers are willing to purchase the resources' outputs at prices significantly above their costs; second, rare, so that buyers cannot turn to competitors with the same or substitute resources; and third, imperfectly imitable, meaning it is difficult for competitors to either imitate or purchase the resources (Barney, 1991). It is also stressed that the use of intangible resources is especially advantageous in wealth creation. They are of key importance in knowledge-based industries, economies of scale usually arise from them, they are more likely to be strategic resources, can affect multiple uses at the same time and are not consumed when are used.

In particular, in this research we have tested the effect of the intangible resources: technological, marketing and financial resources. Technological and marketing resources lie into the category of strategic resources and therefore are likely to positively contribute to wealth creation. Financial resources though are not strategic resources (are neither rare, nor imitable, nor tradable), allow the accumulation of those strategic resources. We did not find technological resources contributing to firm performance. However, this can be explained because R&D may take longer than 1 year –the lag period we have used from the measurement of resources to the measurement of performance- to enhance performance significantly.

In the results we found social capital insignificantly explaining firm performance compared to RBV. This means that the complementary resources that can be obtained because of the ongoing social structure that characterize interorganizational relationships (absorption of new knowledge, quick access to resources or information valuable for the company, the enhancement of trust and cooperation, etc), does not contribute to the wealth creation of a firm with the same strength the resources do. This finding is specially stressed if we take into account that our research is based on companies in the IT industry. This is the industry in which most strategic partnerships have been developed (this industry requires a wide range of technological resources which may not be implemented by firm's individual competencies) and we do not find significant contributions on firm performance of the so much social capital that should be flowing in this industry.

In particular, in this research we have tested the effect of centrality and structural autonomy in firm performance. Centrality and structural autonomy are related to the speed and volume, and variety and exclusiveness respectively, of the information, assets, and opportunities the companies obtain from their position in the network. These advantages are not enough to improve firm performance as compared to the improvement provided by internal resources. Nevertheless, the no significant influence of structural autonomy could be explained by the fact that the performance measures

do not capture the exploratory side of the firm, which is what structural autonomy promotes.

Discussion

We have found that marketing as well as financial resources are a source of wealth creation. This supports the arguments that marketing resources are mainly experience-based resources that make these skills difficult to imitate, and then make marketing resources a source of superior performance. Financial resources, although they are neither rare, nor imitable, nor tradable, they are a source of better performance since the firms that have more financial resources are likely to accumulate a larger stock of strategic resources than others that lack such financial resources (Dierickx and Cool, 1989 in: Lee, Lee and Pennings, 2001). Technological resources are supposed to be sources of wealth because they comprise many aspects such as R&D, technological knowledge, patents, or other technology-specific intellectual capital that are valuable and difficult to imitate by competitors –we measured technological resources as R&D expenditures-. In this research we do not find technological resources contributing to firm performance. However, as we stated before, this can be explained because R&D may take longer than 1 year to enhance performance significantly.

There are other researches that have tested the same variables than us in affecting firm performance. For instance, Caloghirou et al. (2004). This research is different from ours because they used a questionnaire instead of quantitative data, and they measured performance for the same years than they measured resources. They found the same than our research: financial and marketing resources significantly affect firm performance, unlike technological resources that did not appear rewarding firm performance. Lee, Lee and Pennings (2001) also measured the relationship between technological and financial resources and firm performance. Their research differs from ours in that they used a questionnaire and they used a 2-year lagged period. They found that financial resources affect firm performance –the same finding than us– and they also found technological resources affecting firm performance. This latter finding may be due to their use of 2-year lagged period of data collection, which supports our argument that technological resources may take longer than 1 year to enhance performance significantly. Spanos and Lioukas (2001) also found that marketing and technological resources affect firm performance, but they collect data through a questionnaire. Based on this review we observe that our findings are in line with other results in extant literature.

Regarding social capital, we have found that their effect on firm performance is not significant compared to the effect of internal resources. There are researchers that have also tested the influence of firms' structural positions in performance, and we would like to review this literature in order to compare. Rowley, Beherens and Krackhardt (2000) collected data from databases and found that depending on the network under examination (explorative or exploitative), the effect of firm' structural autonomy in performance varies (performance measured by ROA). Ahuja (2000), based on his findings claims that the impact of network positions can only be understood relative to a particular concept. Zaheer and Bell (2005) found that the

structural autonomy of a company benefits its performance (measured by market share). This finding is for the Canadian mutual fund industry which has different characteristics than IT industry. According to the findings of Rowley, Beherens and Krackhardt (2000) and Ahuja (2000), since the industry context is important in order to assess the effects of structural autonomy, we cannot compare those findings with our research results. The findings also lead us to think that since our performance measures do not capture the exploratory side of a firm that structural autonomy promotes, the results are less likely to be significant since there is not reflection in our measures of industry context.

We wanted to look for authors that measured structural autonomy affecting firm performance in an industry comparable with the IT industry, but we do not find any article. We find Lee, Lee and Pennings (2001) who studied technological companies in Korean, what can be an industry comparable to IT, but they used other measures of social capital (partnership and sponsorship relationships) and they obtained the data through a questionnaire (performance is measured by revenue growth). Anyway, they found that social capital does not contribute to firm performance. We also wanted to compare articles that measure the relationship between centrality and in firm performance. We find Tsai (2001) who did not obtain statistically significant results for this relationship (performance measured by ROI). Therefore, although social capital is proven to be promoting firm performance, we see that our specific results regard to structural autonomy and centrality are not far from the findings of extant literature.

Limitations

This study has several methodological weaknesses that are detailed as follows. This study lacks data for a longitudinal study. This lack did not allow us obtain better understanding and draw more meaningful conclusions of the results we have obtained. Especially significant is that we could not assess the profitability indicators of firm performance (it is explained in section 3.5 Internal resources and external networks driving firm performance).

The collected data is at large extent financial information for which in many cases the companies do not report real values. Moreover, we had to approximate some of these data what might have effect in the results.

The measures of external networks we have used do not take into account the quality, direction or intensity of the ties. However, this should not be a problem because they are widely used and accepted measures of structural properties of a network. Nevertheless, this might have influence in the results we obtained for network variables. The measures of performance do not capture the exploratory side of the firms, thereby do not allow for the proper assessment of the effects of structural autonomy.

For some variables we did not obtain normal distributions. These variables are specifically ROA, revenue growth, and structural autonomy. This might be a cause for the lack of significant results for these variables. Besides, internal resources variables

are highly correlated as well as the external networks variables. This may also have an effect on the appearance of significant results.

Our research models do not significantly explain the 100% of variance of one of the performance measures. The variance not explained may be caused because of the lack of other relevant variables. Due to the unavailability of data we could not include more variables.

Our sample size is not large enough to allow us analyze the effects of all interaction terms in one equation. Moreover, the sample includes a no homogeneous set of firms. The IT industry is heterogeneous industry that includes firms from software and hardware sectors what means that the resource accumulation process is not similar across the firms studied. This could make the results of the relationships tested lose some confidence.

Finally, we used data from companies in the network of the Dutch IT industry to test our hypotheses. As a result, generalizability of the results to other country settings or to non-technological firms is questionable.

Recommendations for practice

Since this study explores the performance contribution of internal resources and external networks in Dutch IT industry, this research can provide several managerial implications for managers of IT companies. Managers usually have very limited time and resources and thus should manage them fastidiously. This research shows that internal resources contribute to improve firm performance. In order to succeed the managers should focus on the accumulation of intangible resources especially in those such as marketing and financial resources. Marketing efforts are needed as complementary resources that promote the production of the most suitable products and services according to the current state of the market, and for the delivering of those products and services. The financial resources of a company allow the accumulation of larger stock of key resources than other companies that lack such financial resources.

This research also shows that social capital does not have a significant influence on firm performance compared to the influence of internal resources. Neither the centrality nor the structural autonomy of a firm in a network, which facilitate quick and more, and varied and exclusive information and resources respectively, seems to contribute in firm performance compared to internal resources.

Therefore, the managerial implications of this research are in line with the contention of resource-based scholars that a firm should develop and nurture its strategy profile building upon its available stock of resources (e.g., Rumelt, 1991). As Grant (1991) notes, the resources of a firm are the central considerations in formulating wealth creating strategies.

Future research

The weaknesses provide directions for future research. Future research could include more variables in the analysis, such as control variables, in order to enhance the explanatory power of the models. It could also use more sophisticated measures of firm performance. In order to give an example of measure that captures the exploratory side of the firm, I would suggest new product introduction for instance. It could also include more fine-grained measures of external networks that take into account the quality, direction or intensity of the ties. The research could also take into account other types of relationships like informal interorganizational relationships or relationships with customers. Through those networks social capital is also captured, what may influence firm performance.

Future research could use a larger sample so that we can analyze the effects of all interaction terms in one equation. It could also treat separately the different sectors that compose IT industry. In this way it could be tested homogeneous set of firms in regard to their resource accumulation. Moreover, it is known that the performance due to an interaction between internal capabilities and social capital depend critically on the conditions in a firm's competitive and general environment (Foss, 1997). Therefore, the separation by sectors would also be advisable to overcome that disadvantage. However, it must be taking into account that although by focusing in more specific type of companies you have the benefit of controlling more effects, you also have the downside of limiting the generalizability of results.

Finally, for future research longitudinal study would be of key interest. On one hand, as we have argued in this research, performance is usually first driven by market share and later by profitability. Longitudinal research would allow us to study the profitability indicators of firm performance. On other hand, by longitudinal study it could be investigated the dynamic relationship among internal resources, external networks, and a performance. For example, new avenues of research can explore whether financial resources has an impact on technological resources, which in turn affects future performance. Similarly, new research could examine whether external networks are conducive to the accumulation of internal resources, which in turn facilitates the creation of new ties with valuable external partners.

In conclusion, our empirical study shows that internal resources of IT companies influence firm performance much more than their external networks. In examining those effects we have integrated two major theories: RBV and social capital theory. Therefore, this research suggests that RBV is better than social capital theory in explaining firm performance. We hope that this research will stimulate further research on the increasingly important field of resources and networks contributing to firm performance, and provide new insights for managers.

6. APPENDIX

6.1 Correlations of study variables including interactions variables

Table 10

	Empl ee	Centrality	Structural Autonomy	Tech	Marketi	Finan	CCC_ tech	CCC_ market	CCC_ financia	SSS_ tech	SSS_ market	SSS_ financia
Employee	1,000	,134	-,038	,432**	,460**	,228	,182	,159	,275*	,010	-,118	,214
		,371	,802	,002	,001	,111	,230	,286	,062	,948	,431	,149
	50	47	47	48	50	50	45	47	47	45	47	47
Centr	,134	1,000	,745**	,120	,043	,112	,361*	,531**	,405**	-,049	,336*	,226
	,371		,000	,431	,777	,453	,015	,000	,005	,751	,021	,127
	47	47	47	45	47	47	45	47	47	45	47	47
Structural Autonomy	-,038	,745**	1,000	-,050	-,195	-,129	,015	,251*	,365*	-,127	,376**	,438**
	,802	,000		,743	,189	,387	,921	,089	,012	,405	,009	,002
	47	47	47	45	47	47	45	47	47	45	47	47
Techn	,432**	,120	-,050	1,000	,871**	,651**	,179	,233	,003	-,340*	-,230	-,165
	,002	,431	,743		,000	,000	,239	,123	,983	,022	,129	,280
	48	45	45	48	48	48	45	45	45	45	45	45
Marketing	,460**	,043	-,195	,871**	1,000	,602**	,236	,161	,063	-,234	-,334*	-,126
	,001	,777	,189	,000		,000	,118	,280	,674	,122	,022	,399
	50	47	47	48	50	50	45	47	47	45	47	47
Financ	,228	,112	-,129	,651**	,602**	1,000	-,004	,064	-,215	-,380*	-,278*	-,472**
	,111	,453	,387	,000	,000		,977	,667	,147	,010	,058	,001
	50	47	47	48	50	50	45	47	47	45	47	47

Table 11

	CCC_ tech	CCC_ marketin	CCC_ financial	SSS_ tech	SSS_ marketing	SSS_ financial	ROA	Market Share	Revenue Growth
CCC_ tech	1,000 45	,879** 45	,559** 45	,581** 45	,394** 45	,184 45	-,238 44	,164 45	-,111 43
CCC_ marketing	,879** 45	1,000 47	,505** 47	,375* 45	,620** 47	,122 47	-,179 46	,110 47	-,128 45
CCC_ financial	,559** 45	,505** 47	1,000 47	,376* 45	,272 47	,819** 47	,025 46	-,107 47	,000 45
SSS_ tech	,581** 45	,375* 45	,376* 45	1,000 45	,567** 45	,373* 45	-,172 44	-,226 45	-,080 43
SSS_ marketing	,394** 45	,620** 47	,272 47	,567** 45	1,000 47	,271 47	-,073 46	-,367* 47	-,064 45
SSS_ financial	,184 45	,122 47	,819** 47	,373* 45	,271 47	1,000 47	,072 46	-,347* 47	,015 45

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