

DETERMINANTS OF TECHNOLOGY ADOPTION IN THE RETAIL TRADE INDUSTRY - THE CASE OF SMES IN SPAIN

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Abstract

This paper analyzes the determinants of small and medium-sized enterprises' technology adoption in the retail trade industry. From the theoretical perspective, two types of influential factors are differentiated in this respect: the personal characteristics of the manager/business owner and the business's organizational characteristics. The empirical analysis is based on a survey of 268 small and medium-sized enterprises in the Spanish retail trade sector. A logistic regression specification is used as an econometric method.

The results indicate that both the acquisition of new technical and electronic equipment and the obtaining of new software are affected by the two types of determinants previously pointed out. The manager/business owner's entrepreneurial motivation and educational background have significant influences on technology adoption in this type of companies. Furthermore, being part of a business group, carrying out training activities for the employees and inter-firm cooperation also positively influence technology adoption in the retail trade industry.

Keywords: retail trade, technology adoption, SME, business owner

JEL Classification: L81, O32

Introduction

The literature on retail business shows the positive impact that the adoption of information and communications technology (ICT) has on creating competitive advantages, as well as the favorable effects of new technologies on productivity (Sellers-Rubio and Mas-Ruiz, 2007), efficiency (Oh, Teo and Sambamurthy, 2012) and the degree of innovation of these companies (Chen and Tsou, 2012).

Technological innovations in retail trade enable recording the behavior of consumers, assessing the level of customer satisfaction and obtaining accurate and updated information

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concerning their needs and expectations. Based on this information, different measures can be designed and introduced to improve the production and management of the retail trade businesses, making the customer shopping experience better, reducing certain managerial problems and predicting market trends.

The study of the stimulating external factors and obstacles to the introduction of technology has occupied much of the empirical research in this field. The diffusion of technology-based innovations in retailing appears conditioned by customer acceptance, technological uncertainty and the cost of investment in new technologies. Nevertheless, more research is needed to improve the understanding about the internal factors that determine the adoption of new technologies in the retail trade industry. In particular, the entrepreneur's influence on new technology adoption merits more attention. The analysis of this factor is the main contribution of this article to the previous literature in this area.

This paper studies the determinants of technology adoption by small and medium-sized enterprises (SMEs) in the Spanish retail trade sector. The theoretical framework differentiates between two types of internal factors conditioning technology adoption in these companies: on the one hand, the personal characteristics of the manager/business owner and, on the other hand, the organizational and management characteristics of the companies. The empirical analysis employs data from a survey of 268 SMEs operating in the Spanish retail trade sector and uses a logistic regression specification as an econometric method.

The paper is organized as follows. The next section reviews the literature and proposes the theoretical framework and the research hypotheses. Section 3 presents the dataset and the methodological approach adopted in this work. Section 4 shows and discusses our empirical results. The paper ends with some final considerations.

1. Literature review and theoretical framework

Due to their low innovation capacity, retail SMEs tend to adopt technological innovations which have been developed and verified in other sectors (Pantano, 2014). This adds value to the service, favors the firm's management and enriches the consumer's experience. For this reason it is usual for incremental innovations to be of special importance in this sector (Oke, 2007). In this context, adopting the criterion "new for the firm" from the Oslo Manual (OECD, 2005) seems to be a reasonable and realistic way of valuing the level of novelty of technological innovation that retailers usually introduce into their business, instead of applying other more demanding criteria.

The broadening of the field of study of innovation to all sectors has made the relevance of marketing and organization innovations in services activities clear (OECD, 2005; Drejer, 2004), as well as its influence on the productivity (Windrum, Reinstaller and Bull, 2009) and the competitiveness (Camisón and Villar-López, 2011) of firms in these economic activities. Organizational innovation refers to introducing new organizational methods in the firm. These can be changes in business practices, in the organization of the workplace or in the firm's external relations with other firms or public institutions (OECD, 2005). On the other hand, marketing innovation involves the implementation in the firm of new marketing methods. These can be significant changes in product design and packaging that do not alter the product's functional characteristics, in product promotion and placement,

and in methods for pricing goods and services (OECD, 2005). These marketing methods include the introducing of new sales channels and the development of new price strategies (Damanpour and Aravind, 2012).

The introduction of new ICT fundamentally improves the services firms' management and organization. Empirical research has demonstrated that new ICT favor innovation and competitiveness in the services activities (Moscardo, 2008), specifically in the retail trade industry (Chen and Tsou, 2012; Pantano and Viassone, 2014; Zhu, et al., 2013). Innovation in retailing is strictly linked to the management of advanced technologies introduced in shops and their capacity to improve the sales process from different points of view – customers, suppliers, distributors, workers, etc. (Pantano, 2014). The new ICT have the capacity to alter the production structures of retail firms, favoring their productivity (Sellers–Rubio and Mas–Ruiz, 2007), their innovation capacity (Chen and Tsou, 2012) and their relation with consumers (Oh, Teo and Sambamurthy, 2012).

The retail trade is an especially dynamic industry in which a great number of SMEs compete in a hostile environment with large corporations for a demand with multiple needs in constant evolution. The retail trade is an especially dynamic industry in which a great number of SMEs compete in a hostile environment with large corporations for an important demand with multiple needs in constant evolution. The tendency toward concentration observed in some cases (Coca, Dobraea and Vasiliu, 2013) is another factor that drives the growing competitiveness which is seen in this sector. The retail business is changing due to growing competition and the increase in consumer expectations (Ryding, 2011). A greater presence of advanced technologies in the sales points improves the consumers' shopping experience (Pantano and Viassone, 2012).

Other works support the introducing of new technology to improve the work carried out by retailers (Zhu, et al., 2013) and satisfy the interest of consumers in new technological systems which facilitate the choice and purchase of items (Chiu, Fang and Tseng, 2010; Oh, Teo and Sambamurthy, 2012). Among them are touch screens and other interactive devices in shops and mobile applications for personalized sales in commercial establishments and through the Internet and social networks. Other technological advances solve specific problems, such as checkout queues, thanks to automatic payments. Pantano and Viassone (2014) classify the new ICT used in the retail trade into three large categories according to their technical characteristics: touch screen displays, mobile applications and hybrid systems.

The first of these categories are technologies applicable to the sales point, such as self-service technologies with interactive contents and services which enrich the shopping experience. "Virtual dressing rooms" or the possibility of exploring the stock of items without the help of an employee are applications which can be classified in this group of technological advances in small businesses. The second category is a wide variety of free applications for consumers' mobile devices. These applications offer remote information about the different products available in the shop, providing knowledge about what is most sold, and personalized practical advice about choosing a product and allowing automatic payment, among other, diverse applications (Bennet and Savani, 2011). The last of these categories includes hybrid technologies, as they are used by consumers inside the retail establishments. These systems provide detailed information of each item through QR codes. It is possible to make purchase recommendations after identifying the buyer's profile (Wong et al., 2012). Other examples are the shopping carts which can interact with consumers through easy-to-use interfaces, give

more information, locate the consumer and propose the best route to reach the elements selected, among other useful applications for the consumer (Pantano and Viassone, 2014). We must add to all this the computer applications which facilitate retailers with more efficient management and planning of their resources and their communication with suppliers, distributors, other firms, public administrations, banks and other agents (Zhu et al., 2013). These are all reasons why it is not unusual for the retail trade to be a more innovative sector than other services (Oke, 2007).

In spite of the potential economic impact of new ICT in retail firms and the great availability of advanced technologies applicable to this sector, in the literature there persists a knowledge gap concerning the determinants and the limitations for adopting new technologies and their economic results in the retail trade (Chen and Tsou, 2012; Pantano, 2014), and in general concerning the innovative activity of firms in this sector (Resende and Guimaraes, 2012). The potential benefits stemming from the use of these new technologies in firm management and the great interest that introducing technological innovations in commercial establishments creates in consumers (Oh, Teo and Sambamurthy, 2012) contrasts with the reality of the low level of dissemination of these new technologies (Pantano, 2014). The reluctance to adopt them among retailers hence frustrates the expectations of consumers and potential sales (Pantano and Viassone, 2014).

A review of the literature referring to the adopting of new technologies in retail firms enables two types of explanatory factors to be distinguished: those which boost the introduction of new technologies and those that put a brake on adopting them. In the first category are aspects related to the customer's readiness to adopt the new technology introduced in these establishments. This study area in general goes more deeply into the consumer's motivation for using the new technology and the degree of satisfaction of the customer's expectations with this type of technological advances – problem solving, time saving, knowing which items are available in the shop, advice and recommendations, customer experiences, orientation in the establishment itself and other useful matters. An important section is the study of customer participation in the decision about adopting new technologies. This is an aspect which is extremely valued by retailers, though customers are not aware of its importance.

Among the booster factors there is also the generation of competitive advantage via adopting new technologies. When the firm decides to make technology a source of competitive advantage it must choose between adopting a pioneering strategy in introducing new technological advances in the sector or a follower strategy - adopting technologies already carried out successfully by their competitors. In both cases, the economic analysis must bear in mind the low technological innovation capacity which retailers tend to have and their tendency to externalize activities related to R&D (Pantano, 2014). Lastly, an important advantage of new technologies is their help in predicting market trends, taking into account that anticipation is a key to success in the retail trade industry. The information of the customer databases which is provided by ICT is a valuable instrument to analyze the potential expectations and needs of customers and take the initiative in the sector.

The second category classifies the factors which brake the adopting of technological innovations. One is the cost of adoption - that is to say, the volume of investment necessary to introduce these novelties and the retailers' propensity to invest in these technological advances. The great variety of technologies and the diversity of activities in the sector

generate a wide range of possibilities, from novel teams and costly applications, oriented toward large businesses to mobile applications whose price is negligible for small businesses. Another is the uncertainty linked to adopting technological novelties in this sector. This uncertainty affects the acceptance of the novelty both by customers – how will it affect their expectations and satisfaction level? – and by employees – their skills and readiness for technological change, as well as the horizon of obsolescence of the new technology incorporated. This will lead retailers to decide between adopting consolidated technologies or substantial novelties. Nevertheless, uncertainty has also been considered by other authors as a driving force of technological adoption in this sector (Chiu, Fang and Tseng, 2010; Oh, Teo and Sambamurthy, 2012).

Other investigations have centered their effort on the analysis of the influence of firms' internal characteristics and environmental factors in adopting technological innovations in the retail trade industry (Pantano and Viassone, 2014). In some cases, the importance of human and organizational resources in the adopting of new technologies in this sector's firms is clear (Brush and Chaganti, 1999). In this work, a different perspective is adopted, integrating into a conceptual framework the manager/business owner's personal characteristics and business characteristics as explanatory factors of adopting technological novelties of SMEs in the retail trade industry (figure no. 1).

The manager/business owner's personal characteristics have a great influence on the innovative activity of SMEs (Marcati, Guido and Peluso, 2008). Their education level influences the assimilation and use of new technology in the firm's activity (Koellinger, 2008; Romero and Martínez-Román, 2012), as well as driving internal learning and generating new ideas and novel applications in organizations (Damanpour, 1991; Galende and De la Fuente, 2003). However, the positive relation between the education level and innovation is not always evident (Keizer, Dijkstra and Halman, 2002). Indeed, introducing incremental technological innovations is easily adopted by manager/business owner with different profiles (Bhaskaran, 2006), while substantial innovations will need the manager/business owner to have a greater training. In this respect, we propose the following hypothesis in this paper:

H1: The higher the level of education of the manager/business owner, the higher the probability of new technology adoption by the SMEs in the retail sector.

Likewise, the manager/business owner's motivation is a relevant factor in order to understand the orientation toward technological change and innovation in SMEs. Thus, aversion toward new technologies, reluctance to learning and hostility in the face of risk are some important factors that hinder the incorporating of technological innovations in small firms (Probst and Büchel, 1995). The literature differentiates between "necessity" and "opportunity" as types of motivation which drive the individual to becoming a manager/business owner (Reynolds et al., 2002). Unemployment, precarious jobs and professional dissatisfaction are situations which favor the emergence of necessity managers/business owners, while identifying a business opportunity in the market moves the subject to become an opportunity manager/business owner. The former tend to orientate their businesses toward mere survival and have a low inclination toward introducing technological innovations in them. On the other hand, opportunity managers/business owners tend to be more persistent in the business, though this appears to be conditioned by their level of education (Block and Sandner, 2009). Therefore, we propose the following hypothesis to be tested:

H2: The SMEs in the retail trade industry whose managers/business owners have opportunity entrepreneurial motivations have higher probabilities of adopting new technologies.

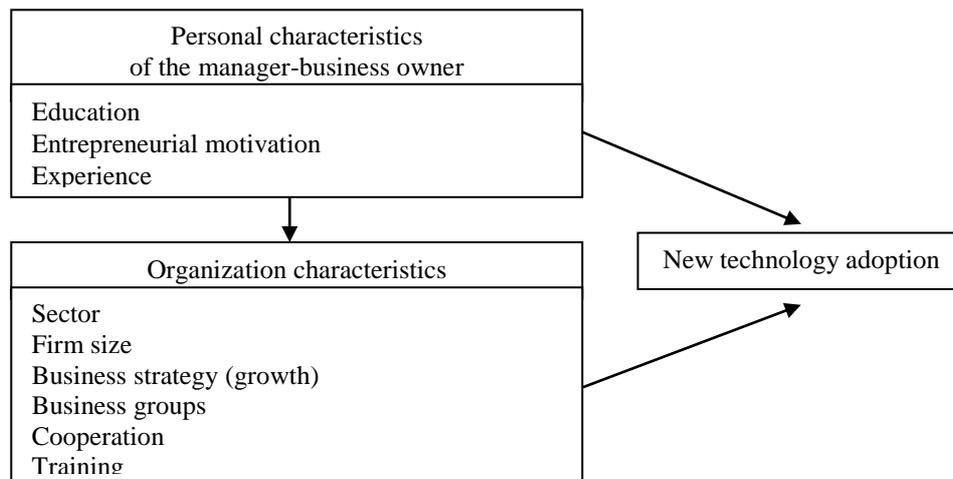


Figure no. 1: Theoretical framework

The manager/business owner's background also conditions the introduction of innovations (Brush and Chaganti, 1999; Romero and Martínez-Román, 2012). In this vein, the manager/business owner's previous experience as a self-employed person has been identified as an influence on incorporating new technologies in SMEs. This base of non-codified and eminently practical knowledge is clearly important in the introduction of incremental technological innovations (Abernathy and Clark, 1985; Malerba and Orsenigo, 1995), mainly in the period of standardizing this technology. Based on these considerations, we propose the following hypothesis:

H3: The greater the manager/business owner's experience in self-employment, the higher the probability of adopting new technologies by the SMEs in the retail trade sector.

On the other hand, the firm's organizational characteristics have demonstrated their influence on the innovative results of services SMEs (Martínez-Román, Gamero and Tamayo, 2011). Thus, the inter-firm relations contribute new resources and capabilities which can facilitate their adopting of new technologies. There is indeed evidence which points to external support being more important than internal knowledge in the process of adopting new technologies in SMEs (Narula, 2004) and in the development of new collaborative experiences in the framework of global economics (Lee, Olson and Trimi, 2012). In this way, establishing a franchise can be an excellent opportunity to learn via experimenting in the retail trade (Sorenson and Sorensen, 2001). This gives small firms a broad know-how, relations and experiences. Furthermore, a franchise facilitates the retailer's competitive advantage, as the necessary resources and capabilities are standardized without losing flexibility in other matters (Pardo-del-Val et al., 2014). The effects of other ways of grouping on adopting novelties in services firms has likewise been analyzed, such as licensed retailers (Pratten, 2007) and authorized dealers (Shirokova, Vega and Kozyreva, 2014). In this sense, research has demonstrated that licenses can favorably

influence the incorporating of organizational improvements and the commercial expansion of retail business firms (Kotabe, 1995). Consequently, we propose the next hypothesis to be tested in the empirical section:

H4: The SMEs in the retail trade industry that are part of business groups (franchisees, licensees, authorized dealers, etc.) have higher probabilities of adopting new technologies.

Firm size appears to be associated with market dominance and the development of a strategy oriented toward growth and technological change (Gundry and Welsch, 2001), as well as representing an entrance barrier in the retail sector (Brush and Chaganti, 1999). The increase of the organizational dimension favors the adopting of more novel and costly technologies, as the sustained growth of sales reduces the investment recuperation period and therefore the new technology's risk of obsolescence. This is why it is easier to introduce new technologies in a sector's growth period (Zahra, 1993). In this sense, we consider the following hypothesis:

H5: The higher the growth prospects of the SMEs in the retail trade sector, the higher the probability of adopting new technologies.

Cooperation also tends to facilitate the introducing of technological innovations in small firms in traditional sectors (Bhaskaran, 2006). These innovations are generally incremental improvements which have been verified in the sector and which can be adopted relatively easily given the experience which other firms in the network have. On the other contrary, the benefits of cooperation are doubtful in the case of radical innovations (De Propris, 2002; Radas and Bozic, 2009). This is because these contacts put at risk the confidentiality necessary to be a pioneer in implementing great novelties. Cooperation with agents of the supply chain has interesting alternatives, such as vertical alliances between retailers and manufacturers. Their successful results in turnover, costs, and time-to-market are clearly seen in this sector (Swoboda, Pop and Dabija, 2010). In this respect, we propose the following hypothesis:

H6: The SMEs in the retail trade sector that have cooperation relationships with other companies have higher probabilities of adopting new technologies.

The literature also highlights the importance of training and staff training in the introducing of technological innovations in organizations (Caloghirou, Kastelli and Tsakanikas, 2004; Yam, et al., 2011). Updating workers' knowledge and skills has been shown to be so important for the capability of innovating (Freel, 2005; Kroll and Schiller, 2010) that the availability of training and learning systems is a basic requirement for services firms which seek a source of competitive advantage in the sector by introducing technological novelties (Martínez-Román, Gamero and Tamayo, 2011). Thus, the last hypothesis to be evaluated in this paper states that:

H7: The SMEs in the retail trade sector that carry out training activities for their workers have higher probabilities of adopting new technologies.

2. Research methodology

Data for this study come from a survey conducted in the last quarter of 2010 among SMEs in Spain. According to the European Commission's standards, SMEs were defined as businesses of up to 250 employees and self-employed people without employees were not

included in the survey. The survey was addressed to a business owner (or co-owner) who also carried out managerial functions within the firm. Ten pilot interviews were done before starting the fieldwork in order to test the questionnaire and detect possible mistakes. A response rate of 20.8% was obtained in the fieldwork. The SMEs participating in the survey were randomly selected using public information from the Official Spanish Company Register and business databases. The final dataset was made up of the 268 observations in the retail industry. The sample is representative of the business population in the retailing sector with an error of $\pm 6.0\%$ at a confidence level of 95%. No bias was detected between respondents and non-respondents.

The questionnaire includes queries about the SMEs' innovative activities and about different possible explanatory variables for them, considering the personal characteristics of the manager/business owner and the characteristics of the firm. The managers/business owners were particularly asked whether in the previous three years they had acquired new technical and electronic equipment (*equipment*), and/or new software (*software*). The answers were coded as binary variables-value 1 was assigned to those SMEs that had adopted new technologies and 0 for the rest of them. These two variables are the dependent variables in our models.

For the estimation of these models, the following explanatory variables are included:

- Control variables:

Firm size and sectorial dummies were included in our models to control for specificities associated with particular types of retail trade and type of firms.

- Retail sale of other household equipment in specialized stores (H_E): Binary variable which takes value 1 for the business operating in the sector code 475 - according to the International Standard Industrial Classification of all economic activities (ISIC rev.4) - and 0 for the rest of businesses.

- Retail sale of cultural and recreation goods in specialized stores (C&R): Binary variable which takes value 1 for the business operating in the sector code 476 (ISIC rev. 4).

- Number of employees (size): firm size, measured by the number of employees, is included in the analysis as a continuous variable.

- Personal characteristics:

- Education (edu): this variable takes the value 1 for the managers/business owners without any studies, 2 for those with primary education, 3 for those with secondary education, 4 for those with higher professional training and 5 for those with a university degree.

- Intrinsic entrepreneurial motivation (int_mot). The managers/business owners interviewed were asked about their level of agreement with the following statement: "I became an entrepreneur to take advantage of a good economic opportunity". The answers were coded using a Likert scale and take values from 1 to 7 -7 meaning full agreement and 1 complete disagreement.

- Experience in self-employment (exp): The managers/business owners interviewed were asked about the number of years of experience as self-employed people (in the current activity or in others).

- Business characteristics:

Four variables were also included in our models as business characteristics that could explain technology adoption in the retail trade industry:

- Business group (group): This binary variable takes value 1 for those businesses in the sample that participate in a business group (as franchisees, licensees, authorized dealers, etc.).

- Growth prospect (grow): This variable indicates the expected employment growth in the company in the following five years to the date of the survey (in percentages).

- Business cooperation (coop): This binary variable takes value 1 for those companies that carried out any type of cooperation –formal or informal- with other businesses (and 0 in the negative case).

- Training activities for workers (train). The managers/business owners were asked whether they regularly carried out training activities in their businesses in order to improve the capabilities of their workers and develop new skills. The answers were coded using a binary variable.

The average manager/business owner in the survey had secondary studies or higher professional training and an experience in self-employment for more than 19 years (table no. 1). The average business in the sample had 5 employees, was not involved in cooperation activities with other companies, but carried out training activities for its workers and expected an increase in employment of about 5% in the following five years.

Since our dependent variables are binary, we adopted a logistic regression model as the econometric specification for the analysis. We estimated separated models for the adoption of new technical and electronic equipment (equipment) and for the adoption of new software (software).

Table no. 1: Descriptive indicators

Variable	Value	Variable	Value
Acquisition of new technical and electr. equipment (1)	72.76	op_mot (2)	4.40
Acquisition of new software (1)	44.03	exper (2)	19.10
H_E (1)	37.69	group (1)	8.58
C&R (1)	10.45	grow (2)	5.05
size (2)	5.06	coop (1)	33.58
educ (2)	3.66	train (1)	61.57

Note: (1) Percentage of affirmative answers. (2) Mean.

3. Results and discussion

The condition indices of the models estimated are below 30 and the variance inflation factors are also low - around 1 - therefore there is not a serious problem of multicollinearity in the analysis.

The results show that, in the case of the acquisition of new technical and electronic equipment, none of the controls are statistically-significant in the model (table no. 2). Regarding the personal characteristics of the manager/business owners, their level of education and the fact of having started up their businesses due to opportunity motivations

have significant positive effects on the probability of introducing new technical and electronic equipment. However, the last variable is only marginally significant in the model. Moreover, those SMEs that are part of business groups and carry out training activities to improve their employees' skills have also higher probabilities associated with technological acquisition.

On the other hand, in the case of acquisition of new software, a differential effect can be observed for the businesses in the retail sale of household equipment. These retail businesses are more active in the introduction of new software than the rest of the retail trade sector -this variable is only marginally-significant in the model though. The three variables capturing the personal characteristics of the manager/business owner -education level, opportunity motivation and experience in self-employment- are also significant in the model and have positive effects on the probability of acquiring new software. However, in the case of the variable capturing their self-employment experience, the positive effect is only marginally-significant in the model. Regarding the business characteristics, training activities are observed to again have a positive effect, along with the cooperation variable. Therefore, those retail trade businesses that cooperate with other companies have higher probabilities of acquiring new software than the rest. The variable related to business groups is not significant in this model.

The most important effects, according to the odds ratio $-Exp(\beta)$ - are those associated with the businesses characteristics compared to the effects of the manager's/business owner's personal characteristics. In the case of the acquisition of new technical and electronic equipment, the participation in a business group is the most important explanatory factor, whereas for the acquisition of new software training activities are the most relevant aspect, though not far from the effect connected to business cooperation.

Overall, the results regarding the personal factors support the positive effect of education and opportunity motivation on technology adoption, in line with H1 and H2. However, no sound evidence is found regarding our hypothesis about the self-employment experience, H3, since only a marginally-significant effect is found regarding the acquisition of new software.

With respect to the firm characteristics, the fact of being part of a group can enable a retail trade business to overcome the financial, organizational and knowledge barriers hampering the introduction of new technical and electronic equipment, in line with H4. The group can facilitate contact with the suppliers, consult about the technical specifications required and collaborate with training activities, if necessary. This seems to be a factor that critically increases the competitiveness of those SMEs that are part of such groups or chains. However, regarding the adoption of new software, the barriers might be less relevant, hence independent SMEs do not apparently suffer a disadvantage compared to the businesses that are part of retail trade groups.

Furthermore, no apparent relationship is observed between the expected employment growth for the company and the technology adoption activities. Therefore, on the one hand, we cannot state that favorable growth prospects stimulate the investment in new technology in retail trade SMEs, as suggested in H5. Nevertheless, on the other hand, our results seem to reject the idea that companies acquire technology to substitute workers. This would have implied observing negative statistically-significant effects in our models.

Table no. 2: Binary logistic regression. Dependent variables: technological innovation in retail trade businesses (innovation=1)

	New technical and electronic equipment				New software			
	β	S. E.	Sig.	Exp(β)	β	S. E.	Sig.	Exp(β)
Control variables								
H_E	-0.504	0.316		0.604	0.505	0.303	*	1.657
C&R	-0.279	0.527		0.756	0.452	0.481		1.571
Size	0.024	0.036		1.024	0.040	0.027		1.040
Personal characteristics								
Educ	0.332	0.135	**	1.393	0.534	0.133	***	1.705
Op_mot	0.113	0.061	*	1.120	0.131	0.058	**	1.140
Exper	-0.008	0.014		0.992	0.022	0.013	*	1.022
Business characteristics								
Group	2.124	1.074	**	8.363	-0.452	0.505		0.636
Grow	0.017	0.014		1.017	-0.007	0.007		0.993
Coop	-0.093	0.329		0.911	0.969	0.297	***	2.635
Train	1.011	0.310	***	2.747	1.224	0.307	***	3.402
Constant	-1.086	0.713		0.338	-4.681	0.819	***	0.009
Goodness of fit								
Chi-squared (Sig.)	40.261 (***)				58.315 (***)			
Nagelkerke R-squared	0.203				0.263			
-2 log-likelihood	272.993				308.218			
Correct predictions (%)	76.4				70.8			

Note: S.E. = Standard Error. * Significant at the 90% level. **Significant at the 95% level. ***Significant at the 99% level. Number of cases = 268. Cutoff value = 0.5

On the contrary, mixed evidence is observed regarding the positive effects of cooperation in technology adoption stated in H6. No evidence is found with respect to the acquisition of new technical equipment, whereas our results support H6 in the case of the acquisition of new software. Our results confirm that training activities play an important role favoring the acquisition of new technology in the retail trade industry, as stated in H7. Those SMEs which are more active and concerned in this respect develop a higher absorption capacity and are more prompt and able to adopt new technologies.

Conclusion

New technologies are transforming the retail trade sector and this trend will continue in the next decades. Consequently, competitiveness in this sector will be increasingly conditioned by the firms' capacity to incorporate technical advances. In this paper we have studied the factors influencing technology adoption by the SMEs in the retail trade industry in Spain. In this respect, we can conclude that both the personal characteristics of the managers/business owners and the SMEs' organizational characteristics affect the companies' willingness and capabilities of technology adoption.

Regarding the personal factors, those managers/business owners with a higher educational background and attracted to business by opportunity motivations are observed to be more active in terms of technology adoption. Furthermore, regarding organizational characteristics, those SMEs in the retail trade industry that are part of business groups exhibit better results in technology adoption. This positive effect is also observed for those SMEs which are involved in training activities for their workers and business cooperation relationships. Contrary to what is stated by other authors (Brush and Chaganti, 1999; Gundry and Welsch, 2001), firm size is not decisive in the process of adopting new technology. Our results also indicate that the technology adoption in retail trade companies is not implemented with the purpose of reducing the number of workers, as is often supposed.

These results have implications from a sectorial policy perspective. Measures oriented to stimulating inter-firm cooperation and improving the employees' technical capabilities can favor technology adoption by the SMEs in the retail trade sector. In this respect, regional and local administrations may catalyze and support technology acquisition or the organization of training courses for employees and managers in a framework of cost sharing among groups of SMEs. This type of initiatives -targeting traditional SMEs in specific commercial areas or branches of trade- could be effective in order to increase productivity and service quality, therefore promoting firm survival and growth. However, more evidence is needed regarding the effective impact of technology adoption on these dimensions of firm performance. This represents a possible extension of the analysis presented in this paper.

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