

THE EFFECT OF INFORMATION TECHNOLOGY MANAGEMENT CAPABILITY ON FIRM COMPETITIVENESS¹

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Abstract

In the last 9 years, the researchers in Information Systems field have turned to Strategic Management theories to model the relationship between information technology investments and company results. Specifically, the resource-based view has become topical in these studies. Some of them have suggested the information technology capability concept, defined as the organizational ability to manage the technology to gain competitive advantages. This way, several papers have analysed different kinds of capabilities and their impact on the company performance, as a measure of competitiveness. However, the factors that influence the capability formation have been forgotten. In this work, we analyse both kinds of relation for the information technology management capability, one of the most important ones. We propose a theoretical framework based on the resource perspective and contrast it on a sample of sixty-five Spanish insurance companies. The results of the analysis show two principal conclusions: the development of this capability depends on both several human resources and organizational capabilities, and the level of this capability moderates the impact of information technology availability on distinct results measures.

Keywords: IT Business Value, Resource Based View, empirical analysis, insurance companies.

1 INTRODUCTION

One of the principal topics in the Information Systems (IS) field has been the relationship between the use of Information and Communications Technologies (ICT) and firm competitiveness. In the last years, the studies in this research line have adopted Strategic Management Theories. Specially, the premises of Resource Based View (Wernerfelt, 1984; Barney, 1991; Grant, 1991; Amit and Schoemaker, 1993; Makadok, 2001) have been incorporated in many cases, thus becoming topical in the IS research.

Although these proposals are somewhat heterogeneous, due to the theory on which are based they can function in an integrated way. On the one hand, several studies have focused on the role played by the so-called complementary resources, as well Powell and Dent-Micallef (1997) article shows. On the other, some researchers have chosen to study the capabilities related to ICT – using several denominations – as a catalyst of the technology effect on competitiveness. The studies of Bharadwaj (2000), Santhanam and Hartono (2003), Bhatt *et al.* (2005), Ray *et al.* (2004, 2005), among others, are the most representative ones in this line.

In the literature, there are few approaches that deal with the integration of both analytic models. There exist different definitions of capability concept. In general, all of them are based on two fundamental aspects: first, a capability is the firm ability to carry out a concrete activity and, second, these capabilities acquire their shape as a result of other resources and capabilities deployment that are

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available to the firm. Of these two aspects, the prominence of the former has implied the predominance of the research about the capability influence on the result measures, both in the IS field and in the Strategic Management one. For this reason, we consider that a very important gap exists in the analysis of capabilities development, which must be analysed.

Using these considerations as a point of departure, the aim of this study is a double one. Primarily, we pretend to examine one of the technology-related capabilities, specifically, the ICT management capability. We will analyse both, the essential resources for its development and the possible effects in the performance that firm obtains from its technology investment. Secondly, we will contrast the proposed model and hypothesis in a sample of insurance companies located in the Spanish market.

The remainder of this paper is structured as follows. First of all, we will bring up the analysis model regarding the technology related capability that we have considered, stating the hypothesis to test. Next, we will briefly describe the methodological aspects of empirical study. In the fourth section, we will analyse the obtained results. Finally, we will expose some conclusions and outline several future research lines.

2 THEORETICAL FRAMEWORK

One of the main technology related capabilities is the company ability to management of the ICT. In point of fact, the possible inefficiency of technology management was one of the suggested reasons (Weill and Olson, 1989) to explain the ICT productive paradox (Brynjolfsson, 1993). As a result, the study of this capability, implicitly or explicitly, has been the aim of many articles in the IS research field.

From our point of view, this capability is both complex and multidimensional. It includes activities such as the planning and designing of the system, the development and implementation of technology projects and the establishment of standards and control procedures.

Many studies have focused on the IS planning. The partial review of this literature (Ein-Dor and Segev, 1978; King, 1978; Boynton and Zmud, 1987; Sabherwal, 1999; Lertwongsatien, 2000) provide us with a definition of planning as the set of activities aimed at the development of IS strategy and purpose, as well as the identification of the ICT uses to support the strategic plan of the company.

The value of this planning has been recognized in significant research (for example, Brancheau *et al.*, 1996 and Sabherwal, 1999) and has been prescribed as an essential tool to gain sustainable competitive advantages (Mata *et al.*, 1995; Powell and Dent-Micallef, 1997; among others). Prekumar and King (1994) found a significant relationship between the quality of IS planning process and the contribution of this system to firm performance. Similarly, Boynton *et al.* (1994) proved that the quality of ICT management have a significant impact on the success of the enterprise in the use of the technology. Bharadwaj *et al.* (1999: 381) affirms, '*IT management ensures consistency of IT policies throughout the enterprise and reduces duplication and redundancies in systems*'.

Several authors have measured the quality of this planning through a construct named sophistication, which can be described as the exhaustiveness of the planning process with respect to information gathering and analysis in order to developing and implementing IS plans (Segars *et al.*, 1998; Segars and Grover, 1998; Segars and Grover, 1999; Lertwongsatien, 2000). The sophistication of the IS planning can impact on company results as a consequence of its influence in the IS alignment with the rest of business (Boynton *et al.*, 1994), the greater rationality in the ICT investment policy (Henderson and Sifonis, 1988; Lederer and Sethi, 1996) and the larger implication of the business units in the carrying out of ICT projects (King and Teo, 1997).

In addition to this, this capability implies the ability of the development of systems, including all those activities linked to the analysis, design, construction and implementation of ICT applications. Lertwongsatien (2000) expressly refers to this dimension; he justifies its value by pointing out the

increment of IS response velocity in face of the demands that can surge in the business (Clark *et al.*, 1997) and the greater reliability of the applications (Curtis *et al.*, 1992).

Finally, with regard to the standards and control procedures establishment, we find in the literature an increasing stream of studies that deal with, at least collaterally, this aspect. Among them, we highlight the Ross *et al.* (1996) study. In this article, the technological asset is mentioned. Of this asset, the authors emphasize two essential characteristics. The first of them is the existence of a well-defined technological architecture. Such architecture implies the drawing up of rules to deployment of hardware, software and system support; in the words of the authors, '*these rules specify what kinds of data to share and how to store them, where to locate servers, and how to support applications and technologies*' (Ross *et al.*, 1996: 34). Moreover, in this study it is recommended the standards establishment, which could limit the range of technologies that the IT personnel have to manage. This fact will have, as a consequence, improvements in time and cost in the maintenance activities. In the same sense, Feeny and Willcocks (1998) affirm the importance of development one of the key competences that they consider in their study: the architecture planning.

With regard to both characteristics, the literature has defended their advisability, incorporating them in a larger concept, in which they significantly influence: the flexibility of ICT infrastructure. In this sense, the studies of Duncan (1995), Broadbent and Weill (1997), Bharadwaj *et al.* (1999), Bharadwaj, (2000), Byrd and Turner (2000, 2001) and Chung *et al.* (2003) have defended the concurrence of this characteristics to achieve this flexibility.

This way, we can conclude that the three facets that we have shown, shape a valuable, rare, heterogeneously distributed among firm, difficult to imitate capability, given that it is consequence of the convergence of multiple factors that are combined over the time and add value to the business. However, from our point of view, the fundamental objective of this capability is to get that the ICT investments could produce profits for the company. We believe that the value of this capability is derived from it moderate the relationship between those investments and the company results. Thus, only those firms that combine great technology availability and a high development of the ICT management capability could obtain those advantages. Therefore, we raise the first hypothesis:

H1: The relationship between ICT investment and firm results is moderated by the development of the ICT management capability.

Our second aim is to delimit the firm resources and capabilities that could influence in the development of the ICT management capability. We have carried out a literature review to filter what are these factors, which we have classified into two groups: human-related resources and organizational capabilities.

In relation to the human-related resources, we have to highlight the IS personnel knowledge and abilities. It is evident the development of the activities that make up this capability only if the people linked to technology management have that knowledge and abilities that are necessary. Lee, Trauth y Farwell (1995) divide this abilities in four fundamental facets: technical, business, management and interpersonal. We believe that a positive relation exists between the availability of these abilities and the development of ICT management capability. This way, we arise the second hypothesis as:

H2: The level of IS personnel abilities have a positive influence on the development of ICT management capability.

The second human-related resource that we have considered is the top management team attitude with regard to the technology. There are several studies that have highlighted this resource as a fundamental piece for the optimal use of the ICT investment in a firm (Jarvenpaa and Ives, 1991; Raghunathan, 1992; Teo and King, 1997; Armstrong and Sambamurthy, 1999; Ranganathan and Kannabiran, 2004). Even, in some of these analysis (Teo and King, 1997; Armstrong and Sambamurthy, 1999) it has been studied the influence that such factor could have on concrete facets of ICT management capability. This way, we propose the third hypothesis as:

H3: The top management team attitude with regard to ICT has a positive influence on the development of ICT management capability.

With regard to the organizational capabilities, several abilities have been analysed as possible influential factors in the development of the considered capability. First of all, the existence of an open organizational climate, characterized by a free and little bureaucratic organization and communications (Weill, 1992; Ward and Peppard, 1996; Powell and Dent-Micallef, 1997) is one of the factors that could complement technology to obtain extraordinary rents. Its existence implies the activities related to the studied capability could carry out. On the contrary, although the responsible of these activities develops correctly his work, the effects do not transfer to the company. Thus, we propose the fourth hypothesis as:

H4: The existence of an open organizational climate has a positive influence on the development of ICT management capability.

The attitude in view of change has been highlighted, traditionally, as other capability that could be fundamental to obtain a positive impact of the technology investments on firm results. Huber (1990) and Barley (1990) affirmed the necessity of significant changes in the organizational structure and communication lines. Benjamin and Levison (1993) state the introduction of ICT in a firm implies, to get the maximum use, an important amount of changes in the business process, which affects most functions and personnel in the organization. The stream that analyse the business process reengineering (Hammer, 1990; Davenport, 1992; among others) recurrently emphasizes this fact as a necessity. Using these contributions as a point of departure, it is evident that all of these changes that are prescribed by the literature to obtain competitive advantages based in ICT, only they are possible if enough organizational flexibility exists. These changes are, without doubt, necessary to the ICT management capability related activities could be develop efficiently. This way, we suggest as a fifth hypothesis the following:

H5: A positive attitude toward the change has a positive influence on the development of ICT management capability.

Other organizational capability that we have considered is the ICT training policy of the firm. On the one hand, this training is important due to the necessity of technical knowledge for the personnel that use the computer equipment of the company. The training policy, without doubt, could complete and standardize the knowledge base, in such a way as that become a factor that must be analyse as a complement, even co specialized capability with regard to ICT. On the other hand, the training to users is fundamental to make the most of technological resources, as it is affirmed in the studies of Nelson and Cheney (1987), White and Christy (1987), Dixon and John (1989), McKeen *et al.* (1994), Lee, Kim and Lee (1995), Choe (1996), Saarinen (1996) and Bergeron and Raymond (1997), among others. In this sense, it is shown that an active and committed training policy have a positive impact on the motivation of the workers, the satisfaction in their jobs and the approval and use of the IS, one of the measures that usually are employed to assess the systems success (Trice and Treacy, 1988), due to the relation with other measures of organizational performance (Delone and McLean, 1992). Additionally, the system development and the standard establishment will be more effective if the personnel that use applications, have got training for it. Thus, we raise the sixth hypothesis as:

H6: An active and committed ICT training policy has a positive influence on the development of ICT management capability.

Finally, the last factor that we introduce in this part of the model is the ICT experience that the firm had gathered. Several authors have emphasized that the firms, which have incorporated the technology early, have obtained an experience that help them to improve in its management and other facets related to the technology (King and Sabherwal, 1992; King and Teo, 1994, 1996; Choe, 1996, among others). This way, we proposed the last hypothesis as:

H7: The previous ICT experience has a positive influence on the development of ICT management capability.

In the figure 1, we summarize the research model and the hypothesis.

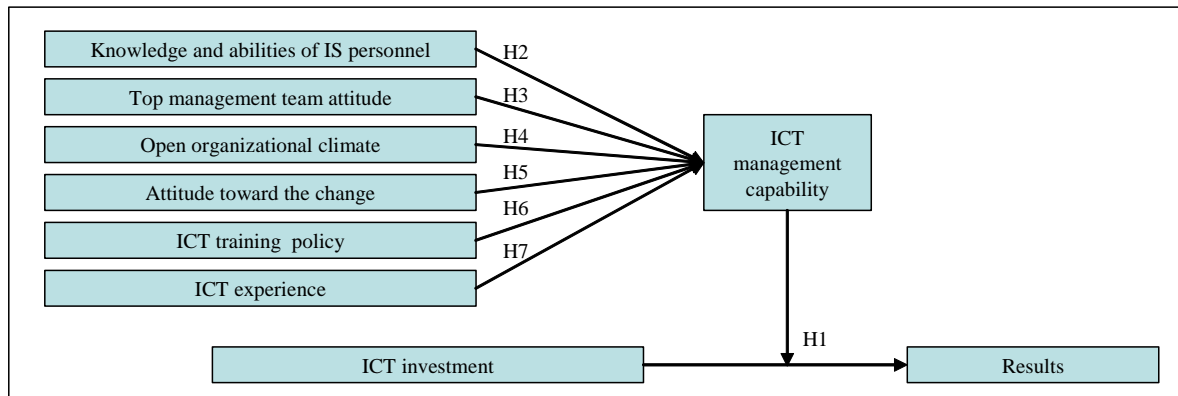


Figure 1. Research model

3 RESEARCH DESIGN

3.1 Sample and data

Many of the studies in this stream have circumscribed the analysis in a unique industry to avoid the effect of technological development and other characteristics that are different in the firms that operate in distinct sectors. Following this tendency, our study analyse just the firms that perform in the Spanish insurance industry. Specifically, our population includes the insurance groups that operate in Spain and had a turnover of more than 30 million euros in 2003. The final population contain 112 groups.

The data for the analysis was obtained from two sources. On the one hand, we use the registry of the 'Insurance and Pension Fund General Department', an organism dependent on Spanish Economy and Treasury Department. This database contains the financial data of the all companies that perform in Spanish market. On the other hand, we send a questionnaire to one member of the top management team for each firm, excluding CIO. The reason of this exclusion is the possible subjectivity of this manager with regard to some of the questions that assess directly his work. The questionnaire was sent by electronic mail and we contacted by phone with the involved managers. Finally, we obtain sixty-five valid responses.

3.2 Measures

Generally, we use measures that have been proposed in previous studies for the distinct constructs that we include in the analysis. In relation to the results, we have used a subjective measure of the manager perception about ICT impact, and two objective measures: the increase of market share and the increase of turnover. The period of time that we choose to assess the firm results was from 1998 till 2003. This choice is due to in the years between 1999 and 2002, the insurance industry was altered by the obligation of Spanish firm to get out the private pension funds that they manage. The consequence for the insurance companies was a sporadic increase of their turnovers that, however, did not represent the actual situation of the firms.

3.3 Methodology

Keeping in mind these measures, we carry out factorial analysis to extract the distinct variables that we have used later in the regressions. We verify as well as the convergent and divergent validity and the reliability of the constructs that we finally include.

With the aim of test the first part of the model, we carry out a correlation analysis between the human-related resources and the organizational capabilities and the ICT management capability. Additionally, we make a regression analysis to prove the dependence relations. For the second part of the model, we carry out several regressions, including interaction term between the variables ICT availability and ICT management capability, following the procedures that Aiken and West (1991) propose.

4 RESULTS

Tables 1 and 2 reports the results of the first part of the model contrast. For the regression analysis, we have used a *backward* procedure to eliminate those non-significant variables from the equation.

	Knowledge and abilities of IS personnel				Top management team attitude	Open organizational climate	Attitude toward change	ICT training policy	ICT experience
	Technical	Management	Business	Interpersonal					
Correlation	0,567	0,575	0,642	0,563	0,212	0,661	0,486	0,652	0,329
Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,093	0,000	0,000	0,000	0,008

Table 1. Correlation between human resources linked resources, organizational capabilities and ICT management capability.

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
(Constant)		-0,01799	0,07014		-0,256	0,799
Knowledge and abilities of IT personnel	Technical	n.s.				
	Management	n.s.				
	Business	0,35567	0,08123	0,36526	4,378	0,000
	Interpersonal	n.s.				
Top management team attitude		n.s.				
Open organizational climate		0,26098	0,09560	0,26746	2,730	0,008
Attitude toward the change		0,14453	0,08306	0,14561	1,740	0,087
ICT training policy		0,28390	0,08604	0,30647	3,300	0,002
ICT Experience		n.s.				
R=0,8257 R Square=0,6818 Adjusted R Square=0,6602 Standard Error of the Estimate=0,5636						

Table 2. Regression on ICT Management Capability.

As it can be seen, the correlations table demonstrates positive and significant connections at 99% between the considered resources and capabilities and the development of the ICT management capability. These results are partially confirmed by the regression analysis. This second analysis stresses the relation among the business knowledge of IS staff, the open organizational climate, the positive attitude toward the change and the ICT training policy. So, we can not reject hypothesis 2, 4, 5 and 7.

In relation to the second part of the model, the obtained results are summed up in the table 3, remarking with an asterisk those significant at 99% relations. In the regressions on objective results

measures it has been included several control variables related to intraindustry diversification of firms, the concentration of the industry's subsectors in which the companies operate, the size, the number of selling points and the placement method. The aim that is pursued is taken into account the effects of these factors on the firm results and, this way, avoid that the ICT effect was faded away.

As it can be appreciated, the results confirm the first proposed hypothesis, provided that the interaction term between ICT availability and ICT management capability has a positive and significant influence on the three performance measures.

	ICT effect on competitiveness				Market share increase (98-03)				Turnover increase (98-03)			
	B	S.E.	t	Sig.	B	S.E.	t	Sig.	B	S.E.	t	Sig.
(Constant)	-0,087	0,110	-0,786	0,435	1,064	0,250	4,258	0,000*	2,310	0,401	5,765	0,000*
ICT Availability	0,014	0,009	1,563	0,123	-0,009	0,009	-0,983	0,330	-0,015	0,015	-0,983	0,330
ICT mgmt. cap.	0,360	0,118	3,046	0,003*	0,132	0,119	1,106	0,273	0,212	0,191	1,106	0,273
Interact. ICT*cap	0,036	0,010	3,562	0,001*	0,030	0,010	3,040	0,004*	0,049	0,016	3,040	0,004*
Diversification					1,009	0,343	2,945	0,005*	1,618	0,549	2,945	0,005*
Concentration					-0,137	0,035	-3,904	0,000*	-0,219	0,056	-3,904	0,000*
Size					0,000	0,000	-0,003	0,998	0,000	0,000	-0,003	0,998
Selling points					0,000	0,000	0,762	0,450	0,000	0,000	0,762	0,450
Placement					1,223	0,381	3,210	0,002*	1,962	0,611	3,210	0,002*
Adjusted R Square	0,2577				0,2577				0,2442			

Table 3. Regressions on firm results.

5 CONCLUSIONS

From our point of view, this study reveals a fundamental matter that remains almost unexplored in the IS field as well as in the Strategic Management one: the analysis of the elements that influence in the capabilities development. The results show there are indeed positive and significant connections between the considered resources and capabilities and the ICT management capability. Specifically, the business knowledge of the CIO, an open organizational climate, a positive attitude toward the change, and a serious ICT training policy is related to the development of higher levels of ICT management capability.

On the other hand, we must also emphasize the approach of the relationship between the ICT management capability and the results, considering the moderating role that this capability plays in the relationship between ICT investment and firm performance. This approach has been used already in other studies (Ray *et al.*, 2004, 2005). In our opinion, it describes the nature of the proposed relationship. In this case, the results confirm neither technology availability nor this capability development have significant effects on results measures themselves. However, the interaction term between both variables has this positive impact.

Using these considerations and the obtained results as a point of departure, we proposed that this approach must be extended. In particular, according to Bharadwaj *et al.* (1999), we think the greatest limitation of our study is derived from taking into account only one capability. These authors refer to the necessity of concurrence of several capabilities related to ICT in order to get comprehensive explanations about the effect of technology on firm competitiveness. In this sense, comprehensive research models are the right method to apply. Nevertheless, we stress also the necessity of considering in these approaches the first part of the model, that is, the dependence on the development of capabilities related to ICT with regard to the resources and capabilities the firm already has.

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