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Web knowledge sharing and its effect on innovation: an empirical investigation in SMEs

Pedro Soto-Acosta[1]
Ricardo Colomo-Palacios[2] and
Simona Popa[1]

[1]University of Murcia, Spain; [2]Universidad Carlos III de Madrid, Spain

Correspondence: Pedro Soto-Acosta, Department of Management & Finance, University of Murcia, Campus de Espinardo, Murcia 30.100, Spain.
Tel: +34 868 887805;
Fax: +34 868 887537;
E-mails: psoto@um.es; ricardo.colomo@uc3m.es; sp.popa@um.es

Abstract
This paper extends previous studies on knowledge management by analysing factors affecting Web Knowledge Sharing (WKS) in small- and medium-sized enterprises (SMEs). In addition, the impact of WKS on organizational innovation and the moderating effect of IT skills on this relation are analysed. Grounded in the technology-organization-environment (TOE) theory and the resource-based view (RBV), this paper develops an integrative research model, which analyses these relations using structural equation modelling on a data set of 535 Spanish SMEs. Results suggest that technological and organizational factors – IT expertise and commitment-based human resources practices – positively influence WKS, while the contrary is found for environmental factors (customer power). In addition, results show that WKS contributes positively to organizational innovation, though support for the moderating effect of IT skills in this relation is not found. The main conclusions of this research can be valuable to SMEs that use or intend to use Internet technologies for knowledge management.
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Introduction

Information and Communication Technology (ICT) innovations and the advent of Internet have played an important role in shaping organizational transformation by influencing workforce productivity and the development of productivity and knowledge-intensive products and services (Soto-Acosta *et al*, 2010; Molina-Castillo *et al*, 2012). Effective adoption and use of Internet technologies are therefore a major management concern (Soto-Acosta & Meroño-Cerdan, 2006; Colomo-Palacios *et al*, 2013). Recent studies (e.g., Gu *et al*, 2012) are starting to analyse the adoption and use of Internet technologies within organizations and how these technologies support specific business processes. However, much of the existing research focuses on a single aggregate view of the organizational adoption and use of Internet technologies (e.g., Zhu & Kraemer, 2005; Hong & Zhu, 2006; Soto-Acosta & Meroño-Cerdan, 2006; Bordonaba-Juste *et al*, 2012). These studies analyse the adoption and use of Internet technologies along the whole value chain activities (or a significant part of it). Thus, while existing research has expanded our knowledge, little is known about the determinants of Internet technologies use for specific business processes, such as knowledge sharing, and how these processes contribute to organizational innovation and business value.

The Internet and open standards technologies characteristics of rapid search, access, retrieval and exchange of information make these technologies suitable for collaboration and knowledge sharing between

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organizational members (Soto-Acosta & Meroño-Cerdan, 2006; Lopez-Nicolas & Soto-Acosta, 2010). In essence, technology supports knowledge acquisition/creation, knowledge dissemination, and knowledge utilization (Darroch, 2003; Tiwana, 2003; Jayasingam *et al*, 2013; Lucio-Nieto *et al*, 2012). Although businesses have extensively adopted Internet technologies, research has shown that actual usage is an important link to business value and that this link is sometimes missing, especially in small- and medium-sized enterprises (SMEs) (Devaraj & Kohli, 2003; Zhu & Kraemer, 2005). In this sense, recent research in SMEs (e.g., Lopez-Nicolas & Soto-Acosta, 2010) suggests that, although having a proper information technology (IT) infrastructure can facilitate knowledge creation, it does not necessarily mean that knowledge is created. Thus, to transfer or create knowledge, interaction of some kind has to take place between the actors. In this sense, knowledge sharing has been considered essential to the creation, dissemination and utilization of knowledge (Valkokari *et al*, 2012). It is important to understand the key factors that facilitate and motivate Internet technologies use for knowledge sharing within SMEs. Beyond technological and the environmental factors, extant research has recognized the importance of organizational and individual factors in influencing ICT adoption and use (Colomo-Palacios *et al*, 2012; Gu *et al*, 2012; Soto-Acosta *et al*, 2013). In fact, organizational factors may constrain or facilitate the implementation and usage of Internet technologies for knowledge sharing. For instance, the literature suggests that organizational human resource (HR) practices that create a commitment-based environment influence the interactions, behaviours and motivation of employees (Collins & Smith, 2006). These practices may therefore affect the organizational social climate that motivates employees to work together and share knowledge.

Furthermore, one of the main characteristics of the Internet-based technology is that it is founded on the democratization of knowledge, so it facilitates the appearance of natural flows of collaboration and knowledge, which, in turn, may favour creativity and innovation (Pérez-López & Alegre, 2012). The literature argues that knowledge is an antecedent of innovation through organizational learning (Nonaka & Takeuchi, 1995; Templeton *et al*, 2002; Lopez-Nicolas & Soto-Acosta, 2010). Moreover, although the literature suggests that findings from studies examining knowledge management practices in large companies are unlikely to be generalizable to SMEs, very few studies focus on this specific type of firms (Lopez-Nicolas & Soto-Acosta, 2010). Meanwhile, SMEs are of great importance for economic growth, employment and wealth creation. For example, in Europe, SMEs represent around 99% of the total number of firms (European Commission, 2004).

To respond to the above gaps in the literature, this paper develops a conceptual model, grounded in the Technology-Organization-Environment (TOE) theory and the resource-based view (RBV), to assess the adoption and use of Internet technologies for knowledge sharing and its effect on innovation within SMEs. With this aim in mind, the rest of our study is organized as follows. First, the literature review and hypotheses are presented. Second, the research methods drawing from a sample of 535 SMEs are described. Third, data analysis and results are examined and, finally, conclusions, limitations and future research guidelines are presented.

The TOE framework

Tornatzky & Fleischer's (1990) TOE theory has been extensively used as the theoretical framework to analyse factors, which affect the adoption and use of different ITs including: electronic data interchange (e.g., Kuan & Chau, 2001), electronic business (e.g., Xu *et al*, 2004; Soto-Acosta & Meroño-Cerdan, 2006; Bordonaba-Juste *et al*, 2012), electronic collaboration (e.g., Chan *et al*, 2012), mobile commerce (e.g., San Martín *et al*, 2012), enterprise resource planning (e.g., Zhu *et al*, 2010) and information and open systems (e.g., Thong, 1999). The TOE framework conceptualizes the context of adoption and implementation of technological innovations as consisting of three aspects: technological context, organizational context, and environmental context. The technological context refers to the characteristics of the technological innovation, the organizational context describes characteristics of the organizations, and the environmental context implies characteristics of the environment in which the adopting organizations operate (Tornatzky & Fleischer, 1990; Thong, 1999).

The TOE framework has also emerged as the main theoretical framework to analyse the different factors, which affect the adoption and use of Internet technologies. Very recent studies have used this theoretical framework to analyse factors affecting Internet technologies adoption and use (e.g., Bordonaba-Juste *et al*, 2012; Chan *et al*, 2012; Gu *et al*, 2012; San Martín *et al*, 2012). Thus, drawing upon literature analysing Internet technologies adoption and use, this paper, based on the TOE framework, analyses the factors that influence Web Knowledge Sharing (WKS).

The resource-based view (RBV)

The RBV has been significantly dominant in the management literature for many years and remains an important element in organizational strategy research (Lockett *et al*, 2009). Initially, researchers considered its adoption to identify insights into the sources of sustained competitive advantages (Porter, 1985; Rumelt *et al*, 1991; Teece *et al*, 1997). At the same time, this theory has become a standard to explain why firms in the same industry vary systematically in performance over time (Hoopes *et al*, 2003). This suggests that the effects of individual, firm-specific resources on performance can be significant (Mahoney & Pandian, 1992). The RBV generally tends to define resources broadly and includes assets, infrastructure, skills and so on. In this regard, it is based on two underlying assertions: resource heterogeneity and resource immobility. Resources

possessed by competing firms are heterogeneously distributed and may be a source of competitive advantage when they are valuable, rare, difficult to imitate, and not substitutable by other resources (Barney, 1991). At the same time, resources are a source of sustained competitive advantage, that is, differences may be long lasting (resource immobility) when protected by barriers to imitation (Mahoney & Pandian, 1992) or isolating mechanisms such as time-compression diseconomies, historical uniqueness, embeddedness, and causal ambiguity (Barney, 1991; Peteraf, 1993).

Technology itself will rarely create superiority. For that reason, some research studies find variations in IT investments and returns (Brynjolfsson & Hitt, 2000). However, even though competitors may copy an IT innovation, relative advantage can be created and sustained where the technology leverages some other critical resource. Kettinger *et al* (1994) draw a number of such complementary resources, such as structure, culture, that could make it difficult for competitors to copy the total effect of the technology. This complementarity of resources is a cornerstone of the RBV theory and has been offered as an explanation of how IT has largely overcome its paradoxical nature and is contributing to business value (Bhatt & Grover, 2005). Ravichandran & Lertwongsatien (2005) and Soto-Acosta *et al* (2010) found that intangible IT resources such as IT skills and IT training are critical determinants of how IT is deployed in the organization which, in turn, affect business value. Thus, this paper, from a resource-based perspective, studies the relation between WKS and innovation as well as the moderating effect of IT skills in this relation. The set of relations is illustrated in Figure 1.

Hypotheses

Factors affecting WKS

The technological contexts plays a pivotal role regarding WKS, since Internet technologies' use for knowledge sharing depends on firms' technology competence. Technology competence depends on tangible and intangible resources, though the latter are more likely to generate competitive advantages (Bharadwaj, 2000; Soto-Acosta & Meroño-Cerdan, 2006; O'Sullivan & Dooley, 2010). Tangible IT resources such as IT integration have been found to be significant in studies using the TOE framework (e.g., Zhu & Kraemer, 2005; Zhu *et al*, 2006). IT integration in the e-business context is conceptualized as front-end integration and back-end integration (Zhu *et al*, 2004). Front-end and back-end integration are built on common Internet technologies in use (Intranet, website and Extranet and so on) and are important antecedents of WKS as they enable communications and collaboration. Regarding IT intangibles resources, IT expertise has been identified as one of the main factors influencing the level of e-business use (Bordonaba-Juste *et al*, 2012). Firms that have IT professionals are more likely to adopt IT innovations because they can implement their own specific IT applications. Therefore, IT integration and IT expertise may be important technological issues in explaining WKS. The following hypotheses incorporate our expectations:

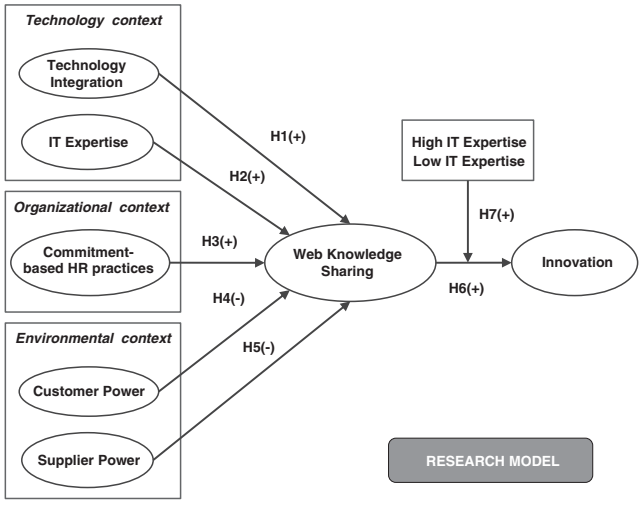

Figure 1 Research model.

Hypothesis 1: *IT integration is positively related to WKS.*

Hypothesis 2: *IT expertise is positively related to WKS.*

Knowledge sharing happens when units and members interact, thus promoting new understanding (Alavi & Leidner, 2001). It is therefore essential for the firm to develop interaction networks that allow individuals not only to access the same information, but also to come together and collaborate through the network. This is even more crucial when sharing tacit knowledge, which requires more interaction between employees (Fox, 2000). However, besides technology enablers, employees need to be willing to collaborate and share knowledge. Thus, building a positive social climate may be crucial to motivate employees to work together and share knowledge.

Cooperation is key in creating a social climate that drives knowledge sharing within firms (Nahapiet & Ghoshal, 1998). A strong climate for cooperation between knowledge workers is expected to positively affect knowledge sharing among them. The literature distinguishes between transaction-based HR practices, which focus on individual short-term exchange relations, and commitment-based HR practices, which emphasize mutual long-term exchange relations, suggesting that the latter may contribute to such a social climate (Tsui *et al*, 1997). In fact, Collins & Smith (2006) find that commitment-based HR practices, by creating a certain social climate conditions, positively influence knowledge exchange among workers. On the basis of this discussion, the following hypothesis is proposed:

Hypothesis 3: *Commitment-based HR practices are positively related to WKS.*

Porter's (1985) five competitive forces framework refers to horizontal competition (threat of substitute products,

the threat of existing rivals, and the threat of new entrants), and vertical competition (the bargaining power of suppliers and the bargaining power of customers). Thus, competition depends on the business environment in which a firm operates. Early studies on technology diffusion found that competition increases firms' incentives to adopt new technologies so as to remain competitive (Thong, 1999). Competition intensity has been found to be an important driver of Internet technologies adoption (Zhu *et al*, 2003; Zhu *et al*, 2006; Chong *et al*, 2009; Wang *et al*, 2010). Studies have also found that external pressure from customers and suppliers affect e-business adoption (Del Aguila-Obra & Padilla-Melendez, 2008; Wang & Ahmed, 2009). Therefore, competition intensity is expected to drive organizations to adopt Internet technologies. However, research (e.g., Zhu *et al*, 2006; Chan *et al*, 2012) has also shown that competition may detract firms from using Internet technologies, thus challenging the traditional wisdom about competition and innovation diffusion. Zhu *et al* (2006) found a positive relation between competition and e-business adoption, but a negative relation between competition and the extent of e-business use. Similarly, Chan *et al* (2012) found that competition intensity is negatively related to the extent of e-collaboration use in SMEs. Thus, Internet technologies use is less tied to competition intensity than initially thought in both large and small business. In fact, too much competitive pressure leads firms to change rapidly from one technology to another without sufficient time to infuse the technology into the company (Zhu *et al*, 2006). This discussion leads to the following hypotheses:

Hypothesis 4: *Customer power (CP) is negatively related to WKS.*

Hypothesis 5: *Supplier power is negatively related to WKS.*

WKS, innovation and the moderating effect of IT skills

The literature suggests that new knowledge is the main driver of new products, services and processes (Nonaka, 1994; Choy *et al*, 2006). However, the ability to create new knowledge, which enables firms to innovate especially in dynamic environments, results from the collective ability of employees to share and combine knowledge (Nahapiet & Ghoshal, 1998). In this sense, there are a number of studies that suggest that knowledge sharing is an antecedent of innovation. For instance, Capon *et al* (1992) found that encouraging scientific discussions enhances the firm's ability to innovate. Other studies link knowledge sharing and innovation to inter-functional coordination and the use of networks (Darroch, 2005). Griffin & Hauser (1996) find that the integration between R&D and marketing is an antecedent of new product success. Thus, innovation largely depends on tacit knowledge, so knowledge sharing is a major requisite for innovation (Nonaka, 1994).

Furthermore, certain systems (e.g., groupware or collaborative systems) nowadays provide a virtual space where the participants can share knowledge and information in real time, giving them more chance to interact (Lee & Choi, 2003). Firms are using more and more collaborative technologies (shared databases, repositories, discussion forums, workflow and so on), usually hosted in the corporate Intranet for knowledge sharing (Meroño-Cerdán, *et al*, 2008a). Meroño-Cerdán *et al* (2008b) found that most collaborative technologies are positively related to innovation in SMEs. Similarly, other Internet technologies can be used for knowledge sharing, such as the Extranet and the website, for instance, with customers and suppliers. Thus, Internet technologies can be used to distribute and share individual experience and innovation throughout the organization (Bhatt *et al*, 2005) and offer the chance of applying knowledge for the creation of new products and/or services or processes. Moreover, these technologies facilitate the formation of virtual teams to execute the innovation process with users and partners from remote places (Kessler, 2003; Adamides & Karacapilidis, 2006). Moreover, IT skills have been found to be a source of business value. In fact, Mata *et al* (1995) found that out of several IT attributes – capital requirements, proprietary technology, and IT skills – only IT skills are likely to be a source of competitive advantage. In short, the benefits from web knowledge sharing, which include efficient information and knowledge sharing as well as working with no distance limitations, are expected to be positively related to innovation. In addition, IT expertise may reinforce the effect of WKS on innovation. Thus, the following hypotheses are proposed:

Hypothesis 6: *WKS is positively related to innovation.*

Hypothesis 7: *IT expertise moderates the relation between WKS and innovation.*

Research methodology

Data collection and sample

The target population of our study are SMEs from Spain. Currently, SMEs represent around 99% of the total number in this country (INE, 2012). Data collection was conducted following two phases. First, a pilot study was performed and, following that, a questionnaire was conducted. Five SMEs were randomly selected from a database to perform the pilot study. On the basis of these responses and subsequent interviews with participants in the pretest, minor modifications were made to the questionnaire for the next phase of data collection. Responses from these five pilot study firms were not included in the final sample.

To ensure a minimum firm complexity in which ITs may be relevant, only firms with at least 14 employees were considered for the questionnaire phase. Thus, the population considered consisted of all Spanish enterprises, with more than 14 employees, located in the southeast of the country, which have their primary business activity in one of the following business activities: manufacturing, commercial, services, and construction (see Table 1). A total of

Table 1 Profile of respondents (N = 535)

Profile of respondents	*Percentage*
Industry	
Manufacturing	32.07
Commercial	29.17
Services	15.22
Construction	23.55
Number of employees	
10–49	74.02
50–249	25.98

2246 were identified and contacted for participation. The survey was administered to the CEO of the companies via personal interview and the unit of analysis for this study was the company. In total, 535 valid questionnaires were obtained, yielding a response rate of 23.8%. The data set was examined for potential bias in terms of non-response by comparing the characteristics of early and late participants in the sample. These comparisons did not reveal significant differences in terms of general characteristic and model variables, suggesting that non-response did not cause any survey bias.

Measures

Measurement items were introduced on the basis of a careful literature review. Confirmatory factor analysis (CFA) was used to test the constructs. On the basis of the CFA assessment, the measurement models were further refined and then fitted again. Constructs and associated indicators in the measurement model are listed in the Appendix and discussed below. To facilitate cumulative research, operationalizations tested by previous studies were used.

Several variables were operationalized as multi-item constructs. Technology Integration (TI) assessed the extent to which the website is connected with back-end information systems and databases, and the extent to which company databases are linked to business partners' systems and databases. Items for TI are based on Zhu *et al* (2006). *Commitment-based HR practices* were operationalized based on Youndt *et al* (1996), Delery & Doty (1996) and Collins & Smith (2006). Overall, 8 items were adapted to measure commitment-based HR practices. WKS measured the extent of use of common Internet technologies (Intranet, website, and Extranet/Internet) to exchange knowledge with different stakeholders: employees, customers, suppliers, competitors and so on. WKS scale is based on Soto-Acosta & Meroño-Cerdan (2006) and Meroño-Cerdán *et al* (2008b). *Innovation* was measured following items in previous studies (Lee & Choi, 2003; López-Nicolás & Meroño-Cerdán, 2011) and represents new technological knowledge and ideas in new products and processes.

Other constructs were directly operationalized as observed variables. *IT expertise* was measured by the number of IT professionals (Zhu *et al*, 2004; Zhu & Kraemer, 2005; Bordonaba-Juste *et al*, 2012). *Customer and Supplier Power* were measured following two of Porter's (1985) concepts of five competitive forces. Such operationalization has been previously used in the IT literature (Thong, 1999; Zhu *et al*, 2004). The survey items assessed the degree of pressure clients and suppliers exert on business regarding purchasing conditions. IT expertise is also used as a moderating variable in the relation between WKS. In this sense, the sample is split at the median to form high- and low-IT expertise groups.

Instrument validation

The measures from the data set were refined by assessing their unidimensionality and reliability. First, an initial exploration of unidimensionality was made using principal component factor analyses. In each analysis, eigenvalues were greater than 1, lending preliminary support to a claim of unidimensionality in the constructs. Next, CFA was performed to establish the required convergent validity, discriminant validity, and reliability of the contructs. The measurement model presented a good fit to the data ($\chi^2(55) = 68.400$; CFI = 0.98; IFI = 0.98; GFI = 0.95; RMSEA = 0.03). All traditionally reported fit indexes were within the acceptable range.

Construct reliability assesses the degree to which items are free from random error and, therefore, yield consistent results. This study calculated reliability of measures using Bagozzi & Yi's (1998) composite reliability index and Fornell & Larcker's (1981) average variance extracted index. For all the measures both indices were higher than the evaluation criteria, namely, 0.6 for composite reliability and 0.5 for the average variance extracted. Convergent validity assesses the consistency across multiple constructs. As shown in Table 2, after dropping insignificant items, all estimated standard loadings are significant ($P<0.01$) and of acceptable magnitude, suggesting good convergent validity (Sethi & King, 1994).

To assess the discriminant validity – the extent to which different constructs diverge from one another – Fornell & Larcker's (1981) criterion, that the square root of average variance extracted for each construct (diagonal elements of the correlation matrix in Table 3) should be greater than the absolute value of interconstruct correlations (off-diagonal elements), was used. All constructs met this criterion, suggesting that the items share more variance with their respective constructs than with other constructs. Table 3 also provides an overview of the means, standard deviations, and correlations of the constructs.

This study measures commitment-based HR practices as a single construct made up of two dimensions: Training support and employees interest (CHRP1) and career plans and evaluation reporting (CHRP2). A second-order factor analysis demonstrated that the two dimensions reflect the higher order construct (see Table 4).

Results

This paper performs structural equation modelling (SEM) to test the hypotheses, using maximum likelihood estimation techniques to test the model. The fit of the model is satisfactory ($\chi^2(89) = 108.404$; RMSEA = 0.03; CFI = 0.98 IFI = 0.98 GFI = 0.94), suggesting that the nomological network of relations fits the data and the validity of the measurement scales (Churchill, 1979).

Figure 2 shows the standardized path coefficients with their respective significant levels. Hypothesis 1 did not find any support, indicating that TI is not related to WKS in SMEs. Hypothesis 2 was confirmed (0.09, $P<0.01$). This result shows that hiring specialized IT personnel in the firm is an important factor for WKS. Hypothesis 3 was confirmed (0.69, $P<0.01$), with commitment-based HR practices being the strongest factor in the proposed model. This indicates that the presence of commitment-based HR practices is a critical factor driving WKS in SMEs. Hypothesis 4 was confirmed (–0.21, $P<0.05$), while Hypothesis 5 did not find any support, indicating a negative relation between CP and WKS and a non-significant relation between supplier power and WKS. In addition, the results show that WKS contributes positively to innovation (0.49, $P<0.01$). Thus, Hypothesis 6 found support.

Table 5 confirms that, although the relation between WKS and innovation is positive and significant, IT expertise does not influence how intense this relation is. Thus, Hypothesis 7 did not find any support. The implications of these results are discussed in the next section.

Table 2 Measurement model: confirmatory analysis and scale reliability

Construct	*Indicators*	*Standard loadings*	*t-value*	*Reliability*
Technology integration	TI1	0.819	—	CR = 0.78 AVE = 0.64
	TI2	0.780	6.29	
IT professionals	ITP	NA	NA	NA
CHRP1	HR1	0.720	—	CR = 0.74 AVE = 0.52
	HR2	0.835	6.87	
CHRP2	HR5	0.444	—	CR = 0.75 AVE = 0.71
	HR7	0.794	6.56	
	HR8	0.940	6.40	
Customer power	CP	NA	NA	NA
Supplier power	CP	NA	NA	NA
WKS	WKS1	0.784	—	CR = 0.76 AVE = 0.63
	WKS2	0.724	8.30	
	WKS3	0.687	6.28	
Innovation	I1	0.902	—	CR = 0.82 AVE = 0.61
	I2	0.835	14.02	
	I3	0.613	9.42	

Fit statistics for measurement model: $\chi^2(55) = 68.400$; CFI = 0.98; IFI = 0.98; GFI = 0.95; RMSEA = 0.03.
Insignificant factors are dropped (HR3, HR4, and HR6); (—): Fixed items; CR: Composite reliability; AVE: Average variance extracted; NA. Loadings, CR and AVE are not applicable to single-item constructs.

Discussion

The empirical results revealed that factors have different effects on WKS. Within the technological context, not only tangible, but also intangible resources have been incorporated in our model: TI and IT expertise. The results suggested that although IT expertise is positively associated with WKS, a non-significant relation was found for the relation between technology integration and WKS. The first finding confirms recent research (Bordonaba-Juste *et al*, 2012), which found that IT expertise is one of the main factors that affect the extent of e-business use. However, the second finding counters existing research analysing Internet technologies (e.g., Zhu & Kraemer, 2005; Zhu *et al*, 2006), which found that TI is positively related to the extent of e-business use (Zhu *et al*, 2006) and positively associated to e-business value (Zhu & Kraemer, 2005). A possible explanation to this is that previous studies have focused on aggregate measures of the organizational adoption and use of Internet technologies and, within that context, tangible IT assets such as TI may be more crucial than intangibles. In contrast, within the

Table 3 Descriptives statistics and discriminant validity

Constructs	*Average*	*Standard deviation*	*Correlation matrix*							
			(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
1. Technology integration	2.67	1.22	**0.80**							
2. IT expertise	0.73	2.79	0.11**	NA						
3. CHRP1	3.88	0.90	0.09**	0.02	**0.71**					
4. CHRP2	3.18	0.91	0.33***	0.04	0.33***	**0.84**				
5. Customer power	3.61	1.09	–0.06	–0.04	0.04	–0.01	NA			
6. Supplier power	3.03	1.08	0.08	–0.01	–0.02	0.06	0.22***	NA		
7. WKS	2.62	0.99	0.05	0.10**	0.29***	0.26***	–0.13**	0.06	**0.72**	
8. Innovation	3.20	0.92	0.06	0.16***	0.26***	0.21***	0.03	–0.01	0.29***	**0.78**

Significance levels: P<0.05**; P<0.01***; NA. Variance extracted is not applicable to the single-item constructs.
Diagonal values in bold represent the square root of the AVE.

Table 4 Second-order CFA of HR commitment practices

First-order construct	*First order*			*Second order*	
	Indicator	*Loading*	*t-value*	*Loading*	*t-value*
CHRP1	HR1	0.674	—	0.910	9.626
	HR2	0.858	7.23		
CHRP2	HR5	0.456	—		
	HR7	0.784	9.80	0.466	6.546
	HR8	0.875	9.50		

Fit statistics: $\chi^2(3) = 6.701$; CFI = 0.99; IFI = 0.99; GFI = 0.99; RMSEA = 0.04; (—): Fixed items.

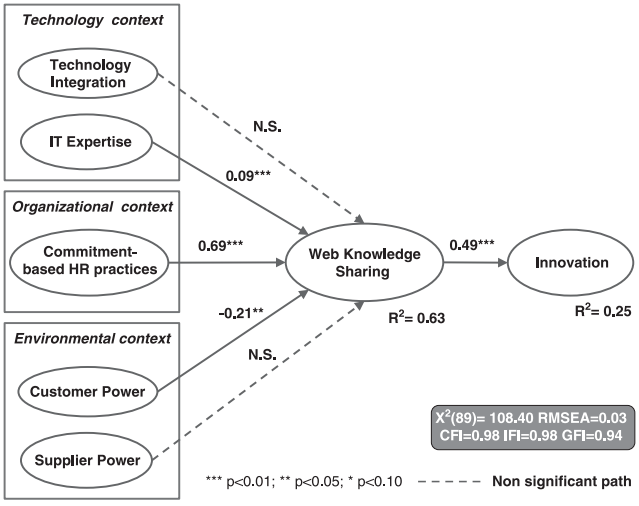

Figure 2 Empirical results.

Table 5 Moderating effect of IT expertise

	Overall model	*IT expertise*		
		Low	*High*	*χ^2 difference*
WKS→innovation	0.496***	0.475***	0.563***	$\chi^2(1) = 1.120$
R^2 (innovation)	0.25	0.22	0.31	

Significance levels: P<0.01***.

specific context of SMEs and knowledge sharing, intangible IT resources (Bharadwaj 2000; O'Sullivan & Dooley, 2010) such as hiring specialized IT personnel seem to be the major technological driver of knowledge sharing through Internet technologies. This results support the idea that IT *per se* do not create value, because every firm can purchase IT in the marketplace. Rather, IT value creation depends more on intangible IT assets (Soto-Acosta & Meroño-Cerdan, 2006).

Within the organizational context, the effect of commitment-based HR practices on WKS is analysed. The results show a positive relation between these two constructs, with commitment-based HR practices being the strongest factor in our proposed model. This finding confirms support for previous studies (Collins & Smith, 2006), which, though not focusing on Internet technologies, found that commitment-based HR practices were significantly related to knowledge exchange among workers. Thus, SMEs should focus on commitment-based HR practices, rather than on transaction-based HR practices, in order to create a social climate, which promotes WKS. Results regarding factors from the environmental context suggest a negative relation between CP and WKS and a non-significant relation between supplier power and WKS. These findings partially support recent research (Zhu *et al*, 2006; Chan *et al*, 2012), which found that competition may detract firms from using Internet technologies. Thus, although external pressure from customers and suppliers affect e-business adoption (Del Aguila-Obra & Padilla-Melendez, 2008; Wang & Ahmed, 2009), competition is not necessarily good for technology use. Too much competitive pressure leads firms to change rapidly form one technology to another without sufficient time to use the technology (Zhu *et al*, 2004; Zhu *et al*, 2006). Our findings also confirm previous research using SMEs. In this sense, Chang & Hughes (2012) found that competition intensity is negatively related to the extent of e-collaboration use in SMEs. Thus, this finding demonstrates that WKS emerges from internal organizational and technological resources rather than from external pressure.

Furthermore, the results suggest a positive relation between WKS and innovation. These findings support previous research suggesting that knowledge sharing is an antecedent of innovation (e.g., Capon *et al*, 1992; Griffin & Hauser, 1996), as well as studies suggesting that Internet technologies uses (including knowledge sharing) are related to innovation (Meroño-Cerdán *et al*, 2008b). Therefore, although the literature suggests that innovation cannot be easily split into separate phases or stages and creativity does not neatly proceed in a linear fashion (Anderson *et al*, 2004), the characteristics of WKS make it suitable to enhance efficient information and knowledge sharing, which, in turn, leads to higher innovation outcomes. Our findings support existing research suggesting positive direct and indirect links between ICT, knowledge management and innovation (e.g., Darroch, 2005; López-Nicolás & Meroño-Cerdán, 2011) by suggesting that to increase organizational innovation it is important to achieve high levels of knowledge sharing.

Conclusions, limitations, and future research

ICT supports knowledge acquisition/creation, knowledge dissemination, and knowledge utilization (Darroch, 2003; Tiwana, 2003; Jayasingam *et al*, 2013). These processes share the use of knowledge as the crucial factor for adding and generating value (Alavi & Leidner, 2001; Pérez-López & Alegre, 2012). However, to transfer or create knowledge, interaction of some kind has to take place between the

actors. In this sense, knowledge sharing has been considered essential to the creation, dissemination, and utilization of knowledge (Valkokari *et al*, 2012). Thus, it is believed that organizations' survival and success depend on the effort and interactions of employees as they carry the skills and generate knowledge to transform new ideas into innovations. Today, firms are migrating towards the Internet platform for knowledge sharing because of the reduction in communication and collaboration costs (Zhu & Kraemer, 2005). Thus, it is becoming essential for firms to assimilate Internet technologies to support information and knowledge sharing within firms. Moreover, previous studies in the literature tend to focus in large businesses, with very few and recent studies analysing Internet technologies adoption and use in SMEs (Chang & Hughes, 2012). This study, grounded in the TOE theory, shed lights on the factors that affect WKS and its effect on innovation SMEs. Results suggest that technological and organizational factors – IT expertise and commitment-based human resources practices – as the main drivers of WKS, while the contrary is found with regard to environmental factors (CP). In addition, results show that WKS contributes positively to organizational innovation, though no support for the moderating effect of IT skills in this relation is found.

This study provides important implications for management. However, it was found that beyond technological factors, organizational factors strongly influence WKS. More specifically, commitment-based HR practices were found to be the strongest predictor of WKS. This can be interpreted that firms should not only adopt technology and have the necessary IT expertise in the firm, but also implement commitment-based HR practices to create a social climate, which promotes WKS. In addition, contrary to our expectations, a negative relation between CP and WKS was found. Thus, to achieve high levels of WKS, firms should pay more attention to internal organizational and technological resources than external pressure. Finally, it was found that WKS supports organizational innovation. Thus, firms should promote WKS to enhance efficient information and knowledge sharing, which, in turn, may lead to higher innovation outcomes. Overall, this study's findings confirm that executives and management need to be aware of the necessity of implementing and promoting the use of Internet technologies for knowledge sharing. They need to recognize that their competitors are already putting effort into these issues and, if the firm does not respond, they will be at a competitive disadvantage.

As any other research, ours suffers from some limitations, which can be addressed in future research. First, the sample used was from Spain. It may be possible that the findings could be extrapolated to other countries, as economic and technological development in Spain is similar to other OECD Member countries. However, in future research, a sampling frame that combines firms from different countries could be used in order to provide a more international perspective on the subject. Second, the key informant method was used for data collection. This method, while having its advantages, also suffers from the limitation that the data reflects the opinions of one person. Future studies could consider research designs that allow data collection from multiple respondents within an organization. Third, developing solid instruments in the IT literature is still an ongoing procedure of development, testing, and refinement (Zhu *et al*, 2004; Zhu *et al*, 2006). Although reliability and validity were empirically tested in our data set, further confirmatory studies are necessary to determine the external validity of the results. Particularly, as discussed in the hypotheses section, competition constructs in our study capture vertical competition, which needs to be enriched in further research to include horizontal competition. Future research designs could consider other important organizational context factors such as organizational strategy and culture. Fourth, this research takes a static, cross-sectional picture of contextual factors affecting WKS, which makes it difficult to address the issue of how contextual factors and their importance may change over years. A longitudinal study could enrich the findings. These suggestions should be taken into account in future studies to increase the validity of our findings.

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About the authors

Pedro Soto-Acosta is a Professor of Management in the Department of Management and Finance at the University of Murcia, Spain. His work has been published in journals such as *Behaviour & Information Technology*, *Computers in Human Behavior*, *European Journal of Information Systems*, *European Management Journal*, *Information Research*, *International Journal of Information Management* and *Information Systems Management*, among others. He is an Editorial Board member and Associate Editor for several international journals and Chairman of various international conferences.

Ricardo Colomo-Palacios is an Associate Professor at the Computer Science Department of the Universidad Carlos III de Madrid, Spain. His research interests include applied research in information systems, software project management and people in IT projects. He received his Ph.D. in Computer Science from the Universidad Politécnica of Madrid. He also holds a MBA from the Instituto de Empresa. He has also vast industry experience software engineer, project manager and software engineering consultant in several companies, including Spanish IT leader INDRA.

Simona Popa is a Ph.D. candidate in the Department of Management and Finance at the University of Murcia, Spain. She holds a BA in Accounting and Data Management from the University Alexandru Ioan Cuza, Iasi, Romania. Her research interests are in the areas of Management Information Systems, Human-Computer Interaction, Business Information Management and eBusiness.

Appendix

Table A1 Measures

Variables	*Description*
Technology integration	
TI1	Extent to which the website is electronically integrated with back-end systems and databases (1–5)
TI2	Extent to which company databases are electronically integrated to that of business partners (clients, suppliers and so on) (l–5)
IT expertise (ITP)	Number of IT professionals (#)
Commitment-based HR practices	
HR1	Employees' interest are taken into account for decision making (1–5)
HR2	Our company support employees willing to take further training (1–5)
HR3	Our company helps employees achieving work-like balance (1–5)
HR4	Selection processes are formalized and rigorous (1–5)
HR5	Our company has established career paths (1–5)
HR6	Promotion is based on objective criteria (seniority, objectives and so on) (1–5)
HR7	Performance appraisals are conducted on a regular basis (1–5)
HR8	Employees are informed about their performance appraisals (1–5)
Customer power	Extent of pressure clients exert on purchasing conditions (1–5)
Supplier power	Extent of pressure suppliers exert on purchasing conditions (1–5)
WKS	
WKS1	Extent to which the Intranet and associated groupware/collaborative technologies are used for knowledge sharing between employees (1–5)
WKS2	Extent to which the website is used to exchange knowledge or debate with customers (1–5)
WKS3	Extent to which the Extranet and the WWW is used to exchange knowledge or debate with business partners (1–5)
Innovation	
I1	The number of new or improved products/services launched to the market is above the average of your industry (1–5)
I2	The number of new or improved processes is above the average of your industry (1–5)
I3	Changes introduced in products and services during the past 5 years are very important