



The Internet as a Complementary Resource for SMEs: The Interaction Effect of Strategic Assets and the Internet

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ABSTRACT

It has been suggested that the Internet can be used to leverage a firm's strategic assets. However, empirical research on complementarity is still rare and frequently inconclusive, especially in the context of small and medium-sized enterprises. We propose a theoretical framework with the independent variables business resources, dynamic capabilities and IT assets. Survey data of 146 small firms suggest that the Internet is complementary with business resources and dynamic capabilities but not with IT assets. Therefore, the framework may enable small firm managers to create competitive advantage by identifying strategic assets that are complementary with the Internet. Furthermore, our research highlights the threat of an over-investment in IT assets.

Keywords: Competitive Advantage; Complementarity; Internet; Performance; Resource-based View; SMEs; Technology

INTRODUCTION

The resource-based view of the firm (RBV) has become the dominant framework in strategic management research. Its basic assumption is that firms can exploit strategic assets in order to create competitive advantage and thus above average performance. Another core assumption of the RBV is that strategic assets can be com-

plementary. This means their value increases when they are combined. "Complementarity represents an enhancement of resource value, and arises when a resource produces greater returns in the presence of another resource than it does alone" (Powell and Dent-Micallef 1997, p.379). Teece (1986, p.301) suggests that complementary assets are especially important for small companies because, in contrast to their

larger competitors, they “are less likely to have the relevant specialized and cospecialized assets within their boundaries and so will either have to incur the expense of trying to build them, or of trying to develop coalitions with competitors/owners of the specialized assets”. However, the complementarity of strategic assets is typically taken for granted but has hardly been empirically scrutinised, and non-anecdotal studies analyzing the interaction effects of strategic assets within a firm are frequently inconclusive (Powell and Dent-Micallef 1997; Song, Droge, Hanvanich and Calantone 2005; Zhu and Kraemer 2002)¹. Therefore, Song et al. (p.271) conclude “clearly, resource combinations do not always lead to synergistic performance impact.”

This paper seeks to analyze whether strategic assets are complementary with the Internet. It contributes to the still underdeveloped research on complementarity by introducing the Internet as a complementary resource. We believe that the Internet can be extremely important for SMEs, and that it can be used to “level the playing field”. With this research we want to give managers of SMEs some information about which strategic assets can be leveraged by the Internet. Based on the literature review and survey data we suggest that researchers should examine complementarity at research settings in which a clear distinction of strategic assets is feasible. The remainder of the paper is organized as follows. In the next section the literature on the resource-based view and complementarity is briefly reviewed and the hypotheses are presented. After that, the research methodology is described, followed by the results. And then the discussion, the conclusions, the limitations, and some suggestions for future research are offered.

Complementarity in Resource-Based Research

According to the resource-based view of the firm (RBV), firms perform differently because they differ in terms of the strategic assets they control (Barney 1991; Penrose 1959; Wernerfelt 1984). The founding idea of viewing a firm as

a bundle of strategic assets was pioneered in 1959 by Penrose in her theory of the growth of the firm. This paper focuses especially on the complementarity of strategic assets. Under the resource-based view, a complementary interaction typically enhances the value for both (or all) strategic assets, although the causality may be ambiguous (Barney, 1991). Yet, researchers have only started to analyze complementarity of strategic assets. Empirical work in that area can be divided in the following two research streams.

One stream of research focuses on complementarity at strategic alliances or at mergers and acquisitions. For example, Rothaermel (2001) found that firms focusing on complementarity outperform those firms that limit their focus on the exploration of new technologies. Stuart (2000) suggested that the reputation of a larger firm is a complementary resource for a smaller firm. In particular, an alliance with a larger firm can help a smaller firm build confidence and attract customers, which then drives financial performance for both partners. Chung, Singh, and Lee (2000) found out that banks tend to ally with other banks that can complement their weaknesses. Krishnan, Miller, and Judge (1997) suggest that complementary top management teams (defined as differences in functional backgrounds between acquiring and acquired firm managers) drive post-acquisition firm performance. Similarly, Capron and Pistre (2002) suggested that acquirers only earn abnormal returns when their strategic assets are complementary with the target and not if they only receive strategic assets from the target.

The second research stream focuses on complementarity within a company. Powell and Dent-Micallef (1997) examined complementarity of IT assets with business resources and human resources and came to inconclusive results. Similarly, Song et al. (2005) found complementarity between marketing-related capabilities and technology-related capabilities only in high, but not in low technology turbulent environments. Zhu and Kraemer (2002) examined the relationship of dynamic capabilities and firm performance and came to inconsistent results

for traditional versus technology companies. In contrast, Zhu (2004) empirically demonstrated complementarity between IT infrastructure and e-Commerce capability.

In conclusion, research on complementarity can be divided into two research streams. The first one is about complementarity of both, internal strategic assets (those that are controlled by a firm) and external strategic assets (those that are controlled by other firms), and the second research stream is about complementarity of internal strategic assets (assets within a single firm). Whereas research of the first category yielded promising results (for example Rothaermel 2001; Capron and Pistré 2002) the inconclusiveness of research of the second category suggests that further work in this area is necessary (Powell and Dent-Micallef 1997; Song et al. 2005). A possible explanation for researchers' problems in evaluating the complementarity of internal strategic assets is that this would require a clear distinction between the different strategic assets (the independent variables). In other words it would be necessary to "unbundle" the performance-driving strategic assets, which appears to be impossible, considering that every firm's bundle of strategic assets is unique (Penrose, 1959). We therefore suggest searching for research settings in which an evaluation of separated strategic assets is more feasible, because this frequently yielded valuable insights, for example at strategic alliances (Rothaermel 2001; Stuart, 2000) or at mergers and acquisitions (Krishnan et al. 1997; Capron and Pistré, 2002).

A notable exception of the research focusing on internal strategic assets is the study of Zhu (2004) which suggested complementarity between IT infrastructure and e-Commerce capability. It differs from other studies on internal strategic assets by including the Internet in the analysis. Therefore, the role of the Internet is explored in more detail in this research, and it is suggested that the Internet itself can be a complementary resource. In our research we analyze if the Internet can be used to enhance the relationship between strategic assets and financial performance. In particular, we ana-

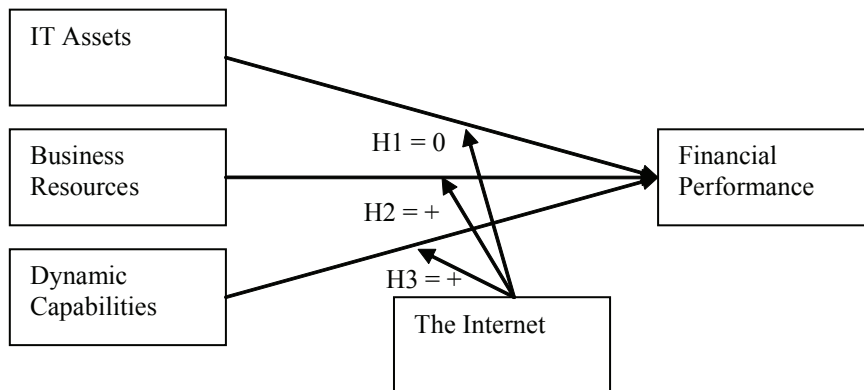
lyze if there is an interaction effect between a construct we labelled Internet performance and the relationship between strategic assets and financial performance.

HYPOTHESES

We believe that the Internet can be seen as a complementary resource. For example it may enable a firm to enhance its supplier relationships, while the pre-existing supplier relationships maximize the Internet's inherent information-sharing capabilities. The ubiquitous Internet would be a commodity resource, yet it may combine with supplier trust to an embedded, mutually reinforcing, advantage producing resource bundle (Barua et al. 2004; Powell and Dent-Micallef 1997). Zhu (2004) demonstrated complementarity of IT infrastructure and e-Commerce capability. However, this research focuses especially on the attributes of the Internet as opposed to Zhu's e-Commerce capability. In particular, we argue that the Internet can be seen as an external strategic asset that can be used by any competing firm (further discussed below), and use the Powell and Dent-Micallef (1997) framework for examining complementarity of business resources, dynamic capabilities, and IT assets with the Internet (see figure 1).

Powell and Dent-Micallef's (1997) model for analyzing the relationships of business resources, human resources, and IT resources with performance is based on the work of Walton (1989) and Keen (1993). It has been modified for this paper, in order to be applicable to small companies instead of larger retailers (details on the modifications are in the methodology section). Furthermore, Powell and Dent-Micallef used human resources as an independent variable. In this paper the newer concept of dynamic capabilities will be used instead. The influential paper about dynamic capabilities of Teece et al. (1997) was published in the same year and in the same journal as the Powell and Dent-Micallef (1997) paper (the Strategic Management Journal). Since then dynamic

Figure 1. Complementarity of the Internet



capabilities have become extremely influential in the strategic management and in the IS literature (see Newbert, 2007 for a review). Powell and Dent-Micallef's measures were especially designed for large enterprises with human resources departments and cross-sectional teams. These measures appeared to be inappropriate for small companies, which perform activities with less expertise, because they don't have functional specialists. In contrast to large firms, their capabilities are mainly determined by the owner manager and not by department managers (Verhees and Meulenberg 2004; Jones 2004). Compared to the construct of human resources (as used by Powell and Dent-Micallef), the dynamic capabilities framework appeared to be more appropriate for small firms, because it evaluates the skills on an organizational rather than a department-level, and it puts a high emphasis on flexibility (in contrast to most human resources measures), and flexibility is a typical strength of small firms (Dean et al. 1998; Verdu-Jover et al. 2006). Furthermore, the theoretical concept of dynamic capabilities is deeply embedded in the resource-based view, whereas most theories on human resources appeared to have other theoretical groundings.

In contrast to Powell and Dent-Micallef's work the main focus of this paper is complementarity of the Internet rather than the direct relationships of strategic assets and perform-

ance. Definitions of resources, capabilities, and strategic assets are shown in table 1.² They are all taken out of the literature. A description of the independent variables (strategic assets) and the hypotheses follows.

IT Assets

IT assets can be defined as "the extent to which a firm is knowledgeable about and effectively utilizes IT to manage information within the firm." (Tippins and Sohi 2003, p.748). Tippins and Sohi's (2003) model was used for this study. It consists of IT knowledge, IT operations, and IT objects. *IT knowledge* is conceptualized as the extent to which a firm possesses a body of technical knowledge about objects such as computer based systems. *IT operations* are the extent to which a firm utilizes IT to manage market and customer information. *IT objects* represent computer-based hardware, software and support personnel.

Mata et al. (1995) examined IT assets as a possible source of competitive advantage. They focus especially on two underlying assertions of the RBV: (1) strategic assets differ between competing firms (resource heterogeneity) and (2) these differences are long lasting (resource immobility).³ They conclude that those IT systems that are used by several competing firms can't be a source of competitive advantage

Table 1. Definitions

	Authors	Definition
Resources	Amit and Schoemaker, 1993	Stocks of available factors that are owned or controlled by the firm.
Dynamic capabilities	Teece et al., 1997	The firm's ability to integrate, build, and reconfigure internal and external strategic assets.
Strategic assets	Amit and Schoemaker, 1993	A set of difficult to trade and imitate, scarce, appropriate, and specialized resources and capabilities that bestow the firm's competitive advantage

because the assertion of resource heterogeneity is not met. Furthermore, IT could only be a source of sustainable competitive advantage if firms without it are at competitive disadvantage acquiring, developing, and using it (resource immobility). The majority of IT assets may be easily copied by competing firms, and subsequently research on the relationship of IT assets with financial performance is frequently inconclusive, and most studies fail to demonstrate IT's direct performance impacts (see Wade and Hulland 2004 for a review). However, Clemons and Row (1991) suggested that even if IT per se can't create sustainable competitive advantage, it can be used to leverage other strategic assets.

We argue that the same logic applies analogously to the Internet. The Internet does not fulfill any of the two criteria: It can be used by any company, and does therefore not fulfill the assertion of resource heterogeneity, and it is ubiquitous, and does therefore not fulfill the assertion of resource immobility. Thus, deploying the Internet can not be a source of competitive advantage. However, it may be possible to deploy complementary strategic assets (like for example dynamic capabilities and business resources), and use the Internet for leveraging them (Fernandez and Nieto, 2006). In this section a set of hypotheses will be offered which suggest complementarity of strategic assets (business resources and dynamic capabilities) with the Internet. However, this does not apply to IT assets. We argue that both IT assets and the Internet don't fulfill the requirements of resource

heterogeneity and resource immobility, and therefore can be used by any competing firm. Combining strategic assets that are ubiquitous can not be a source of competitive advantage. It is therefore suggested that:

Hypothesis 1: *IT assets are not complementary to the Internet.*

(Please note that this is the only hypothesis that does not imply complementarity.)

Business Resources

In addition to the IT assets we also included a number of strategic assets that could be complementary with the Internet. Again we searched the literature for a construct that could be useful for our research. We decided to modify Powell and Dent-Micallef's (1997) set of variables because it appeared to be the most appropriate construct for our research. We define business resources as a set of strategic assets that can be used in combination with the Internet for creating competitive advantage. Business resources were divided into five sub-resources: relationships with customers and suppliers; external-driven e-business; benchmarking; strategic use of the Internet; and financial resources. We now consider each of these in turn.

Supplier relationships are becoming increasingly essential and strategic (Quayle, 2002, Cousins and Spekman 2003), and they play an important role for integrating processes via the Internet (Porter 2001). The capacity

to craft and maintain trusting and economically viable supplier relationships, and then to leverage these relationships with the Internet, appears to require tacit, complex coordination and communication skills that competitors may find difficult to imitate (Hall 1993; Winter, 1987, Pollard and Diggles, 2006). This is especially important for SMEs that participate in supply chains. The marketplace now indicates competition between and among supply chains and industry-wide value chains. The use of the Internet is a necessity not just for remaining competitive, but for mere survival as well. An example of this is Walmart's mandate that top tier suppliers use radio frequency identification at the case and pallet levels. The use of the Internet, therefore, takes centre stage in the design of SMEs' strategic posture in the marketplace.⁴

Customer relationships are a critical success factor in e-business (Schroder and Madeja, 2004). Keller Johnson (2002) argued that companies that already excel in managing customer relationships seem best equipped to take advantage of the Internet's opportunities. Su, Chen and Sha (2007) highlight the importance of technology for managing customer knowledge in the digital economy, and Letaifa and Perrien (2007) suggest that successful implementation of e-CRM tools requires an innovative and customer-driven culture. Zhu et al. (2002) and Xu, Rohatgi and Duan (2007) found that a lack of trading partner readiness to adopt e-Business is a significant e-business adoption inhibitor. Within the RBV-logic, *supplier driven e-business* can be seen as a resource for companies that are deploying the Internet. Consumer readiness is an Internet adoption driver (Zhu et al. 2002), and like the above described supplier-driven e-business *customer-driven e-business* can be seen as a resource for companies that are deploying the Internet. *Benchmarking* is important for small companies (Barclay, 2006; Chan, Bhargava, and Street 2006) and it is a widespread practice for the development of IT systems (Whitley 1992). Teo and Choo (2001) found out that using the Internet has a positive impact on the

quality of competitive intelligence information. Furthermore they found a positive link between the quality of competitive intelligence and firm performance. Porter (2001) believed that strategies that integrate the Internet with traditional competitive advantages and ways for competing win in many industries. *Strategic use of the Internet* can lead to competitive advantage, because production and procurement can be more effective and buyers will value a combination of on- and off-line services. Small companies usually have fewer *financial resources* than larger ones, which often limits their opportunities (Caldeira and Ward 2003; Chow et al. 1997; Van Auken 2005).

We conclude that (in contrast to IT assets) business resources differ between competing firms and that these differences are long lasting. Therefore the assertions of resource heterogeneity and resource immobility are met. Thus business resources may be complementary with the Internet and it is suggested that:

Hypothesis 2: *Business resources are complementary to the Internet.*

Dynamic Capabilities

Dynamic capabilities have the following three characteristics (Teece et al. 1997): (1) coordination/integration, (2) learning, and (3) reconfiguration:

1. The effective and efficient internal **coordination or integration** of strategic assets determines a firm's performance. quality performance is driven by special organizational routines for gathering and processing information, for linking customer experiences with engineering design choices and for coordinating factories and component suppliers (Garvin, 1988). Increasingly, competitive advantage also requires the integration of external activities and technologies, for example in the form of alliances and the virtual corporation. Internet technologies play an important role in the integration of collaborative activities and

knowledge management in the product development process (Lee et al., 2006). Soo, Devinney and Midgley (2007) highlight the importance of integrating external knowledge into the organization.

2. **Learning** is the process by which repetition and experimentation enable tasks to be performed better and quicker. It also enables new production opportunities to be identified. In the context of the firm, learning has several key characteristics. It requires common codes of communication and coordinated search procedures. The organizational knowledge generated resides in new patterns of activity, in “routines“, or a new logic of organization. Routines are patterns of interactions that represent successful solutions to particular problems. These patterns of interaction are resident in group behaviour; certain subroutines may be resident in individual behaviour. Collaborations and partnerships can be a source for new organizational learning, helping firms to recognize dysfunctional routines, and preventing strategic blind spots. Bierly and Daly (2007) highlight the importance of external learning sources and dynamic capabilities at SMEs. They suggest that learning from customers is a predictor of innovation speed, learning from suppliers is a predictor of operational efficiency, and learning from other industries is a predictor of superior process technologies. However, learning from competitors is negatively associated with the development of product technologies and basic research. Additionally, smaller firms learn more from suppliers and the scientific community than larger firms, while larger firms learn more from partnerships and consultants.
3. The capability to **reconfigure** and transform is itself a learned organizational skill. Fast changing markets require the ability to reconfigure the firm’s asset structure, and to accomplish the necessary internal and external transformation (Amit and

Schoemaker 1993). Change is costly and so firms must develop processes to minimize low pay-off change. The capability to change depends on the ability to scan the environment, to evaluate markets, and to quickly accomplish reconfiguration and transformation ahead of competition. This can be supported by decentralization and local autonomy (Teece et al., 1997).

Rindova and Kotha (2001) conducted case studies on Yahoo! and Excite and suggested that the fast changing virtual markets require dynamic capabilities. Ma and Loeh (2007) show that the dynamic capabilities approach can provide a holistic perspective to understand enterprise system driven process innovation at Chinese companies, which are facing a dynamic external environment. They believe that Chinese companies often lack the experience of enterprise system ERP-driven process innovation, however they could solve these challenges if they focus more on effectively building their dynamic capabilities. Wu, Lin and Hsu’s (2007) survey of 100 Taiwan companies related to the electronic IT industries suggests that dynamic capabilities are related to innovative performance. They further found moderating effects between dynamic capabilities and relationship capital. Zhu and Kraemer (2002) found a positive relationship between e-commerce capability (a set of measures based on the dynamic capabilities framework) and some measures of financial performance. In his later work, Zhu (2004) then found complementarity between e-Commerce capability and IT-infrastructure and a positive relationship to financial performance. In this paper a more fine-grained approach is used by distinguishing between the Internet and dynamic capabilities. It is therefore suggested that:

Hypothesis 3: *Dynamic capabilities are complementary to the Internet.*

METHODOLOGY

The Sample

The Internet has the potential to affect entire organizations beyond the boundaries of their departments (Porter 2001). Therefore it may be difficult to identify respondents in large organizations because managers of large companies may have problems to completely understand the impact of the Internet. Even the CEOs of large companies may find it difficult to understand the usage of the Internet in different departments. In contrast, small firms tend to be structured more simply than larger enterprises (Hannan and Freeman 1984). We therefore focused on small firms because they are often governed by owner-managers, and the vast majority of strategic decisions is usually made by one person (Schlenker and Crocker 2003; Feindt, Jeffcoate and Chappel 2002), and they may be involved to a higher degree in the actual Internet usage of their organization.

In order to make sure that all companies of the sample use the Internet, only companies that have a website were examined. This study aimed at examining complementarity that is widely generalizable for small firms in different industries, and therefore does not focus on only one single industry. Thus it complies with the resource-based view, which is grounded in the assumption that performance differences are mainly caused by firm and not by industry effects (Barney 1991; Hawawini et al. 2003). Yeoh and Roth (1999) argue that strategic assets are unique for each industry. In contrast, we believe that for example the quality of customer relationships, which has already been applied for retailers (Powell and Dent-Micallef 1997), or the capabilities of coordination, which has been used for manufacturing companies (Caloghirou et al., 2004), can be valuable for all profit-organizations. In the same vein, Chan et al. (2006) suggest that the key-organizational challenges of small firms are not influenced by the type of industry. Furthermore, the Internet blurs and shifts existing market boundaries (Amit and Zott 2001) and therefore the dif-

ferentiation in different industries appears to be less important.

The “First Stop Shop” (an organization funded by the European Union and the Belfast City Council) database was used for this sample, because it was the only database that we are aware of that also included a large number of websites of local companies (Belfast/Northern Ireland/UK). We focused especially on local companies because this paper is part of a bigger research project, which also required interview data. Those companies that provided their Internet address in the database were selected and a paper-based questionnaire was sent to them. We only examined small firms with less than 250 employees.

The original database contained 7600 companies; 2377 of which provided their Internet address. After separating the non-profit organizations and companies with more than 250 employees, 1963 addresses remained. 50 companies were used for the pilot.⁵ A questionnaire was sent to the remaining 1913 subjects. 44 questionnaires were returned because the companies have gone away or closed, and 11 answered that they would not complete the questionnaire because it was not appropriate for their organization. This led to a sample of 1858 companies. 228 questionnaires were returned therefore the response rate was 12.3 percent (228/1858). After eliminating the remaining non-profit organizations, non-independent and too large companies, 146 companies remained. The response rate of 12.3 percent is not great; however, it may be satisfactory considering the requirement of CEO’s direct involvement (Lee, Lee, and Pennings 2001), and similar response rates are common in SME research (e.g. Voordeckers, Gils and Heuvel (2007) had 9.2% and Cooper, Upton and Seaman (2005) had 11.3%).

On average 14.4 percent of company revenues were generated online, 22.7 percent of products and services were procured on the Internet, and 22.9 staff were employed. Only four companies were pure dotcoms, creating 100 percent of their revenues online.

The Measures

All measures were taken out of the literature. The measures for IT assets are from Tippins and Sohi (2003), dynamic capabilities from Sher and Lee (2004), and business resources from Powell and Dent-Micallef (1997). However, some modifications were necessary because the original measures were actually designed for large rather than small companies. The following two variables were dropped: One of the set for business resources about cross sectional teams and one of the set for IT assets about a formal IT department. We believe that small companies typically neither have cross-sectional teams nor a formal MIS department, and they were therefore dropped. 10 new questions were included, the vast majority of them in the dynamic capabilities section according to the suggestions of Caloghirou et al. (2004). The reason for the modifications of the original dynamic capabilities construct was that they were used as a set of dependent variables and that section appeared therefore quite short. Details of the modifications can be obtained by the first author.

The financial performance measures consisted of revenues, sales growth and return on assets. Revenues indicate the company's success in its market transactions, sales growth indicates increasing customer acceptance, and return on assets indicates the management's effectiveness in deploying their assets. Managers were asked if their performance over the last three years was outstanding and if they have exceeded their competitors. We also measured Internet performance (a modification of Powell and Dent-Micallef's IT-performance), defined as the degree to which firm performance has been improved by the Internet. Similar to Zhuang and Lederer (2003), the Powell and Dent-Micallef measures were modified by replacing the impact of IT by the impact of the Internet. Therefore, managers were asked about the impact of the Internet on their productivity, competitive position, sales, profitability and overall performance. A 5-point Likert-type measurement scale was deployed.

By using Internet performance as a moderating variable we took Tanriverdi and Venkatraman's (2005) critique into consideration, which suggested that most studies on complementarity only capture potential complementarity, which is limited to a firm's potential for improving financial performance by synergy effects of strategic assets. Most researchers assume that the potential for the complementarity of strategic assets will automatically translate into actual complementarity and subsequently improved performance. In practice however, firms are not always able to exploit potential synergies of strategic assets. For example, many unsuccessful mergers, acquisitions, and joint ventures actually destroy value (Tanriverdi and Venkatraman, 2005). The interchangeable usage of potential complementarity and actual complementarity does not take into account that firms may not be able to create complementarity. In this study this problem was approached by asking the managers directly about the performance impacts of the complementary resource (the Internet).

It is broadly accepted that objective performance measures are highly correlated with the subjective ones, and can be used if subjective data is not available (Dess 1987; Dess and Robinson 1984; Powell and Dent-Micallef 1997). By using subjective measures it is assumed, given the senior executives involved, that respondents had sufficient perspective and information to assess their firm performance relative to competitors. Some researchers even prefer subjective measures, because it could reduce the problems of varying accounting conventions in areas such as inventory valuation, depreciation, and officers' salaries (Powell and Dent-Micallef 1997). We ideally would have preferred to triangulate the perceived performance with accounting-based data, but small firms are usually held privately and would not provide confidential information as a matter of policy. We have also been unable to find valid secondary data.⁶ But even where secondary data is available, small firm organizational form (sole proprietorship, partnership, corporation, etc.) can cause artificial differences. Also, owner compensation can

affect the performance of small, privately-held firms (Dess and Robinson 1984).

RESULTS

Strategic Assets and Financial Performance

Following Powell and Dent-Micallef (1997) the following linear regression model was estimated:

$$Z_Y = \alpha + \beta_B Z_B + \beta_D Z_D + \beta_I Z_I + \varepsilon$$

Z_Y stands for financial performance, α for the intercept B for the variable set of business resources, D for dynamic capabilities, and I for IT assets. β_x are the standardized partial regression coefficients for estimating performance Z_Y . We assume that β_B and β_D will be positive and significant and β_I about zero (Powell and Dent-Micallef 1997). ε is the residual term that captures the net effect of all unspecified factors.

Table 2 shows the Cronbach alphas as a measure for scale reliability. The dependent variables were relatively high with 0.90 for financial performance and 0.95 for Internet performance. Cronbach alphas of all variables exceeded the recommended minimum of 0.6 (Bagozzi and Yi 1988), with a range from 0.66 to 0.88 for business resources (overall 0.74), 0.64 to 0.84 for dynamic capabilities (overall 0.87), and 0.61 to 0.92 for IT assets (overall 0.90). All variable sets correlate statistically significant with financial performance (see table 2).

Table 3 presents the results from multiple regression for the independent variable sets (business resources, dynamic capabilities, and IT assets), the control variable (firm size "ln emp" measured as the natural logarithm of employees), and for the dependent variables. The variables combined explain 22.4 percent of financial performance variance, and an estimated 20.2 percent of variance in population (using adjusted R^2 , which estimates population effects based on sample degrees of freedom).

The significant intercorrelations between some of the sub-variables in the model led us to resolve multicollinearity problems by dropping variables (Gujarati 1995). Therefore, in addition to the analysis with the constructs, we dropped variables and the results after dropping variables were compared to the results of the construct. It was then checked if dropping variables changes the conclusions of the study. Variables were dropped if they had correlations higher than 0.5 with an included variable (benchmarking, integration, reconfiguration, IT knowledge, and IT objects). The regression analysis with the remaining variables yielded no significant results for the variables relationships, external driven e-Business, strategic Internet and IT operations. They were therefore also excluded. Thus, in this additional test, business resources were only measured by financial resources, dynamic capabilities by learning, and IT assets were excluded. The results of the regression analysis after dropping variables would not have changed any of the conclusions. We therefore suggest that multicollinearity is not a problem.⁷ Please note that this was just an additional test for ruling out multicollinearity issues; we used the constructs and not single variables for our regression. Furthermore, the assumptions of multiple regression (normality, linearity, homoscedasticity, and independence of residuals) were examined according to the suggestions of Pallant (2002) and the results suggest that the assumptions were not violated.

The results suggest a direct relationship of business resources, dynamic capabilities, and financial performance; and no affect of IT assets on financial performance. Furthermore, business resources and IT assets are related to Internet performance and dynamic capabilities are not.

Complementarity of the Internet and Strategic Assets

Powell and Dent-Micallef (1997) conducted a median split for analyzing complementarity of IT assets with other firm assets. They ranked all companies according to their IT assets and

Table 2. Descriptive statistics

N=146	Alpha	Mean	S.D.	Financial Performance
Relationships	0.69	3,97	0,67	0,07
Extern Driven e-Business	0.66	2,46	0,99	0,17*
Benchmarking	n.a.	2,72	1,22	0,14
Strategic Internet	0.88	3,43	1,14	0,04
Financial Resources	n.a.	3,00	1,11	0,51***
BUSINESS RESOURCES	0.74	3,12	0,65	0,31***
IT Knowledge	0.92	3,33	1,08	0,16*
IT Operations	0.87	2,55	0,93	0,25**
IT Objects	0.61	3,21	1,01	0,14
IT ASSETS	0.90	3,03	0,85	0,22**
Integration	0.64	3,69	0,59	0,27***
Learning	0.84	3,63	0,73	0,33***
Reconfiguration	0.68	3,38	0,63	0,38***
DYNAMIC CAPABILITIES	0.87	3,57	0,56	0,38***
Internet Performance	0.95	2,74	1,10	0,21**
Financial Performance	0.90	2,92	0,81	1

*** Correlation is significant at the 0.001 level (2-tailed).

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

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

Table 3. Regression results

	Internet Performance	Financial Performance
Business Resources	.424***	.190*
Dynamic Capabilities	-.059	.336***
IT Assets	.312***	-.114
In emp	-.250***	.263***
R	.720***	.473***
R ²	.518	.224
Adjusted R ²	.505	.202

*** Correlation is significant at the 0.001 level (2-tailed).

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

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

divided them into IT-leading and IT-lagging companies. We modified their methodology and ranked the companies according to their Internet performance. The median was at 2.8 with 74 companies that achieved 2.8 or less at Internet performance. They were labeled as Internet-lagging and 72 companies that achieved more than 2.8, and they were labeled as Internet-leading.

Powell and Dent-Micallef (1997) used three steps for examining complementarity. First, they compared the means of the independent variables (the strategic assets) between IT-leading and lagging companies. Second, they expected that the correlation between strategic assets and financial performance was stronger for IT-leading companies than for IT-lagging companies. And finally, they expected that financial performance would be better for IT-leading companies, compared to IT-lagging companies.

This study's results are shown in table 4. As expected, the means of all independent variable sets (the strategic assets) are higher for the Internet-leading companies. Furthermore, financial performance of Internet-leading companies is better than financial performance of Internet-lagging performance. Independent samples t-test showed that the differences between Internet-leading and Internet lagging companies were statistically significant for all

variables. Table 5 suggests that the relationship between strategic assets and financial performance differs between Internet-leading and Internet-lagging companies. Whereas performance is strongly related to firm size (measured as the logarithm of employees) at Internet-lagging companies, strategic assets are strongly related to financial performance at Internet-leading companies. Furthermore, the explanatory power of the model is much higher for the Internet-leading companies (adjusted $R^2=0.276$) than for Internet-lagging companies (adjusted $R^2=0.175$).

Hypothesis 1 which suggested no complementarity of IT assets and the Internet was not supported. We would have expected that the relationship between IT assets and financial performance to be non-significant and about zero, like it is for the complete sample (including Internet-lagging and leading companies) and for Internet-lagging companies. Surprisingly, the relationship between IT assets and financial performance is *significantly negative* (-.283*) for Internet-leading companies. Possible reasons could be that Internet-leading companies over-invested in IT assets or that the investments have not paid off yet (further discussed in the next section). Hypotheses 2 and 3, which suggested complementarity between the Internet and business resources and the Internet and dynamic capabilities were supported.

Table 4. Internet-leading and Internet-lagging companies

	Internet-lagging (n=74)		Internet-leading (n=72)		Δ T-Test
	Mean	Std. Deviation	Mean	Std. Deviation	
Business Resources	2,8	0,5	3,4	0,6	6,49***
IT Assets	2,6	0,8	3,4	0,7	6,08***
Dynamic Capabilities	3,3	0,6	3,8	0,4	5,56***
Internet Performance	1,9	0,6	3,7	0,7	17,44***
Financial Performance	2,8	0,8	3,1	0,7	2,31*

*** T-Test is significant at the 0.001 level (2-tailed).

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

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

Table 5. Regression results

	Internet-lagging	Internet-leading
ln emp	.421***	.121
Business Resources	.012	.304*
Dynamic Capabilities	.206†	.460**
IT Assets	-.071	-.283*
R	.469**	.562***
R ²	.220	.316
Adjusted R ²	.175	.276

*** Correlation is significant at the 0.001 level (2-tailed).

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

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

† Correlation is significant at the 0.1 level (2-tailed).

In appendix A we used hierarchical regression analysis for evaluating complementarity of the Internet. The results strongly supported the findings above. However, we did not find a significant interaction effect between IT assets and the Internet. We believe that this could be a problem of the relatively small sample size.

DISCUSSION

This paper sought to examine complementarity between strategic assets and the Internet. The first step in the analysis was the examination of the main effect of strategic assets on financial performance. The analysis showed that business resources and dynamic capabilities are related to financial performance of small firms, and as expected IT assets didn't have a direct relationship to financial performance. In the next step complementarity of the Internet with strategic assets was examined. Therefore the sample was divided into Internet-leading and Internet-lagging companies, and the results suggest that the Internet is complementary with business resources and dynamic capabilities. Surprisingly the interaction effect between the Internet and IT assets was significantly negative at Internet-

leading companies. As already suggested in the literature review, research on the relationship between IT assets and financial performance is frequently inconclusive, however negative relationships are quite untypical (Wade and Hulland 2004), and according to the resource-based logic, we would have expected no direct relationship between IT assets and financial performance (Mata et al., 1995). However, these results are similar to the original study which suggested that financial performance of IT-leading companies was lower than financial performance of IT-lagging companies (Powell and Dent-Micallef 1997). We propose two possible reasons for this phenomenon: First, the Internet-leading companies may have over-invested in IT assets. Song et al. (2005, p.271) suggested "Clearly, resource combinations do not always lead to synergistic performance impact and managers should avoid over-investing in contexts where resources can not be leveraged through configuration, complementarity and/or integration. In terms of resource-based theory, synergistic rents cannot always be obtained". In the literature review we suggested that, according to the resource-based logic, IT assets and the Internet can not be complementary because they both don't fulfill the criteria of

resource heterogeneity and resource immobility. However, this relatively sophisticated resource-based logic may be difficult to understand for managers of small firms, who perform some activities with less expertise because they do not have functional specialists, compared to larger companies (Verhees and Meulenberg 2004). Therefore, there appears to be a threat for managers of small firms to over-invest in IT assets. A second possible reason for the negative relationship could be that the IT investments haven't paid off yet. Performance was evaluated over the past three years. However, the Internet and e-Business are still relatively young areas, and many companies may be in an early stage, and it may take more time until the investments pay off.

CONCLUSION AND IMPLICATIONS

This research suggests that small firms can use the Internet to leverage their business resources and dynamic capabilities, but that IT-assets can not be leveraged by the Internet. The paper contributes to the still underdeveloped research on complementarity by discussing the role of the Internet as a complementary resource for small firms. Based on the literature review and the empirical findings we suggest that researchers should look out for research settings in which a clear distinction of the strategic assets, that are expected to be complementary, is feasible. We further believe that a strategic assets that neither meets the requirement of resource heterogeneity nor the requirement of resource immobility (like for example the Internet and IT assets) can still be used to leverage other strategic assets, if the other strategic assets fulfil those requirements. However, the improving price/performance ratios now emerging in the use of IT assets with the emergence of application service providers (ASPs) as outsourcing vendors and the use of web services, might be a promising development for SMEs. Therefore, it should be even more attractive to use the Internet and Internet-enabled

technologies that enhance business resources and dynamic capabilities.⁸

This paper also has some managerial implications. In particular, the complementarity of the Internet with business resources and dynamic capabilities suggests that companies controlling those strategic assets should seriously consider conducting e-Business.

Furthermore, this research is a warning for managers not to over-invest in strategic assets that have no rent-creating potential. If strategic assets are generic and mobile they can neither be a source of competitive advantage nor can they be complementary with other strategic assets that don't have rent-creating potential. In particular, this research poses the threat of an over-investment in IT assets to managers of small firms.⁹

LIMITATIONS AND FUTURE RESEARCH

Some limitations of this research should be noted. First, since the data was only collected from a single questionnaire, the results can be subject to common method bias. Second, the subjective measures for firm-performance have not been triangulated with secondary data. These limitations are a typical problem that arises when small firms are examined because they frequently don't publish their performance data as a matter of policy (Dess and Robinson 1984). However, we believe that analyzing small firms yields the advantage of relatively simple organizational structures. Furthermore, the owner manager of a small company may be more involved in the actual working processes and be better informed about the impact of the Internet on the processes than the CEO of a large company, who may never even have visited entire departments of his/her firm. In addition, the analysis represents only a snapshot in time, and there are no guarantees that the conditions under which the data is collected will remain the same, this applies especially to the fast changing virtual markets. And finally, we did not control for industry effects.

The limitations suggest avenues for additional research. Future research could aim at identifying research settings in which a separate evaluation of strategic assets is feasible, like for example at strategic alliances (Rothaermel 2001) and mergers and acquisitions (Carpon and Pistre 2002). Furthermore, little is known about complementarity of strategic assets that don't have rent-creating potential by themselves, like for example the Internet or generic IT assets. In addition, the findings could be supplemented by longitudinal research, for example using panel data or time series to examine the development of strategic assets and their complementarity. In addition, whereas the research on small companies yields some advantages, it would also be interesting to triangulate this study with research on large companies. And finally, our data does not yield an explanation for the negative interaction effect of the Internet on the relationship between IT assets and financial performance. We suggested that it could be due to the companies' early Internet adoption stage or due to over-investments in IT. However, these suggestions await empirical verification.

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substitutable by other resources (the VRIN-attributes).

4 The authors thank an anonymous reviewer for this thoughtful comment.

5 Following the suggestions of Dillman (1978) we used a pilot test to identify possible problems with the questionnaire. Therefore managers were asked to complete the questionnaire and then they were asked to identify problems, like for example unclear questions or questions that were difficult to answer. They were furthermore asked, if they believe that any important variables are missing. However, only some minor points were raised, and subsequently the result of the pilot was only some minor changes in the wording of a few questions.

6 The following two attempts were made for triangulating the survey's performance data. First, this research was part of a bigger research project, which also required the collection of qualitative data. We therefore visited 17 companies and conducted interviews with the owner managers, and they were asked about their performance. 9 of the 17 managers refused to offer any performance information as a matter of firm policy, and only 8 managers gave us some performance information. It is of course not possible to triangulate this information with the survey data and to get statistically significant results with a sample size of 8. However, the qualitative analysis of the interviews and of the information that was offered on the firms' websites strongly supported the survey data. Second, a literature review of the leading strategic management journals was conducted to identify suitable databases for this research. Databases that were frequently used in strategic management research were, for example, Dun & Bradstreet, Standard and Poor and Kompass. In addition, we went to the local city council, which provides some basic performance data. However, this data did not appear to be valid. First, we would have expected to find relatively "irregular" numbers with a variety of digits, like for example £123,456. However, we only found numbers that were suspiciously regular, which typically started with the digit 1 and ended with zeros, like for example £100,000. Therefore, the data appeared to be very imprecise. In addition, the performance data appeared to be completely outdated.

ENDNOTES

¹ There were also studies that examined complementarity at strategic alliances (Rothaermel, 2001; Stuart, 2000) and mergers and acquisitions (Krishnan, Miller and Judge, 1997; Capron and Pistre, 2002). However, it may be difficult to apply the findings to this research setting (further discussed in the literature review).

² For a more detailed discussion of different definitions see McGrath et al. (1995) and Caldeira and Ward (2003).

³ This is based on Barney's (1991) earlier work, which suggests that resources can only lead to competitive advantage if they are valuable, rare, imperfectly imitable, and not strategically

For example, we couldn't find data on young companies at all, and when we triangulated the data from secondary sources, with current information from our survey, the interviews and the companies' websites the data appeared too old. Similar problems are frequently reported in small firm research, because they frequently don't publish and performance data (Dess and Robinson, 1984).

7 The VIF values for the construct were between 1.1 and 1.7. The VIF values for the single vari-

ables (after dropping variables) were between 1.1 and 1.4 which also suggests that multicollinearity is not a problem.

8 The authors thank an anonymous reviewer for this thoughtful comment.

9 Please note that we don't suggest that managers should stop all investments in IT, we just suggest that managers should monitor their IT budgets carefully and try to increase value for money in terms of IT spending.

APPENDIX A.

Business Resources

strongly disagree

strongly agree

Relationships

1. We have very open, trusting relationships with our suppliers

1	2	3	4	5
---	---	---	---	---

2. We have very open, trusting relationships with our customers

1	2	3	4	5
---	---	---	---	---

External driven e-Business

3. Our suppliers strongly urged us to adopt e-business

1	2	3	4	5
---	---	---	---	---

4. Our customers strongly urged us to adopt e-business

1	2	3	4	5
---	---	---	---	---

Benchmarking

5. We actively research the best e-business practices of our competitors

1	2	3	4	5
---	---	---	---	---

Strategic use of the Internet

6. The internet has a strategic meaning for our company

1	2	3	4	5
---	---	---	---	---

7. We use the internet actively to reach strategic aims

1	2	3	4	5
---	---	---	---	---

Availability of financial resources

8. Overall, we have enough financial resources

1	2	3	4	5
---	---	---	---	---

APPENDIX A. CONTINUED

IT Assets	strongly disagree					strongly agree				
IT knowledge										
9. Overall, our technical support staff is knowledgeable, when it comes to computer-based systems	1	2	3	4	5	1	2	3	4	5
10. Our firm possesses a high degree of computer-based technical expertise	1	2	3	4	5	1	2	3	4	5
11. We are very knowledgeable about new computer-based innovations	1	2	3	4	5	1	2	3	4	5
12. We have the knowledge to develop and maintain computer-based communication links with our customers	1	2	3	4	5	1	2	3	4	5
IT operations										
13. Our firm is skilled at collecting and analyzing market information about our customers via computer-based systems	1	2	3	4	5	1	2	3	4	5
14. We routinely utilize computer-based systems to access market information from outside databases	1	2	3	4	5	1	2	3	4	5
15. We have set procedures for collecting customer information from online sources	1	2	3	4	5	1	2	3	4	5
16. We use computer-based systems to analyze customer and market information	1	2	3	4	5	1	2	3	4	5
17. We utilize decision-support systems frequently when it comes to managing customer information	1	2	3	4	5	1	2	3	4	5
18. We rely on computer-based systems to acquire, store, and process information about our customers	1	2	3	4	5	1	2	3	4	5
IT objects										
19. Every year we budget a significant amount of funds for new information technology hardware and software	1	2	3	4	5	1	2	3	4	5
20. Our firm creates customized software applications when the need arises	1	2	3	4	5	1	2	3	4	5
21. Our firm's members are linked by a computer network	1	2	3	4	5	1	2	3	4	5

APPENDIX A. CONTINUED**Dynamic Capabilities**

strongly disagree

strongly agree

Integration

22. Overall, our management has expertise to conduct the major strategic moves

1	2	3	4	5
---	---	---	---	---

23. Overall, our employees have very good communication skills

1	2	3	4	5
---	---	---	---	---

24. Our management has expertise in coordinating internal processes and operations

1	2	3	4	5
---	---	---	---	---

25. The feedback of our customers helps us to improve our products and/or services

1	2	3	4	5
---	---	---	---	---

26. The internet has changed our processes significantly

1	2	3	4	5
---	---	---	---	---

27. We have had problems integrating e-business applications in previous IT (reversed)

1	2	3	4	5
---	---	---	---	---

Learning

28. Overall, our company acquires new knowledge effectively

1	2	3	4	5
---	---	---	---	---

29. Overall, our company reacts quickly to market changes

1	2	3	4	5
---	---	---	---	---

30. Overall, our company accumulates knowledge effectively

1	2	3	4	5
---	---	---	---	---

31. Our company recognizes how customers can benefit from new technologies

1	2	3	4	5
---	---	---	---	---

Reconfiguration

32. We continuously adapt to customers shifting needs.

1	2	3	4	5
---	---	---	---	---

33. We quickly respond to competitive strategic moves

1	2	3	4	5
---	---	---	---	---

34. We easily get rid of assets that have no more value

1	2	3	4	5
---	---	---	---	---

APPENDIX A. CONTINUED

Performance

Internet Performance

strongly disagree

strongly agree

35. The internet has dramatically increased our productivity

1	2	3	4	5
---	---	---	---	---

36. The internet has improved our competitive position

1	2	3	4	5
---	---	---	---	---

37. The internet has dramatically increased our sales

1	2	3	4	5
---	---	---	---	---

38. The internet has dramatically increased our profitability

1	2	3	4	5
---	---	---	---	---

39. The internet has dramatically improved our overall performance

1	2	3	4	5
---	---	---	---	---

Financial Performance

strongly disagree

strongly agree

40. Over the past 3 years, our revenues have been outstanding

1	2	3	4	5
---	---	---	---	---

41. Over the past 3 years, our revenues have exceeded our competitors

1	2	3	4	5
---	---	---	---	---

42. Over the past 3 years, our sales growth has been outstanding

1	2	3	4	5
---	---	---	---	---

43. Over the past 3 years, our sales growth has exceeded our competitors

1	2	3	4	5
---	---	---	---	---

44. Over the past three years, our return on assets has been outstanding

1	2	3	4	5
---	---	---	---	---

45. Over the past 3 years, our return on assets has exceeded our competitors

1	2	3	4	5
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General Questions

46. How many full-time employees work in your company?

47. What percentage of your revenue is created by e-commerce?

APPENDIX A. CONTINUED

48. What percentage of the goods and services you buy are ordered via the internet?

49. What is your SIC-code?

50. Are you a for-profit or a non-profit organization? For-profit Non-profit

51. Is your company independent? (This means you have e.g. no parent company or you are not part of a franchising system). Yes No

APPENDIX B

There are two dominant methods for analysing the interaction effect (in this case, the complementarity of strategic assets with the Internet) in social sciences (Jaccard, Turrissi and Wan, 1990). First, in the dichotomising is based on median splits. This procedure was used by Powell and Dent-Micallef (1997), when they ranked all companies according to their IT assets and divided them into IT-leading and IT-lagging companies. We used this approach in the paper. Second, complementarity can be evaluated by deploying hierarchical regression. This approach was chosen by Zhu (2004) and Song et al. (2005). In the appendix we also deploy this approach for demonstrating the validity of our method.

The term without the interaction effect is compared with a term including the interaction effect (the interaction effect is the statistical term for complementarity). At term 1:

$$Z_Y = \alpha + \beta_I Z_I + \beta_B Z_B + \beta_D Z_D + \beta_{IP} Z_{IP} + \varepsilon$$

Z_Y stands again for financial performance, α for the intercept I for the variable set of IT assets, B for business resources, and D for dynamic capabilities. We now also introduce IP for Internet performance. β_X are the standardized partial regression coefficients for estimating performance Z_Y . ε is the residual term that captures the net effect of all unspecified factors. Term 1 is supplemented by an interaction effect (term 2):

Whereas term 2a is the interaction effect of IT and the Internet:

$$Z_Y = \alpha + \beta_B Z_B + \beta_D Z_D + \beta_I Z_I + \beta_{IT} Z_{IT} + \beta_{ITIP} Z_{IT} * Z_{IP} + \varepsilon$$

And term 2b is the interaction effect of business resources and the Internet:

$$Z_Y = \alpha + \beta_B Z_B + \beta_D Z_D + \beta_I Z_I + \beta_{BRIP} Z_{BR} * Z_{IP} + \varepsilon$$

And term 2c is the interaction effect of dynamic capabilities and the Internet:

$$Z_Y = \alpha + \beta_B Z_B + \beta_D Z_D + \beta_I Z_I + \beta_{DCIP} Z_{DC} * Z_{IP} + \epsilon$$

ITIP stands for the interaction effect of IT assets and the Internet, BRIP for the interaction of business resources and the Internet and DCIP for dynamic capabilities and the Internet (Jaccard et al., 1990; Zhu, 2004; Song et al., 2005). If an interaction effect is present, then the R² of term 2 must be higher than at term 1. A hierarchical regression analysis was conducted. The first level were the control variable (ln emp), the second level was term 1, and the third level term 2. The results are shown in the table below.

Adjusted R ²			
Term 1	0.203***		
Term 2	Term 2a	Term 2b	Term 2c
	IT-IP	BR-IP	DC-IT
	0.201***	0.226***	0.225***

As described above, complementarity can be demonstrated by comparing the term without the interaction effect (term 1) with the term with the interaction effect (term 2). A higher adjusted R² of term 2 would indicate complementarity. As expected adjusted R² was lower at term 2a, because the Internet is not complementary with IT assets. However, terms 2b and 2c were higher than term 1, which suggests that the Internet is complementary with business resources and dynamic capabilities. This suggests that hypotheses 2 and 3 were also supported with this method.

The dichotomising approach showed a negative interaction effect of the Internet on the relationship between IT assets and financial performance. At the hierarchical regression analysis the interaction effect was not statistically significant. We believe that this could be due to the relatively small sample size (n=146). The hierarchical regression approach appears to be difficult at small sample sizes because it requires the consideration of additional constructs; which would require larger samples (Jaccard, Turrisi, and Wan, 1990).

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