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Environment and innovation in spanish business: bridging the gap between academics and practitioners[1]

Medioambiente e innovación en la empresa española: reduciendo distancias entre los academicos y la empresa

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1. INTRODUCTION

Confronted with the progressive deterioration of the environment, firms have been forced to adapt their business models in order to compete and adapt to fast-changing conditions whilst also becoming increasingly environmentally friendly. The incorporation of environmental issues into business matters is a common subject in academic circles. Scholars are currently establishing a conceptual framework for the interaction between the environment, the economy and society. Also, the protection of the environment is of interest for policy makers, and this leads practitioners to search for industrial solutions that optimise the use of natural resources and reduce the environmental damage caused by production.

The increasing importance of environmental issues in economic decision-making processes is often articulated through strategies that aim to achieve an equilibrium between economic and environmental efficiency (Hojnik and Ruzzier, 2016). A growing interest in sustainable production may also be noted in management-related research, especially concerning strategic decisions (Díaz-García et al., 2015). A large number of publications examine how economic strategies have changed in order to introduce environmental matters in the mid- and long-term (e.g.

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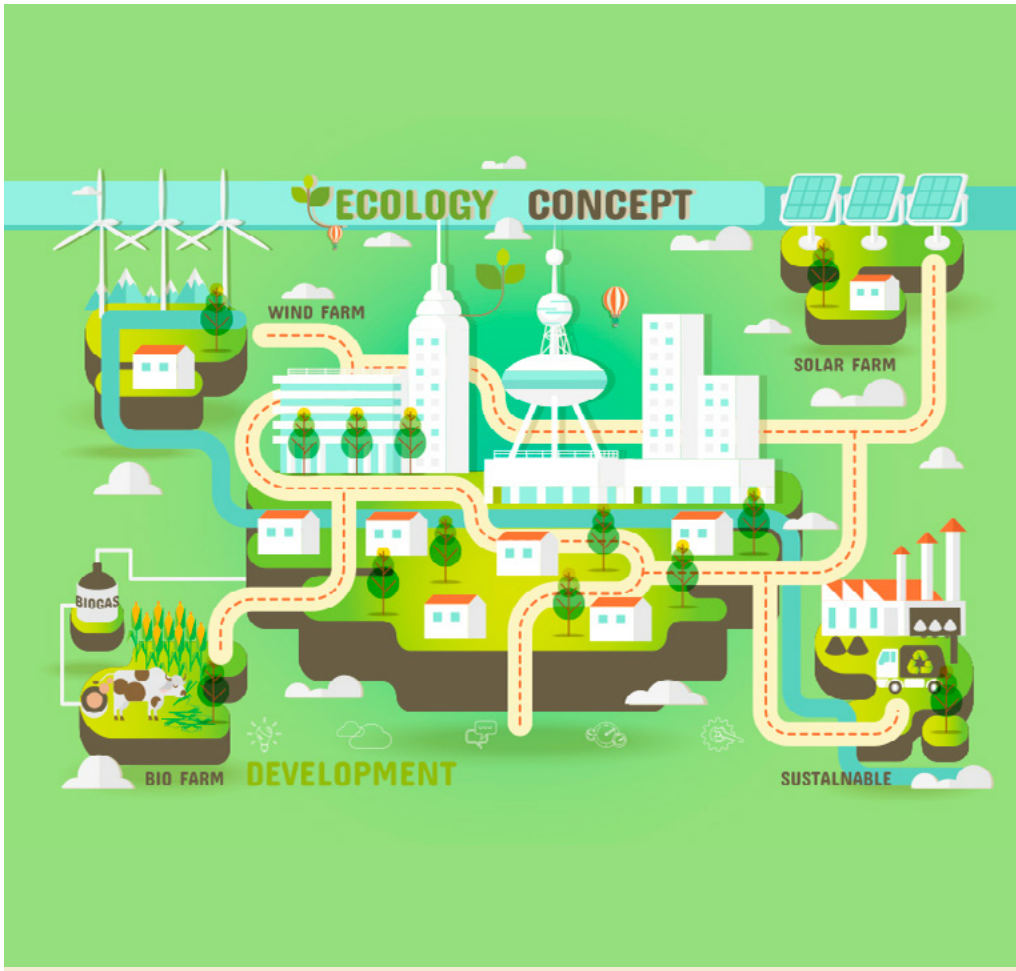


EXECUTIVE SUMMARY

Recent decades have witnessed an increase in the number of eco-innovative solutions which improve the environmental performance of firms whilst also helping them remain competitive. However, the implementation of eco-innovation in Spain has faced certain difficulties, and the number of eco-innovations being put into practice is limited. This paper conceptualises eco-innovation processes, in order to assist their adoption by firms. Also, the most relevant obstacles and incentives to eco-innovation are analysed, as well as the specific capacities and changes that eco-innovation involves for the firm.

RESUMEN DEL ARTÍCULO

Las últimas décadas han traído un aumento en el número de soluciones eco-innovadoras con distintos niveles de mejora medioambiental. Gracias a ellas, las empresas pueden mantener su posición competitiva mejorando su performance medioambiental. No obstante, la implantación de la eco-innovación entraña dificultades, por lo que el número de eco-innovaciones implantadas en la empresa española es todavía limitado. En este escenario, este trabajo proporciona una conceptualización de los procesos eco-innovadores para su adopción en empresas. Se analizan asimismo las barreras y los incentivos más relevantes, profundizando acerca de las capacidades específicas y los cambios de interés para los practitioners.

Aragón-Correa, 1998).

Despite the fact that the term was not coined by Fussler and James (1996) until the 1990s, the concept of eco-innovation is not new: from the start of the industrialisation era, firms that made abundant use of natural resources, for example the steel industry, have tried to find ways to reduce their costs and increase their competitiveness. In recent decades, numerous experts have undertaken the analysis of eco-innovation and its definition. Eco-innovation can be summarised as any innovation that contributes to reducing the environmental impact of the firm's activity. Innovation is generally defined according to the Oslo Manual (OCDE, 2005) as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.

...the aims of the present paper are to present a conceptualisation of eco-innovative processes that will be of use for practitioners and firms

Spain holds 9th position on the *EU Eco-innovation Scoreboard*, according to the EU Eco-innovation observatory (Léger, 2015), close behind countries such as UK and Italy, and above the European average (EU-28). Concerning eco-innovation in firms, however, Spain's score is substantially lower, which indicates a low R&D intensity. Specifically, concerning this indicator, Spain holds 19th position, and 39.4% below the European average (EU-28) according to EUROSTAT data for 2014.

Implementing eco-innovation is complex because it is not only a matter of developing technologies which will minimise environmental impact ('end-of-pipe'), but also a matter of drastically reducing resource consumption (Ehrenfeld, 2008) by applying clean technologies. This is the greatest challenge facing practitioners. Given this challenge and the low R&D intensity attested in terms of eco-innovation, the aims of the present paper are to present a conceptualisation of eco-innovative processes that will be of use for practitioners and firms. This paper aims to increase our knowledge about the implementation of eco-innovative solutions in the firm, through a descriptive general analysis of the main factors that mark the relationship between eco-innovation and business. Thus, the present paper aims to answer and to better understand the following questions, which stem from the firm's need to understand the process of change. Such an understanding will inform its decision-making processes in the short and medium term:

- What kinds of eco-innovation have been most frequently adopted by firms, and in which areas?
- What are the main obstacles and incentives for the firm in the eco-innovative process?
- What and how much do standardized management systems facilitate the adoption of eco-innovations in the firm?
- How do different eco-innovation types affect performance?

In order to achieve our targets, the paper analyses a sample of 303 firms which have shown interest in eco-innovation. The following section present the state of the art concerning research on eco-innovation and business. The following section reviews the descriptive analysis specifically undertaken to study eco-innovative practices in Spanish (Region of Aragon) firms and the degree of dissemination of eco-innovation in the Spanish economy, in general. The fourth section presents the results of this study and briefly examines trends, types, barriers and incentives of this phenomenon. Finally, the last section analyse and discuss the implications and the main conclusions of the work.

KEY WORDS
eco-innovation, environmental proactivity, competitiveness, descriptive-statistical analysis, obstacles and incentives.

PALABRAS CLAVE
eco-innovación, proactividad medioambiental, competitividad, análisis estadístico-descriptivo, barreras e incentivos.

2. ECO-INNOVATION IN BUSINESS

The key differences between eco-innovation and conventional innovation is the former's explicit goal of reducing its environmental impact and balancing economic efficiency and social benefits (Kenji Kondo, 2001). Thus, eco-innovation can be beneficial from two different economic perspectives: environmental economics and innovation economics (Rennings, 2000). In any case, both perspectives agree that eco-innovations play a very relevant role in the achievement of more competitive and environmentally sustainable societies (Carrillo-Hermosilla et al., 2010). From a scholarly perspective, eco-innovation has been studied at the macro, meso, and micro level. Most researchers, however, focus their attention on external factors (e.g. Kesidou & Demirel 2012) within the theoretical framework of institutional theory (Aragon-Correa and Leyva-de la Hiz, 2016) or stakeholder theory (Wagner, 2007). In the last decade, most analyses have aimed to clarify and conceptualise the drivers, general characteristics, types and consequences of eco-innovation, (Díaz-García et al., 2015), because these topics are of direct interest to practitioners.

In general, eco-innovation has arrived to actual firm-scenarios

through technological change and the pressure posed by stakeholders (Carrillo-Hermosilla et al., 2010; Rennings, 2000). On the one hand, the technological market is in a continuous state of development, and the need to achieve greater energy efficiency and to improve product quality and flexibility are forcing firms to constantly update their technologies. One the other hand, new environmental problems, growing social awareness thereof are contributing to increasingly strict and specific environmental regulation. Thus, a growing number of companies are developing and marketing eco-innovation-inspired new products that address environmental issues (Pujari, 2006). Taking into account the first perspective and the traditional perspective on innovation, it is easy to think only in terms of technological change when dealing with eco-innovation. However, eco-innovation must, in order to succeed, be also based on the appropriate social structures, which should, in turn, be influenced by eco-innovation (Hellström, 2007). Therefore, eco-innovations is a very wide field, and can have an effect on different areas and structures within the firm (Carrillo-Hermosilla et al., 2010). Thus, there are different types of eco-innovation based on the firm's external and internal boundaries (Cheng et al., 2014); eco-innovation concerning product, process or management/ organization areas take place across the firm's internal boundaries (Horbach, 2008), while eco-innovation applied to the supply chain takes place outside the firm's external boundaries (Lee and Kim, 2011).

At the micro level, decision making-processes in business are frequently conditioned by the goal of improving performance. Managers must try to appraise the economic impact of their decisions and strategies. The difficulty that eco-innovation entails for companies in comparison to conventional innovation resides in its positive environmental effects; that is, eco-innovation involves trying to make two traditionally opposed goals, improved economic competitiveness and environmental commitment, compatible (Pereira and Vence, 2012). The positive impact of adopting environment-friendly strategies on economic performance have been amply demonstrated (Albertini 2013; Autor 2015). Thus, eco-innovation is currently considered an opportunity for the firm to maintain its competitive edge while improving its environmental performance (Li, 2014). At any rate, little is known about the economic consequences of different approaches to

eco-innovation. Previous studies suggest that the type of eco-innovation implemented is an important factor, and that it could have a significant impact on the firm's performance (Dong et al., 2014). However, the analyses carry out to date have had mixed results and they do not fully clarify the impact of different eco-innovation strategies on performance (Dong et al., 2014; Doran and Ryan, 2016).

In any case, the adoption of eco-innovation is not only due to economic factors. For instance, firms which have a proactive environmental profile tend to incorporate new processes and innovative technologies into their environmental practices (Autor 2016; Kolk & Mauser 2002). For their part, firms which are used to working in a highly-innovative environment have seen eco-innovation as an opportunity to renovate the whole innovation system by taking into account ecological factors, thereby creating new sustainable economic processes (Carrillo-Hermosilla et al. 2010; Rennings 2000). Several drivers have been identified to strengthen the implementation of eco-innovations, even in cases where no significant previous environmental or innovative capability can be attested. The clearest and most significant example of this is the creation, following a new normative framework, of eco-innovative positions in the firms, changes which have not lead to a loss of competitiveness and growth potential (Porter and Van der Linde, 1995). Policy makers regard eco-innovation as a great opportunity to promote sustainable development without undermining the firm's competitiveness. In industrialised countries, eco-innovation is generally fostered by the implementation of public programmes. This public support is justified by the so-called 'double spillover effect of eco-innovation' (Rennings, 2000), which is related to the appropriability of innovative results and the social benefits of environmental improvement (Jaffe, 1998). Several recent examples attest for the growing interest in eco-innovation in the European Union at the institutional, legal and political levels (Díaz-García et al., 2015). On the other hand, it seems clear that eco-innovation and a proactive environmental stance are often related to improvements in the internal organization of firms (Autor 2015). In turn, the introduction of different tools trough the implementation of environmental management and control systems can foster the implementation of eco-innovations (Kesidou and Demirel, 2012). Others authors, (e.g. Amores-Salvadó et al. 2012) suggest that

the introduction of environmental-management systems are in themselves regarded as a form of organizational eco-innovation. At any rate, the actions related to the incorporation of an environmental management system can contribute to the implementation of other eco-innovation measures throughout the firm (Wagner, 2007). Other drivers, although less prevalent, have been marked as playing an important role in fostering the adoption of eco-innovative strategies, including consumer-driven market factors (Doran and Ryan, 2016; Hojnik and Ruzzier, 2016), the need to improve organizational capabilities (Horbach, 2008; Kesidou and Demirel, 2012), and industrial competitiveness and managers' perception (Hojnik and Ruzzier, 2016).

3. STATISTICAL-DESCRIPTIVE ANALYSIS

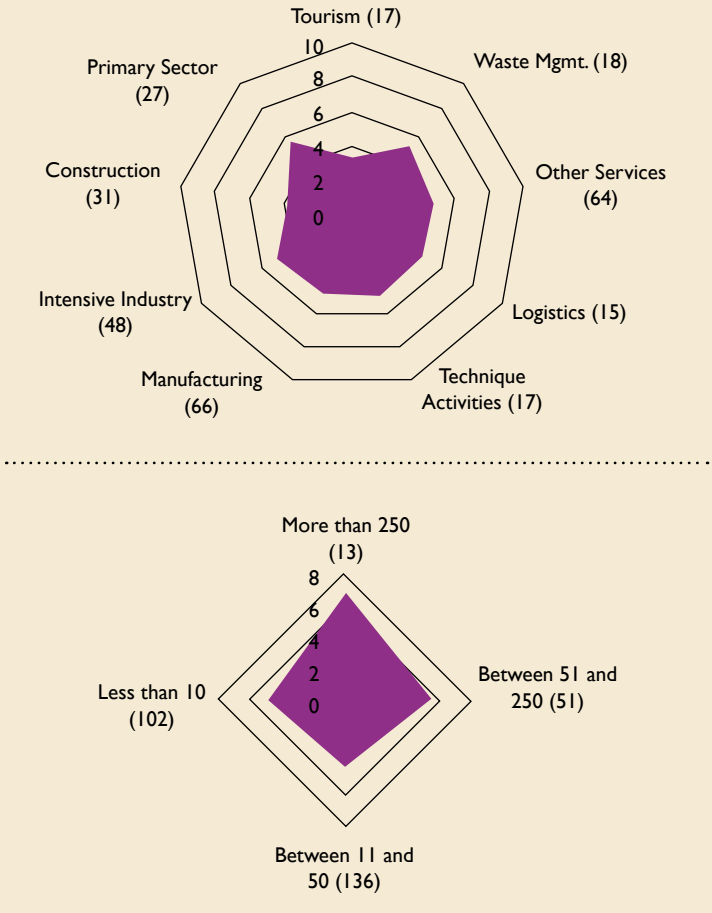
In order to be able to carry out an in-depth analysis of the firm's potential for eco-innovation and its degree of implementation, a database (which was designed specifically for this purpose) was used to manage the data on firms from 4 size categories and 42 sectors (based on the national classification system – NACE codes, see **Figure 1** for more details). The firms were selected as users of potentially high-efficiency technologies and processes, based on the BREF documents[3] developed and published by the Joint Research Centre of the European Commission.

The economic-financial data of the firms, all of which have a workforce of over five and based in the region of Aragón (Spain), were taken from the SABI database. The selected population comprises a total of 2,996 firms, which were exposed to a dissemination campaign about the firm and eco-innovation.[4] Within the context of this campaign, a survey was undertaken to compile information about eco-innovative practices, the main obstacles and incentives detected by firms, green patents owned by firms, and other environmental management-related issues.

The questionnaire, which was endorsed by an expert panel,[5] resulted in 303 valid responses, at a response rate of 10.11%, which is an acceptable rate for this type of study. The companies in the sample have on average assets worth 40M€ and the average turnover is 45M€. Questionnaires were filled by the environmental manager or by the general manager, in the former were unavailable. The following section presents the descriptive results from this

sample as well as the results of the ANOVA and t-student tests carry out. Based on these results, we analyse the level of implantation of eco-innovation in these firms in order to answer the above-noted questions.

Figure 1. **Implantation of eco-innovation according to sector and size of firm**



4. ECO-INNOVATION IN THE FIRM

4.1. Eco-innovation habits and practices

The first topic is the type of eco-innovation most frequently detected in the firm, as the *front end* of each type is different and is indicative of different factors and implementation obstacles (Dong

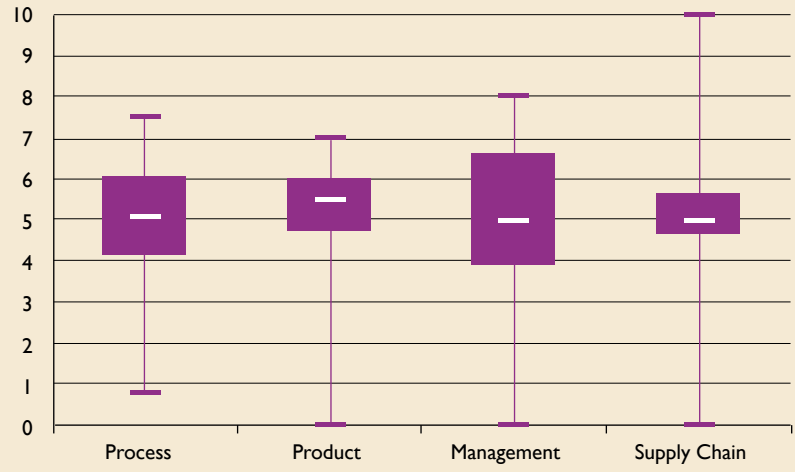
et al., 2014). In this work, our analysis has been focused on both internal and external boundaries of eco-innovation. In this regard, we distinguish between eco-innovation concerning manufacturing processes, products, supply chains and management. The box in **Figure 2** illustrates the implementation of eco-innovative measures in the sample.

In general, eco-innovation in manufacturing processes can involve new equipment, the reorganization of human resources, the adoption of new methods or a combination of these. In terms of eco-innovation in manufacturing processes, the study sample scores a substantial 4.81 points.[6] The large size of the central box indicate that these types of eco-innovation are common, as they are more versatile than other types and easier to implement. This result is consistent with the idea that eco-innovation in manufacturing processes is more easily implemented because it can be acquired from external sources, who are responsible for its development (Autor 2016). That is, while it does not involve the excessive investment of resources, it reduces costs or improves efficiency, i.e. it provides firms with a competitive edge in environmental and economic terms (Dong et al., 2014; Hojnik and Ruzzier, 2016).

In contrast, eco-innovation in products, which involves the development of a new good or service, the functional characteristics of which has been improved through eco-design and eco-innovative manufacture, scored 4.37 points; that is, it is the second least frequent type of eco-innovation within the sample. This can reflect the fact that the implementation of eco-design requires more resources and is less straightforward than applying eco-innovation to manufacturing processes. The goal of eco-design is to develop new methods which aim to manufacture more environmentally friendly products without excessively increasing the final price or overextending the development and manufacturing processes (Knight and Jenkins, 2009).

The less frequent kind of eco-innovation applies to supply chains (a score of 4). This kind of eco-innovation involves guaranteeing that firms take into consideration environmental criteria when organizing their supply and those resources are efficiently used in the distribution of their products, thus optimising transport and improving packing. Despite the potential economic and environmental advantages for the firm, this kind of eco-innovation is less easy to implement, as it requires the cooperation of suppliers

Figure 2. **Box plot that expresses the average implementation of different kind of eco-innovative measures**



and customers (Lee and Kim, 2011), as illustrated by the low score. Eco-innovations in processes and management are detected much more often (as illustrated by the larger boxes). Finally, concerning eco-innovation in management, the score of the sample is 4.87 points (the highest of all), reflecting the fact that this kind of eco-innovation is also the easiest to implement, as indicate the large size of the box in the figure. This kind of eco-innovation involves management systems, audits, management chains and cooperation between areas or centres. Often, this kind of eco-innovation is related to the environmental proactivity of firms and the direct involvement of managers (Sharma, 2000).

Concerning the development of patents, the data reveal that 29 firms own green patents, which is 9.57% of the total. This percentage is very similar to that attested by previous analogous studies, for instance Aragon-Correa & Leyva-de la Hiz (2016). Unsurprisingly, these firms score substantially higher than the rest in terms of implementing eco-innovations. A test ANOVA confirms that firms that own green patents present higher values in the implementation of eco-innovation - 28% on average (p-value<0.000) - than those which do not own green patents; concerning implementation of product-related measures, this difference can be as high as 35% (p-value<0.000). Patents play a crucial role in protecting the

development of new products, where competing firms could easily resort to reverse engineering (Levin et al., 1987).

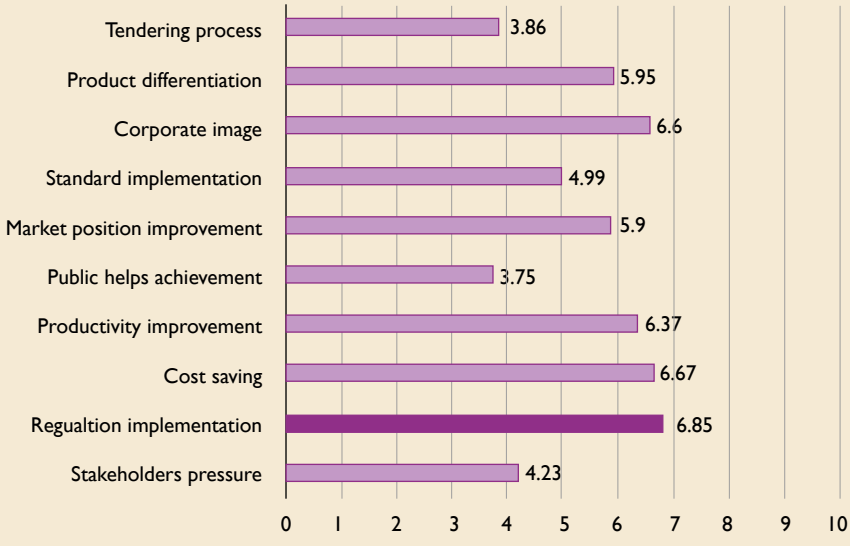
Finally, the analysis deals with two internal factors that could have a limited effect on the eco-innovation potential of firms and their environmental performance, such as size and sector. As **Figure 1** illustrates, eco-innovation is especially common in our sample in the primary sector. This sector includes agriculture and stockbreeding: these are two activities which, in the recent past, have undergone a substantial process of automation and globalisation. This process has increased competition in the sector, which has in turn prompted the adoption of eco-innovations. Ecological production and the more sustainable use of resources such as water and fertilisers have made this sector one of the most active in the sample in terms of eco-innovations. The construction and the touristic sectors are the least eco-innovative. However, in this regard the ANOVA test yields no significant results. Concerning size, large firms are the most prone to eco-innovation; of the small firms, those with fewer than 10 workers are more eco-innovative than the rest. Although, these differences are significant (p-value<0.000) according to ANOVA test, the mean differences is of little relevance.

4.2. Incentives and obstacles to eco-innovation for firms

Figure 3[7] summarises the firms' views on incentives to undertake eco-innovation. Our results suggest that legal compulsion is the most important incentive; even today, most firms adopt environmentally friendly measures only reactively and undertake only what is demanded by legislation (Autor 2008). In addition, these findings suggest that only the 'command and control'[8] policies are effective. As shown by a study published by the (OECD, 2008), this principle applies in equal measure to the EU, the US or Japan. Other public initiatives, such as green purchasing and the inclusion of eco-innovation in the conditions for public contracts, are therefore failing to enthuse these firm managers. Also of note is the lack of pressure posed by stakeholders with regard to eco-innovation.

On the other hand, lower costs, higher productivity, greater market share and product differentiation are, from this firm's perspective, the other greatest incentives to a proactive attitude towards eco-innovation. It is interesting to note the differences between our results and those obtained by Autor (2008) in a study carried out using a similar sample nearly a decade ago, as this comparison

Figure 3. **Main incentives for eco-innovation in the firm**

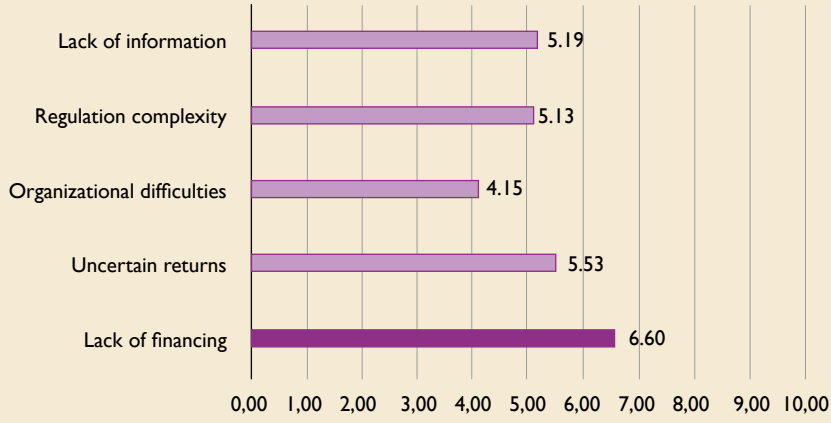


suggests that in the past firms had a more passive approach to eco-innovation, and only acted in reaction to legal requirements.

Eco-innovation in the firm faces also notable obstacles. **Figure 4**[7] illustrates the firms' perception of different kind of obstacle. The most important obstacle is financial in nature, closely followed by high risk. This suggests that the perception exists that eco-innovation is often associated with important levels of initial investment, while returns can often only be realised in the long-term (Hojnik and Ruzzier, 2016). In addition to these finance-related obstacles, firms emphasise the complexity of the environmental legislation in relation to eco-innovation: for example, concerning residue management, the lack of information concerning public incentives for eco-innovation, and the lack of simple ways to calculate returns on investment. Although important obstacles exist, the sample firms' perceive them as being less important overall than the incentives, which suggests that the implementation of eco-innovation in the firm will continue to grow and that more firms will be part of this trend in the future.

The primary sector and large-sized firms are particularly prone to incentives over obstacles. This is consistent with the conclusions presented at the beginning of this section. The historical traditions

Figure 4. **Main obstacles to eco-innovation in the firms**



of the agricultural and stock-breeding sectors, as well as their need to urgently adapt to new international conditions, have transformed them into leading players as far as eco-innovation is concerned. The small size of most Spanish firms (96% of firms are SMEs in 2016, according to the Spanish National Statistics Institute) and the economic environment in which they operate are obstacles to eco-innovative investment; it must be taken into consideration that, as intrapreneurship, eco-innovative investment is also burdened by the obstacles hampering new forms of entrepreneurial initiative, for instance those pointed out by the Global Entrepreneurship Monitor (GEM, 2015).

4.3. Standardized environmental management systems and eco-innovation

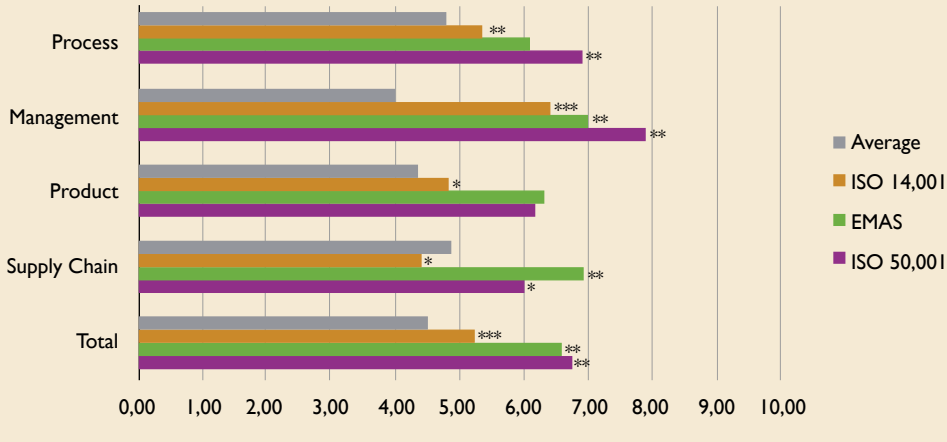
Currently, environmental-management systems are an expression of the will of the firm to introduce environmentally friendly measures. In many cases, their implementation also involves introducing relevant changes to the internal organization of the firm and giving the firm an environmentally friendly philosophy, which involves reducing the firm's environmental impact. **Figure 5** illustrates the implementation of eco-innovations in firms that have been implemented an environmental management systems under standardized certifications such as ISO 14,001, the Eco-Management and Auditing Scheme (EMAS) or ISO 50,001. The asterisks after the bars are related to the results of t-students tests carry out in order to

determine differences between firms with and without certification. * p<0.1; ** p<0.05; ***p<0.000.

Owing to its 'seniority', it dates as far back as 1992, the pioneering ISO 14,001 is the most widespread among firms, while norms ISO 50,001 and EMAS are much less common. In general, firms which implement environmental management systems present significantly above average levels of eco-innovation. The differences are of little significance concerning those firms in possession of the ISO 14.001 certificate, which, in fact, score below average with regard to supply chains. This is because, to a large extent, this certification is now regarded as having a token value, and it is only acquired in order to gain access to certain markets. This is further corroborated by the fact that 90% of these firms also possess the ISO 9,001 certification, which is also generally demanded by certain markets. Both certifications (ISO 14,001 and ISO 9,001) are regularly carried out jointly. Needless to say, the certification of a system does not necessarily imply its effective implementation (Aravind and Christmann, 2011).

As noted, firms with EMAS- or ISO 50,001-certified standards are significantly above average in terms of eco-innovation. The increase in the implementation of eco-innovative measures is particularly extreme (86%) with regard to the internal organization of firms which, as noted before, has been marked as a common action related to organizational eco-innovation which can also have a positive effect in the rest of eco-innovation areas.

Figure 5. **Implementation of eco-innovative measures in certified firms**



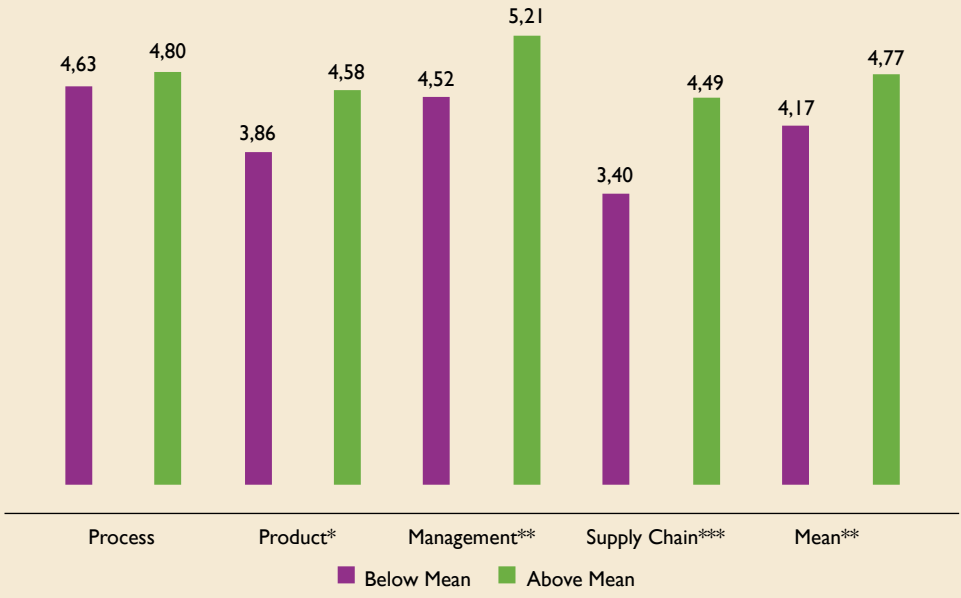
4.4 Eco-innovation practices and performance

As previously noted the implementation of eco-innovations can take place at different levels and also pose a variety of potential obstacles. **Figure 6** illustrate some interesting ideas concerning the relationship between eco-innovation and performance. In the figure, we compare the sample firms' average ROE (Return on Equity) indicator for the period 2013-2015 with the average ROE for the firms' sector overall: 131 firms (Sub-sample A) are shown, on average, to perform better than the sector, and 172 firms (Sub-sample B) are shown to perform worse than the sector. Data from the last three available periods was used in order to minimise the effects of the financial instability that characterised the Spanish economy during this period. This methodology is often used in research, and a large number of previous studies have applied it in order to isolate important external effects linked to sector-specific characteristics (e.g. Calabrese, 2009; Waelchli, 2008). In addition, as suggested by Slater and Zwirlein (1992), firms without a competitive advantage should not be able to present performance values above their sector's average. **Figure 6** shows the average implementation level of eco-innovation measures (0-10) by sub-sample and by eco-innovation type.

These results indicate that the best-performing firms are, on average, more active in the implementation of eco-innovation measures of all types. A t-student test carried out in order to calculate the significance of the differences between both sub-samples confirms that the difference, and not only concerning process-related measures, is significant; the test indicates that firms in Sub-sample A score 14.4% more overall (significance at 0.05) than Sub-sample B. In terms of different eco-innovation types, Sub-sample A scores 15.2% more (significance at 0.05) than Sub-sample B concerning management-related measures, which confirms that these measures are easy to implement but that their impact on the medium-term is limited. Concerning product eco-innovation, Sub-sample A scores 15.2% over Sub-sample B (significance at 0.10). With regard to process eco-innovations, our results suggest that no significant differences between sub-samples exist, despite being in general a well-understood type of innovation. Finally, concerning supply chain-related measures, a category which, as previously noted, is rife with difficulties, Sub-sample A scores 32% (significance at 0.001) over Sub-sample B. This suggests that the implementation

of these measures may lead to substantially better performances in the medium-term, despite which these eco-innovations are seldom detected in our sample.

Figure 6. **Differences between firms with a performance higher than the sector and firms with a performance lower than sector mean.**



5. CONCLUSIONS

Through analysing the implementation of eco-innovation in Spanish firms, this paper aimed to conceptualise eco-innovative processes that will be of use for practitioners adopting eco-innovations and other decision-making processes. The statistical-descriptive results demonstrate the increase in the implementation of eco-innovative solutions and also answer key questions (see above). Most eco-innovations are related to manufacturing processes; in this field, the eco-innovation is versatile option because it offers solutions with different levels of complexity and clear-cut return perspectives. In contrast, eco-design and eco-innovations related to supply chains are, despite their potential, less common to date.

The statistical results indicate that the relationship between eco-innovation and the size of firms is similar regardless of the kind

of eco-innovation concerned. Large firms are more prone to implementing eco-innovations, owing to better access to credit and less risk-aversion. On the other hand, the flexibility of micro-firms makes them more open to implementing eco-innovative solutions. It is clear that by sector, while the primary sector leads the way to eco-innovation, the touristic and construction sectors are in the rear, and, therefore, have greater potential for improvement in the short term.

This analysis of the firms' perception of the main barriers and incentives has emphasised that the greatest obstacle to the implementation of eco-innovations is financial: namely, the difficulty inherent in taking on the elevated initial investment. Other important obstacles are the high level of risk and the fact that returns can often only be realised in the long term. Lower costs, higher productivity, a greater market share and product differentiation are substantial incentives, and the main motivation behind the adoption of eco-innovations is the pressure posed by environmental legislation. In fact, the results indicate that, to date, this is the most effective incentive to the adoption of eco-innovations (which is risky) and also emphasise the largely passive and reactive approach of firms towards eco-innovation. This attitude is not conducive to environmental competitiveness and eco-innovation, as the firms relegate environmentally friendly attitudes to an ancillary position and regard them as an imposition.

The results concerning the relationship between the level of eco-innovation in the firm and the implementation of environmental-management systems are of great interest for practitioners. These results indicate that firms with ISO 50,001 and EMAS certificates are the most powerful to implement eco-innovations. This suggests that advanced environmental-management systems can have a significant impact on the firm's attitude towards eco-innovation, especially among firms which are interested in eco-innovation but which lack previous experience and the capacity to achieve this goal – that is, those firms which lack proactive environmental strategies.

Finally, the joint analysis of eco-innovation and performance offers interesting insights to practitioners. The differences found between the effects of different types of eco-innovation suggest that actions focused on improving supply chains are an interesting option for the short-term. On the other hand, in spite of the popularity and the simplicity of process-related actions, , their effect on performance

in a medium-term scenario seems to be more limited than that of other options. In any case, in order to refine these conclusions, more research is needed on the effects of the different types of eco-innovation on performance in in the long-term.

Eco-innovation is an opportunity to make environmental sustainability compatible with profitability and competitiveness. In order to increase the implementation of eco-innovations in the mid-term and to overcome the reticence of some firms, better financial instruments need to be provided and promotion and dissemination programmes reinforced. Risk, slow returns and externalities contribute to this reticent attitude. The present paper provides practitioners with key data with which to steer decision-making processes towards successfully implementing eco-innovations. For instance, the descriptive results presented in this paper suggest that the introduction of changes in the organization of the firm can foster the implementation of measures to reduce environmental impact; this does not only apply to end-of-pipe measures, but also to prevention and control measures, which can yield much better combined results.

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NOTES

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3. This is one of the documents elaborated on the basis of Directive 2010/75/UE. The document describes, by sector, the best available techniques, and details how they must be designed, built, maintained and exploited in order for the highest environmental standards to be attained under economically and technically viable conditions.
4. More information on the dissemination campaign can be found at http://ecoinnovacion.fcirce.es (accessed: December 2016).
5. The panel had seven members: three representatives of public agencies, two representatives of the private sector, an academic and a CEO. All of them are in some way involved in firm- or environmental-management. Using the Likert scale (from 0 to 10), the experts were asked to evaluate the relevance of each item on the survey.
6. Measured on a Likert scale (0-10): 0 corresponds to 'no measures have been implemented' and 10 'many measures have been implemented'.
7. The final pool of options concerning drivers and obstacles was selected by the panel of experts on the basis of the real conditions of the sector under analysis. They were measured according to the Likert scale (0-10, where 0 means no incentives or obstacles and 10 important incentives of obstacles).
8. This expression refers to environmental rules which establish what is allowed and what is not in a given sector. Other normative frameworks, for instance, those based on linking good practices and economic incentives, are much more effective in promoting proactive policies in firms.