Importance of technological experience for the adoption of business to business electronic commerce

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Abstract

Purpose of the paper: The main objective of the current work is to analyse the importance of firms' previous experience with different information technologies for their adoption of business-to-business electronic commerce. We also test the significance of the moderating effect of industry on that experience.

Research Method: To analyse the different types of experience we conduct a causal study using structural equation modelling techniques. The moderating effect of industry is tested using a multisample analysis.

Research Findings: Our findings show that using various precursor technologies of business-to-business (B2B), such as EDI or the internet, generates knowledge that both facilitates and incentivises the subsequent adoption of this type of interchange. Similarly, once the firm has acquired such experience, the effect of belonging to a sector that is more closely related to IT loses significance.

Practical strategic implications: This work examines the importance of making a continuing investment in IT, showing that previous experience of earlier systems determines a firm's future technological development. Thus, firms should be aware that obtaining this type of knowledge will help them to obtain competitive advantages and hence improve their profitability.

Main contribution: The originality of this study is its analysis of experience from a multiple perspective, on the one hand encompassing different technologies (EDI, internet, commercial management software and B2B), and on the other, its consideration of additional aspects apart from intensity of use (perceived ease of use and usefulness). At the same time, we empirically test the moderating effect of the industry for a group of firms and variables that have rarely been analysed in this perspective previously.

Keywords: Information technology (IT), B2B e-commerce, multisample analysis, moderating effect of industry, technological experience.

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Introduction

In recent years information technology (IT) has come to be regarded as a resource firms can use to generate important competitive advantages, since, through knowledge management, it helps companies to differentiate themselves, and has positive repercussions in their productivity (Grant 1996; Teece 2000). But despite IT's obvious relevance, firms still find it difficult to recognise technological assets (Nonaka, Toyama and Nagata 2000; Von Krogh, Ichijo and Nonaka 2000), because the constant evolution in organisations' current environments hampers their evaluation (Balconi 2002; Tyler 2001).

Among all the innovations that have emerged as a consequence of the development of IT, one of those that has generated most interest has been electronic commerce (or e-commerce), which redefines some of the variables and elements of traditional exchanges (Webb 2002). This application of the internet provides firms with constant business opportunities as a result of its differentiating characteristics, such as for example the extension of opening hours, or the reduction in inventories. It is considered an inexhaustible source of value for the modern firm (Rayport and Sviokla 1994).

Nevertheless, this type of interfirm exchange has not been adopted unanimously by firms[1]. Thus, there are different levels of organisational development responding to decisions of internal management and factors inherent to the firm itself, such as its experience or sector of activity (Collins 2001). We can distinguish between companies carrying out the entire exchange process electronically (when the product is digitisable) and those only using the internet to gather suggestions or orders. Observing these differences in technology acceptance, many researchers have suggested the existence of factors influencing the implementation of innovations. These would conceivably modify not only the firm's adoption rate, but also its eventual intensity of use. Likewise, this type of factor could either derive from the technology under analysis or be inherent to the firm itself.

Thus, if we analyse studies of firms' IT acceptance, we see that previous knowledge relating to the tool being analysed is a key factor in the implementation process. Researchers have shown that knowledge of other applications facilitates the assimilation of EDI (Emmelhainz 1993; Jiménez and Polo 1998; O'Callaghan, Kaufmann and Konsynski 1992), so this tool's link with B2B e-commerce leads us to suggest that this phenomenon will be repeated in the case of interest here.

The first objective of our work is to analyse the importance of the organisation's experience in its adoption of B2B. For this purpose, we investigate if the previous use of tools required for its implementation (such as the internet) or relating to commercial activity (such as EDI and commercial management software) generates a greater affinity in the company and an appropriate internal structure for the successful adoption of e-commerce, at the same time favouring its future expansion (Ngai and Wat 2002; Riggins and Rhee 1999; Watson and McKeown 1999).

On the other hand, the knowledge and experience about IT that firms acquire can vary depending on the sector of activity, with this influencing both their predisposition to adopt new applications and the actual development observed subsequently. This is why we considered it interesting to set ourselves a second objective: to determine if significant behavioural differences exist in function of the firm's economic activity, i.e., deciding whether the so-called "industry effect" can be substantiated, and measuring its importance in the technology acceptance process.

In the following section we describe our review of the literature dealing with the importance of acquired experience and compatibility in B2B e-commerce diffusion. We also look at work carrying out sectorial studies in the technology acceptance process. In the succeeding sections we detail the empirical analyses carried out, the results obtained and the conclusions that we draw from them.

Theoretical Approach

We now outline our literature review of the works directly related to the model under analysis here, which serve as theoretical framework for the hypotheses formulated subsequently.

Importance of technological experience in B2B adoption

The implementation of the internet as a distribution channel and supply channel has been a key change in the evolution of many firms in recent years. But although adopting new technological systems can be regarded as an opportunity for the modern firm, not all firms have chosen to apply them for carrying out their operations. Indeed, while the internet is present in practically all firms, very few of these practise e-commerce[2].

In this context, some researchers have sought to find the different explanatory factors that predict users' intention and/or level of acceptance of technologies, using empirically-validated models for the purpose (Davis, Bagozzi and Warshaw 1989; Featherman and Pavlov 2003; Shih 2004; Taylor and Todd 1995). One of these motivations has been labelled "perceived compatibility". This measures the extent to which individuals consider using an innovation to be consistent with their values, socio-cultural beliefs and past and present experiences (Rogers 1983, 1995). This same author argues that certain technologies have close links to each other, so the subject's previous experience of certain innovations correlates strongly with their subsequent use of related systems. On the basis of this idea, Rogers (1983, 1995) introduces the concept of "technology clustering" applied by various authors (Eastin 2002; Leung 2001). Rogers defines this as the set of elements that the user perceives to be interrelated and determinants of the level of adoption of subsequent technologies.

Much research has used previous experience and knowledge in analyses of consumer behaviour, with B2C e-commerce being one of the fields in which they have been most relevant, as can be seen in various works (Dahlen 1999; Liao and Cheung 2001; Miyazaki and Fernández 2001; Park and Jun 2003). Lohse, Bellman and Johnson (2000) consider that individuals experienced in surfing the internet access it with greater frequency, and hence are more likely to purchase online (Yoon, Cropp and Cameron 2002). For Moschis, Goldstucker and Stanley (1985), online purchasing must be preceded by the existence of compatibility with the subject's past experiences and lifestyle, while Holak and Lehmann (1990) determine that previous experience in similar processes has a direct and positive impact on the user's future intentions, with the risk they perceive during the online purchase declining and their satisfaction rising (Csikszentminhalyi 1997; Ellis, Voelkl and Morris 1994; Miyazaki and Fernández 2001). In this way the organisation as a whole has a very similar behaviour pattern to the individual, so that the knowledge the firm acquired previously by using other systems should also be considered when explaining its subsequent technological behaviour (Bennett, Härtel and McColl-Kennedy 2005).

Thus, what in the individual is established as skills for using IT, in the firm has been labelled technological knowledge, which modifies the organisational culture and conditions the level of future development (Dishaw and Strong 1999). These acquired capabilities allow the firm to adapt its activities to the new opportunities being opened up by the technology, and the previous knowledge gained by using different technologies provides a fundamental support for its subsequent diffusion (Ettlie 1990; Mirchandani and Motwani 2004; Tiessen, Wright and Turner 2001). Equally, Cohen and Levinthal (1990) understand that previous experience is an important factor in learning, since firms tend to use and build their knowledge over the foundation of the already-existing information.

Shirani, Aiken and Reithel (1994) establish a series of variables for predicting the firm's behaviour. The first of these captures previous experience in the field of IT, while the second -labelled organisational culture- refers to the compatibility that must emerge between the firm's general structure and the new technological systems that it adopts (Igbaria et al. 1997). The influence of previous experiences on the firm's behaviour modifies both its attitude towards technology and its intentions to adopt future technology, and very strong links are formed between its attitude and behaviour as a result of the memories arising from past usage (Karahanna, Straub and Chervany 1999).

In this respect, Premkumar and Roberts (1999) analyse the intensity with which the firm uses various information technologies (EDI, online access to data, email, or the internet), and establish a series of

explanatory factors of this variable. They find that the degree of compatibility and experience differs between adopters and non-adopters, leading to both variables being considered determinants of the firm's behaviour. Thus, researchers have particularly focused on analysing the influence of past experience of EDI as antecedent of the technological adoption of B2B. The implementation of this type of interchange requires certain technological knowledge, so that the firm's previous orientation towards EDI-related systems facilitates its development, thanks to the generation of affinity and the simplification of the learning process (Angeles et al. 2001). Jiménez and Polo (1998) empirically demonstrate – for a particular country and sector – that in the early years of EDI a fundamental factor for its diffusion was the level of technological complexity existing in the company, and hence the implementation of the then antecedent information tools, such as fax or videotext. In this way, the so-called "technological sophistication" generates an organisational culture predisposed to accept other electronic applications, positively influencing the firm's perception of its ease of use (Jiménez and Polo 1998). This is why the diffusion of many IT tools has been determined by the firm's intrinsic knowledge, with the lack of skills and non-automation of similar processes being two fundamental barriers for the technological development of the firm (Arunchalam 1997; Attewell 1992; Premkumar and Roberts 1999).

On the other hand, Scala and McGrath (1993) consider the organisational structure or culture to be significant aspects for EDI implementation, so a firm wishing to develop technologically should first introduce another type of system with similar characteristics into its operations. This will improve its culture and provide it with knowledge linked to the target tool (Coopers and Lybrand 1992; Ratnasingham 1997).

More recently, Kaefer and Bendoly (2004) investigate the differences in firms' commercial development on the basis of the different levels of knowledge about EDI manifested. The authors demonstrate that accepting and implementing electronic data interchange is a key factor for explaining the level of progress, so that firms that are more experienced in using that system also manifest a greater flexibility in applying B2B in the future[3], and find it easier to use. In the same line, Härtel (1999) and Patterson Johnson and Spreng (1997) consider compatibility to be associated with the efficiency the firm has achieved in using previous applications, as well as with the way in which this experience affects the development of B2B e-commerce.

In short, we see that the idea of previous knowledge and its various conceptualisations has played a key role in researchers' attempts to determine firms' motivations when they implement EDI, so we can assume that this factor also positively influences in B2B, since this system is the technological extension of electronic data interchange (Kaefer and Bendoly 2004; Lee, Pak and Lee 2003). Likewise, Subramani and Walden (2001) and Truman (2000) argue that most research into EDI is perfectly extendable to B2B e-commerce, and we can reliably predict the consequences of applying this new tool from the firm's past experiences.

Experience undoubtedly modifies some of the user's perceptions about new technologies, such as for example their perceived usefulness or ease of use (Davis, Bagozzi and Warshaw 1989; Venkatesh and Davis 2000), at the same time as it reduces the time and cognitive effort invested in using them (Haider and Frensch 1999; Li, Kuo and Russell 1999; Norman 1998). We can therefore say that this factor transforms the subject's responses and reactions, and increases the firm's probability of adopting other systems linked to the earlier ones (Dahlen 2002; Ward and Lee 2000).

Influence of moderating effect of sector on relations between experience and firms' technological development

The industry in which a firm operates may be a key element in determining how intensely it uses its technological applications, and in particular e-commerce (Chewlos, Benbasat and Dexter 2001; Goodacre and Tonks 1995; Shore 2001). This is why Dyer, Cho and Chu (1998) consider that the environment in which the firm operates should be taken into account when explaining the level of competitiveness demanded of its technology use, and it also helps to predict the development the firm intends to achieve when it implements tools such as EDI (Neo 1991).

Similarly, various studies have analysed IT evolution in companies belonging to different sectors, coming to diverging conclusions. Thus, Teo and Ranganathan (2004) conclude that there are no

significant differences in IT implementation between the services and the manufacturing sectors, so that no generalised and significant industry effect exists at the global level.

Nevertheless, these results have not been unanimously accepted in the literature, with other studies confirming the importance of the economic activity as an explanatory factor of new technology implementation in some companies (Dyer, Cho and Chu 1998; Goodacre and Tonks 1995; Grover 1993; Shore 2000). Thus, Thatcher and Foster (2002) and Shore (2001) find that firms from sectors like textiles are less technologically developed than the rest, while others, such as electricity companies, adopt vanguard technology in their productive systems.

In this line, Motiwalla, Riaz and Xu (2005) study the differences in behaviour among firms from three different sectors, in an attempt to identify which variables affect their behaviour in the e-business context. The authors find that consumer-goods companies are more technologically evolved than firms from the tobacco and alcoholic drinks distribution sector. They conclude therefore that carrying out a particular activity predisposes organisations to develop similar behaviour patterns, at the same time as it modifies their level of IT acceptance (Motiwalla, Riaz and Xu 2005). Freeman and Soete (1997) find that industries such as chemicals or computing differentiate their products from those of their competitors by means of increasing technological innovation, trying at all times to make their organisation as technologically evolved as possible.

Likewise, Premkumar and Roberts (1999) introduce the sector's competitive pressure as a determinant factor of the adoption of a larger number of systems. They reason that carrying out a technologically more competitive economic activity drives firms to implement increasingly sophisticated tools, which leads to an important investment of resources in technology (Gatignon and Robertson 1985). In the same way, initial studies of EDI show how some industries try to improve their efficiency by exploiting new computing opportunities. Technology has thereby become a strategic necessity for firms belonging to sectors such as telecommunications or distribution (Premkumar and Porter 1995). Thus, we can assume that sectors that are more information intensive have a higher probability of implementing new technologies (Min and Galle 2003; Yap 1990), since they can obtain more benefits from using them than other firms (Porter and Miller 1985).

However, despite the existence of some evidence that the industry effect is significant in technology acceptance, the lack of consensus makes us consider that this importance may be conditioned by two key aspects. First, the sectors that have been compared may influence the direction of the results obtained, although it is very difficult to extrapolate to industry as a whole the conclusions from work based on just two specific economic activities in order to confirm the existence of a moderating effect of industry. On the other hand, belonging to a particular sector may alter the relations between a series of variables, but at the same time not affect others. It is for this reason that in order to determine the precise influence of the industry on B2B implementation, we need to work with a sample including firms engaged in different activities from the three main sectors of the economy, and at the same time the analyses of the moderator effect must refer exclusively to the variables included in the study.

Research Model and Hypotheses

Our work starts from the idea that acceptance of the internet and IT is a key aspect in the development of other innovations, since the perceptions and use of previous technologies (technology clustering) make up technological knowledge that helps to determine the development of B2B e-commerce. As explanatory variables we have included those systems that the literature regards as being correlated with the commercial function, and whose previous knowledge generates experience in the firm's technology acceptance: EDI, internet and commercial management software (Lee, Pak and Lee 2003; Subramani and Walden 2001; Truman 2000).

First, we considered EDI, because the literature regards this technology as a precursor of today's e-commerce (Lee, Pak and Lee 2003; Teo and Ranganathan 2004). The implementation of electronic data interchange reduces the firm's perception of the risk associated with trading with other firms, at the same time as it improves the perceived cost-benefit balance of adopting technologies (Teo and Ranganathan 2004). Likewise, EDI has led to important modifications in the traditional productive process, which have favoured the subsequent use of new applications such as the internet or online invoicing programs, and raised the rate of acceptance of the internet as a purchasing channel.

H1: The firm's experience from using EDI positively influences its implementation of the internet.
H2: The firm's experience from using EDI positively influences its implementation of commercial management software.
H3: The firm's experience from using EDI improves its development of B2B purchasing.

Second, we introduced the knowledge derived from using the internet, as this is a fundamental tool for the evolution of the company's exchanges from traditional environments towards new technological channels (Kafer and Bendoly 2004; Soliman and Janz 2004).

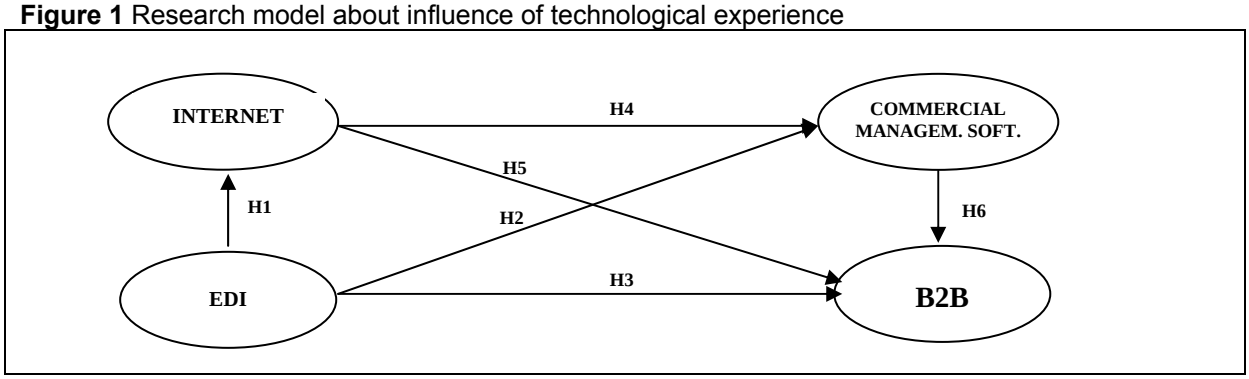
H4: The firm's experience from using the internet positively influences its implementation of commercial management software.
H5: The firm's experience from using the internet improves its development of B2B purchasing.

Finally, we included the use of commercial management software, which computerises the data handled in supplies and invoicing, allowing the firm to administer its commercial activity electronically.

H6: The firm's experience from using commercial management software improves its development of B2B purchasing.

On the basis of these hypotheses, we propose our model, which is shown in Figure 1.

Figure 1 Research model about influence of technological experience



Likewise, we consider that the knowledge acquired from using the internet, EDI or commercial management software will tend to homogenise firms' technological behaviour, so that the moderating effect of industry discussed earlier will not be so relevant in B2B adoption once the firm has obtained previous specialised knowledge relating to IT. In order to test this idea, the global sample was divided into two samples differentiated in function of the economic activity, and we analysed the significance of any differences between both sectors. The first sample is made up of companies belonging to a sector that has become increasingly important in the economy in recent years[4], although despite this it has still not been studied from this perspective: the new technology or IT firms. Given the nature of their business these organisations are in direct contact with technology, so they should conceivably behave differently from traditional firms[5]. The second subsample consists of firms from the three fundamental sectors of the economy (i.e., the primary, industrial and service sectors), excluding those activities with any relation to IT.

H7: The influence of the firm's technological experience on its level of B2B e-commerce development is not modified by the moderating effect of industry.

Methodology

We used surveys to obtain our information, sending questionnaires by post and e-mail to a group of firms from the IT sector[6] (449 firms) and another group of 1256 Spanish firms from the remaining activities. After the initial refinement process, we obtained a final sample of 109 valid cases from the first sample and 149 from the second. The fieldwork was carried out from November 2004 to January 2005.

The sample size would be considered inadequate for research in consumer behaviour, but for studies involving firms it is acceptable, given the difficulty of obtaining responses from this subject (Baldauf, Herbert and Moncrief 1999; Bennett, Härtel and McColl-Kennedy 2005; DeVaus 1995). As in earlier research (Grandon and Pearson 2004; Lu and Yeh 1998; Riemenschneider, Harrison and Mykytyn 2003) the information refers to the firm as a whole and not to each of its employees, so the questionnaires were directed at the managers responsible for the firm's technology use, who were requested to answer in their firm's name.

For the factors to do with the internet, EDI and commercial management software, each question in the questionnaire was measured on a 7-point Likert scale (see Appendix), while for B2B purchasing we used the firm's electronic purchases as a proportion of its total supplies. As this is directly observable, the factor is made up of this single indicator.

With regards the indicators for each technology, the questionnaire included questions about their intensity of use as well as about the firm's perceptions about using these systems (ease of use and usefulness). These latter indicators were included in the scale in the light of the empirical evidence that perceptions about a particular information technology serve as indicators to measure its level of objective development (Amoako-Gyampah and Salam 2004; Davis, Bagozzi and Warshaw 1989; Venkatesh and Davis 2000). In this way, positive perceptions about a specific system (internet, EDI, management software) incentivise the user to apply it more, at the same time as they generate a predisposition to adopt other, more complex tools related to the first one. Thus, the experience with each technology is represented through a technology acceptance model (TAM), which reflects the affinity and knowledge generated in the firm as a result of its experience.

In the following sections we describe the validation process carried out by exploratory and confirmatory factor analyses, which refine the indicators involved in the study appropriately. Finally, we test the structural model and the causal relations postulated between the constructs, thereby testing the hypotheses formulated in this work as well as determining whether the moderating effect of industry exists or not.

Factor Analysis

First, we used the statistics package SPSS/PC version 12.0 for the exploratory analyses, with the aim of approximating the model's underlying structure and refining the constructs that represent the variables included in the questionnaire.

The elimination process consists of eliminating those indicators with a low item-total correlation (Nurosis, 1993), or those whose elimination raises the value of the Cronbach alpha (Nunnally 1978). The scales achieve values of 0.870 for internet, 0.884 for EDI and 0.903 for commercial management software, while the item-total correlations comfortably exceed the minimum established value of 0.3 in all cases.

The following step was to study the unidimensionality of the proposed factors by means of exploratory factor analyses, using the "principal axis factoring" method and varimax rotation with Kaiser, as the literature recommends (Hair et al. 1999; Kaiser 1970, 1974; McDonald 1981). In all cases one factor is extracted through the eigenvalue criterion, the factor loadings exceed the minimum threshold of 0.5 (Hair et al. 1999), and the variances explained of the factors are as follows: 80.79% for internet, 72.29% for EDI and 84.46% for commercial management software. Our results present satisfactory and stable values as they have been tested through rotation in all the existing methods (direct Oblimin, Quartimax, Equamax and Promax).

The second phase of the study was to carry out a confirmatory factor analysis jointly for all the constructs making up the model. In this way we continued with the process of refinement and validation of the scales and evaluated the reliability and validity of the proposed dimensions, applying structural equation modelling (SEM) techniques using the statistics package EQS 5.7b. The estimation method used was robust maximum likelihood, since our data do not comply with the normality assumption (Bentler 1995; Hu, Bentler and Kano 1992).

The scale refinement process continued with the three criteria proposed by Jöreskog and Sörbom (1993)[7]: weak convergence, strong convergence and explanatory coefficient. All the indicators achieve acceptable values in these three criteria (Table I), so we then went on to analyse the validity and reliability of the factors making up the model (Churchill 1979; Gerbing and Anderson 1988).

As we explained above, the reliability was initially tested using the Cronbach alpha. But because of the exploratory nature of that analysis this property was also verified using the composite reliability index of the construct (ρ) (Jöreskog 1971) and the average variance extracted (AVE) (Fornell and Larcker 1981) (Table I).

With regards the validity of the scales as instruments to measure the concepts that they are intended to measure, we calculated the content validity and the construct validity. In this respect, the content validity is guaranteed by the review of the literature that we have carried out to determine the technologies forming part of experience (internet, EDI and commercial management software), as well as to design the scales.

Table I Analysis of reliability and validity of model for IT sector

	ÍTEM	ρ	**AVE**	**R^2**	**Lambda**	**F**	**Confidence Intervals**
Internet (F1)	INT_1	0.885	0.722	0.670	0.819	F1- F2	(0.197- 0.297)
	INT_2			0.911	0.954	F1- F3	(0.109- 0.421)
	INT_3			0.584	0.764	F1- F4	(0.037- 0.241)
EDI (F2)	EDI_1	0.892	0,735	0.835	0.914	F2- F3	(0.104- 0.292)
	EDI_2			0.607	0.779	F2- F4	(-0.034- 0.266)
	EDI_3			0.763	0.874	F3- F4	(0.100- 0.324)
Commercial management software (F3)	CMS_1	0.909	0.770	0.876	0.936		
	CMS_2			0.743	0.862		
	CMS_3			0.691	0.832		
B2B (F4)	B2B						
Absolute Fit: **GFI= 0.961** **MFI = 0.950** **RMSR = 0.038** **RMSEA = 0.058**	**Incremental Fit:** **NFI = 0.963** **NNFI = 0.973** **CFI= 0.982** **IFI= 0.983**		**Parsimony Fit:** **X^2/ g.l. = 1.87**				

The construct validity is made up of two fundamental types of validity: convergent and discriminant. With regards convergence, in Table I we can see that the factor loadings exceed 0.5 and are statistically significant at the 99% level, so the measurement scales satisfy this property (Bagozzi and Yi 1988; Anderson and Gerbing 1988; Steenkamp and Van Trijp 1991). The discriminant validity implies that the factor being analysed should be significantly far from other constructs with which it is not theoretically related (Lehmann, Grupta and Steckel 1999). This was confirmed through three different criteria:

1. The correlations between the different factors making up the model do not exceed 0.8, as this would indicate a low discrimination between them (Bagozzi 1994).
2. We estimated the confidence intervals of the correlations between the different latent variables, ensuring that none of them contained the value 1 (Bagozzi and Yi 1988) (Table I).
3. We confirmed that the variance extracted of each factor is greater than the variance shared with the remaining constructs (Wang et al. 2003; Dholakia, Bagozzi and Klein 2004).

Moreover, the model presents an acceptable goodness of fit, since all the absolute, incremental and parsimony fit indices achieve optimal values (Hair et al. 1999) (Table I).

Structural Analysis

Having refined the scales and validated the measurement model, we went on to test the proposed hypotheses through a structural relations model. We also confirmed that the goodness of fit exceeds the theoretically recommended limits (Table II).

Table II Goodness-of-fit indices of causal model

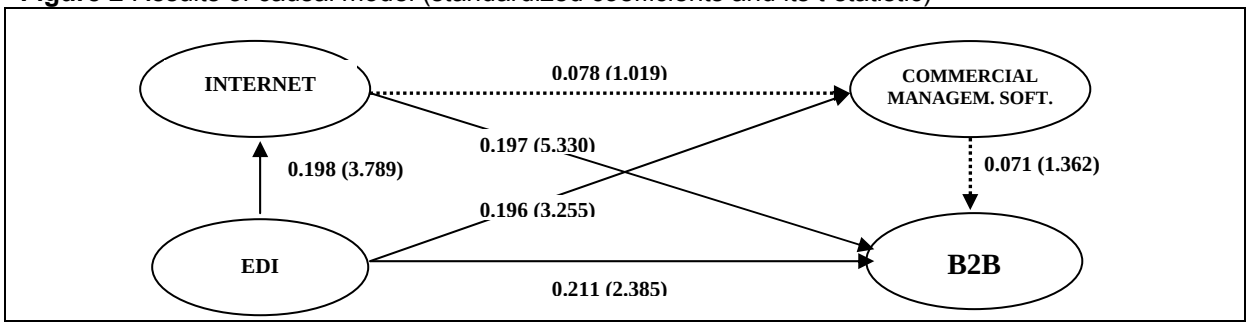
Absolute Fit		**Incremental Fit**		**Parsimony Fit**	
Indicator	Value	**Indicator**	Value	**Indicator**	Value
GFI	0.961	**NFI**	0.963	**X^2/ g.l.**	1.87
MFI	0.950	**NNFI**	0.973		
RMSR	0.038	**CFI**	0.982		
RMSEA	0.058	**IFI**	0.983		

The results obtained (Figure 2) show that implementing an EDI system in the firm generates knowledge that positively influences the acceptance of other information systems, such as the internet (γ= 0.198), commercial management software (γ= 0.196), or exchanges with other firms through the internet (B2B). This last relation is both direct (γ= 0.211), and indirect via the experience acquired from the internet, with the global weight amounting to 0.25[8]. Thus, H1, H2 and H3 are all satisfied.

In contrast, the knowledge generated from using the internet does not favour the implementation of commercial software, so H4 is rejected. But it does modify the proportion of acquisitions made on the internet, providing support for H5. The relation between the commercial management programs and B2B has not achieved a statistically significant weight, so Hypothesis H6 must be rejected. This phenomenon is conceivably due to the fact that firms have still not adopted these programs in large numbers, so the experience generated from using them does not influence the firm's choice of B2B for its purchases.

Thus, knowledge of those systems that are fundamental for the execution and development of B2B e-commerce, such as internet or EDI, does directly influence the proportion of purchases, but does not in contrast affect this factor indirectly through management software. We can therefore see that the firm's technological evolution depends on the knowledge it acquires from using previous IT, and on the general technological culture created from this, which reduces the firm's perception of risk associated with using innovations.

Figure 2 Results of causal model (standardized coefficients and its t-statistic)



But we must bear in mind that the technology field is a dynamic process, so the importance of the programs may depend on the firm's economic activity, as well as on the general technological knowledge it has obtained previously. Thus, and in order to determine the moderating effect of industry on the firm's behaviour with regards the use of B2B, we conducted a multisample analysis. The results of this allowed us to test for the existence of differences in technological behaviour between the two subsamples as a result of the sector of activity.

Multisample Analysis

Much of the research in marketing and involving the firm has centred on analysing different sectors of the economy (Ganesan 1994; Morgan and Hunt 1994), and it has come to different conclusions in function of the activity analysed. Likewise, the influence of the sector has also been of interest in the technology field. Some work, founded on theories of innovation adoption, has investigated the

influence of the firm's sector of activity on its technological development (Dyer, Cho and Chu 1998; Goodacre and Tonks 1995; Grover 1993; Shore, 2000). Thus, the following step was to use a multisample analysis and structural equations methodology to compare the significance of the moderating effect of industry on the relations postulated in our model of B2B implementation. Hence we divided the sample into two groups: traditional sectors and IT companies.

The goodness-of-fit indices for the multisample model present acceptable values in all cases (Table III). We then re-estimated the proposed model, introducing equality restrictions in both subsamples for the regression coefficients of the structural model[9]. The tool we used to analyse these restrictions was the Lagrange multiplier (LM), using the chi-square different test (Bentler 1995), which produces significant values when the parameters of both groups are different, in which case we would reject the equivalence of the factor loadings for the two groups. Thus, for the relations postulated in the structural model, we find that the differences as a result of the sector are not significant in any case (Table IV).

Table III Goodness-of-fit indices of multisample analysis

Absolute Fit		**Incremental Fit**		**Parsimony Fit**	
Indicator	Value	**Indicator**	Value	**Indicator**	Value
GFI	0.934	**NFI**	0.946	**X^2/ g.l.**	1.25
MFI	0.925	**NNFI**	0.984		
RMSR	0.057	**CFI**	0.988		
RMSEA	0.032	**IFI**	0.988		

From these results we can conclude that the experience generated from using previous technologies homogenises the knowledge of all these firms, regardless of the sector to which they belong, and so no significant differences exist in the development of B2B as a result of the moderating effect of industry. Likewise, we can conclude that despite the initial divergences between companies from different sectors, the previous experience acquired evens out the firms' technological behaviour, so that the effect of the internet, EDI and commercial management software on B2B e-commerce development is similar for all organisations. Thus, Hypothesis H7 is satisfied.

Table IV Hypothesis test of multisample analysis

	$\Delta\ \chi 2$	**p-value**
EDI→ INT ($\gamma_{121}=\gamma_{122}$)	0.391	0.532
EDI→ CMS ($\gamma_{321}=\gamma_{322}$)	0.896	0.344
EDI→ B2B ($\gamma_{421}=\gamma_{422}$)	1.151	0.283
INT→ CMS ($\beta_{311}=\beta_{312}$)	0.289	0.591
INT→ B2B ($\beta_{411}=\beta_{412}$)	0.343	0.558
CMS→ B2B ($\beta_{431}=\beta_{432}$)	2.592	0.107

Conclusions

The objective of this work has been to determine how the firm's experience from its past IT use affects its subsequent development of B2B e-commerce. For this purpose, we have analysed different technologies that generate knowledge related to B2B purchasing: the internet, EDI and commercial management software.

The analyses we have carried out show that systems such as EDI directly influence the firm's use of the internet, commercial management software and B2B, while the internet positively modifies the implementation rate of e-commerce. With regards the importance of each tool, we find that EDI has the greatest weight in the development of B2B e-commerce. We therefore demonstrate that firms familiar with previous systems linked to the electronic interchange of data possess a predisposition and experience that favour the purchasing of supplies on the internet. On the other hand, commercial management programs have not yet been adopted intensively by firms[10], so the transmission of knowledge from these to B2B is not significant. Thus, we have shown that the experience and knowledge acquired previously influence the level of development of other subsequent innovations,

thereby facilitating the application of the new supply channel and providing the firm with synergies as a result of the aspects that they all have in common.

We then used a multisample analysis to look for divergences between the firms as a result of their sector of activity. We find that the acquisition of knowledge homogenises B2B diffusion in all the organisations, regardless of their sector of activity. In other words, being engaged in a productive activity related to the new technologies does not influence the moderating effect generated by experience, since the knowledge acquired from using past systems facilitates new technology implementation in all firms equally. Hence the so-called industry effect disappears.

Our findings have important implications for firms and their technology adoption processes. Companies should be aware about the interrelations that exist between the different information technologies. Investing in a specific tool can help them to accept subsequent ones, as well exploit them more effectively. Likewise, the knowledge accumulated from using a technological innovation can be considered an important aspect of organisational knowledge, which allows firms not only to obtain sustainable competitive advantages, but also to obtain a number of benefits as a result of applying systems that are complementary. These benefits incentivise firms to acquire knowledge that they can exploit in numerous future activities and that will improve their efficiency. In this way, the learning that occurs reduces the perception of risk associated with the implementation of a new program, creating a global compatibility that significantly affects the level of future development.

Similarly, the diffusion of different tools in the productive process requires a previous technological experience to sustain the organisation's capacity to transform and use the information acquired previously in IT-related knowledge. This knowledge minimises, for example, the impact of implementing the new electronic market, at the same time as it facilitates its subsequent development in the firm. In this respect, Hirschman's (1980) early work showed that experienced users can easily recognise the potential benefits of innovations.

Hence firms should invest significant financial resources in technology, in an attempt to achieve a general level of knowledge for the whole company that will help them to differentiate themselves from their rivals. The so-called industry effect – apparently relevant when evaluating the importance of IT – tends to disappear as the firm acquires more experience. Thus, we have shown in this work that previous technologies generate a key compatibility that can be exploited by firms from all sectors. Our general recommendation would therefore be for firms to introduce a corporate culture based on IT, to try not to get stuck in familiar, mature systems, and to continually improve the computerisation of their traditional functions.

With regards the main limitations and future lines of research, we would first note that the analysis carried out here is based on cross-sectional data. These have helped us to determine the relevance of experience in firms' technological development, but cannot say anything about how the internet and EDI have evolved over time in them. Earlier researchers such as Venkatesh and Morris (2000) and Venkatesh and Davis (2000) have studied the importance of experience over a time period, in longitudinal studies allowing them to analyse the evolution of a particular information technology. As a future line of research for this work we propose to examine the variation of each tool that influences B2B e-commerce over a period of time.

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Appendix Measurement scale

	ITEM	**ANALYSIS***
INTERNET		
Internet is intensively applied in the performance of the activity	INT_1	Accepted
Internet is useful for the performance of the activity	INT_2	Accepted
In general, Internet is easy of use in the performance of the activity	INT_3	Accepted
EDI		
EDI is intensively applied in the performance of the activity	EDI_1	Accepted
EDI is useful for the performance of the activity	EDI_2	Accepted
In general, EDI is easy of use in the performance of the activity	EDI_3	Accepted
COMMERCIAL MANAGEMENT SOFTWARE		
Commercial management software is intensively applied in the performance of the activity	CMS_1	Accepted
Commercial management software is useful for the performance of the activity	CMS_2	Accepted
In general, commercial management software is easy to use in the performance of the activity	CMS_3	Accepted

* Results obtained from the empirical analysis

[1] According to data from the Spanish Association of E-commerce (AECE, 2004) and AIMC (2005).
[2] Data from the Aragon Information Society Observatory (2004). Available from http://www.observatorioaragones.org.
[3] These authors distinguish between two types of e-commerce. The first is electronic data interchange (EDI), whereby firms use previously standardised and structured formats to interchange information electronically. The second type of e-commerce is B2B, a development that has improved upon EDI and rectified its weaknesses, so it can be regarded as a direct substitute of it.
[4] In 2004, according to the Spanish Ministry of Science and Technology, 6% of the EU's GDP, 9.4% of America's GDP, and 7.8% of Japan's GDP corresponded to the ICT sector.
[5] We shall label those firms whose output is not connected to IT as "traditional".
[6] SIC code 737.
[7] The weak convergence criterion, according to Steenkamp and Van Trijp (1991), analyses the significance of the factorial regression coefficients between the indicators and their latent variable. The non-significant indicators should be eliminated (student's $t > 2.58$; $p = 0.01$). The strong convergence criterion implies eliminating non-substantial indicators, i.e. those whose standardised coefficient is less than 0.5 (Hildebrandt, 1987). The explanatory coefficient of the indicator should exceed 0.3.
[8] 0.25 (Global influence) = 0.211 (Direct influence) + 0.198*0.197 (Indirect influence).
[9] A similar application can be found in Iglesias and Vázquez (2001).
[10] On the scale of 1 to 7, this software scores 4, while the internet scores almost 7.