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The effects of Information Technology on absorptive capacity and organisational performance

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Information Technology (IT) offers many opportunities for firms to succeed. The aim of this paper is to present a model to reflect how technical IT skills and the use of IT in interdependent tasks may influence the development of organisational absorptive capacity, both potential and realised, which also affects organisational performance. Since knowledge constitutes one of the main resources for organisations to gain competitive advantages and helps firms to improve their organisational performance, absorptive capacity is a key factor in success. This model was tested empirically using a sample of 160 European technological firms. The results of our analysis suggest that the mastery of technical IT skills and the use of IT in interdependent tasks positively affect potential and realised absorptive capacities, which in turn enhances organisational performance. The study concludes by presenting some theoretical and practical implications, limitations, and future research lines.

Keywords: Information Technology; technical IT skills; interdependent tasks; potential absorptive capacity; realised absorptive capacity; organisational performance

1. Introduction

In dynamic and turbulent environments, the management of external knowledge is becoming a key factor enabling firms to gain competitive advantages (Camisón and Forés 2010; Lin 2011). However, many organisations face severe difficulties in attempting to derive benefits from external knowledge flows. This problem shows the need to strengthen their absorptive capacity.

Cohen and Levinthal (1990, 128) define absorptive capacity as 'the ability to recognize the value of new information, to assimilate it, and apply it to commercial ends'. Zahra and George (2002) argue that absorptive capacity is a dynamic capability with two subsets: potential and realised absorptive capacities. Potential absorptive capacity refers to external knowledge acquisition and assimilation, whereas realised absorptive capacity consists of a firm's ability to transform and exploit the assimilated knowledge by incorporating it into the firm's operations

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(Jansen, Van Den Bosch, and Volberda 2005; Kotabe, Jiang, and Murray 2011; Zahra and George 2002). Absorptive capacity thus has four dimensions: acquisition, assimilation, transformation, and exploitation of knowledge (Fosfuri and Tribó 2008; Zahra and George 2002).

Given the importance of absorptive capacity, the principle objective of this study is to develop a framework to analyse how mastery of technical Information Technology (IT) skills and the use of IT in interdependent tasks can enable organisations to enhance their potential and realised absorptive capacities, in turn affecting their organisational performance. Previous studies have emphasised the need to analyse the relationship between IT and absorptive capacity in greater depth, due to their significant economic and organisational consequences (Malhotra, Gosain, and El Sawy 2005; Roberts et al. 2012). Our investigation begins from these premises and provides greater understanding of how organisations with a higher level of technical IT skills are able to improve their absorptive capacity and, more specifically, their two subsets of potential and realised absorptive capacities. This study also contributes to the need for further research to explore how the increasing tendency to use IT in interdependent tasks by building virtual teams may improve the acquisition, integration, and exploitation of external knowledge flows (Alavi and Tiwana 2002; Griffith, Sawyer, and Neale 2003). To help to fill these gaps, this investigation also develops a theoretical and empirical model to analyse the repercussions for organisational performance. We perform this analysis in the framework of technological firms, due to the significant position these firms occupy in modern economies (Grinstein and Goldman 2006).

Technical IT skills constitute 'the know-how needed to build IT applications using available technology and to operate them to make products or provide service' (Mata, Fuerst, and Barney 1995, 498). They include knowledge of programming languages, operating systems, database design, data warehousing, networks, and telecommunications (Byrd and Turner 2001; Tallon 2008); skills that enable firms to manage the technical risks associated with investing in IT (Mata, Fuerst, and Barney 1995). Furthermore, mastery of technical IT skills stimulates the generation of absorptive capacity. The development and use of information and communication technologies in a firm (i.e. knowledge databases) establish an information platform that encourages knowledge seeking, acquisition, integration, and exploitation (Daghfous 2004; Fosfuri and Tribó 2008), which is related to potential and realised absorptive capacities.

In addition, our research explains how using IT in interdependent tasks creates a favourable context for developing the two subsets of absorptive capacity. Task interdependence has been conceptualised as the extent to which members of a group must interact and depend on each other in order for the group to get done its work (Bailey, Leonardi, and Chong 2010). Here, we highlight the importance of virtual teams, those that interact via electronic communication systems (Rico and Cohen 2005). Performing interdependent tasks using information and communication technologies facilitate new applications for interaction of employees, such as groupware, intranet, or virtual communities, which have a positive influence on the relationship between knowledge acquisition, sharing, and exploitation (Alavi and Leidner 2001; Daghfous 2004) and thus affect both potential and realised absorptive capacities.

Finally, our study explores how improvement in potential and realised absorptive capacities through appropriate use of IT may place firms in a better position to achieve competitive advantages and better organisational performance (Roberts et al. 2012).

This article is structured as follows. Section 2 draws on the prior literature to develop the study hypotheses. Section 3 presents the data analysis and methodology used in the research. Section 4 discusses the results obtained. Section 5 presents theoretical and practical implications of this study and its limitations and future research lines. Finally, Section 6 shows the main conclusions.

2. Theoretical background and hypotheses

2.1. *The influence of technical IT skills and the use of IT in interdependent tasks on potential absorptive capacity*

IT technical skills influence the development of important organisational capabilities, such as absorptive capacity. These skills are essential for the development of IT in all areas of an organisation (Byrd and Davidson 2003). Since IT applications provide quick and easy access to external sources of knowledge and new, more intense communication channels (Corso et al. 2003), the utilisation and mastery of new and advanced technical IT skills will be associated with the development of potential absorptive capacity (Daghfous 2004).

Proper use of technical IT skills can enhance potential absorptive capacity. For instance, technical IT skills are necessary to design and use advanced storage technology and sophisticated retrieval techniques (i.e. multimedia databases and expert systems) to enhance knowledge-storing capabilities (Chou 2005). Similarly, having the technical IT skills necessary to utilise groupware enables organisations to access new information rapidly (Civi 2000).

Promotion and development of technical IT skills that cover the depth and breadth of the IT technical specialties (database management systems, networks, telecommunications, etc.) within the organisation (Byrd and Turner 2001) foster the creation of corporate knowledge directories and knowledge networks (Alavi and Leidner 2001), increasing the organisation's ability to capture and assimilate knowledge. Based on the foregoing, we propose the following hypothesis:

Hypothesis 1: Technical IT skills will be positively related to potential absorptive capacity.

In the current technology environment, purely face-to-face teams are becoming less common. IT makes virtual teams a viable alternative to face-to-face work (Griffith, Sawyer, and Neale 2003). Information and communication technologies are increasingly important in interdependent tasks, as they allow members of virtual teams to share knowledge despite disparities in location (Rico and Cohen 2005). Interaction with other organisational members through tools such as email, web-based repositories of shared knowledge, instant messaging, chat, and videoconferencing encourages knowledge collection processes (Griffith, Sawyer, and Neale 2003; Rico and Cohen 2005). Because these technologies facilitate the acquisition and dissemination of knowledge across the organisation, teams that use IT in interdependent tasks can access larger networks for sources of knowledge (Griffith, Sawyer, and Neale 2003) and thus have the opportunity to capture more knowledge for the organisation.

Potential absorptive capacity (building the organisation's ability to access and share external knowledge) requires a knowledge-sharing culture (Daghfous 2004). Since IT can lead to greater breadth and depth of knowledge creation and storage and improve group members' ability to share knowledge (Alavi and Leidner 2001; Young-Choi, Lee, and Yoo 2010), it is possible to expect that promoting the use of IT to complete interdependent tasks will increase potential absorptive capacity. We thus propose the following hypothesis:

Hypothesis 2: The use of IT in interdependent tasks will be positively related to potential absorptive capacity.

2.2. *The influence of technical IT skills and the use of IT in interdependent tasks on realised absorptive capacity*

Nowadays, the importance of anticipating future IT trends requires that IT professionals update their technical IT skills, as these may constitute a source of competitive advantage (Siqueira and Fleury 2011). As an illustration, technical IT skills are required to develop new web-based systems that promote the establishment of infrastructures to share knowledge, facilitating the development of knowledge exchange, transformation, and exploitation (realised absorptive capacity) that foster problem solving (Kotabe, Jiang, and Murray 2011). Furthermore, organisations demand advanced technical IT skills related to mobile technologies, because such devices can support applications such as email, instant messaging, and virtual meetings (Lee and Mirchandani 2010) used by communities of practice that influence the ability to transform potential team knowledge into usable knowledge (Griffith, Sawyer, and Neale 2003).

The exploitation of related and complementary knowledge resources entails significant costs and requires a high degree of coordination (Tanriverdi 2005). Organisations with technical IT skills have greater expertise to build and use advanced IT applications (Dehning and Stratopoulos 2003) (e.g. software or network architectures) that reduce these coordination costs through higher quality information exchange (Jean, Sinkovics, and Kim 2008) and facilitate knowledge communication, coordination, and exploitation (realised absorptive capacity) within the organisation (Jansen, Van Den Bosch, and Volberda 2005; Jiménez-Barrionuevo, García-Morales, and Molina 2011). We thus propose the following hypothesis:

Hypothesis 3: Technical IT skills will be positively related to realised absorptive capacity.

The use of IT in interdependent tasks is becoming an important building block in today's knowledge-based organisations (Rico et al. 2008). A team's ability to integrate its existing knowledge stock and apply it in a new context is a key factor in team performance (Young-Choi, Lee, and Yoo 2010) but also affects the development of organisational realised absorptive capacity, which involves the transformation and exploitation of new external knowledge (Zahra and George 2002).

Teams that interact through the use of IT must not only share knowledge but also apply it effectively to address the given challenge (Young-Choi, Lee, and Yoo 2010). This ability is related to organisational realised absorptive capacity, since it encompasses the application of new external knowledge to commercial ends (Cohen and Levinthal 1990). Thanks to the use of IT in interdependent tasks, team members can solve complex problems and invent new solutions by considering diverse perspectives (Boland and Tenkasi 1995), improving their exploitation of knowledge.

All information and communication technologies implemented within the firm – e.g. web-based repositories, instant messaging, chat, videoconferencing (Rico and Cohen 2005) – and used in interdependent tasks promote the emergent process of rich exchanges to integrate and apply knowledge and expertise (Alavi and Tiwana 2002), thereby fostering organisational realised absorptive capacity. We thus propose the following hypothesis:

Hypothesis 4: The use of IT in interdependent tasks will be positively related to realised absorptive capacity.

2.3. *The influence of potential absorptive capacity on realised absorptive capacity*

Potential and realised absorptive capacities play separate but complementary roles (Camisón and Forés 2010). Previous studies have already shown there is a relationship between these two subsets

of absorptive capacity (Lev, Fiegenbaum, and Shoham 2009). Firms cannot possibly exploit knowledge without first acquiring it (Zahra and George 2002). Similarly, organisations focusing on acquisition and assimilation of new knowledge can continually renew their knowledge stock, but they may suffer from the costs of acquisition without gaining benefits from exploitation (Jansen, Van Den Bosch, and Volberda 2005). The mere fact that a firm evaluates and acquires knowledge from the exterior does not guarantee that it will exploit this knowledge (Jiménez-Barrionuevo, García-Morales, and Molina 2011). Consequently, to produce tangible benefits, organisations must recognise the value of new external knowledge and acquire, assimilate, and exploit it so as to generate commercialisable outputs (Kostopoulos et al. 2011). More specifically, firms must be receptive to external knowledge, that is, to acquiring, analysing, interpreting, and understanding this knowledge. These abilities involve not only potential absorptive capacity (Fosfuri and Tribó 2008), but also realised absorptive capacity to transform and exploit the assimilated knowledge by incorporating it, with existing knowledge, into the firm's operations to achieve its commercial ends (Zahra and George 2002). We thus propose the following hypothesis:

Hypothesis 5: Potential absorptive capacity will be positively related to realised absorptive capacity.

2.4. *The influence of realised absorptive capacity on organisational performance*

Absorptive capacity can promote financial performance and contribute to the achievement of competitive advantage (Kostopoulos et al. 2011; Lane, Koka, and Pathak 2006). Although both potential and realised absorptive capacities are required to improve such performance, it is necessary to point out the special role of the latter. Through realised absorptive capacity, firms derive new insights and outcomes from the combination of existing and newly acquired knowledge (Jansen, Van Den Bosch, and Volberda 2005). Transformation and exploitation of such knowledge may translate into the creation of new goods, systems, processes, and knowledge or new organisational forms (Spender 1996; Zahra and George 2002). As a result, organisations will find themselves in a better position to promote innovation activities and achieve better organisational performance (Kostopoulos et al. 2011). According to Kotabe, Jiang, and Murray (2011), firms that lack the realised absorptive capacity to internalise knowledge created by others and modify it to fit their existing applications, processes, and routines cannot benefit from knowledge acquisition to improve their new product market performance. Similarly, Jansen, Van Den Bosch, and Volberda (2005) state that processes underlying realised absorptive capacity generate income by transforming and exploiting knowledge into products and services. Thus:

Hypothesis 6: Realised absorptive capacity will be positively related to organisational performance.

3. Methodology

3.1. *Sample and procedures*

The population for this study consisted of technological organisations within the European Union (EU). We chose technological firms due to the interest inherent in performing a study of IT and absorptive capacity on sectors with a substantial technological component. Technological firms are organisations that emphasise an orientation towards R&D, innovativeness, and entrepreneurship and that maintain a special pattern of work relations (a corporate culture of technology). These elements describe shared values, beliefs, and symbols, as well as the way things are done in the

firm (Grinstein and Goldman 2006). We selected technological firms because they are potential vehicles for transferring knowledge from the academic environment to the production sector and are strategic for the economy (Fontes 2001). The Amadeus (2009) database was used. This database provides comprehensive financial and business data, by assets, on around 19 million companies in 43 European countries. Drawing on our knowledge about key dimensions of this investigation, previous contacts with managers and scholars, and new interviews with managers and academics interested in these strategic variables, we developed a structured questionnaire to investigate how organisations face these issues. We then established a list of the CEOs of the organisations, with the help of partial funding from the Spanish Ministry of Science and Research and the Andalusian Regional Ministry for Economy, Innovation, and Science.

CEOs were our main informants, since they manage a great deal of information in all departments in the company. Although numerous actors may be involved in the management process, the CEO is ultimately responsible for plotting the organisation's direction and plans, as well as for guiding the actions carried out to achieve them (Bolívar-Ramos, García-Morales, and García-Sánchez 2012).

We used stratified random sampling by country to divide the population into strata (based on the 10 EU countries analysed: Austria, Belgium, Denmark, France, Germany, Italy, Poland, Spain, the Netherlands, and the UK). Within each stratum, a random sampling procedure was used. Through systematic sampling in each stratum, we obtained 16 firms for each target country in the study. We put out a call to the CEOs and explained that the data obtained would be confidential and would be treated in aggregate form. We offered to send each CEO a comparative study specific to his/her firm on the variables analysed. This approach enabled us to obtain an approximate response rate of 17.7% (Table 1).

Technologies have played an important role in market globalisation and, in turn, in globalising business practices. For these reasons, it is advisable to perform the study within the framework of the EU countries (Verdú-Jover, Lloréns-Montes, and García-Morales 2006). Characteristics of the responding businesses were compared with those of the non-responding businesses to reduce the possibility of non-response bias. We also determined whether the sample is representative of the target population by comparing the sample and target population means for the descriptive characteristics of firms included in the study (e.g. location, activities, and size). A series of χ^2- and *t*-statistics revealed non-significant differences between respondents and non-respondents and between the sample and target population (Aragón-Correa et al. 2008; Armstrong and Overton 1977; García-Morales, Verdú-Jover, and Lloréns-Montes 2009). Since all measures were collected

Table 1. Technical details of the research.

Sectors	Technological firms (pharmaceutical industry, hardware and other computer science equipment, automotive industry, and space and aeronautics products)
Geographical location	Europe (Austria, Belgium, Denmark, France, Germany, Italy, Poland, Spain, the Netherlands, and the UK)
Methodology	Structured questionnaire
Universe of population	5441 firms
Sample (response) size	160 firms (17.7%)
Sample error	7.7%
Confidence level	95%, p-$q = 0.50$; $Z = 1.96$
Period of data collection	From May 2010 to September 2010

with the same survey instrument, the possibility of common method bias was tested using Harman's one-factor test (Konrad and Linnehan 1995). A principal component factor analysis of the questionnaire measurement items yielded four factors with eigenvalues greater than 1.0, accounting for 64% of the total variance. A substantial amount of method variance does not appear to be present, since several factors, not just one single factor, were identified and because the first factor did not account for the majority of the variance (Podsakoff and Organ 1986).

3.2. *Measures*

Technical IT skills. We used the scales designed by Ray, Muhanna, and Barney (2005) and Byrd and Davidson (2003) to establish a scale of four items that reflects technical IT skills. Using a confirmatory factor analysis ($\chi_2^2 = 1.93$; NFI = .99; NNFI = .99; GFI = .99; CFI = .99), we validated our scales and then verified each scale's one-dimensionality and its high validity and reliability ($\alpha = .843$).

Use of IT in interdependent tasks. We used the scales designed by Van der Vegt and Janssen (2003) to establish a scale of three items to measure the use of IT in interdependent tasks. Through confirmatory factor analysis, we validated our scales and then verified each scale's one-dimensionality and its high validity and reliability ($\alpha = .786$).

Potential absorptive capacity. We used three items to measure knowledge acquisition developed by Kale and Singh (2000). We developed a confirmatory factor analysis to validate the scale and showed that the scale had good validity and reliability ($\alpha = .787$). We used three items to measure knowledge assimilation developed by Kale and Singh (2000) and developed a confirmatory factor analysis to validate the scale. The analysis showed that the scale had good validity and reliability ($\alpha = .769$). After validating the constructs of knowledge acquisition and assimilation, we calculated the arithmetical mean of these constructs for use in the structural model (a high score of each construct indicates good level of acquisition and assimilation, respectively).

Realised absorptive capacity. We used four items to measure knowledge transformation developed by Kohli, Jaworski, and Kumar (1993). We developed a confirmatory factor analysis to validate the scale and showed that it had good validity and reliability ($\alpha = .781$). We used two items to measure knowledge exploitation developed by Szulanski (1996) and developed a confirmatory factor analysis to validate the scale. The analysis showed that the scale had good validity and reliability ($\alpha = .839$). Once the constructs of knowledge transformation and exploitation had been validated, we calculated the arithmetical mean of these constructs for use in the structural model (a high score of each construct indicates good level of transformation and exploitation, respectively).

Organisational performance. After reviewing how performance is measured in different works of strategic research, we used the five-item scale developed by Murray and Kotabe (1999). The use of scales for evaluating performance relative to the main competitors is one of the most widely employed practices in recent studies (Choi, Poon, and Davis 2008; Douglas and Judge 2001). Many researchers have used managers' subjective perceptions to measure beneficial outcomes for firms. Others prefer objective data, such as return on assets. The literature has established widely that there is a high correlation and concurrent validity between objective and subjective data on performance, which implies that both are valid when calculating a firm's performance (Venkatraman and Ramanujan 1987). We included questions involving both types of assessments in the interviews, but the CEOs were more open to offering their general views than to offering precise quantitative data. When possible, we calculated the correlation between objective and subjective data, and these were high and significant. We developed a confirmatory factor analysis

to validate the scales ($\chi^2_5 = 22.13$, NFI = .94, NNFI = .90, GFI = .98, CFI = .95) and showed that the scale was one-dimensional and had high reliability ($\alpha = .833$). We used a Likert-type 7-point scale (1 'Much worse than my competitors,' 7 'Much better than my competitors') to ask about the organisation's performance as compared with that of its most direct competitors. All items were duly adapted to the present study (Table 2).

3.3. *Model and analysis*

The data were analysed through a structural equation model (LISREL 8.30) to determine the existence of exogenous latent variables (technical IT skills [ξ_1], use of IT in interdependent tasks [ξ_2]), first-grade endogenous latent variable (potential absorptive capacity [η_1]), and second-grade endogenous latent variables (realised absorptive capacity [η_2], organisational performance [η_3]) and to establish the causal relationships among these variables. The hypotheses are plotted graphically in the theoretical model presented in Figure 1. We used a recursive non-saturated model. Structural equation modelling takes into account errors in measurement, variables with multiple indicators, and multiple-group comparisons.

4. Results

In this section, we present the main research results. First, Table 3 shows the means and standard deviations as well as the inter-factor correlation matrix for the study variables. There are generally significant and positive correlations among technical IT skills, use of IT in interdependent tasks, potential absorptive capacity, realised absorptive capacity, and organisational performance. Second, structural equation modelling was performed to estimate direct and indirect effects using LISREL with the correlation matrix and asymptotic covariance matrix as inputs. This type of analysis has the advantage of correcting for unreliability of measures and also gives information on the direct and indirect paths between multiple constructs after controlling for potentially confounding variables. Figure 2 shows the standardised structural coefficients.

For quality of the measurement model for the sample, the constructs display satisfactory levels of reliability, as indicated by composite reliabilities ranging from 0.780 to 0.960 and shared variance coefficients ranging from 0.548 to 0.757 (Table 4). Convergent validity can be judged by observing both the significance of the factor loadings and the shared variance. The amount of variance shared or captured by a construct should be greater than the amount of measurement error (shared variance > 0.50). All of the multi-item constructs meet this criterion, each loading (λ) being significantly related to its underlying factor (t-values > 10.50) in support of convergent validity. To assess discriminant validity, we performed a series of χ^2 difference tests on the factor correlations among all constructs. We did this for each pair of latent variables by constraining the estimated correlation parameter between them to 1.0 and then performing a χ^2 difference test on the values obtained for the constrained and unconstrained models (Anderson and Gerbing 1988). The resulting significant differences in χ^2 show that the constructs are not perfectly correlated and that discriminant validity is achieved.

The overall fit measures, multiple squared correlation coefficients of the variables (R^2s), and signs and significance levels of the path coefficients all indicate that the model fits the data well ($\chi^2_{97} = 197.43$, $p > .05$; $\chi^2_{\text{ratio}} = 2.03$; NFI = 0.91; NNFI = 0.94; GFI = 0.96, CFI = 0.95, IFI = 0.95, PGFI = 0.68). All of the modification indices for the beta pathways between major variables were small, suggesting that additional paths would not significantly improve the fit.

Table 2. Research items.

Technical IT skills	The skills of the people in the organisation: 1. Are very superior to closest competitors in hardware and operating systems performance 2. Are very superior to closest competitors in business applications software performance 3. Are very superior to closest competitors in communications services efficiency 4. Are very superior to closest competitors in the generation of programming languages
Use of IT in interdependent tasks	1. The workers need information and advice obtained from their colleagues using IT to perform their job well 2. The workers must collaborate with their colleagues using IT to perform their job well 3. The workers must communicate regularly with colleagues about work-related issues using IT
Potential absorptive capacity	Think of an organisation–for example, a direct competitor, a firm in the another industry, a supplier, or a customer–that has had frequent contact with your organisation over the past three years, or with which you would like to have had contact in order to obtain or exchange new information or useful knowledge to perform the business of the organisation
	Knowledge acquisition 1. There is close personal interaction between the two organisations 2. The relation between the two organisations is characterised by mutual trust 3. The relationship between the two organisations is characterised by a high level of reciprocity
	Knowledge assimilation 1. The main capabilities of the two organisations are very similar/overlap 2. The organisational cultures of the two organisations are compatible 3. The operating and management styles of the two organisations are compatible
Realised absorptive capacity	Knowledge transformation 1. Interdepartmental meetings are organised to discuss the development and tendencies of the organisation 2. The important data are transmitted regularly to all units 3. When something important occurs, all units are informed within a short time 4. The organisation has the capabilities or abilities necessary to ensure that knowledge flows within the organisation and is shared among the different units
	Knowledge exploitation 1. There is a clear division of functions and responsibilities regarding use of information and knowledge obtained from outside 2. We have the capabilities and abilities needed to exploit information and knowledge obtained from the outside

(*Continued*)

Table 2. Continued.

Organisational performance	Relative to your main competitors, what is your firm's performance in the last three years in the following areas? 1. Organisational performance measured by return on assets (economic profitability or ROA) 2. Organisational performance measured by return on equity (financial profitability or ROE) 3. Organisational performance measured by return on sales (percentage of profits over billing volume or ROS) 4. Organisation's market share in its main products and markets 5. Growth of sales in its main products and markets

Notes: ROA, return on assets; ROE, return on equity; ROS, return on sales.

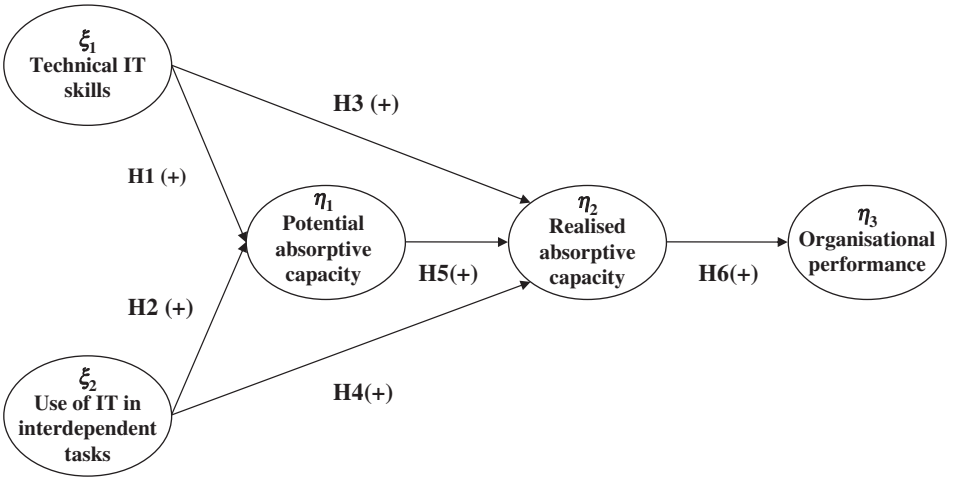

Figure 1. Hypothesised model.

Table 3. Means, standard deviations, and correlations.

Variable	Mean	SD	1	2	3	4	5
1. Technical IT skills	4.796	1.395	1.000				
2. Technological task interd.	5.564	1.309	0.085	1.000			
3. Potential absorptive capacity	5.008	1.334	0.181*	0.270***	1.000		
4. Realised absorptive capacity	5.287	1.337	0.116	0.218**	0.506***	1.000	
5. Organisational performance	4.705	1.202	0.249**	0.216**	0.052	0.199**	1.000

$^{\dagger}p < .10$.
$^{*}p < .05$.
$^{**}p < .01$.
$^{***}p < .001$ $n = 160$.

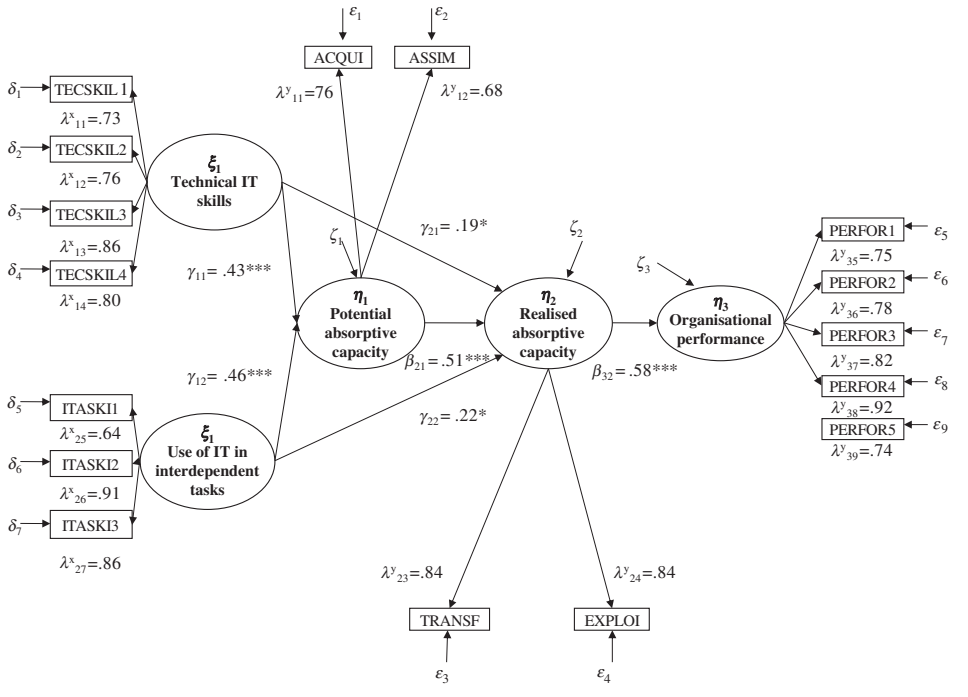

Figure 2. Results of structural equation model.

If we examine the standardised parameter estimates (Table 5), the findings show that technical IT skills ($\gamma_{11} = .43$, $p < .001$) and the use of IT in interdependent tasks ($\gamma_{12} = .46$, $p < .001$) are related to potential absorptive capacity and affect it positively, as predicted in Hypotheses 1 and 2, respectively. Comparing the magnitudes of these effects indicates that the effect of using IT in interdependent tasks on potential absorptive capacity is larger than the effect of technical IT skills on potential absorptive capacity. Globally, potential absorptive capacity is explained well by the model ($R^2 = .39$).

Technical IT skills ($\gamma_{21} = .19$, $p < .05$) and the use of IT in interdependent tasks ($\gamma_{22} = .22$, $p < .05$) also affect realised absorptive capacity directly. Furthermore, we have shown an indirect effect of technical IT skills (.22, $p < .001$) and the use of IT in interdependent tasks (.22, $p < .001$) on realised absorptive capacity by potential absorptive capacity (.43 × .51 and .46 × .22, respectively; see, for instance, Bollen (1989) for calculation rules). The global influence of technical IT skills and the use of IT in interdependent tasks on realised absorptive capacity are thus 0.41 ($p < .001$) and 0.46 ($p < .001$), supporting Hypotheses 3 and 4, respectively. Realised absorptive capacity is influenced by potential absorptive capacity ($\beta_{21} = .51$, $p < .001$), supporting Hypothesis 5. Comparing the magnitudes of these effects indicates that the effect of potential absorptive capacity on realised absorptive capacity is larger than the effect of technical IT skills or the use of IT in interdependent tasks on realised absorptive capacity. Globally, realised absorptive capacity is explained well by the model ($R^2 = .52$). Finally, for organisational performance, we find a significant relationship with realised absorptive capacity ($\beta_{32} = .58$, $p < .001$), supporting Hypothesis 6. Globally, organisational performance is explained well by the model ($R^2 = .34$). Additional indirect effects are shown in Table 5.

Table 4. Validity, reliability, and internal consistency (measurement model).

Variable	Item		λ^*	R^2	AM
Technical IT skills	Tecskil1		0.82*** (23.63)	.67	
	Tecskil2		0.81*** (25.06)	.66	$\alpha = .843$
	Tecskil3		0.88*** (34.07)	.78	CR = .906, SV = .707
	Tecskil4		0.85*** (24.94)	.72	
Technological task interdependence	Itaski1		0.72*** (15.10)	.51	$\alpha = .786$
	Itaski2		0.94*** (31.78)	.89	CR = .890, SV = .678
	Itaski3		0.89*** (29.15)	.80	
Potential absorptive capacity	Acqui	Acqui1	0.80*** (23.82)	.65	$\alpha = .787$
		Acqui2	0.92*** (31.88)	.84	
		Acqui3	0.89*** (27.91)	.78	CR = .903, SV = .757
	Assim	Assim1	0.68*** (13.86)	.56	
		Assim2	0.56*** (10.50)	.51	$\alpha = .769$
		Assim3	0.84*** (18.74)	.71	CR = .780, SV = .548
Realised absorptive capacity	Transf	Transf1	0.83*** (21.54)	.69	
		Transf2	0.61*** (12.91)	.58	$\alpha = .781$
		Transf3	0.89*** (30.43)	.79	CR = .890, SV = .673
		Transf4	0.84*** (27.25)	.70	
	Exploi	Exploi1	0.83*** (20.76)	.69	$\alpha = .839$
		Exploi2	0.78*** (18.52)	.60	CR = .784, SV = .646
Organisational performance	Perfor1		0.78*** (22.13)	.61	
	Perfor2		0.83*** (23.06)	.69	$\alpha = .833$
	Perfor3		0.80*** (24.85)	.64	CR = .960, SV = .699
	Perfor4		0.96*** (38.13)	.92	
	Perfor5		0.80*** (22.54)	.64	

Notes: λ^*, Standardised structural coefficient; R^2, reliability; α, alpha Cronbach; CR, compound reliability; SV, shared variance; AM, adjustment measurement.
*$p < .05$.
**$p < .01$.
***$p < .001$(two-tailed).

5. Discussion and future research

5.1. *Discussion and implications*

This study analyses the relationships between technical IT skills, the use of IT in interdependent tasks, potential and realised absorptive capacities, and organisational performance. Prior literature has found these constructs to be related to the generation of organisational competitive advantages (Dehning and Stratopoulos 2003; Griffith, Sawyer, and Neale 2003; Zahra and George 2002). However, little research has been carried out to understand their relationships in an integrated way, that is, to determine how they interact and how they affect improvement of organisational performance.

IT does not necessarily enhance productivity or business performance itself (Jean, Sinkovics, and Kim 2008). However, successful use of IT can improve a company's performance and competitive position (Dehning and Stratopoulos 2003). The literature related to the business value of IT

Table 5. Relationship (direct, indirect, and total effects) and goodness-of-fit statistics.

Effect from		To	Direct effects[a]	*t*	Indirect effects[a]	*t*	Total effects[a]	*t*
Technical IT skills	→	Potential absorptive capacity	.43***	5.10			.43***	5.10
Technical IT skills	→	Realised absorptive capacity	.19*	1.98	0.22***	3.29	.41***	5.32
Technical IT skills	→	Organisational performance			0.24***	4.73	.24***	4.73
Technological task interd.	→	Potential absorptive capacity	.46***	5.36			.46***	5.36
Technological task interd.	→	Realised absorptive capacity	.22*	2.24	0.24***	3.33	.46***	5.73
Technological task interd.	→	Organisational performance			0.26***	5.11	.26***	5.11
Potential absorptive capacity	→	Realised absorptive capacity	.51***	3.87			.51***	3.87
Potential absorptive capacity	→	Organisational performance			0.29***	3.70	.29***	3.70
Realised absorptive capacity	→	Organisational performance	.58***	7.68			.58***	7.68
Goodness-of-fit statistics	$\chi^2_{97} = 197.43$ ($P > 0.05$) GFI = 0.96 AGFI = 0.94 ECVI = 1.73 AIC = 275.43 CAIC = 434.36 NFI = 0.91 NNFI = 0.94 IFI = 0.95 PGFI = 0.68 NCP = 100.43 CFI = 0.95 RMSEA = 0.08							

[a]Standardised structural coefficients.
$^{\dagger}p < .10$.
$^{*}p < .05$.
$^{**}p < .01$.
***p < .001.

has highlighted that the impact of IT on firm performance is more indirect than direct, as it enables other organisational capabilities that create performance gains for firms (Rai, Patnayakuni, and Seth 2006). Our study contributes to this line in the literature by verifying the positive and direct effect of technical IT skills and the use of IT in interdependent tasks on the development of potential and realised absorptive capacities, also confirming their indirect impact on organisational performance through potential and realised absorptive capacities.

Our findings show that the recent dramatic increase in the use of IT in business requires organisations to have qualified staff with the technical IT skills necessary to develop and use IT applications (Lee and Mirchandani 2010) – i.e. business application software, web-based repositories of shared knowledge, databases, etc. – to benefit from acquiring the greater new external knowledge flows that using such applications provides (Corso et al. 2003). Furthermore, the use of IT enables the interaction of team members who must perform interdependent tasks, facilitating knowledge sharing despite disparities in location or time zone (Rico and Cohen 2005). Further, using technical IT skills to develop or use new IT applications that improve communication and coordination within the organisation (Jean, Sinkovics, and Kim 2008) facilitates the exploitation of knowledge. This result is also achieved when team members interact using IT to foster rich exchanges to integrate and apply knowledge and expertise (Alavi and Tiwana 2002). Therefore, we provide theoretical and empirical evidence that all of these processes influence the development of potential and realised absorptive capacities. This finding is especially significant, since absorptive

capacity is linked to the improvement of organisational performance (Kostopoulos et al. 2011; Lane, Koka, and Pathak 2006).

This research also deepens our understanding of the importance of absorptive capacity to improve organisational performance. Previous literature has emphasised that absorptive capacity enables organisations to acquire and use external knowledge flows effectively, enhancing their ability to learn, adapt to changes in the environment, and innovate (Fosfuri and Tribó 2008; Jiménez-Barrionuevo, García-Morales, and Molina 2011), thereby achieving greater organisational performance (Kostopoulos et al. 2011; Lane, Koka, and Pathak 2006). More specifically, in analysing such relationships, our investigation provides theoretical and empirical evidence that realised absorptive capacity has a direct impact on organisational performance. This result is consistent with arguments that stress that it is necessary not only to acquire and be receptive to external knowledge flows, but also to exploit them effectively to enhance organisational performance (Jiménez Barrionuevo et al. 2011; Zahra and George 2002).

Finally, this study has several implications for business practitioners. First, organisations must foster the acquisition and development of advanced technical IT skills. To achieve this goal, firms can acquire technical IT skills or develop their own through education and training of current employees (Dehning and Stratopoulos 2003). In this context, top management must devote continuous effort to supporting the creation of stimulating work environments to facilitate application of external knowledge (Chou 2005).

Second, promoting the use of IT in interdependent tasks must be considered as a means to achieve organisational competitive advantages. Because organisations can form teams regardless of the physical location of their members, they have the opportunity and flexibility to build the best teams, which in turn will affect the ability to acquire, use, and transform knowledge (Griffith, Sawyer, and Neale 2003). Consequently, organisations will improve their absorptive capacity, a critical ability in today's knowledge-intensive business environments (Kostopoulos et al. 2011).

5.2. *Limitations and future research*

The investigation presented exhibits several limitations. First, survey data based on self-reports may be subject to social desirability bias (Podsakoff and Organ 1986). However, assurance of anonymity can reduce such bias even when responses are related to sensitive topics (Konrad and Linnehan 1995). Second, although Harman's one-factor test and other method tests did not identify common method variance as a problem, it still might have been (Konrad and Linnehan 1995; Podsakoff and Organ 1986). Although Spector (2006) has argued that it is incorrect to assume that the use of a single method automatically introduces systematic bias, we recommend that future research gather measures of independent and dependent variables from different data sources to minimise the effects of any response bias.

Third, our data are cross-sectional. We have tried to temper this limitation through attention to theoretical arguments by rationalising the relationships analysed and integrating temporal considerations into measurement of the variables. Fourth, the model only analyses the relation of technical IT skills and the use of IT in interdependent tasks to organisational performance through potential and realised absorptive capacities. It should be noted that the variables selected explain an acceptable amount of the variance in organisational performance. However, other constructs apart from potential and realised absorptive capacities could be analysed to determine their influence on organisational performance, such as knowledge management. We could also examine other consequences of realised absorptive capacity in organisations (e.g. quality improvement and staff satisfaction).

6. Conclusions

Due to recent globalisation, market pressures, and demand for innovation, strengthening absorptive capacity is becoming an imperative for firm success (Lane, Koka, and Pathak 2006). External knowledge now constitutes a valuable asset for achieving competitive advantages (Zahra, Filatotchev, and Wright 2009). In this scenario, modern ITs perform a critical role in the development and maintenance of a firm's absorptive capacity (Roberts et al. 2012), a key factor affecting the improvement of organisational performance (Kostopoulos et al. 2011).

Firms aiming to achieve such goals require new skills to manage and exploit the potential benefits of new technologies (Kunz and Warren 2011). Rapid advances in IT require that IT professionals update their skills continuously (Lee and Mirchandani 2010). Under these circumstances, organisations must be conscious of the relevance of this phenomenon, which is related to the increasing importance of using IT to develop interdependent tasks to foster interaction among organisational members (Griffith, Sawyer, and Neale 2003). Interaction, in turn, facilitates the capture and the application of knowledge in different contexts (Rico and Cohen 2005). Firms will thus be more ready to improve their potential and realised absorptive capacities, increasing the levels of external knowledge acquisition, assimilation, transformation, and exploitation (Jiménez-Barrionuevo, García-Morales, and Molina 2011). As a result of applying such knowledge, which requires previous potential absorptive capacity, organisations will obtain better performance results (Alavi and Leidner 2001).

In sum, information and communications technologies, when properly used, offer firms significant opportunities for enhancing absorptive capacity (Roberts et al. 2012). Organisations must consider this issue as a factor that enables competitiveness and increases organisational performance (Jansen, Van Den Bosch, and Volberda 2005).

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