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External relationships in the organizational innovation

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Abstract

The empiric literature regarding on technological innovation suggests that cooperation has a highly positive effect on the performance of firms' technological innovation, however, very little is known about its impact on the organizational innovation. To fill this gap, the present study aims to analyze the impact of the external relationships with business and science partners about the capacity of firms to introduce organizational innovation. To reach the objective proposed, a quantitative investigation was chosen, based on a sample of 684 firms. Data were obtained through the inquiry CIS 2010 – Community Innovation Survey 2010. There came evident the external relationships established with business partners and with science partners on the performance of organizational innovation of the firms.

This study contributes for the development of the existent theory when analyzing the external relationships of firms and the innovating development on the organizational level, considering that the investigation that has been carried out about innovation has been focused, in general, on the technological innovation.

Keywords: Innovation; Cooperation; External relationships; Organizational innovation; CIS

Introduction

In economies based in knowledge, innovation assumes itself as a key factor of competiveness. Therefore, sources of information and the knowledge as source of supreme innovation (Adams, Bessant, & Phelps, 2006) determine the capacity that a company must possess to adopt necessary innovations, in time to reach competitive advantage in the market.

A growing literature's body that investigates the determinants of innovation, identified the external relationships as a critical factor of success in the introduction of innovations (Gellynck & Vermeire, 2009; Gronum, 2012; Ozman, 2009). For this reason, several studies have investigated the impact of cooperation with different kinds of partners in the firms' innovator performance (Birkinshaw, Hamel, & Mol, 2008; Ganter & Hecker, 2013; Kang & Kang, 2010; Mol & Birkinshaw, 2009; Zhou, 2012) having in consideration, for instance, that the cooperation with business partners allows the access to a base of knowledge different from the established cooperation with science partners.

Considering the typology used by Silva and Leitão (2009) and taking in consideration the data obtained through the inquiry of firms' innovation – CIS.2010, the different kind of partners of innovation, were classified in two groups of partnership: business and science.

Business partners include: clients, suppliers, other firms of the group and competitors. Science partners include universities, other higher education institutions, research public institutions, non-profitable private organizations and consulting firms.

It is notorious that the investigation about innovation has been concentrated, generally, in the technological innovation,

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that is, innovation of product and/or of process (Pippel, 2014). The emphasis in this kind of innovation is the result of an innovation concept of technological nature that has molded scientific investigation (OECD, 1997). Due to the investigation's evolution about innovation has continuous growth and spread in many fields of research including sociology, psychology, business administration and public management (Damanpour & Aravind, 2012), the concept of innovation has also changed throughout the last few years, into a wider perspective, including non-technological innovation, such as organizational and marketing innovation (OECD, 2005).

In these circumstances and considering that the external inter-organizational relationships have been underexplored while determinants of organizational innovation (Tether & Tajar, 2008) it becomes necessary a deeper investigation, which examines the combined effect of cooperation and organizational innovation in the capacity of firms to introduce innovation in the market (Mention, 2011). Indeed, it becomes pertinent a study in this area that evokes and analyses the national business scenery.

In this sequence and following the Oslo Manual (OECD, 2005) this work focuses in organizational innovation and intends to analyze if the external relationships established with the business partners and with science partners, stimulate the business innovation capacity, in what organizational innovations is concerned, being its analysis focused in the study of manufacturing and service firms, located in Portuguese territory, between 2008 and 2010.

In accordance with the foregoing objective as well as with the research eyeliner parameters, it becomes a crucial issue to which is necessary to find an answer: The external relationships with different kind of partners have impact on the performance of organization innovation? Therefore, to reduce the sparse literature about the impact of cooperation in organizational innovation, this study contributes for the development of the theory already existent.

Theoretical framework

Conceptual model proposal

The literature about innovation focuses, in general, in the technological innovation, that is, the innovation of the product (Brettel & Cleven, 2011; Nieto & Santamaría, 2007; Un, Cuervo-Cazurra, & Asakawa, 2010) or of process (Tomlinson, 2010) related to the development of new technologies.

However, the last edition of the Oslo Manual (OECD, 2005), enlarges the concept of innovation, including the non-technological innovation and, specifically in this study, the organizational innovation.

Initial contributions about the innovation in firms addressed administrative innovation (Damanpour & Evan, 1984; Damanpour, Szabat, & Evan, 1989; Damanpour, 1991; Ettlie & Reza, 1992) defined as innovational of organizational structure and on the practices of human resources. More recent studies refer to innovation in management (Birkinshaw et al., 2008; Hamel, 2006; Mol & Birkinshaw, 2009) or organizational innovation (Battisti & Stoneman, 2010; OECD, 2005).

As posited by Damanpour and Aravind (2012) administrative, management and organizational definitions considerably overlap each other.

In this study is used a terminology and definition proposed by OECD (2005, p. 51) which defines organizational innovation as the "introduction of a new organizational method in business practice, in the organization of the workplace or, in the external relations of the company". The characteristics that distinguish organizational innovation from other organizational changes, are based in an organizational method never used before in the company and also in the result of strategic decisions of the company's management.

In the organizational innovation framework it is important to highlight the impact of this kind of innovation in the performance of firms (Camisón & Villar-López, 2014; Sapprasert & Clausen, 2012). For instance, between the small and medium innovative Italian enterprises, the organizational change is one determinant innovative strategy for its growth (Morone & Testa, 2008). Also for Masso and Vahter (2012) organizational innovation is very important in the productivity improvements in the services sector of intensive knowledge.

In this regard, organizational innovation is many times intended to reduce the administrative transaction costs, as well as to improve the satisfaction in the work place.

In summary, the reduction on the acquisitions costs and the access to non-transactional assets, such as the external knowledge is the goal of the organizational innovation (OECD, 2005).

Literature about innovation includes the change of the concept of innovation, from a technological approach to a wider perspective, which includes the non-technological innovation and specifically the organizational innovation. This change demands a detailed analysis of the firms' external factors, namely the relationships with different kind of partners.

According to the approach of inter-organizational innovation relationships (Armbruster, Bikfalvi, Kinkel, & Lay, 2008), it is considered that the external relationships with different partners affect, in an interaction way, the organizational innovation.

For example, for Birkinshaw et al. (2008) the adoption of organizational innovation results from the interaction of organizations, Tether and Tajar (2008) identify the organizational innovation of cooperation as prominent in the non-technological innovation, as well as for Mol and Birkinshaw (2009) the access to external knowledge sources affect positively the organizational innovation and Meuer (2014) outlines the important role of the inter-company relations in the organizational innovation.

In this sense and according with the recommended by the theory about the technological innovation, cooperation has a positive effect in the performance of this kind of innovation in firms (Un et al., 2010). Even though there are differences between technological innovation and non-technological innovation, particularly in the organizational innovation it can be assumed that the majority of the relevant arguments for the technological innovation, namely for the innovation of process (Ganter & Hecker, 2013), can also be applied in the organizational innovation (Mol & Birkinshaw, 2014). For instance, it seems plausible that the access to external knowledge, as well as the option of sharing costs and risks of an innovation process

or yet, the access to external skilled labor, are arguments which also seem relevant to the organizational innovation.

In this sequence, and having in attention that the necessary knowledge to organizational innovation is complex, tacit, normally it is not patentable (Ganter & Hecker, 2013), it is idiosyncratic to the context and system where it is raised and, it is difficult to be transmitted (Birkinshaw & Mol, 2006; Wolfe, 1994), it is crucial that the company obtains it from previous adopters and integrates it in the whole organization (Damanpour & Aravind, 2012).

In these terms and taking in consideration that the external partners share the management knowledge that motivates the adoption of the firms' organizational innovation (Birkinshaw et al., 2008), specifically suppliers and clients, form a common and cooperation group of partners.

One of the motives mostly referred in the literature to collaborate with suppliers, is the access to knowledge (Romijn & Albaladejo, 2002). Sharing knowledge between the company and its suppliers supports the process of interaction between both partners (Barratt, 2004), that is, on one hand firms need to understand the requirements of its suppliers and, on the other hand, the suppliers must understand the needs of the firms they supply. This kind of partners is particularly significant in the innovation process (de Faria, Lima, & Santos, 2010; Freel & Harrison, 2006).

In turn, clients as a major force in the organizational innovation (Tether & Tajar, 2008), since the needs and wishes of clients may give valuable information (Tether, 2002), which encourages firms to adopt new practices (Guler, Guillen, & Macpherson, 2002).

In this sequence, cooperation with clients is particularly valuable in the context of new technologies and/or complex products (Bogers, Afuah, & Bastian, 2010; Lilien, Morrison, Searls, Sonnack, & Hippel, 2002; Tether, 2002) as it implicates the development of organizational innovations, especially intended to intensify the vertical and lateral communication, that is, promotes the exchange of knowledge between the company and its clients, and also between its workers, with the purpose to spread the ideas brought by those external agents and apply them on the development of other kind of innovation (Foss, Laursen, & Pedersen, 2011).

Knowledge from competitors is valuable for firms, since rivals have similar needs in the innovation process (Lhuillery & Pfister, 2009), whereby, cooperation with this kind of partners offers the opportunity to explore and establish the organizational structures of success of rivals (Pippel, 2014).

Cooperate with competitors can be dangerous due to the possibility of anticompetitive behaviors, however, it is possible when all face common problems, especially when these problems are out of the field of competition, for example the creation of regulation of a sector (Tether, 2002).

In summary, business partners such as clients, suppliers and competitors supply operational knowledge which is essential to improve the management processes (Al-Laham, Amburgey, & Baden-Fuller, 2010; Su, Tsang, & Peng, 2009), offer new ideas, examples of production and management processes (Brito, Brito, & Hashiba, 2014). That is, this kind of partners have the information about practices and technological processes, and firms copy them through the implementation of management practices that they have adopted and become a group of reference (Mol & Birkinshaw, 2009).

Based on the considerations presented, it is indicated the following hypothesis:

Hypothesis 1. The relationships with business partners influence the propensity of firms to innovate in the organizational level.

Also private investigation institutions (consulting, laboratories or private institutions of Research and Development (R&D)) and public (public laboratories or other public organizations with R&D activities) represent alternative partners in cooperation, while source of information and knowledge for innovation (Tether, 2002), besides, the cooperation is an opportunity to share the costs and risks related to the innovation projects (Hagedoorn, 2002). For instance, laboratory and scientific personnel can be shared between the institution of investigation and the company.

Contrary to the cooperation with other external agents, cooperation with public organizations does not represent commercial risk, since it aims the creation of knowledge (Cassiman & Veugelers, 2002; Miotti & Sachwald, 2003). This kind of cooperation allows also the access to key personnel, namely teachers, investigators, students, necessary to the efficient development of the innovation activities (Azagra-Caro, Archontakis, Gutiérrez-Gracia, & Fernández-de-Lucio, 2006; Link & Scott, 2005).

Other partners of cooperation of this study, frequently described as growing motors, are universities (Laursen & Salter, 2004), since they can provide top knowledge for the firms and, in particular, the radical organizational innovation demands this kind of knowledge (Pippel, 2014). Therefore, firms cooperate with universities and public institutions of R&D to access scientific knowledge, technical teams or, new technological options (Frenz & Ietto-Gillies, 2009; Hagedoorn, 1996), to develop new skills or to reduce costs in its organizational structure or in its technical personnel (Borrell, 2005).

It is important to mention that, despite the pressure of integration of investigations and teaching activities of universities in the business field, generally, these are not orientated to the firms' needs (Drejer & Jørgensen, 2005) nor their investigators are subjected to restrictions of business terms (Pavitt, 2003).

Highlighted also, is the multidisciplinary perspective of universities that leads to a wide variety of ideas and possible innovations (Henard & McFadyen, 2006) in the innovation of product as well as in the firms' process (Pippel & Seefeld, 2015). Regarding organizational innovation, Kim and Lui (2015) show that knowledge transmitted by business and science partners is relevant to innovation.

Thus, it is important to know if the external relationships established with these partners influence firms to innovate in the organizational level, indicating then the following hypothesis:

Hypothesis 2. The relationships with science partners influence the propensity of firms to innovate in the organizational level.

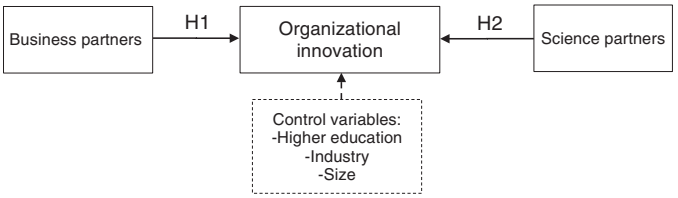

Fig. 1. External relationships in organizational innovation.
Source: Own.

The hypothesis have subjacent the relation highlighted in the conceptual model (Fig. 1) and will be object of empiric validation, being considered that, to such, the data obtained by CIS 2010 – The Community Innovation Survey 2010.

Methodology

Population, sample and data

The data used in this research are secondary data, collected through a survey based that consisted of a questionnaire named Community Innovation Survey 2010 – CIS 2010. In Portugal, the survey was conducted by GPEARI/MCTES – Gabinete de Planeamento, Estratégia, Avaliação e Relações Internacionais/Ministério da Ciência, Tecnologia e Ensino Superior (Office of Planning, Strategy, Evaluations and International Relations/Ministry of Science, Technology and Higher Education), in collaboration with INE – Instituto Nacional de Estatística (National Institute of Statistics), according to EUROSTAT'S methodological specifications (Eurostat, 2011) and based on the conceptual principles presented in the Oslo Manual (OECD, 2005).

The period of collection of data took place from July 2011 and April 2012, however the period of reference to which they refer to 2008 and 2010.

CIS 2010 supplies a set of general information about firms (industry, business group, volume of business, geographical markets); information about innovation (of product, process, marketing and organizational); the factors that difficult the activities of innovation; as well as the objectives of innovation. This inquiry also provides data about the identification of the kind of partners which the firms cooperate with and its localization.

The target population in which the analysis focuses in, includes firms based in Portuguese territory with at least 10 people working for the manufacturing and service sectors concerning the Standard Industrial Classification (SIC) codes 05 to 86, (SIC Rev.3, 2007). The synthesis about the methodological aspects described, can be seen in Table 1.

The investigation focused in the external relationships undertaken by firms in what concerns organizational innovation, there are considered 684 firms which cooperated in the period between 2008 and 2010. It is viewed that 78.7% of the firms innovated at the organizational level, while 21.3% of the firms have not accomplished any kind of organizational innovation. Observing the percentage values of innovating firms at the organizational level by sector, it is observed that the manufacturing and service sectors fill 42.4% and 57.6% respectively, of innovating firms. In what dimension is concerned (number of employees) innovating firms at the organizational level, 43.4% employ between 10 to 49 people; 29.7% have from 50 to 249 employees and 26.6% with 250 or more employees.

Table 1
Methodological aspects of empirical research.

Analysis unit	Firms
Population	Codes 05 until 86 – SIC – Standard Industrial Classification
Geographical area	Portugal
Data collection	Secondary data CIS 2010 – Community Innovation Survey 2010
Date of data collection	July 2011 to April 2012
Survey	The survey was conducted by GPEARI – Gabinete de Planeamento, Estratégia, Avaliação e Relações Internacionais/Ministério da Ciência, (Office of Planning, Strategy, Evaluations and International Relations/Ministry of Science, Technology and Higher Education), in collaboration with INE – Instituto Nacional de Estatística (National Institute of Statistics) according to the methodological specifications of EUROSTAT.
Analysis period	2008–2010
Stratification sample	Size (number of employees) Industry SIC codes-Rev.3-2007 NUTS II
Sample/response rate	684 Firms
Software statistic	IBM SPSS Statistics (version 22)
Data analysis	Exploratory data analysis Data modeling and statistical inferences

Source: Own.

With regard to the relationships established with external partners, it is registered that the major are the suppliers (63.4%), followed by clients (57.8%), private institutions of R&D and universities (46.7%), public institutions of R&D (29%) and at last the competitors (25.7%).

Variables

Dependent variable – organizational innovation

In this study the dependent variable used is the organizational innovation that corresponds to the "introduction of a new organizational method in business practices (including management of knowledge), in the organization of the working place or in the firms' external relations" (CIS 2010:13), during a three-year period (2008–2010).

Independent variables – business and science partners

The set of data used concerning the period between 2008 and 2010, contains information about the cooperation with sis partners: (i) equipment suppliers, materials, components or software; (ii) clients or consumers; (iii) competitors or other firms in the same industry; (iv) consultants, laboratories or private institutions of R&D; (v) universities or other high education institutions; and (vi) state laboratories or other public institutions with R&D activity. These data were submitted to statistic treatment of factorial analysis, with the purpose to identify possible associations between the observational variables, to be able

Table 2
Retained factors.

Item	Factor		Commonality
	Science partners	Business partners	
Suppliers		0.595	0.359
Clients		0.742	0.551
Competitors		0.708	0.536
Consultancy or private institutions of R&D	0.710		0.558
Universities	0.804		0.654
State laboratories with R&D activities	0.789		0.652
Eigenvalue	2.090	1.220	
Variance explained	34.8%	20.3%	

Source: Own.

to define the existence of a latent common factor, not directly observable in between them.

Depending on the measuring scale of variables considered (nominal dictomous) there were used tetrathoric correlations as measure of association of the variables considered in this analysis.

The extraction of factor(s) from the initial variables was carried out through the major components method. To evaluate the validity of the factorial analysis it was used the criteria of Kaiser–Meyer–Olkin (KMO), observing KMO = 0.688, sphericity test Bartlett = 486.433, p-value = 0.000.

It is shown in Table 2, the relational structure of the six cooperation partners analyzed in this study is explained by two latent factors: "Science partners" and "Business partners" (Silva & Leitão, 2009).

The Table 2 show the factor weights of each item of 2 factors retained, and eigenvalues and percentage of variance explained following a factorial analysis with extraction factors by the method of principal components, followed by a Varimax rotation.

The first factor shows high factorial weights in private and public institutions of R&D, as well as universities, and explains 34.8% of the total variable. The second factor with high weights in suppliers, clients and competitors explains 20.3% of the total variable (globally the two factors explain 55.2% of the total variable).

Control variables

There were chosen to be used on the control variables "higher education", "industry" and "size" of the company.

The firms' human capital is very important, since the capacity of a company to absorb external knowledge is deeply related to its human capital (Cohen & Levinthal, 1990). A great proportion of skilled workers increases the ability of a company to absorb and explore the external knowledge to the organizational innovation. The main purpose of the categorical variable "higher education" is to capture the company's human capital depending on the percentage of people at service with or without higher education, in 2010: "0" without higher education and "1" with higher education.

Based on the explored literature organizational innovation makes sense both in manufacturing and in services (Flikkema, Jansen, & Van Der Sluis, 2007), being therefore appropriate to analyze the industry present in this study, particularly at the organizational level. It was chosen to be used the control variable "industry". In this investigation, the base of analysis of the industry follows the SIC codes 05 to 86, (SIC Rev.3, 2007): "0" Manufacturing includes SIC codes 05 to 39 and "1" Services from SIC codes 46 to 86.

Lastly the company's dimension is used in the majority of studies about innovation which can be closely related to innovation (Arvanitis, 2008) or, on the other hand, the results can be ambiguous (Koch & Strotmann, 2008). On organizational level, the results of the studies of Gallego, Rubalcaba, and Hipp (2012) and Tether and Tajar (2008) show that innovation is particularly relevant for small firms.

To measure the category "size" and taking as reference the classification proposed in the Commission's recommendation 2003/361/CE there were created three variables: "2" small enterprise: 10–49 employees; "3" medium enterprise: 50–249 employees and "4" big company with 250 or more employees. Table 3 shows the frequency and valid percentage of the variable samples.

Logistic model for organizational innovation

Since the objective is to study the impact of external relations on the ability of Portuguese companies in the introduction of organizational innovation, logistic regression presents itself as an appropriate analytical technique to analyze whether external relationships established with business partners and science partners (categorical independent variables) influence organizational innovation (dichotomous nominal dependent variable) in companies.

Subsequently, we present below the equation of logistic regression model of this study:

$$Logit(IO) = \beta_0 + \beta_1 P_1 + \beta_2 P_2 + \beta_{21} FS + \beta_{31} SA + \beta_{41} DIM_1 + \beta_{42} DIM_2 + \beta_{43} DIM_3 + \varepsilon_i$$

where IO is Organizational Innovation, ε_i residuals, β_i regression coefficients, P_i business and science partners, FS higher education, SA industry, and DIM_i size.

Logistic regression analysis revealed as the analytical technique suitable for the proposed conceptual model, since it includes a categorical dependent variable (binary or dummy),

Table 3
Descriptive information of the variables.

Variables	Description	Frequency	%
Organizational innovation	Not innovate	146	21.3
	Innovate	538	78.7
Suppliers	The firm does not perceive as a cooperation partner	277	40.5
	The firm perceives as a cooperation partner	407	59.5
Clients	The firm does not perceive as a cooperation partner	317	46.3
	The firm perceives as a cooperation partner	367	53.7
Competitors	The firm does not perceive as a cooperation partner	515	75.3
	The firm perceives as a cooperation partner	169	24.7
Consultancy or private institutions of R&D	The firm does not perceive as a cooperation partner	388	56.7
	The firm perceives as a cooperation partner	296	43.3
Universities	The firm does not perceive as a cooperation partner	374	54.7
	The firm perceives as a cooperation partner	310	45.3
State laboratories with R&D activities	The firm does not perceive as a cooperation partner	504	73.7
	The firm perceives as a cooperation partner	180	26.3
Higher education	No	21	3.1
	Yes	663	96.9
SIC codes	Manufacturing	326	47.7
	Services	358	52.3
Size	(10–49) persons employed	305	44.6
	(49–249) persons employed	203	29.7
	≥250 persons employed	176	25.7

Source: Own.
$n = 684$.

and categorical independent variables (Hair, Black, Babin, & Anderson, 2010) or predictors, also known as covariates, which can be metric or nonmetric (Marôco, 2014).

Analysis and discussion of results

Organizational innovation model

From the research hypothesis to be tested declared in "Conceptual model proposal" section, we built a logistic regression model for organizational innovation, using data collected by the CIS in 2010, having obtained the model that is presented in the Table 4 as Model A.

Looking at the quality of Model A fit, the Nagelkerke's pseudo-R^2 value shows that the model explains 13.1% of the dependent 's variable behavior. The chi-square test statistic has a value of 60.650 with $p < 0.001$. The statistic −2 log-likelihood, with a value of 648.647 supports the global significance of the model when compared to the null model. Still in the analysis of Table 4 and having used Wald's test, it shows in Model A that the variables "Business Partner", "Science Partner", "Higher education" and "Industry" are statistically significant, whereas the variable "Size" is not.

The analysis of the matrix of bivariate correlations shows low correlation (<0.40) between the independent variables, which indicates the absence of multicolinearity problems, since the correlations are less than 0.90 (Marôco, 2014).

Given that we proceeded to the exclusion of the variable "Size" and to analyze the possible changes to the significance of the other variables and, on the other hand, there is also whether there are changes to be registered in the global adjustment quality of the model. Thus, it elaborated a new model (Model B), excluding for this purpose the said variable. Regarding the fit of Model B, we can see that Nagelkerke's pseudo-R^2 and the proportion of correctly predicted cases do not change over the previous model. Model B has a lower chi-squared test statistic (59.780), with an associated mean value test. There is however an increase of the -2 log-likelihood statistic, without however affect the overall significance of the model. We should stress that all estimates of the regression parameters of the independent variables included in Model B are statistically significant.

We opted then for the removal of 46 cases, because of high values of standardized residuals, which led to an improvement in the adjusted model (Model C).

Regarding the quality of the Model C fit, the Nagelkerke pseudo-R^2 reveals that the independent variables included in the model explain 35.8% of the dependent variable behavior. It has a higher chi-square test statistic (148.696). The statistic −2 log-likelihood (405.374) supports the overall significance of the model compared to the null model. In the final model finds an improvement of predictive capacity (85.4%) of this model when compared with models A and B. The area of the Receiver Operating Characteristic (ROC) curve ($c = 0.851$), indicates that the adjusted model has a good and statistically significant discriminant capacity, so that it can carry out the analysis of estimates of the final model, as well as the test of associated hypotheses.

In Model C, the explanatory variables Business Partner and Science Partner are positive and significant. This indicates that

Table 4
Logistic regression of the external relations model for organizational innovation (*logit*).

	Model A	Model B	Model C		
	Estimation of B	Estimation of B	Estimation of B (SE)	Wald	Exp (B)
Business partner	0.510***	0.489***	1.072 (0.168)***	40.506	2.922
Science partner	0.325**	0.332**	0.533 (0.148)***	13.025	1.703
Higher education	1.180**	1.258**	2.449 (0.612)***	15.992	11.581
Industry	0.959***	0.980***	2.591 (0.359)***	51.980	13.340
Size					
10–49					
50–249	0.185				
≥250	0.203				
Constant	−0.273	−0.257	−1.054 (0.566)*	3.474	0.348
Nagelkerke's Pseudo-R squared	0.131	0.130	0.358		
Correctly predicted (%)	79.1%	79.1%	85.4%		
Chi-square	60.650***	59.780***	148.696***		
−2 Log likelihood	648.647	649.517	405.374		
ROC curve area (p)	0.702***	0.703***	0.851***		
n	684	684	638		

Source: Own.
Notes: Method *Enter*; SE within parenthesis.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.001$.

cooperation with business and science partners have a positive and significant effect on organizational innovation, as indicated by the point estimates of the parameters (1.072) and (0.533) respectively. Also analyzing the marginal effects associated with these variables, it follows also that cooperation with such partners endows the advantages of companies in organizational innovation. As such, it can be said that companies that establish cooperative relationships with Business Partners and Science Partners have a superior advantage to other companies (2.922) and (1.703) respectively, to innovate the organizational level. Thus, they support the hypotheses H1 and H2, confirming the results of another test with the UK Data (Laursen & Salter, 2004), that show the use of business and science partners (competitors, suppliers and customers, private research institutes and universities) and external sources of knowledge in their innovation activities.

Comparing these results with the literature on technological innovations, (Brettel & Cleven, 2011; Nieto & Santamaría, 2007) it was also found a positive and significant impact of cooperation with business partners in developing new products, which suggests interaction and communication along the supply chain.

The result of the cooperation with science partners have a positive impact on organizational innovation differs from work on technological innovations, (Brettel & Cleven, 2011; de Faria et al., 2010) wherein no significant contribution cooperation with such partners. This difference may stem from companies that innovate in product/process having internally qualified human resources to organize and manage their activities; no need to establish relationships with these outside partners.

At the organizational level, Mol and Birkinshaw (2009) with data from the Community survey of UK Innovation 2001, found that business partners are important insofar as providing important sources of new ideas that can influence the introduction of organizational innovation. On the other hand, Ganter and Hecker (2013) tested the model of Mol and Birkinshaw (2009) with data from the German Community Innovation Survey 2005, and concluded that this type of partner is not significant in the adoption of organizational innovation. Recently, Kim and Lui (2015) comparing the external cooperation partners show that business partners are relevant to organizational innovation, however, its influence is not significantly larger than the science partners. Discrepancies in previous empirical results at the organizational level have roots in heterogeneous factors such as the time lag of the studies, as well as countries with different national innovation systems, or also the competitive environment in which companies operate.

Table 5
Summary of results of the hypotheses of innovation model.

Variable	Hypothesis	Result
Business partner	H1	Supported
Science partner	H2	Supported

Source: Own.

To summarize the results of the empirical study relating to the organization innovation model Table 5 presents the results of each hypothesis and the respective variable analysis.

Conclusions, limitations and suggestions for future research

In recent years, the concept of innovation has changed from a technological approach to a broader perspective, including organizational innovation. Given that little has been researched into cooperation as a determinant of this type of innovation, this paper

investigates the impact of external relationships established with business partners and science partners in the performance of organizational innovation companies, contributing to the development of the existing theory.

Given this context, the first part of the statistical analysis carried out in this investigation was intended to empirically identify the determinants that somehow control the variables of cooperation: (i) suppliers; (ii) clients; (iii) competitors; (iv) consultants, private institutions of R&D; (v) universities; and (vi) state laboratories with R&D activities. Following the analysis developed two factors: "Business Partner" and "Science Partners" identifying structural relationships between variables. The second part of the statistical analysis was designed to empirically identify the cooperating partners that impact on organizational innovation of the companies during the period under study (2008–2010), using for this purpose the logistic regression model, given the characteristic of the dependent variable (organizational innovation).

Results lead us to conclude that external relationships with business partners have a positive impact on performance of organizational innovation, in particular through new organizational practices such as vertical and lateral communication, rewards to employees for the acquisition and sharing of knowledge, interaction and communication that allow introduce organizational innovations along the supply chain.

Cooperation with science partners also have a positive impact on organizational innovation. External relationships established with these partners can be especially important for companies that do not have internally qualified staff in sufficient numbers and can provide access to relevant knowledge, which will enable companies in the introduction of organizational innovations. In this sense, the objective of collaboration with science partners may be the opportunity to get technical training for staff of companies.

Besides the scientific staff also spending laboratories can be shared between research institutions and companies.

However, it should be noted that the gap between research universities and the needs of companies can reduce the usefulness of cooperation between the partners.

In short, cooperation with science partners not only contribute to the development of technological innovations, but also provides access to technical information to improve the organization of work and skills of company staff. This exchange may induce companies to introduce new methods of organization of responsibilities and decision-making, for example, use of new accountability systems for employees, team work, decentralization, integration or disintegration services, training systems, among others.

The fundamental idea arising from this study is that cooperation, regardless of the type of partner, is an important strategy for companies to develop innovations at the organizational level. In particular, when companies intend to carry out structural or organizational changes, it is recommended to collaborate in an integrated fashion with partners. In addition, propose innovations at the organizational level requires the external partner knows the structure of companies in depth, as well as their ways of organizing, for that, in these cases, the further integration of partners in business activities is needed.

This study contributes to the development of existing theory to analyze the external relationships of companies and breakthrough performance at the organizational level, we answer that the research that has been built on innovation has focused, in general, technological innovation.

A first limitation and without doubt the most important result of the lack of 2010 CIS data for some companies, which therefore were not included in the sample, which somehow conditioned the results obtained, in particular with regard to the variable firm size, there was the existence of 1.081 invalid responses, relating to companies, in the database, indicated more than one dimensional level simultaneously. Still on the database, the use of secondary data implied that the study was prepared in survey function CIS 2010.

Another delimitation of this study relates to the fact of not having carried out a qualitative study, particularly through case studies, in order to be able to further deepening of knowledge about the phenomenon of organizational innovation, as well as contact with other factors that could to be included in the analysis model.

It is suggested, for future research, the study of external relationships established with business and science partners in organizational innovation in detail by manufacturing and service sectors, not only to directly understand the intrinsic dynamics of these industry groups, but also to clarify neglected aspects innovation.

Conflicts of interest

The authors declare no conflicts of interest.

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