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EXTENDED ABSTRACT

Title: Factor affecting innovative decisions: Characterization of Extremaduran firms

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Abstract[1]:

It is commonly recognized that innovation is essential for the growth and well-being of economies. Companies, as agents of national and regional innovation systems, play a fundamental role in the innovative activity of economies. Innovation implies important benefits for companies, which is converted into increased productivity and competitiveness. However, knowledge generated by innovation has certain characteristics of public goods (Arrow, 1962; Nelson, 1959), which discourages firms from innovating (Geroski, 1995). This leads to that innovation can be imitated and appropriate, so it reduces the benefit of inventors. On the other hand, innovating carries high risks, depending on the type of innovation developed. In addition, innovation requires high costs in most cases and there are financial problems, especially by small and medium enterprises. These factors, together with other internal and external obstacles, discourage the innovative activity of the companies, resulting in the provision of this activity being inferior to the socially desirable one. Occurrence of market failures in the provision of innovative activities by firms justifies that, from an economic point of view, certain public actions are established, through the called Scientific and

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Technological policies. In practice, these policies tend to be oriented towards the activities more distanced from the market, in which the time taken to obtain results are higher compared with the lower possibilities of generating profits. Therefore, although the concept of innovation includes a wide range of activities, the spending on research and development (R&D) activities, considered an important factor in the innovation process, is the most incentivized aspect. The objectives of these policies are not only stimulating realization of innovation activities by firms, but also achieve an encouragement and support all the innovation system of the economy.

This economic reality justifies the present study. The existence of barriers to innovation translates into a low willingness to innovate by companies despite being an important element of competitiveness. These two perceptions are fundamental when deciding to innovate, which is influenced by a set of variables such as the size of the company, its degree of internationalization, the perception of internal and external obstacles to innovation, or the importance that companies confer to develop these activities. It also influences the perception of government intervention to boost innovation and the type of actions that would be demanded by companies to be encouraged to innovate or continue carrying out innovative activities. In this sense, the objective of this study is to analyze the characteristics of companies in the Extremadura region (Spain) based on the perceptions they have about these two variables: *willingness to innovate* and *assessing innovation as an essential element of competitiveness*.

We have revised the most relevant literature linked with the main objective of our study. First, there are several studies on innovation related to the regions as those of Buesa (1998), Buesa *et al.* (2002), and Badiola and Coto (2012) in Spain; at the international level there are the studies of Santos and Simoes (2014) in Portugal; and Niembro (2017) in Argentina, among others. The analysis of innovative activity in particular regions and their companies is found in Ruiz (2005), EOI (2011), and Fernández and León (2006) in Andalusia; Buesa and Zubiaurre (2009), González-Pernía *et al.* (2009), and López-Rodríguez, Faiñas and Manso (2010) in Basque Country; or Corchuelo and Carvalho (2013), Corchuelo and Mesías (2015, 2016), and Corchuelo, Mesías and Eighannam (2018) in Extremadura.

In these contexts (innovation systems), companies occupy a central role in the application and exploitation of knowledge. Companies develop technological

capabilities that give rise to new processes or products, marketing and organization innovations, as a result of a process of learning and accumulation, a process in which other factors (financial, human resources, commercial, etc.) join in additionally. Companies are the agents that materialize and transfer new knowledge and technologies to productive system and markets (González, 2003). Given the important role that firms play in the systems of innovation, economists have been interested in determining which factors influence the companies' decision to innovate and the innovation effort (Schumpeter, 1942; Cohen & Levinthal 1989; Galende del Canto & Suárez, 1998). All of these factors determine the barriers to innovation that firms face, and that can vary based on some defined profiles (Baldwing & Lin, 2002; McCann, 2010; Segarra & Teruel, 2010; Pellegrino & Savona, 2017; among others). Barriers to innovation can be external or internal to the company (Segarra, García & Teruel, 2008).

This theoretical justification justifies this study that, specifically, analyze the behavioral patterns and typology of the companies located in Extremadura that determine their characteristics in relation to factors that affect their innovative decisions by answering two questions: the *willingness to innovate and to assume derived risks from innovation*, and *perception of innovation as an essential element of competitiveness*. In this sense and in our knowledge, only the study of Corchuelo and Mesías (2017) analyzes this topic applied to the study of agri-food companies.

In order to reach this objective, the authors use an *ad hoc* questionnaire focused mainly on variables related to innovation and other additional aspects. This survey was conducted during the months of September 2011 and June 2013, obtaining data from companies placed in the Autonomous Community of Extremadura, a region that has a lower innovative activity than Spanish national average. Both questionnaires focused on issues not included in other studies on innovation. Companies in the sector of manufacturing and knowledge intensive business services (KIBS) of the Autonomous Community of Extremadura were contacted. The final sample obtained is formed by 777 companies in 2011 and 524 companies in 2013.

Firstly, a descriptive study of data is carried out. In relation to the two main questions analyzed (*willingness to innovate* and competitiveness), data detect a temporary image with few variations, highlighting the lack of willingness to innovate among non-innovative companies, although innovation is considered an essential element of

competitiveness in both analyzed periods. They constitute the essential variables for the purpose of determining the characterization of companies. Table 1 shows the percentage of companies that make assessments in each category, distinguishing between innovative and non-innovative firms in the analyzed years.

Table 1. Assessment about *Willingness to innovate* and assume risks/Innovation as an essential element of firm's *competitiveness*

	Willingness to innovate		
	Low	Medium	High
2011 (% firms)			
Innovative firms	18.4	39.7	41.8
Non- innovative firms	68.5	20.9	10.6
2013 (% firms)			
Innovative firms	27.9	30.2	41.9
Non- innovative firms	69.5	20.1	104.
Competitiveness			
2011 (% firms)			
Innovative firms	3.6	16	80.4
Non- innovative firms	12.1	35.9	52.1
2013 (% firms)			
Innovative firms	6.9	47.2	45.9
Non- innovative firms	27.2	47.7	25.1

Secondly, we analyzed the characteristics of Extremaduran companies based on perceptions they have about the variables shown in Table 1. It is hypothesized that these two perceptions determine different profiles of companies. The methodology used for this purpose is a bivariate probit model. This model allows distinguishing four profiles of mutually exclusive companies: i) *high-medium willingness to innovate and high-medium competitiveness (1,1)*; ii) *high-medium willingness to innovate and low competitiveness (1,0)*; iii) *low willingness to innovate and high-medium competitiveness*; and, iv) *low willingness to innovate and low competitiveness.* As independent variables, first, we consider some general characteristics of companies (binary variables as to be an *exporting firm*, *micro firm*-fewer than 10 employees-, *manufacturing firm*, and *innovative firm*); second, we also take into account variables of obstacles, including those that are valued mainly by companies (binary variables: *lack of internal financing*, *lack of external financing*, *high costs*, *high risks*, *occurrence of companies established in market*, *lack of flexibility in regulation*, *lack of support from public administrations*, and *not need innovations in the market*); finally, binary variables that display public demands for innovation that are demanded by companies to

boost innovative activities are also included (*personalized advice*, *direct public support*, *seminar information*, *tax incentives for R&D*, and *free training*).

Overall, using this methodology, a series of results are observed: firstly, according to general characteristics variables, companies that present a higher willingness to innovate are innovative companies, being common this characteristic in the companies belonging to the profiles *(1,1)* and *(1,0)*. Conversely, for companies that have a low willingness to innovate and take risks derived from innovation (profiles *(0,1)* and *(0,0)*), the fact of being innovative decreases this probability, but increase it having a smaller size (fewer than 10 workers) and belonging to the manufacturing sector; secondly, in relation to perception of obstacles to innovation, obtained results vary in the different profiles and are differently valued; finally, demands for public policy actions also vary depending on the group of companies derived from the joint probabilities.

So, results show that the obstacles to innovation are perceived as inhibitors or enhancers of the innovative activity of companies. They play an important role in their decisions as having a lower or greater willingness to innovate in spite of consider innovation as a key element of competitiveness. In particular, results display that, for Extremaduran firms, certain obstacles such as *lack of external financing*, *high costs* and *high economic risks*, *lack of flexibility in regulation* and *lack of support from public administrations* are valued in different ways according to the obtained profiles of companies and they influence their characteristics in the decision of performance innovation activities. Based on these characteristics and perceived obstacles, different public actions are demanded by companies. Among them, offer *personalized advice*, mainly to companies that have a high willingness to innovate; increase *free training* through specialized seminars; and provide enough *public support by subsidies or soft credits* for smaller companies and firms with a lower innovative willingness in order to increase the willingness to perform innovative activities.

The authors are aware that this study has some limitations, mainly motivated by the difficulty of obtaining data (the questionnaire is not compulsory for companies), although finally we have got a fairly representative sample of Extremaduran business reality. Another limitation of the study is that we have information about only two periods (2011 and 2013). Spanish and regional economic crisis must be taken into

account in these periods of time. Data obtained come from a recessionary environment; which could also be related to a higher or lower willingness to innovate.

Despite these limitations, we consider that having information about the actions that are demanded by the companies together with the analysis of the factors that inhibit innovation in companies is important because it allows focusing policies to mitigate the impact of these factors in order to increase levels of innovation. The obtained information is interesting and maybe crucial for designing public policy actions, especially regional ones, to promote and stimulate innovation.

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