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An investigation of the effect of electronic business on financial performance of Spanish manufacturing SMEs

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ABSTRACT

This paper aims to fill research gaps in the existing literature on the effect of electronic business on financial firm performance within the specific context of manufacturing Small and Medium Enterprises (SMEs). More specifically, this research analyzes not only the direct effects of e-business on firm performance but also the mediating effect of organizational innovation the relationship. Building on the knowledge and resource-based views, the proposed research model and its associated hypotheses are tested by using partial least squares (PLS) structural equation modeling on a dataset of Spanish manufacturing SMEs. Results suggest that electronic business has a direct effect on financial performance and is positively associated to organizational innovation. In addition, results show that the relationship between electronic business and financial performance is mediated by organizational innovation.

1. Introduction

Economic globalization is having a profound impact across all industries worldwide. However, the process of globalization is not uniform, and there are large differences in the extent to which industries are being integrated into a single global market. In this context, economic globalization is putting increasing pressure upon manufacturing companies, specially manufacturing Small and Medium Enterprises (SMEs) which must today compete globally (Raymond et al., 2005; Soto-Acosta et al., 2015). In this context, brought by the advent and development of Internet technologies, among other factors, manufacturing companies are adopting e-business technologies to increase productivity and quality, lower operating costs, and respond faster to customers' and business partners' needs (Jardim-Goncalves et al., 2012). As a result, effective adoption and use of e-business technologies have become major management concerns (Popa et al., 2016; Soto-Acosta and Meroño-Cerdan, 2008).

Furthermore, the majority of the existing e-business literature still relies on studies conducted in large companies, to a great extent, with very few recent studies analyzing SMEs (e.g. Chan et al., 2012; Chong et al., 2009; Lopez-Nicolas and Soto-Acosta, 2010). Moreover, although the literature suggests that actual technology use is an important link to business value and that such link has been found to be especially lacking in SMEs (Devaraj and Kohli, 2003), it is even less common to find studies analyzing e-business use in manufacturing SMEs (Raymond et al., 2005; Soto-Acosta et al., 2015). In addition, much of the existing research focuses on a single view of e-business, how these technologies support specific business processes (Gu et al., 2012; Palacios-Marqués et al., 2015; Soto-Acosta et al., 2014), with very few studies examining the use of e-business along the whole value chain in manufacturing SMEs (Soto-Acosta et al., 2015). However, according to the conceptual e-business frameworks, this is the level of adoption and integration of e-business that produces the best opportunities for business value creation (Martin and Matlay, 2001; Teo and Pian, 2004). Another issue is that most of the investigation on e-business adoption/use has focused on high e-business intensity countries (e.g. USA, Canada and Scandinavian countries) (Kongaut and Bohlin, 2016). However, the international growth of e-business has shown the need to extend this research to other less studied countries of the South Europe (Spain, Portugal, Greece…), with potential for growth but different cultures (Hernández et al., 2010).

Equally important is to analyze the effects of e-business use on the performance of SMEs. Firm performance in the e-business literature has been fundamentally measured by using subjective measures (Devaraj et al., 2007; Lucia-Palacios et al., 2014; Soto-Acosta and Meroño-Cerdan, 2008; Soto-Acosta et al., 2015; Tallon et al., 2000), with few works employing objective measures (Loukis et al., 2013; Meroño-Cerdan and Soto-Acosta, 2005, 2007; Zhu, 2004). In addition,

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most of the studies have analyzed the direct relationship between e-business and firm performance, while very little work has been undertaken to identify variables that mediate this relationship. Thus, there is a need to develop more comprehensive research models capable of being used to analyze the link between e-business use, intermediate outcomes or mediators and firm performance.

To respond to the above gaps in the literature, this paper focuses on industrial Spanish SMEs, analyzing not only the direct effect of e-business use on financial performance, but also the mediating effect of organizational innovation and other intermediary financial measures in these relationships. 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

2.1. The knowledge and resource-based views

The Knowledge-Based View (KBV) considers knowledge as the most significant strategic resource available to a firm and states that a firms' knowledge is usually difficult to imitate and socially complex and, therefore, with the potential to generate sustained competitive advantage and superior firm performance (Grant, 2002; Nickerson and Zenger, 2004). The KBV is an extension of the Resource-Based View (RBV). The RBV has become the basis for developing explanations as to why firms in the same industry vary systematically in performance over time (Hoopes et al., 2003). The RBV suggests that the effects of individual, firm-specific resources on performance can be significant (Mahoney and Pandian, 1992). The RBV generally tends to define resources broadly and includes assets, infrastructure, skills, and so on. The RBV is based on two underlying assertions: resource heterogeneity and resource immobility. Resources and capabilities 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; Schulze, 1992). At the same time, resources and capabilities are a source of sustained competitive advantage, that is, differences may be long lasting (resource immobility) when protected by barriers to imitation (Mahoney and Pandian, 1992) or isolating mechanisms such as time-compression diseconomies, historical uniqueness, embeddedness, and causal ambiguity (Barney, 1991; Peteraf, 1993).

The RBV also highlights the role of complementarities between resources as a source of business value. Firm resources are considered complementary when the presence of one resource enhances the value of another resource (Ravichandran and Lertwongsatien, 2005). This complementarity of resources is a corner stone of the RBV and has been used, for instance, as an explanation of how information and communication technologies overcomes its paradoxical nature and contributes to business value (Bhatt and Grover, 2005). E-business technology is by itself typically imitable and, thus, such tools should not be a source of competitive advantage (Barney, 1991). However, as argued by Soto-Acosta and Meroño-Cerdan (2008:51) "the combination of Internet resources and other valued corporate resources, and their integration in the organizational processes, may lead to better firm performance". Since knowledge is a key factor for increasing the competitiveness of firms and e-business tools may facilitated knowledge creation and sharing (Del Giudice et al., 2015), this paper grounded in knowledge and resource-based views studies the relationships between e-business use, organizational innovation and financial performance as well as the mediating effect of innovation in the relationship between e-business use and firm performance.

2.2. E-business use and financial performance

There is existing literature that uses the RBV to give theoretical support to research models that examine the relationships between technological resources and financial performance. For example, based on the RBV, Bharadwaj (2000) develops a research model to analyze the association between firm specific Information Technology (IT) resources and financial performance. The empirical findings show that profit ratios are significantly higher for firms with superior IT capability, whereas cost ratios are significantly lower. In order to confirm the robustness of Bharadwaj's (2000) study, using the RBV, Ravichandran and Lertwongsatien (2005) investigate the relations between IT resources, Information System capabilities, IT support for core competencies and financial performance. The results show that firm performance depends on how IT resources are used to enhance the core competencies of a firm. Zhu and Kraemer's (2002) work provide empirical support for the positive association between e-commerce capability and business value. Also, they concluded that, in order to achieve higher benefits from e-commerce, firms need to align its e-commerce capability and IT infrastructure. In the same vein, Zhu (2004) find that the complementarity between e-commerce capability and IT infrastructure positively contributes to firm performance, as these firm specific resources become more effective when combined together. Meroño-Cerdan and Soto-Acosta (2007) obtain that external Web content (e-communication and e-transaction orientations) positively affects financial performance. More recently, Loukis et al. (2013) conclude that the adoption of e-business strategy has a positive effect on business performance due to business processes adaptation, which may improve non-hierarchical decentralized coordination, specific technical and operational requirements, and the decentralization of individual employees' competences. In conclusion, although the majority of previous research has assessed the relationships between e-business by using subjective indicators of business value (Devaraj et al., 2007; Lucia-Palacios et al., 2014; Soto-Acosta and Meroño-Cerdan, 2008; Soto-Acosta et al., 2015; Tallon et al., 2000), the above research provided evidence that e-business also affects financial performance positively. However, little is known about the benefits of e-business in terms of cost reduction or income generation in the specific context of SMEs, while, it is even less common to find studies analyzing e-business use in manufacturing SMEs (Raymond et al., 2005; Soto-Acosta et al., 2015).

Previous research shows that the use of Internet-based technologies may create benefits in the form of significant cost reduction and improved efficiency of business processes along the whole value chain, such as human resources management, procurement, logistics, marketing, sales or customer service. Moreover, these benefits are expected to be superior in activities that may require higher levels of information processing and exchange (Porter, 2001; Soto-Acosta et al., 2013, 2015; Zhu and Kraemer 2005). The value propositions that can be provided by Internet-based technologies derive from the large connectivity in terms of quick and effective access and exchange of information. These technologies enable to overcome temporal and geographical barriers by improving the information flow within firms as well as between companies and their stakeholders (Bordonaba-Juste et al., 2012; Lucia-Palacios et al., 2014). In this sense, e-business may improve the effectiveness of supply chain management by means of facilitating the collaboration between the firm and its trading partners. Also, the automation of core business activities such as procurement, order processing, production planning or inventory management allow firms to reduce errors and costs as well as to improve the operational efficiency along their supply chain. At the same time, the routinization of some sales activities along with the easy search and distribution of information reduces the workload of employees so they can participate more in decision-making processes and develop more complex tasks (Soto-Acosta and Meroño-Cerdan, 2009). Also, from a resource-based perspective, previous studies state that companies that develop firm-specific capabilities, such us IT capabilities, may obtain superior

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economic returns because they become more effective in deploying resources than competitors (Santhanam and Hartono, 2003). For the above mentioned reasons, the first two research hypotheses propose that the use of e-business along the value chain may reduce operating costs and improve the return on assets:

H1. E-business use has a negative direct effect on operating costs.

H2. E-business use has a positive direct effect on return on assets.

Furthermore, the democratization of knowledge brought by the Internet fosters knowledge exchange and collaboration, which, in turn, may stimulate knowledge creation and innovation (Pérez-López and Alegre, 2012; Soto-Acosta et al., 2014). Previous literature suggests that knowledge creation is the main antecedent in the development of new products, services and processes (Nonaka, 1994; Choy et al., 2006). However, knowledge creation depends on the collective ability of employees to share and combine existing knowledge (Del Giudice and Della Peruta, 2016; Nahapiet and Ghoshal, 1998). Thus, knowledge sharing was found to be another important antecedent of innovation (Capon et al., 1992; Del Giudice et al., 2013; Del Giudice and Maggioni, 2014; Griffin and Hauser, 1996).

Internet technologies have a high potential to generate competitive advantages through the development of important innovations in products, services and business processes. Meroño-Cerdan et al. (2008b) found that most collaborative technologies are positively related to innovation in SMEs. These technologies facilitate the creation of virtual teams, where employees are empowered and stimulated to share individual experiences, knowledge and information in real time (Bhatt et al., 2005; Lee and Choi, 2003; Meroño-Cerdan et al., 2008a). Similarly, technologies such as the website or the extranet can be used to share knowledge with clients and suppliers and apply it for innovation (Kessler, 2003; Adamides and Karacapilidis, 2006). In short, e-business benefits, which include efficient information and knowledge sharing as well as working with people from remote places, are expected to impulse the development of organizational innovation. Based on these arguments, our third hypothesis proposes a positive effect of e-business use on organizational innovation:

H3. E-business use has a positive direct effect on innovation.

There is literature that has found positive relations between e-business and firm performance measured through objective financial measures (Lee et al., 2011; Ravichandran and Lertwongsatien, 2005; Zhu and Kraemer, 2002). However, few studies have investigated these relations within SMEs (Meroño-Cerdan and Soto-Acosta, 2007). Even less research has analyzed the effect of intermediate outcomes or mediators in the complex relations embodied in the electronic business-performance link. However, there is research that has examined the importance of Internet technologies for knowledge creation (e.g. Lopez-Nicolas and Soto-Acosta, 2010) and the relationship between IT, knowledge management, innovation and firm performance (e.g. López-Nicolás and Meroño-Cerdán, 2011; Pérez-López and Alegre, 2012; Soto-Acosta et al., 2014), finding positive direct and indirect links between IT, knowledge management, innovation and firm performance. Thus, innovation may mediate the relationship between e-business use and firm performance given its potential to reduce costs and improve return on assets. The following hypotheses are proposed:

H4. Innovation mediates the relationship between e-business use and operating costs.

H5. Innovation mediates the relationship between e-business use and return on assets.

This paper, grounded in the knowledge and resource-based views of the firm, develops a conceptual model to assess the links between e-business, innovation and firm performance. The set of relationships is illustrated in Fig. 1.

3. Methodology

3.1. Data collection and sample

The organisations selected for this study are manufacturing SMEs from Spain. Previous research in the context of Spanish SMEs (e.g., Meroño-Cerdan et al., 2008a, 2008b) suggested that using information and communication technologies is crucial for firms with at least 10 employees and over. To ensure a minimum firm complexity in which ITs may be relevant, the population considered in this study was the set of all Spanish SMEs, with at least 10 employees, located in the South-east of the country whose primary business activity is manufacturing. A total of 1291 were identified and contacted for participation. Data collection was conducted in two stages: a pilot study and a questionnaire were conducted. 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 survey was administered in face-to-face interviews with to the CEO of the companies and the unit of analysis for this study was the company. Surveys were administered over a period of 3 months from February 2012 to April 2012. In total, 175 valid questionnaires were obtained, yielding a response rate of 13.55%. Table 1 presents the profile of respondents. 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 characteristics and model variables, suggesting that non-response did not cause any survey bias.

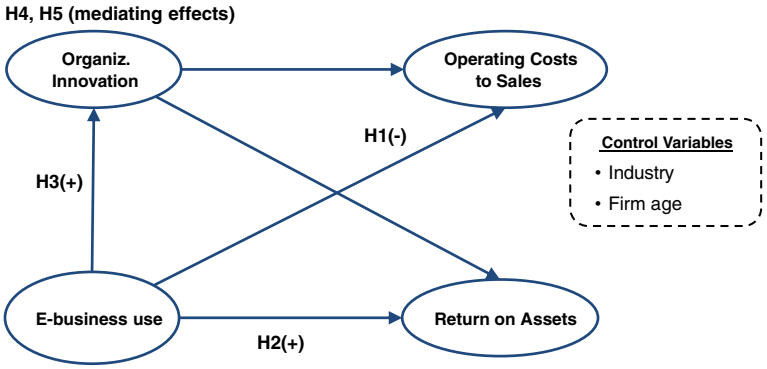

Fig. 1. Research model.

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Table 1
Profile of respondents ($N = 175$).

Profile of respondents	Percentage
Industry	
Manufacture of food products	24%
Manufacture of textiles	1.71%
Manufacture of wearing apparel	2.86%
Manufacture of leather and related products	2.29%
Manufacture of wood and wood products cork, except furniture	3.43%
Manufacture of paper and paper products	3.43%
Manufacture of chemicals and chemical products	5.14%
Manufacture of rubber and plastic products	4.57%
Manufacture of coke and refined petroleum products	4.57%
Manufacture of other non-metallic mineral products	9.71%
Manufacture of basic metals; manufacture of basic metals	1.14%
Manufacture of fabricated metal products, except machinery	10.86%
Manufacture of machinery and equipment n.e.c.	6.86%
Manufacture of electrical equipment	2.29%
Manufacture of motor vehicles, trailers and semi-trailers	2.86%
Manufacture of other transport equipment	1.14%
Manufacture of furniture	13.14%
Number of employees	
10–49	76.57%
50–249	23.43%

3.2. Measures

Measurement items were introduced on the basis of a comprehensive literature review. To facilitate cumulative research, operationalizations tested by previous studies were used. Non-financial measures were operationalized as multi-item constructs and measured on a 5-point Likert scale with anchors from strongly disagree (1) to strongly agree (5). The extent of e-business use measured the use of e-business to conduct or support business process along the value chain: product design, manufacturing, logistics, marketing, coordination with suppliers, and after-sales service (Zhu and Kraemer, 2005; Zhu et al., 2006; Soto-Acosta et al., 2015). Innovation was measured following the definition of the overall innovation of the firm by the OSLO manual (OECD, 2005) and items in previous studies (Soto-Acosta et al., 2014; Weerawardena, 2003) and represents the implementation of a new or significantly improved product (good or service), or process, organizational practice, or marketing method.

Firm performance was operationalized along two dimensions: cost reduction and profitability (Bharadwaj, 2000; Ravichandran and Lertwongsatien, 2005; Santhanam and Hartono, 2003; Zhu and Kraemer, 2002). Specifically, based on Ravichandran and Lertwongsatien (2005) and Zhu and Kraemer (2002), two ratios corrected by firm size were used: 1) *Operating Costs to Sales* calculated by diving total operating costs by net sales. Operating costs are defined as the normal costs of running the businesses and exclude special expenses like repurchase of stock or large capital investments; 2) *Return on assets* calculated by comparing net income to average total assets. These performance metrics reflected the average position over a three-year period based on secondary data collected from the SABI (Sistema de Análisis de Balances Ibéricos) database.

4. Instrument validation

We used Structural Equation Modeling (SEM) for measurement validation and testing the structural model. SEM is particularly useful for testing complex models and when researchers need to incorporate latent variables. More specifically, we opted to use SEM based on Partial Least Squares (PLS) approach because the variance-based PLS method is preferable to the covariance-based when sample sizes are small and it can incorporate both reflective and formative measures (Chin et al., 2003). The general rule of thumb regarding appropriate sample size when using PLS is to multiply by ten the number of indicators on the most complex construct or the largest number of paths leading to a dependent construct in the model. In the proposed model, the highest number of paths leading to a dependent variable is four, while the number of indicators on the most complex is seven (Barclay et al., 1995). Thus, according to this rule, the minimum sample size necessary would be 60. With 175 responses, the PLS analysis appears to have sufficient power.

The measures from the dataset were refined by assessing their unidimensionality and reliability of multi-item constructs. First, an initial exploration of unidimensionality was made using principal components analysis followed by varimax rotation for factor extraction. The rule used to determine the number of factors was eigenvalue >1 criterion (Kaiser, 1974). To test the appropriateness of the data set for using factorial analysis, Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used. Hair et al. (1998) recommended a KMO index of >0.6 and Bartlett's $p < 0.5$ as suitable for factor analysis. The final results of the factorial analysis are presented in Table 2, lending preliminary support to a claim of unidimensionality in the constructs.

Next, we verified the reliability and validity of the measurement model (Barclay et al., 1995). Convergent validity of the scales is contingent on the fulfillment of three criteria (Fornell and Larcker, 1981; Hair et al., 1998): (1) all indicator loadings should exceed 0.65 (2) Composite Reliabilities (CR) should exceed 0.8; and (3) the average variance extracted (AVE) for each construct should exceed 0.5. As shown in Table 3, all the indicator loadings are above the recommended threshold, the CR values were 0.85 and 0.88, and the AVE were 0.62 and 0.73. All three conditions for convergent validity thus hold. As presented in Table 4, discriminant validity holds for the model, since the AVE for each construct is greater than the shared variances between pairs of constructs (Fornell and Larcker, 1981). Furthermore, the Cronbach's alpha values of all indicators should exceed the recommended value of 0.6 (Nunnally, 1978) and all our measurement items noted in Table 3 exceed 0.6. Thus, overall measurement items have adequate item reliability.

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. First, the Harman's one-factor test was used by entering all the indicators into a principal components factor analysis (Podsakoff and Organ, 1986). With all indicators entered, no single factor accounted for threshold of 50% variance, indicating no substantial common method bias. Second, a partial correlation method was used (Podsakoff and Organ, 1986). We checked for bivariate correlations

Table 2
Exploratory factor analysis.

Items	Component	
	1	2
EB3	0.865	
EB1	0.856	
EB4	0.850	
EB2	0.831	
EB5	0.820	
EB6	0.770	
OI5		0.826
OI4		0.823
OI1		0.819
OI3		0.802
OI2		0.795
KMO	0.858	
Barlett	0.000	
Variance accounted by factor (%)	44.17	25.27

Extraction method: principal components analysis.
Table shows factor loadings that exceed 0.4 only.
Rotation method: Varimax with Kaiser Normalization.

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Table 3
Reliability and convergent validity.

Construct	Item loadings[a]	t-statistic	Cronbach's alpha	CR & AVE
E-business use				
EB1	0.90	25.55	0.91	
EB2	0.83	11.41		CR = 0.85
EB3	0.90	28.04		AVE = 0.73
EB4	0.89	21.79		
EB5	0.71	7.22		
Organiz. innovation				
OI1	0.73	8.16	0.86	
OI2	0.72	7.72		CR = 0.88
OI3	0.76	10.24		AVE = 0.62
OI4	0.90	25.07		
OI5	0.89	21.86		

AVE: Average variance extracted; Insignificant factors are dropped (EB6).
[a] All factor loadings are significant at the $p < 0.01$ level; Composite reliability;

between constructs and did not find extremely high correlations ($r > 0.90$) and, thus, this test confirmed no evidence of common method bias as well (Bagozzi et al., 1991). In summary, these tests suggested that common method bias is not a serious threat in our study.

5. Empirical results

Prior to the hypotheses testing, cross validation (CV)-communality and CV-redundancy indices assess the quality of the structural model. The mean of the CV-communality indices confirms the global quality of the structural model if the indices are positive for all the blocks, taking into account the measurement model as a whole. In addition, the CV-redundancy index offers a metric to evaluate the quality of each structural equation. This index should be positive for all endogenous constructs (Tenenhaus et al., 2005). For this study, since all the latent variables had positive values for CV-redundancy and CV-communality indexes, the model demonstrated adequate predictive validity and fit. After analyzing the quality of the structural equation, the next step is to test the relations between all constructs. Consistent with Chin (1998), bootstrapping (500 subsamples) generates standard errors and t-values. Fig. 2 displays the results of hypotheses H1, H2 and H3, showing the path coefficients along with their significance levels. The results of the statistical model offer support for H1 and H3, while fail to corroborate H2.

With regard to hypotheses H4 and H5, a variable may be considered a mediator to the extent to which it carries the influence of a given independent variable to a given dependent variable. We conducted three tests to examine the mediating effects: the Sobel test, the Aroian test, and the Goodman test. According to MacKinnon et al. (1995), the Sobel test and the Aroian test perform best with sample sizes >50 or so. Results offer support to hypotheses H4 (Sobel test statistic: −2.108; Aroian test statistic: −2.052; Goodman test statistic: −2.170) and H5 (Sobel test statistic: 2.378; Aroian test statistic: 2.328; Goodman test statistic: 2.431).

Table 4
Descriptives statistics and discriminant validity.

Constructs	Av.	SD	(1)	(2)	(3)	(4)
1. E-business use	3.23	1.07	**0.73**			
2. Organiz. innovation	3.28	0.89	0.07	**0.62**		
3. Operative costs to sales	0.98	0.39	0.04	0.06	**na**	
4. Return on assets	0.02	3.82	0.01	0.05	0.51	**na**

Av. = average score of all items included in the construct; SD = Standard Deviation.
na. Variance extracted is not applicable to formative constructs.
Diagonal values in bold represent the AVE.
Shared Variances are given in the lower triangle of the matrix.

6. Discussion, conclusions, limitations and future research

The present study, grounded in the resource and knowledge-based views, shed light on the positive influence of e-business on financial performance of manufacturing SMEs. The empirical results reveal that e-business use directly improves financial performance in terms of operational cost reduction. The empirical results fail to corroborate a statistically significant direct effect of e-business use on return on assets, but there is an indirect effect through innovation. Thus, the direct influence of e-business use on financial performance is limited to cost reduction. In this sense, these first findings support only partially the previous literature that confirms a positive and direct influence of Internet-based technologies on objective measures of organizational performance (Zhu and Kraemer, 2005; Lee et al., 2011; Ravichandran and Lertwongsatien, 2005). A possible explanation of these results may be that e-business use and performance of Spanish SMEs are influenced by specific socio-economical characteristics. The countries of the Southern Europe, such as Spain, are known to have a lower economical and technological development than the European North. Previous literature has associated these weaknesses of Southern European economies with the size and structure of manufacturing sector, the deficits in innovation and the larger share of low skill industries (Loukis and Kyriakou, 2015). Regarding the technological culture in Spain, SMEs seem to be unaware of the full benefits of e-business. There is a general tendency to accept "the status quo" of the existing IT (Moon et al., 2008; Hernández et al., 2010). Also, firms have a high tendency to avoid uncertainty. Thus, despite its high potential for firms' growth, the level of use of complex Internet-based technologies, such as electronic commerce, is lower in Spain than the mean of European Union countries (EU-28) (ONTSI, 2014). Another issue that can explain these results is that the use of e-business in Spanish manufacturing SMEs is more oriented to improve internal efficiency than to generate direct incomes. In this sense, in Spanish SMEs Internet is most frequently used for information search (97.7%), Internet as a communication platform: e-mail, VoIP… (92.6%), financial and banking services (90.3%), post-purchase services (58.1%) and e-learning (51.1%), while the use of Internet as a selling platform is quite low (17.8% of the total of SMEs in Spain) (INE, 2014). However, the firms' volume of purchase on Internet is superior to their volume of sales (28.5%), this elapse being more acute in SMEs (INE, 2014). Thus, Spain is a high potential market for e-commerce although underexploited (Hernández et al., 2010).

The empirical results also confirm that the use of e-business along the whole value chain has a positive effect on organizational innovation. This finding confirms previous research, which found that IT infrastructures and competencies are positively related to the innovation in products, services and processes (Del Giudice and Della Peruta, 2016; Meroño-Cerdan et al., 2008b; Soto-Acosta et al., 2015; Tarafdar and Gordon, 2007). Thus, firms are using more collaborative technologies, such as data bases, repositories, forums or work flows, in order to develop innovation processes. In this sense, Meroño-Cerdan et al. (2008b) found that most of collaborative technologies enable and drive organizational innovation in SMEs. In line with the literature, this study offers empirical evidence for the positive effect of e-business use on innovation.

Furthermore, the research model presented in this paper examines not only the direct effect of e-business use at the firm level on variables of firm performance objectively measured, but also, the mediating effect of innovation in these relationships. The empirical findings confirm that e-business may reduce operational costs and improve return on assets through innovation. That is, although there is no statistically significant direct effect of e-business on return on assets, a positive indirect effect of e-business on return on assets is found through innovation. These results supports a partial mediation effect of innovation in the relationships of e-business use with operational costs and return on assets, since the effect of the use of e-business along the whole value

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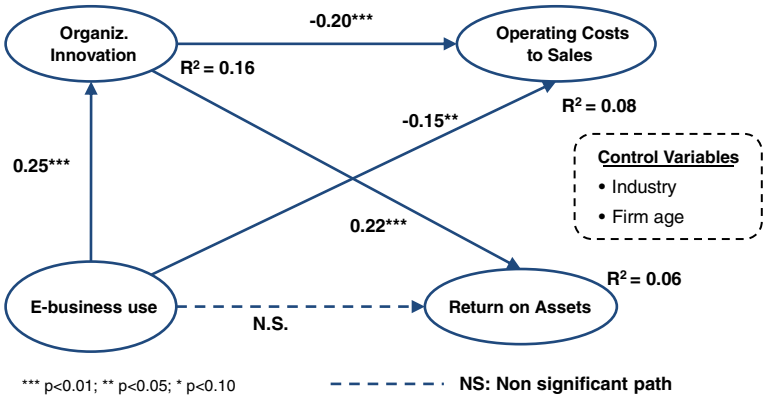

Fig. 2. Empirical results.

chain on the two variables of firm performance shrink upon the addition of innovation to the research model. These findings support recent studies in Spanish firms that assume that the relationship between Internet-based technologies and firm performance is mediated by non-financial variables, such as differentiation, enterprise agility, partner attraction or knowledge management processes (Lucia-Palacios et al., 2014; Pérez-López and Alegre, 2012). Based on this, the present study offers evidences that firm performance of manufacturing SMEs is influenced by e-business use directly and indirectly, trough innovation.

While this study presents interesting findings, it has 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 in the Mediterranean Region (South Europe) such as Greece, Portugal or Italy, since traditions and socioeconomic context in Spain are similar to these countries. However, similar studies in different countries such as the USA, Finland, and Canada may show different results. Thus, in future research, comparative studies between countries or areas (e.g. Mediterranean, Central European or North European countries) could be used in order to provide a more international view on the subject. Second, developing solid instruments in the IT literature is still an ongoing procedure of development, testing and refinement. Although reliability and validity were empirically tested in our data set, further confirmatory studies are necessary to determine the external validity of the results. Third, the key informant method was used for data collection regarding e-business use and innovation. 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. Fourth, innovation measure is subjective in the sense that they were based on Likert-scale responses provided by managers. Thus, it could also be interesting to include objective innovation data for measuring this construct. In addition, future research designs could consider different degrees of innovation (radical and incremental) as well as other forms of innovation such as new business models. Fifth, this research takes a static, cross-sectional picture of contextual factors affecting e-business use, 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.

Appendix A. Measures

A.1. E-business use

EB1 Extent to which e-business technologies are used to conduct product design activities (1–5).

EB2 Extent to which e-business technologies are used to support manufacturing activities (1–5).

EB3 Extent to which e-business technologies are used to support marketing activities (1–5).

EB4 Extent to which e-business technologies are used to support product tracking and distribution (1–5).

EB5 Extent to which e-business technologies are used to support procurement activities and coordination with suppliers (1–5).

EB6 Extent to which e-business technologies are used to support after sales activities (1–5).

A.2. Organizational innovation

OI1 Number of new or improved products launched to the market during the last three years is above the average of your industry (1–5).

OI2 Number of new or improved processes during the last three years is above the average of your industry (1–5).

OI3 Top management at the company emphasizes the importance of research and development (1–5).

OI4 Number of new or improved management practices during the last three years is above the average of your industry (1–5).

OI5 Number of new or improved marketing practices during the last three years is above the average of your industry (1–5).

A.3. Financial performance

Return on Assets is calculated by comparing net income to average total assets (#).

Operating Costs to Sales is calculated by diving total operating costs by net sales. Operating costs are defined as the normal costs of running the businesses and exclude special expenses like repurchase of stock or large capital investments (#).

Note. (1–5): five-point Likert-type scales; (#): continuous variable that reflects the average position over a three-year period.

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