Examining Whether Highly E-Innovative Firms are More E-Effective

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The resource-based view (RBV) ascribes superior firm performance to firm resources and capabilities. In recent years, much debate about the value of e-business has been raised because of the costly investments required. Although studies have found positive relationships between e-business and firm performance, there is a need to further investigate into these topics. Since innovation has become a key factor for increasing the competitiveness of firms and e-business has been proposed as complement to innovation, this paper analyses, based on the RBV perspective, whether companies with high level of Internet resources and with high e-innovation are more effective electronically. The methodology involved a large sample firms and data collected by the European e-Business Market Watch, an established e-business observatory sponsored by the European Commission. Results indicated that differences of e-sales effectiveness of firms with high and low Internet resources were not statistically significant, while on the contrary firms with a high level of e-innovation outperformed on e-sales effectiveness.

Povzetek: Članek preučuje, koliko raznovrstna uporaba interneta izboljša spletno prodajo.

1 Introduction

The relationship between information technology (IT) and business value has been the subject of much research over the past decade. The results of these studies were varied and the term "productivity paradox" was coined to describe such findings. Nonetheless, recent studies have found positive and stronger linkages, and have attributed the productivity paradox to variation in methods and measures [22, 44]. Firms make important investments in the development of costly IT infrastructures to benefit from the real-time connectivity and collaboration capabilities provided by the Internet, and to conduct various types of e-business activities [18, 38, 50, 51]. Therefore it is quite important to understand whether and how such IT and Internet-related infrastructures create business value, so that appropriate guidance can be provided to managers.

Although IT in general and e-business provide distinct value propositions to the firm, it has been argued that the technology itself is available to all firms (including competitors), so it will rarely create superiority. In this sense, evidence suggesting that IT spending rarely correlates to superior performance exists [22, 9, 11, 34, 40, 44]. However, even though competitors may copy an IT infrastructure, relative advantage can be created and sustained in cases where the technology leverages some other critical resources. The literature suggests that a number of such complementary resources, such as size, structure, culture, and so on, that could make it difficult for competitors to copy the total effect of the technology [3, 2, 30]. This complementarity of resources is a corner stone of the resource-based view (RBV) of the firm [4, 28] and has been offered as an explanation of how IT has largely overcome its paradoxical nature and is contributing to business value [6, 7, 15, 34, 43].

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 [10]. Many researchers [e.g. 23] emphasized the role of IT as an enabler of innovation, suggesting that IT produces innovations in business processes, products

and services that lead to better firm performance [9, 12, 13, 16, 24, 25, 27]. In this sense, there is considerable literature arguing that Internet technologies have enabled substantial transformations in firms with regard to their business models, internal processes, value propositions and services, providing considerable benefits [1, 36, 49, 54, 55, 59]. As a result, research is starting to focus on analysing whether and how the web is and will change innovation within and between companies.

To respond to these challenges, this paper examines, grounded in resource-based view (RBV) of the firm perspective, whether companies with high level of e-innovation are more effective electronically, which is measured as the effectiveness of online sales. Also, it assesses whether the level of Internet resources is related to e-sales effectiveness. The analysis employs data from a large sample of firms from different industries, which have been collected by the European e-Business Market Watch (www.ebusiness-watch.org), an established e-business observatory organization sponsored by the European Commission. The results of this analysis are interesting to researchers, firms' managers of various levels and consultants dealing with e-business and/or innovation.

The paper consists of six sections and is structured as follows: The next section 2 outlines the background of this study. Following that, the data and methodology of this study are discussed in section 3. Then, data analysis and empirical results are presented in section 4. Finally, the paper ends with a discussion of research findings in section 5, and conclusions, limitations and proposed future research directions in section 6.

2 Literature Review

2.1 The RBV within IT and e-business literature

The RBV of the firm has its origins in the management strategy literature and has been used in a variety of management, including management of information systems, to explain and study the sources of sustained competitive advantages [4, 42]. The RBV is based on two underlying arguments: resource heterogeneity and resource immobility. Resources and capabilities possessed by competing firms are heterogeneously distributed and may be a source of competitive advantage when they are valuable, rare, difficult to imitate, and not substitutable by other resources [4, 52]. At the same time, resources and capabilities are a source of sustained competitive advantage, that is, differences may be long lasting (resource immobility) when protected by barriers to imitation [33] or isolating mechanisms such as time-compression diseconomies, historical uniqueness, embeddedness and causal ambiguity [4, 39]. Consequently, the RBV suggests that the effects of individual, firm-specific resources and capabilities on performance can be significant [33].

The RBV provides a solid foundation to differentiate between IT resources and IT capabilities and to study their separate influences on performance [43]. Based on this analysis, Bharadwaj [6] 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 [43]. 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, being capabilities are rooted in processes and business activities [44].

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 [4]. 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 [15]. 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 [6, 7, 34, 43].

This research framework is very useful for our study, because it enables on the one hand to distinguish between Internet resources (an IT resource) and, on the other hand, the results from the e-innovation capability (a mixture of resources, including IT resources) and, then, to examine the effect of each one on e-effectiveness. Internet resources are not difficult to imitate. 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 implement similar strategies. These arguments suggest that Internet resources may not have a significant impact on e-effectiveness.

2.2 E-business and Innovation

There is considerable literature analyzing the innovative potential of the Internet/e-business. This existing literature concludes that e-business enables and drives significant innovative transformations regarding business models, value propositions, products and services of firms and internal business processes, which can offer substantial benefits [1, 54, 55, 49, 48, 59]. Amit and Zott [2], based on one hand on a broad theoretical foundation concerning virtual markets, value chain analysis, Schumpeterian innovation, resource-based view of the firm, strategic networks and transaction cost economics,

and on the other on extensive cases study, proposed four dimension of innovation and value creation in e-business: transaction efficiency, novelty, complementarities (between various products and services, on-line and off-line assets, activities) and customers lock-in. Wu and Hisa [54, 55] categorise the innovations caused by e-commerce based on the extent of change in product's core components (defined as 'the distinct portions of the product that embody the core design concept and perform a well-defined function') and on the extent of change in the business model (defined as 'the way in which the components are integrated and linked into a coherent whole') into four groups: incremental innovation (no significant changes in core components and business models), modular innovation (considerable changes in core components but not in business model), architectural innovation (considerable changes in business model but not in core components) and radical innovation (considerable changes in both core components and business model). Tavlaki and Loukis [48] propose a methodology for designing new 'digital business models', which consists of six stages: design of value proposition, design of production architecture (value chain), definition of value chain actors, analysis of competition, design of economic model and elaboration of relations among actors. Another research stream focuses on analysing how the web supports 'distributed' collaborative innovation creation both within and among firms. Timmers [49] argues that Internet gives rise to new business models, and describes the most important of them: e-shop, e-procurement, e-auction, e-mall, third party marketplace, virtual community, value chain service provider, value chain integrator, collaboration platform, information brokerage and trust services. Zwass [59] argues that the WWW/Internet compound enables significant innovations in the way organizations arrange their business processes, address their marketplaces and partner with other organizations; also, he proposes a large number of innovation opportunities grouped in eleven categories associated with marketplace, universal supply-chain linkage, network of relationships, collaboration, use of forum, interactive media, goods and services delivery, anytime-anywhere connectivity, development platforms, universal telecommunications networks and computing utility.

The RBV research framework is also useful for our study, because it enables to suggest that the results from the e-innovation capability (a mixture of resources, including Internet resources) are firm-specific and, hence, may have a positive impact on e-effectiveness. That is, merely having Internet resources may not generate value per se, but if these resources are used in combination with other resources to build IT capabilities such as the e-innovation capability, the output from this type of capabilities is, in accordance with the RBV, business value and effectiveness improvements.

2.3 Organizational Impact of e-Business and e-innovation: e-effectivess

The evaluation of the organisational performance impact of ITs is also an important issue within the area management information systems. In this sense, firm performance has been principally measured by subjective measures [e.g., 17, 32, 44, 45, 57] or by using financial measures [e.g., 5, 35, 58]. The first normally uses senior executives as the key informants on the subjective measures of firm performance. These studies has produced considerable evidence that e-business has a positive impact on various non-financial and financial measures of organizational performance. However, none of these studies has dealt with e-innovation and its impact on performance. Given the fact that e-business investments may provide benefits after a certain period but increase operating costs in the short term, the locus of impact, 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 [37]. 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 this study. The present research uses the effectiveness of online as a measure of firm performance. The business value of this process is discussed here.

Selling online can potentially provide distinct value propositions to the firm. These come from its positive impact on the volume of sales, the number of customers and the quality of customer service. The Internet enables high reach and richness of information [19] and connects firms to consumers or potential consumers in geographic areas that would be costly to reach before the Internet [46]. All this can help increasing sales and number of customers. Moreover, virtual communities enable frequent interactions with customers on a wide range of topics and thereby create a loyalty and enhance transaction frequency [2]. At the same time, e-business allows innovation in the way firms do business (new business models) and the introduction of new products and services, which may again influence sales and number of customers. In addition, selling online can provide value through the automation of the sales processes, which reduces overall load on staff supporting the customer and allows staff to focus on more complex tasks or on exceptions instead of routine tasks.

3 Methodology

3.1 Data

The data source for the present study is the European e-Business Market Watch (www.ebusiness-watch.org), an initiative launched by the European Commission for monitoring the adoption of IT and e-business activity in Europe. The field work of the survey was conducted by Ipsos Eco Consulting on behalf of the e-business Watch and was carried out using computer-aided telephone

interview (CATI) technology. Telephone interviews with decision-makers in firms were conducted. The decision-maker targeted by the survey was normally the person responsible for IT within each firm, typically the IT manager. Alternatively, particularly in small firms not having a separate IT unit, the managing director or owner was interviewed.

Number of employees	%	N
1-9	38.4	338
10-49	25.8	261
50-249	26.8	271
More than 249	8,9	90
Respondent title	%	N
Owner/proprietor	12.1	122
Managing director	19.6	198
Strategy development	1.9	19
Head of IT/DP	22	222
Other IT senior member	32.4	327
Others	12.1	122

Table 1: Sample Characteristics.

The population considered in this study was the set of all firms which are active at the national territory of Spain and which have their primary business activity in one of ten highly important sectors considered. The sample drawn was a random sample of firms 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 final number of firms totalled 1,010. As shown in Table 1, 91.1% of firms were small or medium-sized, and each sector considered had a share of around 10% of the total sample.

With regard to respondents' positions, 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' positions. 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: responses from IS managers (heads of IT/DP and other IT senior managers) versus responses from non-IS managers (owners, managing directors 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.

3.2 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.

Internet resources: This construct represents the adoption of physical Internet technologies. In this sense, respondents were required to assess the presence various Internet technologies. These indicators were obtained from the literature on e-business adoption [31, 44, 57, 58].

E-innovation: This construct assessed whether firm made innovations in product/services and processes directly related to or enabled by Internet-based technology. Indicators were extracted from the literature on e-innovation [1, 23, 29].

E-sales effectiveness: As discussed in section 2, the present research measures the effectiveness of online sales by its impact on the volume of sales, the number of customers, the quality of customer service and the costs of logistics and inventory) for measuring e-business value. It was measured by 5 items following previous literature [44, 54, 55, 57].

3.3 Instrument validation

CFA using AMOS was conducted to assess empirically the above constructs theorized. Multiple tests on construct validity and reliability were performed. Model fit was evaluated using the maximum likelihood (ML) method. The measurement properties are reported below (Table 2):

Construct reliability. All constructs had a composite reliability over the cut-off of 0.70 [47], and also the average variance extracted for all exceeded the preferred level of 0.5 [14].

Content and construct validity. This validity was verified by checking the meanings of indicators and by a careful literature review. Construct validity has two components: convergent and discriminant validity. After dropping insignificant items, all estimated standard loadings were significant, suggesting good convergent validity. To assess the discriminant validity, the Fornell and Larcker's [20] criterion, that average variance extracted for each construct should be greater than the squared correlation between constructs, was used. All constructs met this criterion.

The insignificant p-value ($p = 0.187$) for the chi-square statistics implied good absolute fit. The root mean square error of approximation (RMSEA) was below the cut-off value 0.08 suggested by Browne and Cudeck [8]. Five incremental fit indices were all above the preferred level of 0.9 [21].

In conclusion, the overall fit statistics, validity, and reliability measures allow the confirmation of the proposed constructs.

Factor	*Indicat.*	*Loadings*	*CV (t-value)*	*Composite Reliability*
IR	IR1	0.506	--	SCR = 0.909 AVE = 0.716
	IR2	0.722	11.52 [b]	
	IR3	0.560	10.79 [b]	
	IR4	0.576	10.96 [b]	
EI	EI1	0.700	--	SCR = 0.960 AVE = 0.923
	EI2	0.860	4.855 [a]	
ESE	ESE1	0.655	--	SCR = 0.830 AVE = 0.621
	ESE2	0.827	5.157[b]	
	ESE3	0.683	5.311[b]	

Note. $p<0.05$[a]; $p<0.01$[b]
IR: Internet resources; EI: e-Innovation
ESE: e-Sales effectiveness
Insignificant factors are dropped (IR5 and ESE4)
CV: Convergent validity; SCR: Scale composite reliability
AVE: Average variance extracted; (--): Fixed items in the scale

Table 2: Measurement Model.

4 Empirical Results

In order to test whether E-sales effectiveness is influenced by the level of Internet resources and the level of e-innovation within firms, statistical techniques of group differences were employed. More specifically, the T-test was applied after having checked parametric assumptions as well as homogeneity of group variances (Levene's test of significance >0.05). The sample was divided according to the mean of then Internet resources and the mean of e-innovation constructs, respectively. Internet resources was introduced as a two-level categorical variable, coding whether the firm had Internet resources above the mean (low level of Internet resources firms) or below it (high level of Internet resources firms). E-innovation was introduced as a two-level categorical variable, coding whether the firm had introduced e-innovations above the mean (low level of e-innovation firms) or above it (high level of e-innovation firms). Internet resources were those with Internet resources below the mean. Similarly, firms with high e-innovation were firms with e-innovation above the mean, while firms with low e-innovation were those with e-innovation below the mean.

An examination of the underlying distribution of the variables and the Levene's test of significance ($p> 0.05$) suggested a parametric test would be more appropriate (see table 3). Results showed that the association between Internet resources and e-sales effectiveness was not statistically significant ($p= 0.934$), while e-sales effectiveness was influenced by e-innovation ($p= 0.001$).

Internet Resources (IR)	Mean (ESE)	Levene (Sig.)	T-test (Sig.)
High level IR firms	11.71	0.845	0.934
Low level IR firms	11.66		
E-innovation (EI)	Mean (ESE)	Levene (Sig.)	T-test (Sig.)
High level EI firms	12.01	0.428	0.001
Low level EI firms	9.55		

Table 3: Internet resources, e-innovation and e-sales effectiveness.

5 Discussion

Previous literature concludes that e-business enables and drives significant innovative transformations regarding business models, value propositions, products and services of firms and internal business processes, which can offer substantial benefits This paper examines, grounded in the resource-based view (RBV) firms, whether companies with high level of Internet resources and with high e-innovation are more effective electronically. 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 firms with a high level of Internet resources did not outperformed on e-sales effectiveness. This finding indicates that, since competitors may easily duplicate investments in Internet resources by purchasing the same hardware and software, Internet 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, since IT is widely available and at declining prices. This result supports the findings of recent research [7] that did not find evidence of a positive link between IT quality and firm performance. Similarly, Powell and Dent-Micallef [40] showed that IT by itself cannot be a source of competitive advantage. Thus, our results extend the conclusion of previous research that technology by itself will rarely create business value.

Moreover, results demonstrated that firms with a high level of e-innovation outperformed on e-sales effectiveness. This finding supports existing empirical research using the RBV domain [6, 41, 43], 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. Findings also support extant literature which concludes that e-business enables and drives significant innovative transformations regarding business models, value propositions, products and services of firms and internal business processes, which can offer substantial benefits [2, 54, 55, 48, 49, 59].

6 Conclusion

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 affects firm performance. Since innovation has become a key factor for increasing the competitiveness of firms and e-business has been proposed as complement to innovation. To respond to these challenges, this paper examines, grounded in resource-based view (RBV) of the firm perspective, whether companies with high level of e-innovation are more effective electronically, which is measured as the effectiveness of online sales. Also, it assesses whether the level of Internet resources is related to e-sales effectiveness. Results indicated that differences of e-sales effectiveness of firms with high and low Internet resources were not statistically significant, while on the contrary firms with a high level of e-innovation outperformed on e-sales effectiveness.

The study provides an important implication for managers. E-business resources are easy to duplicate, and, hence, per se do not provide competitive advantages. Although Internet resources are argued to be valuable, they will rarely lead to superior performance. However, when Internet resources are used appropriately, in combination with other resources, they are expected to facilitate product/service innovation and process innovation. That is, merely having Internet resources may not generate value per se, but if these resources are used in combination with other resources to build IT capabilities such as the e-innovation capability, the output from this type of capabilities, in accordance with the RBV, is business value and effectiveness improvements.

While this study presents interesting findings, it has some 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 firms.

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Appendix. Measures

Constructs & Indicators		*Description*	*Literature support*
IR	IR1	Does your company have a website? (Y/N)	[31, 44, 57, 58]
	IR2	Does your company use an Intranet? (Y/N)	[31, 44, 57, 58]
	IR3	Does your company use an Extranet? (Y/N)	[31, 44, 57, 58]
	IR4	Does your company use a LAN? (Y/N)	[31, 44, 57, 58]
	IR5	Does your company use a WAN? (Y/N)	[31, 44, 57, 58]
EI	EI1	Have any of your product/service innovations over the past 12 months been directly enabled by Internet-based technology? (Y/N)	[1, 23, 29]
	EI2	Have any of your process innovations over the past 12 months been directly related to or enabled by Internet-based technology? (Y/N)	[1, 23, 29]
ESE	ESE1	What effect has selling online on your sales? (1-5)	[44, 54, 55, 57]
	ESE2	What effect has selling online on the num. of customers? (1-5)	[44, 54, 55, 57]
	ESE3	What effect has selling online on the quality of your customer service? (1-5)	[44, 54, 55, 57]

Note. IR: Internet resources; EI: e-Innovation;
ESE: e-Sales effectiveness
(1-5), five-point Likert-type scale; (Y/N), dummy variable