E-Activity and Intelligent Web Construction:

Effects of Social Design

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Chapter 8
E-Innovation as Source of Business Value in Firms

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ABSTRACT

This chapter seeks to assess the relationship between Web infrastructure and Internet-based innovation as sources of business value. To respond to this challenge, a conceptual model, grounded in the resource-based view (RBV) is developed. To test hypotheses, a large sample consisting of Spanish firms is employed. The results show that, as hypothesized, Web infrastructure is not positively related to business value and that Internet-based innovation has a positive significant impact on business value. In addition, the results show no significant complementarity between Web infrastructure and Internet-based innovation.

INTRODUCTION

Recently, much debate about the value of IT and e-business has been raised. The technology itself will rarely create superiority. For that reason, some research studies found that IT spending rarely correlates to superior performance (Carr, 2003; Brynjolfsson and Hitt, 2000; Soto-Acosta and Meroño-Cerdan, 2009). However, even though competitors may copy an IT infrastructure, relative advantage can be created and sustained where the technology leverages some other critical resource. A number of such complementary resources have been identified by previous studies, such as size, structure, culture, and so on, that could make it difficult for competitors to copy the total effect of the technology (Kettinger et al, 1994; Hempel, 2003; Arvanitis 2005; Loukis et al, 2009). This complementarity of resources is a corner stone of the resource-based view (RBV) and has been offered as an explanation of how IT has largely overcome its paradoxical nature and is contributing to business value (Bhatt and Grover, 2005; Clemons and Row, 1991).

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Innovation can be defined as the search for, the discovery and development of new technologies, new products and/or services, new processes and new organizational structures (Carneiro, 2000; Meroño-Cerdan et al., 2008b). Many researchers (e.g. Hamel 2002) emphasized the role of IT as an enabler of product and process innovation. Thus, IT may be source of competitive advantage through innovation. Web-based tools allow information and knowledge exchange, as well as work execution by integrating information, documents and employees. Thus, for instance, intranets can be used to distribute and share individual experience and innovation throughout the organization (Bhatt et al, 2005). In this sense, research is starting to focus on analysing how the web is and will change innovation within and between companies (Sawhney and Prandelli, 2000).

Consequently, to respond to these challenges, this chapter develops a conceptual model, grounded in the RBV, to analyze the relationship between Web infrastructure and Internet-based innovation as source of business value at the level of an individual firm. The analysis employs a large sample of companies from different industries for hypothesis testing.

The chapter consists of six sections and is structured as follows: The next section reviews the relevant literature. In Section 3, hypotheses are developed. Following that, the methodology used for sample selection and data collection is discussed. Then, data analysis and results are examined. Finally, the chapter ends with a discussion of research findings, limitations and concluding remarks.

LITERATURE REVIEW

The RBV of the firm (Barney, 1991; Schulze, 1992; Hoopes et al, 2003) is a well established theoretical framework from the strategic management domain which provides a solid foundation to differentiate between IT resources and IT capabilities and study their separate influences on performance (Santhanam and Hartono, 2003).Based on this analysis, Bharadwaj (2000) suggested that if firms can combine IT related resources to create unique IT capabilities, they can improve their performance. IS researchers have followed this consideration of IT capability because competition may easily result in the duplication of investment in IT resources, and companies can purchase the same hardware and software to remove competitive advantage (Santhanam and Hartono, 2003). In this respect, research offers a useful distinction between IT resources and IT capabilities. The former is asset-based, while the latter comprises a mixture of assets formed around the productive use of IT.

In general, IT resources are not difficult to imitate; physical technology is by itself typically imitable. If one firm can purchase these physical technologies and thereby implement some strategies, then other firms should also be able to purchase these technologies, and thus such tools should not be a source of competitive advantage (Barney, 1991). However, firms may obtain competitive advantages from exploiting their physical technology in a better (and/or different) way than other firms, even though competing firms do not vary in terms of the physical technology they possess. IT resources are necessary, but not a sufficient condition, for competitive advantages (Clemons and Row, 1991). IT resources rarely contribute directly to competitive advantage. Instead, they form part of a complex chain of assets (IT capabilities) that may lead to better performance. Thus, some researchers have described this in terms of IT capabilities and argue that IT capabilities can create uniqueness and provide organizations a competitive advantage (Bhardwaj, 2000, Bhatt and Grover, 2005; Mata et al., 1995; Santhanam and Hartono, 2003).

The evaluation of the organisational performance impact of ITs is also an important issue within the area management information systems (Soto-Acosta, 2008). In this sense, firm

performance has been principally measured by subjective measures (e.g., Lederer et al. 2001; Soto-Acosta and Meroño-Cerdan 2008; Zhu and Kraemer 2005) or by using financial measures (e.g., Meroño-Cerdan and Soto-Acosta 2007; Zhu and Kraemer 2002). The first normally uses senior executives as the key informants on the subjective measures of firm performance. Given the fact that IT investments may provide benefits after a certain period but increase operating costs in the short term, the locus of impact, that is, the business process, should be the primary level of analysis. As a result, some researchers have given up on trying to correlate financial results with IT investments and suggest focusing on the actual processes that IT is supposed to enhance (Mukhopadhyayet al. 1995). These arguments lead to the conclusion that a process approach should be used to explain the generation of IT value from a resource-based perspective, and this is the approach adopted in the present study. The present research uses the effectiveness of online procurement to measure e-business value. The business value of this process is discussed here.

E-procurement, or buying online, can potentially provide distinct value propositions to the firm. These come from the reduction of procurement and inventory costs, as well as strategic networks with suppliers that allow effective and efficient supply chain management (SCM). With regard to procurement costs, Kaplan and Sawhney (2002) indicated that buying in e-marketplaces considerably reduces transaction costs. With regard to strategic links and SCM, Internet technologies can enhance SCM decision making by enabling the collection of real-time information, and access to and analysis of this data in order to facilitate collaboration between trading partners in a supply chain. In this sense, Frohlich and Westbrook (2002) showed the importance of linking customers and suppliers together in tightly integrated networks. As a result of e-procurement, the collection of real-time information on demand is possible and, more importantly, products and services are delivered quickly and reliably when and where they are needed (Frohlich, 2002).

DEVELOPMENT OF HYPOTHESES

This section develops hypotheses for the present study, drawing on the existing information systems and e-business literature. Three relationships will be explored: Web infrastructure and business value, Internet-based innovation and business value, and the complementarity of Web infrastructure and Internet-based innovation as source of business value.

Web Infrastructure and Business Value

Firms obtain competitive advantages on the basis of corporate resources that are firm specific, valuable, rare, imperfectly imitable, and not strategically substitutable by other resources (Barney, 1991). IT resources are easy to duplicate, and, hence, IT resources per se do not provide competitive advantages (Santhanam and Hartono, 2003). Although IT infrastructure is argued to be valuable, it is not a source of competitive advantage (Bhatt and Grover, 2005). Thus, IT infrastructure will rarely lead to superior performance. Similarly, Web infrastructure is not difficult to imitate. In general, Internet technology is by itself imitable. If one firm can purchase certain Internet technologies and thereby implement some strategies, then other firms should also be able to purchase these technologies, and thus such tools should not be a source of competitive advantage. Furthermore, as the diffusion of the Internet continues, the ability of proprietary IT to be a source of competitive advantage continues to be eroded. These arguments suggest that Web infrastructure may not have a significant impact on business value. Thus, the following hypothesis is proposed:

Hypothesis 1: There is no relationship between Web infrastructure and business value

Internet-Based Innovation and Business Value

Investing in IT is not a necessary nor sufficient condition for improving firm performance, since IT investments might be misused (Tallon et al., 2000). In this sense, IT assets cannot improve organizational performance if they are not used appropriately. However, when used appropriately IT is expected to create intermediary effects, such as IT being embedded in products and services and streamlined business processes (Ravichandran and Lertwongsatien, 2005). That is, IT may facilitate product/service innovation and process innovation which can be expected to have an influence on business value. IT may be source of competitive advantage through innovation. Thus, since Web-based tools allow innovation through information and knowledge exchange, as well as work execution by integrating information, documents and employees (Meroño-Cerdan et al., 2008a), the following hypothesis is formulated:

Hypothesis 2: There is a positive relationship between Internet-based innovation and business value

The Complementarity of Web Infrastructure and Internet-Based Innovation

Although there is research that posit a direct relationship between IT and firm performance (Bharadwaj, 2000; Santhanam and Hartono, 2003), others have questioned the direct-effect argument and emphasized that ITs are likely to affect firm performance only when they are deployed to create unique complementarities with other firm resources (Clemons and Row, 1991; Powell and Dent-Micallef, 1997).

The RBV highlights the role of complementarity as a source of value creation in e-business, though it is not the only source as suggested by Amit and Zott (2001). As mentioned earlier, Web infrastructure is not difficult to imitate and per se do not provide competitive advantages. However, having a proper Web infrastructure may facilitate the internal processing of online operations and this way influence positively firm performance. That is, the fact of possessing an adequate Web infrastructure can be critical for efficient information and knowledge sharing as well as for the formation of virtual teams to execute the innovation process (Adamides and Karacapilidis, 2006; Kessler, 2003). The following hypothesis incorporates these expectations:

Hypothesis 3: The complementarity between Web infrastructure and Internet-based innovations explains variations in business value

METHODOLOGY

Data

The data source for the present study is the e-business W@tch survey 2003, an initiative launched by the European Commission for monitoring the adoption of IT and e-business activity. The field work of the survey was conducted by Ipsos Eco Consulting on behalf of the e-business W@tch and was carried out using computer-aided telephone interview (CATI) technology. Telephone interviews with decision-makers in enterprises were conducted in March and November 2003. The decision-maker targeted by the survey was normally the person responsible for IT within the company, typically the IT manager. Alternatively, particularly in small enterprises without a separate IT unit, the managing director or owner was interviewed.

The population considered in this study was the set of all enterprises which are active at the national territory of Spain and which have their primary business activity in one of ten sectors considered (see Table 1). The sample drawn was a random sample of companies from the respective sector population with the objective of fulfilling strata with respect to business size. A share of 10% of large companies (250+ employees), 30% of medium sized enterprises (50-249 employees) and 25% of small enterprises (10-49 employees) was intended. The number of firms totalled 1,010. 91.1% of firms were small and medium-sized enterprises (less than 250 employees) and each sector considered had a share of around 10% of the total sample.

With regard to respondents' titles, 54.4% were IS managers, nearly 20% were managing directors, and 12.1% were owners. The dataset was examined for potential bias in terms of the respondents' titles. Since respondents included both IT managers and non-IT managers, one could argue that IT managers may overestimate e-business value. To test this possible bias, the sample was divided into two groups: IS managers (head of IT/DP and other IT senior managers) versus non-IS managers (owner, managing director, strategy development and others). One-way ANOVA was used to compare the means of factor scores between the two groups. No significant differences were found, suggesting that the role of the respondents did not cause any survey biases.

Measures of Variables

Measurement items were introduced on the basis of a careful literature review. Confirmatory factor analysis (CFA) was used to test the constructs. Based on the CFA assessment, the constructs were further refined and then fitted again. Constructs and associated indicators, as well as prior research support, are listed in the Appendix and discussed below.

- **Business value.** As discussed earlier, the present research uses the effectiveness of e-procurement for measuring business value. That is, business value is assessed through the business impact of purchasing online.
- **Web infrastructure construct.** This construct represents the adoption of physical Internet technologies. In this sense, respondents were required to assess the presence of four Internet tools: website, Intranet, Extranet and LAN (local area network).
- **Internet-based innovation.** This construct represents the introduction of product/service and process innovations directly related to or enabled by Internet-based technology.

Since correctly measuring is important, tests of reliability and validity for the three constructs were performed. The validity of the construct is established by relating a measuring instrument to a general theoretical framework in order to

Table 1. Statistics for reliability and validity tests

Measures	Items	Reliability	Convergent validity	Discriminant validity
		(Cronbach alpha)	(correlation of item with total store-item)	(factor loading on single factors)
E-business value	3	0.767	0.841; 0.828; 0.811	0.673; 0.719; 0.521
Web infrastructure	5	0.724	0.669; 0.749; 0.676; 0.707; 0.659	0.625; 0.747; 0.718; 0.685; 0.690
Internet-based innovation	2	0.862	0.929; 0.929	0.862; 0.862

determine whether the instrument is tied to the concepts and theoretical assumptions they are employing. In order to obtain evidence of construct validity, convergent validity and discriminant validity are assessed. For the first one, the item-to-total correlation is examined. The lower limit is 0.4. Discriminant validity is checked by a factor analysis. Each variable must have a factor loading in a single factor over 0.5. The results (Table 1) confirm that each construct is unidimensional and factorially different and that all items employed for operationalizing a particular construct load on a single factor. The reliability is the accuracy or precision of a measuring instrument, that is, the extent to which the respondent can answer the same or practically the same value each time. The internal reliability was assessed by calculating the Cronbach's alpha. It can be also observed that acceptable values (above 0.70) are obtained in all cases. Relatively high values of reliability and validity imply that the instruments used in this study are adequate. As shown in Table 1, tests of reliability and validity for the scales presented acceptable values in all cases.

EMPIRICAL RESULTS

To test the hypotheses, business industry and business size were introduced as control variables in order to avoid unexpected effects on e-business value. The former identified whether the business was operating at the manufacturing, services or commercial industry and was coded as a dummy variable. The latter was measured as the total number of employees and was coded as a continuous variable.

The basic econometric relationships may be specified as follows:

$$DV = f(WI, IBI, WI * IBI, \varepsilon) \quad (1)$$

where WI denotes Web infrastructure; IBI stands for Internet-based innovation; and WI * IBI represents the interaction effect between Web infrastructure and Internet-based innovation. DV denotes the dependent variable (e-business value). More specifically, the regression equation is:

$$DV = \alpha + \beta_1 WI + \beta_2 IBI + \beta_3 WI * IBI + (FirmSize + IndustryDummies) + \varepsilon \quad (2)$$

Where α is the intercept; the βi's are coefficients; and ε is the residual term that captures the net effect of all unspecified factors. The model includes both main and the interaction effect between Web infrastructure and Internet-based innovation. Mathematically, the interaction effect can be expressed by taking the first derivative of Equation (2):

$$\frac{\partial DV}{\partial WI} = \beta_1 + \beta_5 IBI \quad (3)$$

High Web infrastructure-oriented firms exhibit stronger relationship between Internet-based innovation and business value than low Web infrastructure-oriented businesses.

The analysis was performed in 3 steps. The dependent variable was initially regressed on the control variables in step 1. Then, in step 2, Web infrastructure and Internet-based innovation were added. Finally, in step 3 the interaction effect was included. To examine the adequacy of using regression analysis, tests were conducted to assess the normality of residuals and the homogeneity of variance of residuals (Hair et al. 1998). No significant violations of these assumptions were observed.

Regression results are summarized in Table 2. Results in model 1 confirmed that the one of the control variables employed (business industry) explains the dependent variable. Model 2 showed that the direct effect of Web infrastructure and Internet-based innovation upon business value was significant as the increment in the squared multiple correlation coefficient (R2) was statis-

tically significant. The effect for Internet-based innovation upon e-business value was positive and statistically significant, while for Web infrastructure the relationship was not significant. Finally, Model 3 showed no significant interaction between Web infrastructure and Internet-based innovation (the increment in R2 was not significant). Thus, support for hypotheses H1 and H2 was provided, whereas hypothesis H3 was rejected.

DISCUSSION

This chapter develops a conceptual model, grounded in the resource-based view (RBV) firms, which analyzes the complementarity of Web infrastructure and e-business capabilities as source of business value at the level of an individual firm. Moreover, it is intended to offer results more widely applicable than studies of Internet leaders or IT industry companies. In this sense, this study attempts to offer an explanation to why there are cases where firms engage in e-business without deriving any benefits.

The results showed that Web infrastructure is not positively related to business value. This finding indicates that, since competitors may easily duplicate investments in IT resources by purchasing the same hardware and software, IT resources per se do not provide better performance. This can be explained through the RBV, because IT is not considered a resource that is difficult to imitate; IT is by itself typically imitable. This result supports the findings of recent research (Batt and Grover, 2005) that did not find evidence of a positive link between IT quality and firm performance. Similarly, Powell and Dent-Micallef (1997) showed that IT by itself cannot be a source of competitive advantage. Thus, our results confirm that Internet technology by itself will rarely create business value.

Furthermore, results demonstrate that there is a positive relationship between Internet-based innovation and business value. This finding supports existing empirical research (Bharadwaj, 2000; Santhanam and Hartono, 2003), which found that firms create competitive advantages though intermediary effects, such as IT being embedded in products and services and streamlined business processes, which in turn affect higher levels of firm performance.

Finally, the empirical results did not offer support for the complementarity of Web infrastructure and Internet-based innovation. The RBV highlights the role of complementarities between resources as a source of business value. Researchers such as Steinfield et al. (1999) suggest that business value can come from synergies between

Table 2. Web infrastructure, Internet-based innovation and business value

	Model 1	Model 2	Model 3
Manufacturing industry	-0.148	-0.100	-0.094
Commercial industry	0.016	0.059	0.064
Number of employees	0.115	0.077	0.075
Web infrastructure (WI)		0.104	0.177
Internet-based innovation (IBI)		0.302**	0.372**
Interaction (WI * IBI)			-0.218
F-value	2.363	4.119**	3.500**
Adjusted R^2	0.019	0.068	0.091
Δ in R^2		0.057**	0.002

Significance levels: *$0.01<p\leq0.05$; **$p\leq0.01$.

online and offline presence. In this sense, using case studies, they showed the lack of exploitation of these synergies in SMEs. However, this chapter shows that the complementarity argument of the RBV as a source of business value is not found for Web infrastructure and Internet-based innovation. Therefore, it can be concluded that having a more complete Web infrastructure is not critical for the influence of Internet-based innovation on business value.

CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

In recent years, much debate about the value of IT and e-business has been created, due to the gap between e-business investment and the lack of empirical evidence on e-business value. Thus, today IS researchers face pressure to answer the question of whether and how e-business creates value. This study developed a conceptual model, grounded in the RBV of the firm, to analyze the relationship between Web infrastructure and Internet-based innovation as source of business value at the level of an individual firm. The analysis employed a large sample of companies from different industries for hypothesis testing. Broadly, this research offers several contributions: (1) it tests the RBV logic, arguing that not all IT resources are source of competitive advantage; (2) it demonstrates that Web infrastructure is not positively associated with e-business value and that Internet-based innovation is positively related to e-business value.; (3) it shows that the interaction effect of Web infrastructure and Internet-based innovation on e-business value is not significant.

While this study presents some interesting findings, it has some obvious limitations which can be addressed in future research. First, the sample used was from Spain. It may be possible that the findings could be extrapolated to other countries, since economic and technological development in Spain is similar to other OECD Member countries. However, in future research, a sampling frame that combines firms from different countries could be used in order to provide a more international perspective on the subject. Second, the e-business value measures are subjective in the sense that they were based on Likert-scale responses provided by managers. Thus, it could also be interesting to include objective performance data for measuring e-business value. Third, the key informant method was used for data collection. This method, while having its advantages, also suffers from the limitation that the data reflects the opinions of one person. Future studies could consider research designs that allow data collection from multiple respondents within an organization.

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APPENDIX

Measures

Constructs & Indicators	Description	Literature support
Web infrastructure WI1 WI2 WI3 WI4	Does your company have a website? (Y/N) Does your company use an Intranet? (Y/N) Does your company use an Extranet? (Y/N) Does your company use a LAN? (Y/N)	*Soto-Acosta & Meroño-Cerdan (2008;Zhu et al. (2003);Zhu & Kraemer (2005)* *Kowtha & Choon (2001);Soto-Acosta & Meroño-Cerdan (2008);Zhu et al. (2003);Zhu & Kraemer (2005)* *Kowtha & Choon (2001);Soto-Acosta & Meroño-Cerdan (2008);Zhu et al. (2003);Zhu & Kraemer (2005)* *Soto-Acosta & Meroño-Cerdan (2008);Zhu & Kraemer (2005)*
Internet-based Innovation IBI1 IB2	Have any of your product or service innovations over the past 12 months been directly related to or enabled by Internet-based technology? Have any of your company process innovations over the past 12 months been directly related to or enabled by Internet-based technology?	*Adamides and Karacapilidis, (2006);Hamel(2002);Kessler (2003)* *Adamides and Karacapilidis, (2006);Hamel(2002);Kessler (2003)*
Business value: e-Procurement effectiveness IP1 IP2 IP3	What effect has online procurement on the procurement costs? (1-5) What effect has online procurement on your relations to suppliers? (1-5) What effect has online procurement on the costs of logistics and inventory? (1-5)	*Soto-Acosta & Meroño-Cerdan (2008);Wu et al. (2003);Zhu et al. (2003);Zhu & Kraemer (2005)* *Tallon et al. (2000);Soto-Acosta & Meroño-Cerdan (2008); Teo & Pian (2003);Wu et al. (2003);Zhu et al. (2003);Zhu & Kraemer (2005)* *Soto-Acosta & Meroño-Cerdan (2008);Wu et al. (2003);Zhu & Kraemer (2005)*
Note. Y/N, dummy variable; 1-5, five-point Likert-type scale.		