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Research Paper

Innovation Strategies in Economic Crisis Context: The Case of the Cork Industry in Portugal

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ABSTRACT

Purpose: This article aims to analyse the innovation strategies adopted by the Portuguese cork industry in the 2009-2016 crisis period.

Methodology: In particular, it was analysed a sample of 32 companies and studied the relationships between their characteristics and the types of innovation introduced using a quantitative methodology through surveys.

Findings: The results show that 28% of the sample companies adopted offensive type strategies and 25% traditional type strategies. Regarding the access mode to technology, 34% of the sample companies acquired turnkey technology and 31.3% established partnerships with other entities. With regard to the types of innovation, 75% used process innovations and 43.8% product innovations. It was also found that R&D development is associated with the number of new products, and that the number of full-time R&D employees is associated with the number of new products and patents registered. Also the number of part-time R&D staff is associated with patent registration. It was also shown that the size of the company affects the number of new products and patent registration.

Research limitations: The low percentage of responses, given by the surveyed companies, results in a limitation in the application of statistical tests.

Pratical implications: Based on the findings, the study recommends among others that small and medium enterprises (SMEs) management should endeavor to carry out a robust recruitment and selection process to ensure that they recruit talents that are valuable, uncommon, inimitable, and not substitutable. However, they should also, ensure to implement employee engagement strategies so as to retain the selected talents in the firm.

Originality/Value: This article has highlighted the tendency of companies in the cork industry to increase R&D activities and to establish partnerships for innovation, in the 2009-2016 period.

Keywords: Innovation; Innovation Strategies; Cork Industry; Portugal.

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1. Introduction

Innovation has been regarded as the engine of economic development (Schumpeter, 1934) capable of making widespread advances by its characteristic of creative destruction (Schumpeter, 1942), once this destruction is featured by the process of change and renewed outbreaks of new technological advances in the economy. According to Druker (1985), innovation is the ability to transform something that already exists into a resource that can generate wealth. The same author argues that some of the innovations come from genius traits, yet, most innovations, especially the most successful ones, result from a conscious and intentional search for innovation opportunities. Innovation has a significant influence on the competitive potential of organizations (Dobni, 2010; Bayraktar, Hancerliogullari, Cetinguc & Calisir, 2017). In this sense, Bowonder, Dambal, Kumar and Shirodkar (2010) states that innovation strategies are used to explain innovation choices and from them one can develop new products and experiences that stimulate the customer, enabling to reach a better position in the market.

There was a strong growth in the cork industry in Portugal in recent years, making a positive contribution to the improvement of the Portuguese economy (APCOR, 2013). The innovation strategies adopted and the strong investment in R&D (research and development) have ensured the leading position as a producer of cork stoppers and at the same time to present truly innovative and differentiating products in the areas of decoration, furniture, fashion, transports, building, among others (APCOR, 2015; 2016).

This study aims to contribute to a better knowledge about the Portuguese cork industry, focusing on the innovation strategies adopted by the cork companies in the period 2009-2016. More specifically, it attempts to know what are the characteristics of cork industry companies that influence the type of innovation and its performance? The study aims to fill a gap in the literature, as existing studies focus on concrete case studies on high renowned companies, such as Amorim & Irmãos S.A. (Pereira, 2016) and not on the sector as a whole.

The article is structured as follows. After the introduction, it begins with a literature review related to the concepts used and a review of previous studies aimed at deducing research questions and hypotheses. Section 3 explains the methodology used. The results and their discussion are detailed in section 4. Finally, section 5 presents the conclusions and the study contributions.

2. Theoretical fundaments

2.1. Innovation and innovation strategies

Although the concept of innovation has been widely studied, there is not a single definition, but a multiplicity of concepts from different perspectives. This can be a new source of raw materials, a new form of organization, a new product, a new process or a new market (Schumpeter, 1942). It may also be the ability to transform an existing resource into a resource that can generate wealth (Druker, 1985), or a continuous improvement, introduced radically or incrementally into the organizational practices over time (Tidd, Bessant and Pavitt, 2009). The concept of innovation includes not only the creative activities of invention or the discovery of new technologies, but also the activities of management, diffusion and adoption of new features. This idea is reflected in the Oslo Manual (OECD, 2005), which defines innovation as constituting a new or significantly improved new product (good or service), or a process, or a new marketing method, or a

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new organizational method in business practices, in the workplace organization, or in external relations. Other perspective has been made by Christensen (2003) when he makes the distinction between sustainable and disruptive innovations depending on the degree of change, namely regarding risk and patterns of clients behaviour and thinking."

Moreover, the notion of strategy is not unanimous. It can mean policies, techniques, goals and programs. It can be defined as the goals combination that a company pursues and the means to achieve them (Porter, 1980), or as a guarantee of coherence and direction to the actions and decisions of organizations, through the identification of their goals, the perception and understanding of their competitive environment, the effective implementation and evaluation of both in use and in needed resources (Grant 2016).

Regarding the innovation strategy, the choice should be linked to the technical and scientific functions and capabilities of each organization, such as basic research, applied research, experimental development, project engineering, quality control, production, patents, technical services, technical and scientific information, education and training, and production planning (Linstone and Devezas, 2012; Boh, Evaristo and Ouderkirk, 2014). It is also important to integrate the type of innovation the company intends to carry out, the type of R&D (fundamental, applied or experimental development), and the existence or non-existence of partnerships (universities, R&D labs, suppliers, competitors, among others (Forsman, 2009). Freeman and Soete (2008) classify innovation strategies according to the organization's behaviours: offensive, when the goal is to achieve technical and market leadership; defensive when they do not want to be the first to introduce products nor to be left behind by the profusion of technological change; imitative when they choose to be behind the leaders in terms of established technologies; dependent when they play an essentially satellite or subordinate role towards others, more strongly established companies; traditional when companies see no reason to change their product; opportunistic when related to the identification of any new opportunity or niche in the marketplace.

More recently, Marques (2018) has expanded the knowledge concerning the mechanisms and ways for companies accessing technology and innovating and has proposed an integrated approach with three dimensions of analysis, which are: why innovate (Freeman and Soete, 2008), who innovates (Arnold and Thuriaux, 1997), and how to innovate (Tidd et al., 2009). Companies should, therefore, look for the mechanism/mode of innovation best suited to their resources, competences and needs.

2.2. Empirical studies and research questions

Scientific and empirical studies focused on the cork sector are scarce, therefore, it was used contributions from some authors in different sectors. These studies focused attention on the strategies adopted by Freeman and Soete (2008). They also focus upon the study of the types of innovations chosen, on the access mode to technology, the way in which the types of innovations influence the companies performance in terms of innovation, production, marketing and financial performance, and how innovation types depend on the type of R&D (Gonzaga and Ribeiro, 2015; Silva, Vasconcelos, Oliveira and Spers, 2017; Fernandes, 2016; Hassan, Shaukat, Nawaz and Naz, 2013; and Todtling, Lehner and Kaufmann, 2009).

Gonzaga and Ribeiro (2015) in a case study of the Brazilian automotive industry called Strategic Management Innovation in the Automotive Industry, described how strategic innovation management has been applied in the Brazilian automotive industry, focusing

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on a company that operates in the material engineering, engines and transmissions sectors. It was found that the sector adopted an offensive strategy, focusing on product, process and marketing innovations, using R&D development internally, and partnerships with suppliers. Thus, it is suggested to make a transition of some analyses carried out in this study, to the Portuguese cork industry, in terms of innovation strategies and access to technology. The first two research questions are then suggested:

1. What type of strategy did the cork industry adopt during the economic downturn, taking into account Freeman and Soete's innovation strategies (offensive, defensive, imitation, traditional, dependent, opportunistic)?
2. What access mode to technology and innovation did the cork industry adopt during the economic downturn (R&D alone, R&D in partnership, licensing or technology purchase)?

Silva et al. (2017) analysed the critical aspects of innovation management in terms of structure, strategy and innovation processes at Natura and Oxiteno. They identified that technological knowledge in these two companies can occur from the outside in and from the inside out. In Oxiteno case, the ideas are analysed by the verticalization of raw material needed by the petrochemical industry (inside out). In the outside in case, ideas are developed through funded programs, which may be at government level, through R&D agency developments, or by client requests. It was found that Oxiteno has been committed to high performance solvents through the development of new products, through partnerships with other companies in the same market, by establishing inter-linkages with other agencies that promote research and innovation and also by internalizing innovations developed by its suppliers. As for Natura, it does not have an R&D department, but it has several areas involved in the innovation process. Several departments are responsible for different types of innovation, focusing on product development on an open innovation basis. It is proposed to derive the findings observed in the study on Natura and Oxiteno to the cork industry, thus formulating the third question:

3. What types of innovations were introduced by the cork industry (product, process, organizational and market)?

In a study of the Portuguese footwear industry, Fernandes (2016) found that the growth of this sector and the consecutive increase in exports is the result of a growing focus on quality products and high added value, as well as on innovation factors based on alliances and partnerships with Universities and technological centres. These partnerships have resulted in increased production capacity, both in terms of products, production process, organization and marketing through marketing actions, as well as technological innovation, vocational training and design. There was a bet on product innovations, on process and marketing innovations, involving in this process not only their own capabilities but also scientific and technological system national entities, technology-based companies and the suppliers themselves. This study reinforces the question previously raised (question number 1) and allow to introduce a new research question:

4. What are the characteristics of cork companies in terms of R&D development, size, partnerships, technology licensing and patenting?

A study of 150 companies in the Pakistani manufacturing industry analysed the effects of innovation types (product, process, marketing and organizational) on the innovation, production, marketing and financial performance (Hassan et al., 2013). The study found that the effect of organizational innovation explains a considerable proportion of process innovation (31.8%), and that marketing innovation leads to product innovation, while

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product innovation is essential for process innovation. It also shown that organizational innovation explained a higher proportion of innovative performance (38.7%), followed by process, marketing and product innovation (28.9%, 21.4% and 17.3%). Innovative performance, in its turn, explained a larger proportion of production performance (77.9%).

A study of the Austrian entrepreneurial fabric by Todtling et al. (2009) examined how innovation types depend on the type of research. The results showed that different types of innovations use different types of inputs, sources and links. More advanced innovations require more patented internal R&D, and often cooperate and are supported by universities and research organizations. This type of innovation relies more often on scientific inputs and less on advanced innovations. The introduction of new products in companies (adoptions, incremental changes) requires some R&D activity, but to a lesser extent. As far as external relations are concerned, there is cooperation with service companies rather than universities (that is to say, practical knowledge rather than scientific knowledge). The study then concluded that companies that introduced more advanced innovations rely more heavily on R&D and patents and cooperate more often with universities and research organizations, companies that introduced less advanced innovations rely more on pre-existing knowledge and on business services. Question five is then suggested:

5. Do the characteristics of industry companies determine the type of innovation and its performance?

To proceed to the analysis of this question, we resorted to inferential analysis with the test of 14 hypotheses.

- *Hypotheses H1 and H2* - Existence of correlation between the R&D development variables and number of new products resulting from innovation and number of new patents;

- *Hypothesis H3* - Existence of correlation between the R&D development and antiquity variables;

- *Hypotheses H4, H5, H6 and H7* - Existence of correlation between the variables size, antiquity and number of new products resulting from innovation and number of new patents;

- *Hypothesis H8* - Existence of correlation between the variables number of new products resulting from innovation, number of new patents and type of innovation;

- *Hypotheses H9 and H11* - Existence of correlation between the variables number of part-time employees attached to R&D activity and number of new products resulting from innovation and number of new patents;

- *Hypotheses H10 and H12* - Existence of correlation between the variables number of full-time employees attached to R&D activity and number of new products resulting from innovation and number of new patents;

- *Hypotheses H13 and H14* - Existence of correlation between the variables number of new products resulting from innovation and number of new patents, and type of research developed (fundamental or basic research, applied research and experimental development);

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3. Methodology

The study used a quantitative methodology, characterized by a systematic process of observable, quantifiable data collection, based on observation of objective facts and existing events, regardless of the researcher, which can be translated into numbers and information in order to be tested and analysed, (Sekaram and Bougie, 2013). It was followed the Hypothetical-deductive method, which leads into a systematic approach to create knowledge in order to solve basic and management problems (Sekaran and Bougie, 2013).

Dependent variables were identified as variables of primary interest, with the objective of understanding and describing, or explaining or predicting their variability, and independent variables as those that influence dependent variables positively or negatively (Sekaran and Bougie, 2013).

Dependent variables were defined as the number of new products resulting from innovation, number of patents or provisional patent applications and R&D development, and as independent variables, R&D development, types of innovation, size, antiquity, part-time employees engaged in R&D activities, number of full-time employees engaged in R&D activities and types of research developed.

An online survey was conducted for 273 member companies of APCOR (Portuguese Cork Association) in the second half of 2017, with 32 responses corresponding to a sample of 11.7%. Among the questions raised in the survey, the first 6 allow a characterization of the company, being questioned the location, age, size, R&D implementation, type of R&D and number of employees engaged by R&D. The remaining 5 questions address the types of innovation, technology access, number of products and patents, and types of innovation strategies. The data was processed, starting with a descriptive analysis of the variables of the research questions 1 to 4, and subsequent inferential analysis for the answer of the research question 5, with the 14 hypotheses test. For that end, it was used the SPSS (Statistical Package for Social Sciences) program, applying the Kruskal-Wallis and Mann-Whitney tests with a confidence level of 95%. The decisions, regarding the meaning of differences and associations, will be based on the significance level of 5%, that is to say, when the calculated probability of differences that is not due to random, is less than 0.05 (p <0, 05).

The following levels of significance were considered:

- $p < 0.05$ * - significant statistical difference;
- $p < 0.01$ ** - very significant statistical difference;
- $p < 0.001$ *** - highly significant statistical difference;
- $p \geq 0.05$ - non-significant statistical difference.

As for the importance on the relationship between the variables and the interpretation of the correlation coefficient, five levels were considered for the absolute value: from the coefficient 0 to 0.19 very weak correlation; 0.20 to 0.39 weak correlation; 0.40 to 0.69 moderate correlation; 0.70 to 0.89 strong correlation; 0.90 to 1 very strong correlation.

4. Results and discussion

The empirical analysis of the sample is divided into two parts: first, a descriptive analysis of the data collected in the surveys, enabling the answer to questions 1 to 4; second, an

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inferential analysis, using statistical tests identified in the methodology, allowing to test the hypotheses raised in question 5.

4.1. Descriptive analysis

Tables 1 and 2 summarize the results found in the characterization of the sample companies. According to Freeman and Soete's innovation strategies, 28% of the strategies adopted by the sample companies are of offensive type following a pattern similar to that described by Gonzaga and Ribeiro (2015), 25% of traditional type and 22% of defensive type, which can be justified by the conventional cork industry standard, consisting mostly of small and medium-sized companies, where the main product is cork stopper, where a large market share is concentrated in a minority of companies, and because the variety of products is low (APCOR, 2015).

Table 1 – Characterization of companies according to the type of adopted strategy, technology access mode, types of innovation and type of R&D

Type of adopted strategy					
Opportunist	Dependent	Traditional	Imitative	Defensive	Offensive
8%	11%	25%	6%	22%	28%

Technology access mode	
Turnkey technology acquisition	34%
Technology licensing	0%
Business Partnerships	31%
Partnerships with technology centres	25%
Partnership with suppliers	25%
Partnership with universities and R&D centres	22%
R&D Development Internally	31%

Types of innovations introduced in the sector	
Product Innovation	44%
Process Innovation	75%
Organizational Innovation	41%
Marketing	13%
I&D Types	
Fundamental or basic research	33%
Applied research	17%
Development	78%

Source: Data from the survey

Regarding how to access technology, there is also a wide variety of modes, with 34% of companies acquiring turnkey technology, 31% internal R&D development and 31% partnering with other companies.

Concerning the type of innovation introduced, 75% of the sampled companies made process innovations. Despite this high figure, it was also found that there are also large percentages of product innovation and organizational innovation, 43.8% and 40.6% respectively. It is also noticeable that these companies do not apply large resources in marketing innovations, as evidenced by the low percentage verified. It was also observed

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that 56% of the sample companies have performed R&D, 41% are micro enterprises, 31% are small companies, and 19% are medium companies.

With regard to partnerships, 22% of the sample companies had partnerships with universities and R&D institutes, 25% partnerships with suppliers, in the same percentage, partnerships with technology centres, and the majority with 31%, made partnerships with other companies, verifying a pattern very similar to that observed by Fernandes (2016) and Bayraktar et al. (2017). Finally, 70% of the sampled companies did not register patents and 15.6% registered 2 or less patents within the period under study.

Table 2 – Dimension and R&D development

Dimension / development of R&D	**Large Company (> 250 employees)**	**Medium company (< 250 employees)**	**Microenterprise (< 10 employees)**	**Small company (< 50 employees)**	**Total**
	9%	19%	41%	31%	100%
No	0%	0%	28%	16%	44%
Yes	9%	19%	13%	16%	56%
Total	9%	19%	41%	31%	100%

Source: Data from the survey

4.2. Inferential Analysis

The answer to the fifth research question was performed by the test of the 14 formulated hypotheses, having the application of the statistical tests highlighted the results of Tables 3 and 4. Regarding hypothesis H1, a Spearman's Rho coefficient of 0.459 is verified for a significance of 0.008, Kendall's Tau of 0.419 for a significance level of 0.011, with the Mann-Whitney test indicating significant differences ($U = 62$, $p = 0.014$), noting that the correlation is positive, moderate and statistically significant, which allows to state that the number of new products differs depending on whether there is R&D development or not, validating hypothesis H1, which confirms Todtling et al. (2009) which indicated the relevance of R&D as an input to innovation. In contrast, hypothesis H2 was not validated because there was no statistically significant evidence that the development of R&D affects patent registration.

Regarding hypothesis H3, Spearman's Rho coefficient is 0.432 with a significance of 0.014, while Kendall's tau has a value of 0.406 with a significance of 0.016, and the correlation is positive, moderate and statistically significant, giving evidence to state that the development of R&D and the antiquity of the company are related, validating hypothesis H3, which is consistent with the expectation associated to new products development potential of larger companies (Boh et al., 2014).

Regarding hypothesis H4, there is statistical evidence to state that the number of new products differs depending on the size of the firm (Rho de Spearman and Kendall's tau are equal to 0.355 and 0.303 respectively, with a significance of 0.046), being the Kruskal-Wallis an indicator that the differences are statistically significant ($H = 7.647$; $p = 0.044$). The same result was observed in hypothesis H5 which shows that the number of patents registered varies according to the size of the company (Spearman's Rho and Kendall's tau equal to 0.604 and 0.565 with significance of 0.00). Kruskal-Wallis test

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indicates that the differences are statistically significant (H = 16.694; p = 0.000), noting that the correlation is positive and moderate.

Table 3 – Spearman's rho correlation coefficient, Kendall's Tau and Mann-Whitney non-parametric tests

			Developed R&D	**Nº products**	**Developed R&D**	**Nº patents**
Kendall's Tau b	Developed R&D	Correlation Coefficient	1	0,419	1	0,235
		Sig. (bilateral)		0,11		0,176
	Nº products / patents	Correlation Coefficient	0,419	1	0,235	1
		Sig. (bilateral)	0,11		0,176	
Spearman's rho	Developed R&D	Correlation Coefficient	1	0,459	1	0,243
		Sig. (bilateral)		0,008		0,18
	Nº products	Correlation Coefficient	0,459	1	0,243	1
		Sig. (bilateral)	0,008		0,18	
U Mann-Whitney				62		99
Asymptotic Sig (Bilateral)				0,11		
Accurate Sig [(Unilateral Sig.)]				0,14		0,319
			Developed R&D	**Antiquity**		
Kendall's Tau b	Developed R&D	Correlation Coefficient	1	0,406		
		Sig. (bilateral)		0,016		
	Antiquity	Correlation Coefficient	0,406	1		
		Sig. (bilateral)	0,016			
Spearman's rho	Developed R&D	Correlation Coefficient	1	0,432		
		Sig. (bilateral)		0,014		
	Antiquity	Correlation Coefficient	0,432	1		
		Sig. (bilateral)	0,014			
			Dimension	**Nº products**	**Dimension**	**Nº patents**
Kendall's Tau b	Dimension	Correlation Coefficient	1	0,303	1	0,565
		Sig. (bilateral)		0,046		0
	Nº products / patents	Correlation Coefficient	0,303	1	0,565	1
		Sig. (bilateral)	0,046		0	
Spearman's rho	Dimension	Correlation Coefficient	1	0,355	1	0,604
		Sig. (bilateral)		0,046		0
	Nº products / patents	Correlation Coefficient	0,355	1	0,604	1
		Sig. (bilateral)	0,046		0	
U Mann-Whitney				99		

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Accurate Sig [(Unilateral Sig.)]				0,319		
			Antiquity	**Nº products**	**Antiquity**	**Nº patents**
Kendall's Tau b	Antiquity	Correlation Coefficient	1	0,227	1	0,314
		Sig. (bilateral)		0,141		0,055
	Nº products / patents	Correlation Coefficient	0,227	1	0,314	1
		Sig. (bilateral)	0,141		0,055	
Spearman's rho	Antiquity	Correlation Coefficient	1	0,263	1	0,349
		Sig. (bilateral)		0,146		0,05
	Nº products / patents	Correlation Coefficient	0,263	1	0,349	1
		Sig. (bilateral)	0,146		0,05	

Source: Data from the survey

Hypothesis H6 and H7 were not verified because there was no statistical evidence that the firm's antiquity is linked to the number of new products and patent registration. The correlations, although positive, are weak, which shows that, companies labour years do not influence patent registration by itself nor the introduction of new products, suggesting the existence of other drivers that may encourage innovative activity.

Regarding hypothesis H8, the Kruskal-Wallis test indicates that the differences are not statistically significant in the number of products ($H = 12.690$; $p = 0.177$), and in the number of patents ($H = 13.769$; $p = 0.131$), therefore providing no statistical evidence to validate the association of these variables with the types of innovation.

As far as the hypothesis H9 is concerned, the Kruskal-Wallis test indicates that the number of part-time R&D employees is not associated with the introduction of new products ($H = 1.822$; $p = 0.769$) and therefore the association was not validated. In contrast, with regard to hypothesis H10, the Kruskal-Wallis test indicates that the differences are statistically significant ($H = 11.719$; $p = 0.020$) and it can be stated that the number of new products differs depending on the number of full-time working employees, validating hypothesis H10.

Concerning hypothesis H11 the Kruskal-Wallis test indicates that the differences are statistically significant ($H = 14.054$; $p = 0.007$), that is to say, there is statistical evidence to state that the number of patents differs depending on the number of part-time employees, validating hypothesis H11. Regarding H12, the Kruskal-Wallis test also indicates statistically significant differences ($H = 10.261$; $p = 0.036$), existing statistical evidence to state that the number of patents differs according to the number of full-time employees. These correlations between the numbers of R&D engaged employees and the number of patents confirm the study by Todtling et al. (2009), underlining both the importance of developing R&D and the allocation of additional human resources to research, in order to increase patent registration.

Finally hypotheses H13 and H14 reveal similar results in the sense that they are either not statistically supported. In particular, the type of research that was carried out (fundamental, applied or experimental development) is not associated with the number of products and patent registration.

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In short, the results found allow to validate hypotheses H1, H3, H4, H5, H10, H11 and H12, and to reject the remaining hypotheses.

Table 4 – Kruskal-Wallis nonparametric tests

Cluster variable: innovation type	**Nº products**	**Nº patents**
Chi Square Test	12,69	13,769
DF	9	9
Asymptotic Sig.	0,177	0,131
Accurate Sig.		0,092
Cluster variable: dimension	**Nº products**	**Nº patents**
Chi Square Test	7,647	16,694
DF	3	3
Asymptotic Sig.	0,54	0,001
Accurate Sig.	0,044	0
Cluster variable: innovation type	**Nº products**	**Nº patents**
Chi Square Test	12,69	13,769
DF	9	9
Asymptotic Sig.	0,177	0,131
Cluster variable: Part-time employees engaged in R&D activities	**Nº products**	**Nº patents**
Chi Square Test	1,822	14,054
DF	4	4
Asymptotic Sig.	0,769	0,007
Cluster variable: Full-time employees engaged to R&D activities	**Nº products**	**Nº patents**
Chi Square Test	11,719	10,261
DF	4	4
Asymptotic Sig.	0,02	0,036

Source: Data from the survey

5. Conclusion

This article sought to deepen the knowledge about innovation strategies in the cork industry in Portugal, throughout an empirical study of a sample of 32 companies. The results point out that, according to Freeman and Soete (2008) typology, the most common type of strategy is the offensive one, followed by traditional and defensive. The predominant modes of access to technology are through partnerships with universities and R&D institutions, suppliers and other companies, with highlight to a percentage of companies doing R&D alone. This is evidence of a drive towards innovation activities, characteristic of companies seeking to achieve technical and market leadership. Regarding technology access modes, the most frequent were the acquisition of turnkey technology, internal R&D development and partnerships.

It was also found that the process innovation type is the most common type in use, suggesting that the sector's traditionalism and the type of constitution of the business fabric may justify the preferential adoption of this type of innovation with a possible

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modernization, or increase, of production capacity, also supported by increased exports and production of other cork-based products (APCOR, 2015).

When it was tested the relationship between company characteristics with performance and types of innovation, an association between R&D development and the number of new products resulting from innovation activities was verified, that is to say, companies performing R&D have a greater possibility of launching new products. Also, older companies tend to develop R&D activities.

Regarding the size of the company, it was noted an association with the number of new products resulting from innovation activities and the number of registered patents.

Analysing the influence of R&D full-time employees, we found that companies with more research staff tend to be more likely to register new patents and launch new products. The influence of the number of part-time R&D staff is also associated with patent registration.

5.1. Limitations

The low percentage of responses, given by the surveyed companies, resulted in a limitation in the application of statistical tests and may constrain the future comparability of the results.

5.2. Future research lines

It is suggested to carry out the same type of research in other economy's traditional industries, to understand which innovation strategies are adopted, both in times of economic crisis and in other contexts. The comparison between industries can allow to find match action points or even a decision matrix that enables the recovery of industries in difficulties.

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