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Analyzing the effects of technological, organizational and competition factors on Web knowledge exchange in SMEs

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ABSTRACT

Internet technologies are increasingly being used within all knowledge management processes, including knowledge acquisition, knowledge exchange and knowledge use. Although technological issues are key drivers for Internet technologies adoption and use, organizational and environmental aspects have been found to be equally important. This paper extends previous studies on the use of Internet technologies and knowledge management by analyzing factors affecting Web knowledge exchange in small and medium-sized enterprises (SMEs). More specifically, by drawing on the technology–organization–environment framework, a model to examine how distinct contextual factors influence Web knowledge exchange in SMEs is developed. The hypotheses are tested by using structural equation modelling on a large sample of Spanish SMEs from different industries. Results suggest that IT expertise and commitment-based human resource practices positively affect Web knowledge exchange, with the latter being the strongest factor in our proposed model. In contrast, a negative relationship is found between competition and Web knowledge exchange.

1. Introduction

With the advent of the Internet and open standards technologies and the associated reduction of communication costs, firms are migrating toward the Internet platform (Zhu et al., 2006) and cloud computing environments (Colomo-Palacios et al., 2012; Hsu et al., 2014). As a consequence, effective adoption and use of Internet technologies have become management concerns (Soto-Acosta and Meroño-Cerdan, 2008; Meroño-Cerdan et al., 2008b).

The characteristics of rapid search, access, retrieval and exchange of information make Internet technology suitable for collaboration and knowledge exchange between organizational members (Lucio-Nieto et al., 2012). One of the main characteristics of the Internet-based digital platform 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 (Lucio-Nieto et al., 2012; Pérez-López and Alegre, 2012; Soto-Acosta et al., 2011). Thus, it is important to understand the key factors that facilitate and motivate the use of Internet technologies for knowledge exchange within firms. Competitive pressure has been defined in various studies as a key determinant of firm's readiness to accept new technology (Bayo-Moriones and Lera-Lopez, 2007; Sila, 2013; Teo et al., 2006). At the same time, the literature considers that technological factors are important

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drivers for the adoption and implementation of IT innovations (Aboelmaged, 2014; Ramdani et al., 2013). However, beyond technological and the environmental factors, research has recognized the importance of organizational factors in influencing Internet technologies adoption and use (Aboelmaged, 2014; Gu et al., 2012; Lian et al., 2014; Sila, 2013). Organizational factors may restrict or facilitate the implementation and usage of Internet technologies (Soto-Acosta et al., 2014). In this sense, the literature suggests that organizational human resource (HR) practices that create a commitment-based environment influence the interactions, behaviours and motivation of employees (Collins and Smith, 2006). HR practices may therefore affect the organizational social climate that motivates employees to work together and exchange knowledge by being organizational enablers of technology use.

Furthermore, small and medium-sized enterprises (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 (Lopez-Nicolas and Soto-Acosta, 2010). However, studies in the literature tend to examine Internet technology adoption and use in large businesses, with very few recent studies analyzing Internet technologies adoption and use in SMEs (e.g. Aboelmaged, 2014; Chan et al., 2012; Chong et al., 2009; Lopez-Nicolas and Soto-Acosta, 2010; Huy et al., 2012; Ramdani et al., 2013; Soto-Acosta et al., 2014). Findings from studies examining large companies are unlikely to be generalizable to SMEs because of various differences between these types of firms (Bhagwat and Sharma, 2007; Lopez-Nicolas and Soto-Acosta, 2010). Moreover, although businesses have extensively adopted Internet technologies, actual use is an important link to business value and such a link has been found to be especially lacking in SMEs (Devaraj and Kholi, 2003).

To respond to the above-mentioned gaps in the literature, this paper develops a conceptual model, grounded on the technology–organization–environment (TOE) framework, to analyze the key factors that facilitate Web knowledge exchange and it uses a large sample of SMEs from different industries for hypothesis testing. The paper consists of six sections and is structured as follows: The next section presents the literature review and hypotheses. Following that, the methodology used for sample selection and data collection is discussed. Then, data analysis and results are examined. Finally, the paper ends with a discussion of research findings, limitations and concluding remarks.

2. Theoretical background and hypotheses

The technology–organization–environment (TOE) theory (Tornatzky and Fleischer, 1990) has emerged as the main theoretical framework to analyze factors which affect the adoption and use of different ITs including: cloud computing (e.g. Hsu et al., 2014; Lian et al., 2014), electronic business (e.g. Bordonaba-Juste et al., 2012; Sila, 2013; Soto-Acosta and Meroño-Cerdan, 2008; Xu et al., 2004), electronic collaboration (e.g. Chan et al., 2012), mobile commerce (e.g. San Martín et al., 2012), enterprise resource planning (e.g. Bradford et al., 2014; Zhu et al., 2010) and information and open systems (e.g. Chau and Tam, 1997; 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. Technological context refers to the characteristics of the technological innovation; organizational context describes characteristics of the organizations; and environmental context involves characteristics of the environment in which the adopting organizations operate (Tornatzky and Fleischer, 1990; Thong, 1999). According to Thong (1999), competition is the business environment in which the business operates. Porter's (1985) five forces refer to horizontal competition (the 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).

The TOE framework has also been extensively used to analyze the factors which affect the adoption and use of Internet technologies. Recent studies have employed this theoretical framework to analyze 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 analyzing Internet technology adoption and use, this paper proposes a comprehensive research model based on the TOE framework to study factors that influence Web knowledge exchange in SMEs. The next subsections discuss the hypotheses of the model.

2.1. Technological context

The extent of Internet technologies use for knowledge exchange would depend on firms' technology competence, since IT plays a pivotal role in supporting organizational knowledge exchange processes. Technology competence refers not only to tangible assets, but also to intangibles resources, which are more likely to create competitive advantages (Aboelmaged, 2014; Bharadwaj, 2000; O'Sullivan and Dooley, 2010; Soto-Acosta and Meroño-Cerdan, 2008). With regard to tangible IT assets, technology integration is a factor, within the TOE framework, that has been found to be significant in studies focusing on Internet technologies adoption and use (e.g. Zhu et al., 2006; Zhu and Kraemer, 2005). Technology integration is the degree of connectivity of front-end and back-end IT systems and databases. Front-end integration refers to the degree of integration of the Web site functionalities with databases inside the firm, while back-end integration represents the degree of integration of the legacy systems so as to provide data integration among internal databases (Zhu et al., 2004). Front-end and Back-end integration are built on common Internet technologies in use (intranet, website and extranet...) and are important antecedents of Web knowledge exchange since they enable communications and collaboration. Regarding IT intangibles resources, IT expertise has been identified as one of the main factors that influence the level of e-business use

(Bordonaba-Juste et al., 2012). Firms that have IT specialists are more likely to adopt IT innovations because they can develop their IT applications or better adapt them to their organizations (Lin and Lee, 2005). IT expertise provides the technical skills to develop Internet-based applications. Therefore, IT integration and IT expertise may influence the extent to which firms are ready to use Internet technologies for knowledge exchange. This discussion leads to the following hypotheses:

Hypothesis 1: IT integration is positively related to the extent of Internet technologies use for knowledge exchange.
Hypothesis 2: IT expertise is positively related to the extent of Internet technologies use for knowledge exchange.

2.2. Organizational context

Technology enablers are a necessary but not sufficient condition for employees to collaborate and exchange knowledge through Internet technologies. Knowledge exchange happens when units and members interact, promoting new understanding (Alavi and Leidner, 2001). It is therefore essential for the firm to develop interaction networks. However, besides technology applications, employees need to be willing to collaborate and exchange knowledge. Thus, building a positive social climate may be crucial to motivate employees to work together and exchange knowledge. This is even more crucial when exchanging tacit knowledge, which requires more interaction (Fox, 2000).

Nahapiet and Ghoshal (1998) suggest that cooperation between employees is a key aspect for creating a social climate that drives knowledge exchange within firms. A strong climate for cooperation between knowledge workers positively affects the exchange of valuable and unique knowledge among them (Collins and Smith, 2006). The literature distinguishes between transaction-based HR practices, which focus on individual short-term exchange relationships, and commitment-based HR practices, which emphasize mutual long-term exchange relationships (Tsui et al., 1997). Collins and Smith (2006) found that commitment-based HR practices are significantly related to knowledge exchange among workers. Thus, the following hypothesis incorporates our expectations:

Hypothesis 3: Commitment-based HR practices are positively related to the extent of Internet technologies use for knowledge exchange.

2.3. Competition context

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 (Chong et al., 2009; Sila, 2013; Wang et al., 2010; Zhu et al., 2003, 2006). Studies have also found that external pressure from customers and suppliers affect e-business adoption (Del Aguila-Obra and Padilla-Melendez, 2008; Wang and Ahmed, 2009). Therefore, competition intensity is expected to drive organizations to adopt Internet technologies for knowledge exchange. However, research (e.g. Chan et al., 2012; Zhu et al., 2006) has also shown that competition may deter firms from using Internet technologies, challenging the traditional wisdom about competition and innovation diffusion. Zhu et al. (2006) found a positive relationship between competition and e-business adoption, but a negative relationship 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 technology use is less tied to competition intensity than initially believed in both large and small businesses. 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). Porter's (1985) five forces refer to horizontal competition (the 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, although competition encourages technology adoption, it is not necessarily good for technology use. This discussion leads to the following hypotheses regarding vertical competition and Web knowledge exchange:

Hypothesis 4: Vertical competition from customers is negatively related to the extent of Internet technologies use for knowledge exchange.
Hypothesis 5: Vertical competition from suppliers is negatively related to the extent of Internet technologies use for knowledge exchange.

The set of relationships is illustrated in Fig. 1.

3. Research methodology

3.1. Data collection and sample

The organizations selected for this study are SMEs from Spain. Currently, SMEs represent around 99% of the total number of firms in Spain. Nonetheless, to ensure a minimum firm complexity in which ITs may be relevant, only firms with at least 15 employees were used. Data collection was conducted in two stages: a pilot study and a questionnaire were conducted.

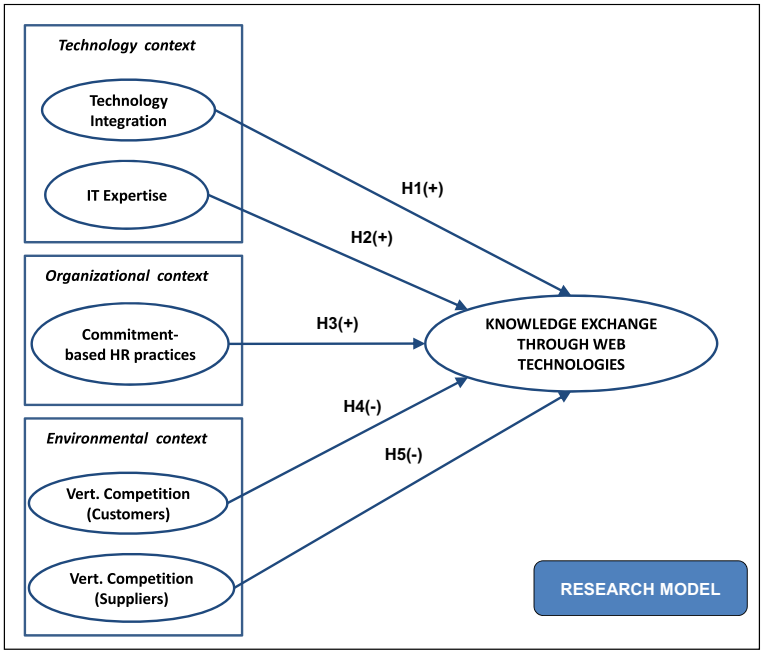

Fig. 1. Research model.

Five SMEs were randomly selected from a database to pretest the questionnaires. Based on these responses and subsequent interviews with participants in the pilot study, 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.

The population considered in this study was the set of all Spanish enterprises, with at least 15 employees, located in the southeast of the country whose primary business activity is in one of the following business activities: manufacturing, commercial, services and construction. A total of 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 percent. The dataset 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.

3.2. Common method variance

Most researchers agree that common method variance is a potentially serious bias threat in behavioral research, especially with single informant surveys. Two procedures were used to empirically determine whether or not common method bias threatened the interpretation of our results: (a) the Harman one-factor test; and (b) a confirmatory factor-analytic approach to Harman one-factor test.

The rationale for the first test is that, if common method bias poses a serious threat to the analysis and interpretation of the data, a single latent factor would account for all manifest variables or one general factor would account for the majority of the covariance among the measures. In our case, the one-factor model obtained using principal components analysis revealed several factors in the unrotated factor solution. However, this test is weak, as suggested by Podsakoff et al. (2003). More recently, some researchers using this technique have used confirmatory factor analysis (CFA) as a more sophisticated test. A worse fit for the one-factor model would suggest that common method variance does not pose a serious threat. The one-factor model yielded a $\chi^2 = 222.007$ with 35 degrees of freedom (compared with the $\chi^2 = 30.209$ with 29 degrees of freedom for the measurement model). The fit is considerably worse for the one-dimensional model than for the measurement model, suggesting that common method bias is not a serious threat in our study.

3.3. Measures

Measurement items were introduced on the basis of a careful literature review. Exploratory and confirmatory factor analysis (CFA) were used to test the constructs. 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. Scales were measured on a 5-point Likert scale with anchors from strongly disagree (1) to strongly agree (5).

Several constructs were operationalized as multi-item constructs. First, Technology Integration was measured by 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 (Zhu et al., 2006). Second, *Commitment-based HR practices* were operationalized from previous research (Collins and Smith, 2006; Delery and Doty, 1996; Youndt et al., 1996) work. Overall, 5 items were adapted to measure Commitment-based HR practices. *Knowledge exchange through Internet technologies* represents the extent of use of common Internet technologies (Intranet, website, extranet/Internet...) to exchange knowledge with different stakeholders: employees, customers, suppliers, competitors... (Meroño-Cerdan et al., 2008a,b; Soto-Acosta and Meroño-Cerdan, 2006).

There are circumstances when single-item indicators are or must be used for diverse reasons, such as when the construct is simple and single-faceted, making it difficult to create many different items that measure the same construct (Petrescu, 2013; Poon et al., 2002). Bergkvist and Rossiter (2007) showed that single-item measures are equally as valid as multiple-item measures and theoretical tests and empirical findings would be the same if single-item measures are used instead of multiple-item measures. As noted by Baumgartner and Homburg (1996), around 20% of the studies applying SEM in social sciences, use single indicators for examining the relationships among variables. Thus, other variables are directly operationalized by observed variables. First, *IT expertise* was measured by the number of IT professionals (Bordonaba-Juste et al., 2012; Zhu et al., 2004, 2006). Second, *Customer and Supplier Power* were measured following two of Porter's (1985) concepts of five competitive forces. This type of operationalization has been 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.

3.4. Instrument validation

The covariance-based structural equation modelling (SEM) approach, like many other multivariate statistical analyses, requires multivariate normality. The data were examined for kurtosis and skewness to obtain insights about the distributional characteristics. Both Kurtosis and Skewness fell within the acceptable range of −1 to 1 and their absolute values were less than three times their standard error (Hair et al., 2011). The data were therefore close to a normal distribution. Tests for linearity and homoscedasticity were also conducted. To test for linearity, the deviation from linearity test available in the ANOVA test in SPSS was used. Statistical differences ($p > 0.05$) were not found, which suggests that linearity problems did not exist. To test for homoscedasticity, scatter plots with the variables and the variables' residuals were conducted. No inconsistent patterns were observed, which suggests that data were homoscedastic. Thus, through these analyses normality, linearity and homoscedasticity of data were confirmed.

The unidimensionality and reliability of the dataset was assessed by different procedures. First of all, an initial exploration of unidimensionality was made using principal component factor analyses. In each analysis, the eigenvalues were greater than 1, lending preliminary support to a claim of unidimensionality in the constructs. Following that, CFA was performed to assess the unidimensionality of each construct. In this sense, construct reliability, convergent and discriminant validity were assessed. The measurement model presented a good fit to the data ($\chi^2(29) = 30.209$; CFI = 0.99; IFI = 0.99; GFI = 0.97; RMSEA = 0.04). All traditionally reported fit indexes were within the acceptable range.

Construct reliability assess the degree to which items are free from random error and, therefore, yield consistent results. This study calculated reliability of measures using Bagozzi and Yi's (1998) composite reliability index and Fornell and 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 1, all estimated standard loadings are significant ($p < 0.01$) and of acceptable magnitude, suggesting good convergent validity (Sethi and King, 1994).

Table 1
Measurement model: confirmatory analysis and scale reliability.

Construct	Indicators	S. loadings	*t*-Value	Reliability
Technology integration	TI1	0.651	–	CR = 0.71
	TI2	0.82	4.18	AVE = 0.55
IT professionals	ITP	na	na	na
Training support and employees' interest	HR1	0.749	–	CR = 0.75
	HR2	0.806	6.56	AVE = 0.61
Career plans and evaluation reporting	HR3	0.542	–	CR = 0.81
	HR4	0.806	6.58	AVE = 0.60
	HR5	0.926	6.44	
Customer power	CP	na	na	na
Supplier power	SP	na	na	na
Knowledge Exchange through Web technologies	WKE1	0.835	–	CR = 0.76
	WKE2	0.746	4.23	AVE = 0.58
	WKE3	0.697	4.24	

Fit statistics for measurement model: $\chi^2(29) = 30.209$; CFI = 0.99; IFI = 0.99; GFI = 0.97; RMSEA = 0.048.
(–), Fixed items; CR, composite reliability; AVE, average variance extracted; na, loadings, CR and AVE are not applicable to single-item constructs.

To assess the discriminant validity – the extent to which different constructs diverge from one another – Fornell and Larcker's (1981) criterion that the square root of average variance extracted for each construct (diagonal elements of the correlation matrix in Table 2) 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.

This study measures commitment-based HR practices as a single construct made up of two dimensions: Training support and employees' interest and career plans and evaluation reporting. A second-order factor analysis demonstrated that the two dimensions reflect a higher-order construct (see Table 3).

4. Results

This paper performs SEM to test the hypotheses, using maximum likelihood estimation techniques to test the model. The fit of the model is satisfactory ($\chi^2(51) = 54.085$; RMSEA = 0.040; CFI = 0.99 IFI = 0.99 GFI = 0.96), suggesting that the nomological network of relationships fits the data and the validity of the measurement scales (Churchill, 1979). The model explained substantial variance of Web knowledge exchange (see Fig. 2).

Fig. 2 and Table 4 show the standardized path coefficients with their respective significant levels. Hypothesis 1 did not find support, indicating that technology integration is not related to Web knowledge exchange in SMEs. Hypothesis 2 was supported (0.13, $p < 0.05$), a result that shows that hiring specialized IT personnel in the firm is an important factor for knowledge exchange through Internet technologies. Hypothesis 3 was confirmed (0.55, $p < 0.01$), 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 Web knowledge exchange. Hypothesis 4 was supported (-0.23, $p < 0.01$), while Hypothesis 5 did not find support, indicating a negative relationship between customer power and Web knowledge exchange and a non-significant relationship between supplier power and Web knowledge exchange through Internet technologies. The implications of these results are discussed in the next section.

5. Discussion

The effects of five TOE factors on Web knowledge exchange are analyzed using a data set of SMEs. The empirical results reveal that factors have differential effects. Regarding the technological context, not only tangible but also intangible resources have been incorporated in our model: technology integration and IT expertise. The results suggest that though IT expertise is positively associated with Web knowledge exchange, a non-significant relationship was found for the relationship between technology integration and Web knowledge exchange. The first finding confirms recent research (Aboelmaged, 2014; 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 (e.g. Zhu et al., 2006; Zhu and Kraemer, 2005), which found that technology integration is positively related to the extent of e-business use (Zhu et al., 2006) and positively associated to e-business value (Zhu and Kraemer, 2005). A possible explanation may be that previous studies have focused on aggregate measures of the organizational adoption and use of Internet technologies and, within that context, technology integration may be more crucial. In contrast, within the specific context of SMEs and knowledge exchange, intangible IT resources (Bharadwaj, 2000; O'Sullivan and Dooley, 2010) such as hiring specialized IT personnel seem to be the major technological drivers of knowledge exchange through Internet technologies. These 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 and Meroño-Cerdan, 2008).

Regarding the organizational context, the effect of commitment-based HR practices on Web knowledge exchange is analyzed. Results show a positive relationship between these two constructs, with commitment-based HR practices being the strongest factor in our model. This finding supports previous studies (Collins and Smith, 2006) which, though not focusing

Table 2
Descriptives statistics and discriminant validity.

Constructs	Mean	Standard deviation	Correlation matrix						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Technology integration	2.67	1.22	**0.74**						
2. IT expertise	0.73	2.79	0.11**	na					
3. Training support and employees' interest	3.88	0.90	0.09**	0.02	**0.77**				
4. Career plans and evaluation reporting	3.18	0.91	0.33***	0.04	0.33***	**0.78**			
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. Knowledge Exchange through Web technologies	3.52	0.79	0.05	0.12***	0.17***	0.21***	−0.09	0.06	**0.76**

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 3
Second-order confirmatory factor analysis of HR commitment practices.

First-order construct	Fist-order			Second-order	
	Indicator	Loading	*t*-Value	Loading	*t*-Value
Training support and employees' interest	HR1	0.674	–	0.910	9.626
	HR2	0.858	7.23		
Career plans and evaluation reporting	HR3	0.456	–	0.466	6.546
	HR4	0.784	9.80		
	HR5	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.

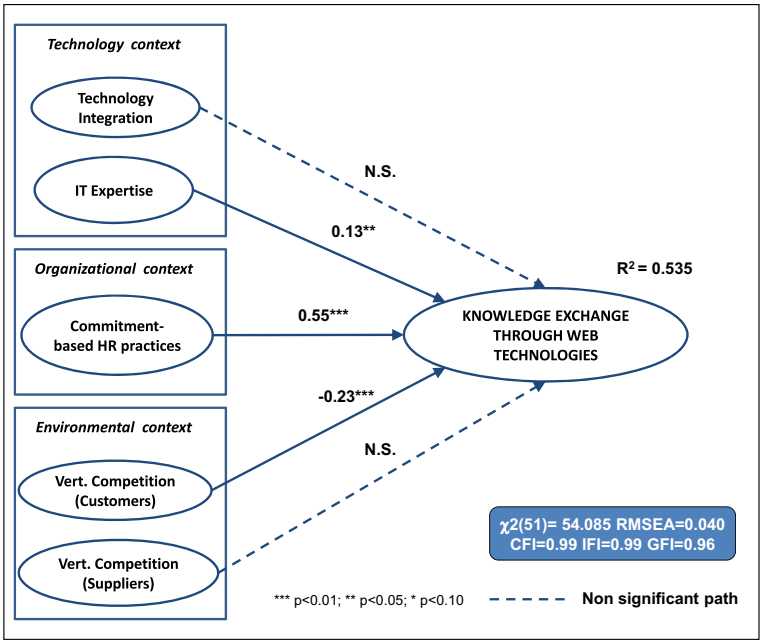

Fig. 2. Empirical results.

Table 4
Results of hypotheses tests.

Hypothesis	Hypotheses paths	Path coefficients	*T*-values	Support significance
H1	TI → WKE	0.21	1.425	Not supported
H2	ITE → WKE	0.13	2.314	Supported**
H3	CBHRP → WKE	0.55	3.244	Supported***
H4	VCC → WKE	−0.23	−2.635	Supported***
H5	VCS → WKE	0.10	1.232	Not supported

TI: Technology Integration; WKE: Web Knowledge Exchange; CBHRP: Commitment-Based HR Practices.
VCC: Vertical competition from customers; VCS: Vertical competition from suppliers.
Critical *t*-values for a two-tailed test are: <1.96 ($p > .05^{*}$), 1.96 ($p = .05^{**}$), and 2.58 ($p = .001^{***}$).

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 Web knowledge exchange. With regard to the environmental context, results suggest a negative relationship between customer power and Web knowledge exchange and a non-significant relationship between supplier power and Web knowledge exchange. These findings partially support recent research (Chan et al., 2012; Zhu et al., 2006), which found that competition may deter firms from using Internet technologies. Thus, although external pressure from customers and suppliers affects e-business adoption (Del Aguila-Obra and Padilla-Melendez, 2008; Wang and 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, 2006). Our

findings also confirm previous research using SMEs. In this sense, (Chan et al., 2012) find that competition intensity is negatively related to the extent of e-collaboration use in SMEs. Thus, this finding demonstrates that Internet technology use for knowledge exchange does not emerge from external pressure.

6. Conclusions, limitations and future research

Organizations' survival and success depend on the effort and interactions of employees since they carry the skills and generate knowledge to transform new ideas into innovations. Since firms are increasingly adopting Internet technologies for business processes (Soto-Acosta and Meroño-Cerdan, 2008), it is essential to assimilate Internet technologies to support information sharing and knowledge exchange within firms. Hence, it is important to understand which factors influence the use of Internet technologies for knowledge exchange. This study examines the influence of five contextual factors on knowledge exchange through Internet technologies. Empirical results identified significant factors shaping knowledge exchange through Internet technologies and their effects.

This paper makes several contributions to the literature. First, it analyzes significant factor shaping Web knowledge exchange in SMEs. Previous studies in the literature have tended to focus on large businesses, with very few and recent studies analyzing Internet technology adoption and use in SMEs (e.g. Chan et al., 2012; Chong et al., 2009; Dholokia and Kshetri, 2004; Huy et al., 2012). Based on a large sample of SMEs, this paper favors the generalizability of results to SMEs. Second, using the TOE framework the use of Internet technologies for knowledge exchange is conceptualized within SMEs. Previous studies have shown the usefulness of the TOE framework for understanding the adoption and use of Internet technologies within firms (e.g. Bordonaba-Juste et al., 2012; Chan et al., 2012; Gu et al., 2012; San Martín et al., 2012). However, much of the existing research is focused on a single aggregate view of the organizational adoption and use of Internet technologies (e.g. Bordonaba-Juste et al., 2012; Gibbs and Kraemer, 2004; Hong and Zhu, 2006; Xu et al., 2004; Zhu et al., 2003; Zhu and Kraemer, 2005). In this paper, we extend previous work by analyzing how Internet technologies use affect a specific activity within SMEs: knowledge exchange. Third, we theorized and tested differential effects of the TOE factors on knowledge exchange through Internet technologies in SMEs. Previous research has found that organizational factors are key drivers of Internet adoption and usage. The high positive influence found suggests that commitment-based HR practices affect the organizational social climate that motivates employees to work together and exchange knowledge.

While the contributions of the present study are significant, there are some aspects which can be addressed in future research. First, the sample used was from Spain. It may be possible that the findings could be extrapolated to other countries, since economic and technological development in Spain is similar to other OECD Member countries. However, similar studies in different countries are likely to show different results, especially when considering high IT advanced countries such as the USA, Finland, and Canada. Thus, 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, developing solid instruments in the IT literature is still an ongoing procedure of development, testing and refinement (Zhu et al., 2004, 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. Third, this research takes a static, cross-sectional picture of contextual factors affecting Web knowledge exchange, 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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Appendix A

Measures

Technology integration

- The website is electronically integrated with back-end systems and databases.
- Company databases are electronically integrated to that of business partners (clients, suppliers...).

IT expertise

- Number of IT professionals (#).

Commitment-based HR practices

- Employees' interest are taken into account for decision-making.
- Our company support employees willing to take further training.
- Our company has established career paths.
- Performance appraisals are conducted on a regular basis.
- Employees are informed about their performance appraisals.

Vertical competition

- Pressure clients exert on purchasing conditions.
- Pressure suppliers exert on purchasing conditions.

Web knowledge exchange

- The Intranet and other Web technologies are used to exchange knowledge between employees.
- Website and other Web technologies are used to exchange knowledge or debate with customers.
- The Extranet and other Web technologies are used to exchange knowledge or debate with business partners.

References

Aboelmaged, M.G., 2014. Predicting e-readiness at firm-level: an analysis of technological, organizational and environmental (TOE) effects on e-maintenance readiness in manufacturing firms. Int. J. Inf. Manage. 34 (5), 639–651.

Alavi, M., Leidner, D.E., 2001. Review: knowledge management and knowledge management systems: conceptual foundations and research issues. MIS Q. 25 (1), 107–136.

Bagozzi, R.P., Yi, Y., 1998. On evaluation of structural equations models. J. Acad. Mark. Sci. 16 (1), 74–94.

Baumgartner, H., Homburg, C., 1996. Applications of structural equation modelling in marketing and consumer research: a review. Int. J. Res. Mark. 13 (1), 139–161.

Bayo-Moriones, A., Lera-Lopez, F., 2007. A firm level analysis of determinants of ICT adoption in Spain. Technovation 27 (6/7), 352–366.

Bergkvist, L., Rossiter, J.R., 2007. The predictive validity of multiple-item versus single-item measures of the same constructs. J. Mark. Res. 44 (2), 175–184.

Bhagwat, R., Sharma, M.K., 2007. Information system architecture: a framework for a cluster of small- and medium-sized enterprises (SMEs). Prod. Plan. Control 18 (4), 283–296.

Bharadwaj, A.S., 2000. A resource-based perspective on information technology capability and firm performance: an empirical investigation. MIS Q. 24 (1), 169–196.

Bordonaba-Juste, V., Lucia-Palacios, L., Polo-Redondo, Y., 2012. Antecedents and consequences of e-business use for European retailers. Internet Res. 22 (5), 532–550.

Bradford, M., Earp, J.B., Grabski, S., 2014. Centralized end-to-end identity and access management and ERP systems: a multi-case analysis using the technology organization environment framework. Int. J. Account. Inf. Syst. 15 (2), 149–165.

Chan, F.T.S., Chong, A.Y.-L., Zhou, L., 2012. An empirical investigation of factors affecting e-collaboration diffusion in SMEs. Int. J. Prod. Econ. 138 (2), 329–344.

Chau, P.Y.K., Tam, K.Y., 1997. Factors affecting the adoption of open systems: an exploratory study. MIS Quart. 21 (1), 1–24.

Chong, A.Y.L., Ooi, K.B., Lin, B., Tang, S.Y., 2009. Influence of interorganizational relationships on SMEs' e-business adoption. Internet Res. 19 (3), 313–331.

Churchill, G.A., 1979. A paradigm for developing better measures of marketing constructs. J. Mark. Res. 16 (1), 64–73.

Collins, C.J., Smith, K.G., 2006. Knowledge exchange and combination: the role of human resource practices in the performance of high-technology firms. Acad. Manag. J. 49 (3), 544–560.

Colomo-Palacios, R., Fernandes, E., Sabbagh, M., Amescua-Seco, A., 2012. Human and intellectual capital management in the cloud: software vendor perspective. J. Univers. Comput. Sci. 18 (11), 1544–1557.

Del Aguila-Obra, A., Padilla-Melendez, A., 2008. Organizational factors affecting Internet technology adoption. Internet Res. 16 (1), 94–110.

Delery, J.E., Doty, D.H., 1996. Modes of theorizing in strategic human resource management: test of universalistic contingency, and configurational performance predictions. Acad. Manag. J. 39 (4), 802–835.

Devaraj, S., Kholi, R., 2003. Performance impacts of information technology: is actual usage the missing link? Manage. Sci. 49 (3), 273–289.

Dholokia, R.R., Kshetri, N., 2004. Factors impacting the adoption of the internet among SMEs Small Bus. Econ. 23, 311–322.

Fornell, C., Larcker, F.D., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 18 (1), 39–50.

Fox, S., 2000. Communities of practice, Toucault and actor network theory. J. Manage. Stud. 37 (6), 853–867.

Gibbs, J.L., Kraemer, K.L., 2004. A cross-country investigation of the determinants of scope of e-commerce use: an institutional approach. Electronic Markets 14 (2), 124–137.

Gu, V.C., Cao, Q., Duan, W., 2012. Unified modeling language (UML) IT adoption – a holistic model of organizational capabilities perspective. Decis. Support Syst. 54 (1), 257–269.

Hair, J.F., Celsi, M., Money, A., Samouel, P., Page, M., 2011. Essentials of Business Research Methods, 2nd ed. ME Sharpe, Armonk, NY.

Hong, W., Zhu, K., 2006. Migrating to internet-based e-commerce: factors affecting e-commerce adoption and migration at the firm level. Inf. Manage. 43 (2), 204–221.

Hsu, P.-F., Ray, S., Li-Hsieh, Y.-Y., 2014. Examining cloud computing adoption intention, pricing mechanism, and deployment model. Int. J. Inf. Manage. 34 (4), 474–488.

Huy, L.V., Rowe, F., Truex, D., Huynh, M.Q., 2012. An empirical study of determinants of e-commerce adoption in SMEs in Vietnam an economy in transition. J. Global Inf. Manage. 20 (3), 23–54.

Lian, J., Yen, D., Wang, Y., 2014. An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. Int. J. Inf. Manage. 34 (1), 28–36.

Lin, H.F., Lee, G.G., 2005. Impact of organizational learning and knowledge management factors on e-business adoption. Manage. Decis. 43 (2), 171–188.

Lopez-Nicolas, C., Soto-Acosta, P., 2010. Analyzing ICT adoption and use effects on knowledge creation: An empirical investigation in SMEs. Int. J. Inf. Manage. 30 (6), 521–528.

Lucio-Nieto, T., Colomo-Palacios, R., Soto-Acosta, P., Popa, S., Amescua-Seco, A., 2012. Implementing an IT service information management framework: the case of COTEMAR. Int. J. Inf. Manage. 32 (6), 589–594.

Meroño-Cerdan, A., Soto-Acosta, P., Lopez-Nicolas, C., 2008a. Analyzing collaborative technologies' effect on performance through intranet use orientations. J. Enterp. Inf. Manage. 21 (1), 39–51.
Meroño-Cerdan, A., Soto-Acosta, P., Lopez-Nicolas, C., 2008b. How do collaborative technologies affect innovation in SMEs? Int. J. e-Collab. 4 (4), 33–50.
Nahapiet, J., Ghoshal, S., 1998. Social capital, intellectual capital, and the organizational advantage Acad. Manag. Rev. 23, 242–266.
O'Sullivan, D., Dooley, L., 2010. Collaborative innovation for the management of information technology resources. Int. J. Hum. Cap. Inf. Technol. Prof. 1 (1), 16–30.
Pérez-López, S., Alegre, J., 2012. Information technology competency, knowledge processes and firm performance. Ind. Manage. Data Syst. 112 (4), 644–662.
Petrescu, M., 2013. Marketing research using single-item indicators in structural equation model. J. Market. Anal. 1 (2), 99–117.
Podsakoff, P.M., Mackenzie, S.B., Lee, J., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J. Appl. Psychol. 20 (5), 879–903.
Poon, W.-Y., Leung, K., Lee, S.-Y., 2002. The comparison of single item constructs by relative mean and relative variance. Org. Res. Methods 5 (3), 275–298.
Porter, M.E., 1985. Competitive Advantage. Free Press, New York.
Ramdani, B., Chevers, D., Williams, D., 2013. SMEs adoption of enterprise applications: a technology–organisation–environment model. J. Small Business Enterp. Dev. 20 (4), 89–115.
San Martín, S., López-Catalán, B., Ramón-Jerónimo, M.A., 2012. Factors determining firms' perceived performance of mobile commerce. Ind. Manage. Data Syst. 112 (6), 946–963.
Sethi, V., King, W., 1994. Development of measures to assess the extent to which an information technology application provides competitive advantage. Manage. Sci. 40 (12), 1601–1627.
Sila, I., 2013. Factors affecting the adoption of B2B e-commerce technologies. Electronic Commerce Res. 13 (2), 199–236.
Soto-Acosta, P., Meroño-Cerdan, A., 2006. An analysis and comparison of web development between local governments and SMEs in Spain. Int. J. Electron. Bus. 4 (2), 191–203.
Soto-Acosta, P., Meroño-Cerdan, A., 2008. Analyzing e-Business value creation from a resource-based perspective. Int. J. Inf. Manage. 28 (1), 49–60.
Soto-Acosta, P., Colomo-Palacios, R., Perez-Gonzalez, D., 2011. Examining whether highly e-innovative firms are more e-effective. Informatica 35 (4), 481–488.
Soto-Acosta, P., Perez-Gonzalez, D., Popa, S., 2014. Determinants of Web 2.0 technologies for knowledge sharing in SMEs. Ser. Bus. 8 (3), 425–438.
Teo, T.S.H., Ranganathan, C., Dhaliwal, J., 2006. Key dimensions of inhibitors for the deployment of web-based business-to-business electronic commerce. IEEE Trans. Eng. Manage. 53 (3), 395–411.
Thong, J.Y.L., 1999. An integrated model of information systems adoption in small businesses. J. Manage. Inform. Syst. 15 (4), 187–214.
Tornatzky, L.G., Fleischer, M., 1990. The Process of Technological Innovation. Lexington Books, Lexington, Lexington, MA.
Tsui, A.S., Pearce, J.L., Porter, L.W., 1997. Alternative approaches to the employee-organization relationship: Does investment in employees pay off? Acad. Manag. J. 40, 1089–1121.
Wang, Y., Ahmed, P., 2009. The moderating effect of the business strategic orientation on e-commerce adoption: evidence from UK family run SMEs. J. Strateg. Inf. Syst. 18 (1), 16–30.
Wang, Y.M., Wang, Y.S., Yang, Y.F., 2010. Understanding the determinants of RFID adoption in the manufacturing industry. Technol. Forecast. Soc. Chang. 77, 803–815.
Xu, S., Zhu, K., Gibbs, J., 2004. Global technology, local adoption: a cross-country investigation of Internet adoption by companies in the United States and China. Electron. Markets 14 (1), 13–24.
Youndt, M.A., Snell, S.A., Dean Jr., J.W., Lepak, D.P., 1996. Human resource management, manufacturing strategy and firm performance. Acad. Manag. J. 39 (4), 836–866.
Zhu, K., Kraemer, K., 2005. Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. Inf. Syst. Res. 16 (1), 61–84.
Zhu, K., Kraemer, K., Xu, S., 2003. Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. Eur. J. Inf. Syst. 12 (4), 251–268.
Zhu, K., Kraemer, K.L., Xu, S., Dedrick, J., 2004. Information technology payoff in e-business environments: an international perspective on value creation of e-business in the financial services industry. J. Manage. Inf. Syst. 21 (1), 17–54.
Zhu, K., Kraemer, K.L., Xu, S., 2006. The process of innovation assimilation by firms in different countries: a technology diffusion perspective on e-business. Manage. Sci. 52 (10), 1557–1576.
Zhu, Y., Li, Y., Wang, W., Chen, J., 2010. What leads to the post-implementation success of ERP? An empirical study of the Chinese retail industry. Int. J. Inf. Manage. 30 (3), 265–276.