A framework to move forward on the path to eco-innovation in the construction industry: implications to improve firms´ sustainable orientation

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Abstract

This paper examines key aspects in the innovative behavior of the construction firms that determine their environmental orientation while innovating. Structural equation modeling was used and data of 222 firms retrieved from the Spanish Technological Innovation Panel (PITEC) for 2010 to analyse the drivers of environmental orientation of the construction firms during the innovation process. The results show that the environmental orientation is positively affected by the product and process orientation of construction firms during the innovation process. Furthermore, the positive relation between the importance of market information sources and environmental orientation, mediated by process and product orientation, is discussed. Finally, a model that explains these relations is proposed and validated. Results have important managerial implications for those companies worried about their eco-innovative focus as the types of actions and relations within firms most suitable for improving their eco-innovative orientation are highlighted.

Keywords: Eco-innovation, environmental orientation, sustainability, construction industry, structural equation modelling.

1. Introduction

The relation of the construction sector with innovation, sustainability and environment has been analyzed in depth by several authors, from both the urban standpoint and economic and social perspectives (Tse, 2001; Pearce, 2006; Turner, 2006; Luetzkendorf, 2010; Hill and Lorenz, 2011; Du Plessis and Cole, 2011; Lam et al. 2011; Cervelló-Royo et al. 2012; Huedo and Lopez-Mesa, 2013). The latter are the most incidental and fundamental in the most populated European countries, due to the potential impact that construction as well as the built environment, may have on gross domestic product and the whole environment, for good or for bad (Jensen et al. 2011; Carter and Fowler, 2008).

Over the last few years, there has been an accelerating trend towards major initiatives to improve the performance of national engineering studies (Kuhn, 2001; Davis, 2001;

Beamon, 2005; Vanasupa et al. 2006; Song et al. 2014; Petruzzelli et al. 2011; Losada, 2013) and also construction industries in order to reveal elements of good practice (Courtney and Winch 2002; Courtney and Winch, 2003; Ding, 2008). However as stated by Van Bueren and De Jong (2007), while some countries' building sectors have accepted and implemented public policies aimed at promoting a sustainable built environment, these measures have had little impact and changes have been modest although the EU strategy has been trying to orientate member states towards a greener policy (Liefferink and Andersen, 1998; Schmidt and Radaelli, 2004; Burciu et al. 2010; Audet and Guyonnaud, 2013; Kim et al. 2014).

Environmental and ecological orientation has been found to be a key component of companies' performance as well as corporate social responsibility, with the corresponding tangible and intangible benefits for those companies that adopt this new approach (Porter and Van der Linde, 1995).

Thus, as several authors have written, sustainable development and innovation should be considered fundamental elements in the competitive positioning of companies (Esty and Winston, 2006; Segarra-Oña et al. 2011). Therefore, the synergies between both concepts, known as eco-innovation, must also be considered when designing companies' policies. In fact, eco-innovation, understood as innovation processes toward sustainable development (Rennings, 2002; Rennings et al., 2006) has become a fundamental factor for achieving the objectives set out in the Lisbon Strategy (European Commission, 2004; European Commission, 2010) and in the Competitiveness and Innovation Framework Programme 2007–2013. So knowing the benefits of being innovative, what is required to shift from innovative to eco-innovative behavior? What are the drivers that help companies to become eco-innovative and what are the mediating effects of a proactive environmental focus? Knowing the answers is fundamental to orientating public policy towards the articulation of greener actions, fulfilling EU strategy, business´ competitive achievement of businesses and what it is more important, society´s needs.

The purpose of this paper is to study the determinants of the eco-innovative orientation on the Spanish construction industry.

There is ample literature about environmental proactiveness and eco-orientation in companies. In this line of argument and focusing on Spain, Segarra-Oña, et al (2011) analysed a representative sample of Spanish companies and studied which moderating factors determine how innovative companies perform when implementing a sustainable proactive approach; and González-Benito and González-Benito (2008) studied the effect of Spanish industrial firms' market orientation on perceptions of environmental pressure exerted by stakeholders and the environmental practices implemented in response to that pressure. They found that managerial concern about environmental aspects, the desire for economic benefits in the long and short terms, the implications of stakeholders, and the implementation of EMS, positively influence the environmental orientation of the firm, while the perception of managerial obstacles to the firm's environmental development and perception by companies of administration influence on environmental issues are highly influential in reducing the odds of being environmentally oriented (Segarra-Oña et al., 2013)

Evidence shows how some industries' performance has improved after enhancing their eco-orientation, for example in the tile and ceramic industry (Carrascosa-López et al., 2012) and the food industry (Peiró-Signes et al., 2013), and how other industries are deeply concerned about the tangible and intangible benefits of being more sustainable, for example the wine industry (Gázquez-Abad et al. 2014), the hospitality industry (Sánchez-Ollero et al. 2013; Parsa et al. 2014; Peiró-Signes et al. 2014) and the tourism industry (Sigala, 2014).

The evaluation of eco-orientation is a complex issue, given that several aspects are to be considered. Peiró-Signes et al. (2013) use quantitative analysis techniques and apply them to the Spanish food industry in order to analyse if there is any relation between economic indicators like total income, net sales, profit margin, etc. and the use of the ISO 14001 eco-management tool. They also study how food companies evolve from being innovative to eco-innovative by means of identifying the aspects that determine whether their environmental impact is minimized as a result of their innovative activity. Results show significant differences in most of the analysed variables among the groups they study. On the other hand, Segarra-Oña et al. (2012) also analyse the relationship between the implementation of the ISO 14001 standard and the generation of economic revenues in the Spanish hotel industry and, at the same time, consider the possible effects of factors such as company-size, organisational factors, location, etc. on business results. By means of quantitative analysis techniques they found significant differences in the economic-performance of ISO-certified hotels and the non-certified ones, especially for urban and beach hotels. Evidence also showed that only small rural hotels saw no real difference in revenues due to the presence or absence of ISO certification. Furthermore, Carrascosa-López et al. (2012) verified the influence of company size and the multinational nature of the companies in environmental proactivity. They identify significant benefits that arise from the implementation of proactive environmental management actions, by order of importance: avoidance of sanctions (major benefit), improvement of corporate image, long-term cost savings and new business opportunities. The authors also identify the lack of institutional and financial support as main obstacles that companies have to face. However, they state that the conclusions they obtained from this study are not the same as the findings obtained in similar studies from different industrial sectors in the same region (Segarra-Oña et al. 2011), therefore conclusions may remain in the scope of the study.

Thus, considering the main limitations of those works are regarding the nature of case studies, conclusions obtained for one specific sector cannot be generalized easily for all economic sectors.

In the industry studied here, the construction industry, the publication of the EU Action Plan for Energy Efficiency (Commission of the European Communities, 2006), The Stern Review (Stern, 2006) and the IPCC's Fourth Assessment Report (IPCC, 2007a and 2007b) are examples of the involvement and compromise of the construction industry with regards to the environment.

At a strategic level, a lot of effort has been made by companies in this sector whose main goals were to reduce waste and energy consumption or increase flexibility and capacity (Van Bueren and De Jong, 2007) as well as to reach new markets, increase the quality of products/services, increase their market share, etc. (Kibert, 2007; Leman and Bordass, 2007). Thus, it might be of interest to review if process-oriented companies, which are looking for cost and operational efficiency, are simultaneously looking to reduce impact and to improve their environmental performance. On the other hand, it might be also relevant to check if product-oriented companies, interested in increasing the quality or the number of products to penetrate in new markets or to increase market share are more likely to be environmentally oriented, as they will try to reach green markets.

Furthermore, there is an increasing importance and interest in gathering the views and concerns of the main stakeholders such as competitors, suppliers and customers. Those actors are the most important sources of information, and it becomes important to measure their implication on the environmentally-oriented innovative aspects of construction companies. There have been several attempts to define those aspects; for example, there was an initiative lead by the CIB (International Council for Research and Innovation in Building Construction) called “Revaluing Construction” (Barrett and Lee, 2005), whose main philosophy was the need for a shared vision that can resolve and align the multiple views between actors and thus achieve meaningful concerted progress (Ang, 2004). In this vein, Barrett (2007) suggests that ongoing communication processes need to be cultivated in order to develop a single integrative conceptualisation of the sector in the guise of a ‘shared vision amongst stakeholders’ (Barrett, 2007). However, none of these works have tried to find evidence of whether those construction firms that rely on market information sources, i.e. the information from customers, suppliers and competitors (through the mediation of process and product-orientation), are more likely to be environmentally-oriented.

With all this being considered and in order to gather and make the most of the data available, the following constructs will be defined: process-oriented companies, product-oriented companies and firms that rely on the market information sources.

Process-oriented companies are defined as those companies that are oriented towards cost reduction, and to increased capacity and flexibility. As Van Bueren and De Jong (2007) state, the building sector has a fragmented institutional context and is in need of radical restructuring. Given that there is no sense of urgency, a process approach to policy-making could facilitate an incremental path towards a sustainable built environment. Process-oriented companies will focus on materials, energy and water saving, as this will reduce product or service costs. Moreover, they will be focused on increasing the efficiency of their processes, which is also cost-related. Sharma et al. (2008) found perceived factors, including benefits and cost savings, which are important to innovation adoption in organizations. Then, it can be expected that process-oriented companies, looking for cost and operational efficiency, may be simultaneously looking to reduce impact and improve their environmental performance, i.e. to be environmentally oriented.

H1: Process-orientation has a positive effect on the environmental orientation of the construction firms while innovating.

The construction industry is under pressure to be green, especially due to their customers' increasing demand (Kibert, 2007; Leman and Bordass, 2007). But far from being a threat, environmental awareness should be considered as an opportunity with regards to studies that relate to competitiveness improvement and differentiation (Vastag et al. 1996; McKeiver and Gadenne, 2005; Matthyssensa and Vandenbempta, 2008; Gebauer et al. 2011). Product-oriented companies are those companies that focus on increasing the quality or the number of products, to penetrate new markets or to increase market share. Thus, the green niche represents a big and increasing market gap to tap into and which cannot be ignored. It can be expected that construction companies that are focusing on their product are more likely to be environmentally oriented, as they will try to reach green customers.

H2: Product-orientation has a positive effect on the environmental orientation of the construction firms while innovating.

Many authors have studied questions regarding consumer perceptions toward green practices in construction (Kibert, 2007; Leman and Bordass, 2007). Eco-labels and environmental certifications lead to enhance customer awareness of construction companies environmental efforts and act as differentiating asset over those that do not engage in eco-certification schemes (Lützkendorf and Lorenz, 2007).

Conversely, the higher cooperation and more intense relationship that eco-innovative firms establish with suppliers, sharing resources and knowledge and putting the absorptive capacity into value, are characteristics that should be considered in order to achieve greater competitiveness. Indeed, information sources affects the way companies innovate (Amara and Landry, 2005). Furthermore, competitors attitude to environmental aspects might condition firms environmental behaviour (Stone and Wakefield, 2000).

Then, it can be expected that those construction firms that rely on market information sources, that is, the information from customers, suppliers and competitors, are more likely to be environmentally-oriented. In relation to this, we can expect a mediating effect of both, process and product-orientation,. Construction firms which consider market information to be important will be more sensible to the market demands to reduce water, energy and waste consumption and to increase operational efficiency (process orientation). Moreover, they will be more sensible to the "green" demands of their customer or to the "green" actions of their suppliers or competitors. Consequently, it has been hypothetised that:

H3: The importance of the market information sources in the innovation process positively affects the product-orientation of construction companies.

H4: The importance of the market information sources in the innovation process positively affects the process-orientation of construction companies.

2 Material and methods

2.1 Data collection

The Technological Innovation Panel (PITEC) is a statistical instrument for studying the innovation activities of Spanish firms over time. The database is being maintained by the INE (The National Statistics Institute), which counts on advice from a group of university researchers and the sponsorship of the Spanish Foundation for Science and Technology (FECYT) and the Technological Innovation Foundation (COTEC). Available since 2004, the final aim of this project is to improve the statistical information available on firms' innovation activities, and the conditions for scientific research on this topic.

PITEC is designed as a panel data survey to estimate the changes of the innovation activities over time. A set of variables is subjected to anonymization in order to avoid the disclosure problem. Anonymisation in this study only affects the segmentation carried out to get the sample. Original 4-digit Nomenclature of Economic Activities, NACE codes are replaced with a 44-industry breakdown in the variable ACTIN. Therefore, under the same economic activity code (called ACTIN), construction-related industries are selected: construction of buildings, civil engineering and specialised construction activities (NACE codes 41, 42 and 43 respectively).

The latest data available (2010) was used to analyse a total of 222 firms from the construction industry included in the database.

Items used in this study were selected from PITEC variables. The variables selected refer to two different questions:

1) During the period 2008-2010 how important to your enterprise's innovation activities were each of the following information sources? Please identify information sources that provided information for new innovation projects or contributed to the completion of existing innovation projects.

2) How important were each of the following objectives for your activities to develop product or process innovations during the three last years?Table 1 shows the 23 variables that were chosen to characterise these firms. In the PITEC survey, companies entered their level of agreement to these items on a 4-point scale ranging from 1 (High) to 4 (Not considered or Not important).

Table 1. Selected variables from PITEC[1] database

PITEC Variables	Function type	Explanation
$SOURCE_i$ (i=F1,…,F11)	Cat.	Importance of information source "i" while innovating (1-internal sources, 2-supliers, 3-clients, 4-competitors, 5-external consultants, labs or private institutes 6-universities, 7-public research institutions, 8-research institutes, 9- conferences, industrial fairs, 10-scientific and technical journals, 11-industry&professional associations)
$OBJET_i$ (I=O1,..,O12)	Cat.	Importance of the objective "i" while innovating (1-increase the number of products or services offered, 2-Old product or processes substitution, 3-new markets penetration, 4-increase market share, 5-increase goods or services quality, 6-increase flexibility, 7-increase capacity, 8-labour cost reduction (per unit) 9-raw material cost reduction(per unit), 10-energy cost reduction (per unit), 11-reduce environmental impact, 12-increase employees' health and security,

Categorical variables: 1=High; 2=Medium; 3= Low; 4=Not considered or not important.

F1 is defined as internal information sources, F2-F5, are defined as market sources, F6-F8 as government sources, F9-F11 other external sources.

O1-O5 are defined as product-oriented objectives, O6-O10 as process-oriented objectives, O11-O12 as other types of objectives

Source: Spanish Innovation Panel, PITEC, database

2.2 Data analysis. Model measurement and assessment.

A Partial Least Squares (PLS) approach was used with SmartPLS 2.0.M3 by Ringle et al. (2005) to analyse the data. This method was considered appropriate because this study is more exploratory than confirmatory (Leimeister et al., 2009), requires no presupposition of normality in variables and is geared to research models that predict the effects of some variables on others. Moreover, Anderson and Gerbing (1988), Bagozzi and Yi (1988), Barclay et al. (1995) and Chin et al. (2003) recommend it over maximum likelihood techniques in studies in which the theory is not firmly established.

[1] www.fecyt.es

The sample size was considered appropriate for the study as it largely exceeds the suggested threshold proposed by Barclay et al. (1995), that the sample size be equal to the larger of the following: ten times the number of indicators of the scale with the largest number of formative indicators, or ten times the largest number of structural paths directed at a particular construct in the inner path model.

Item reliability, internal consistency, and discriminant validity were used (Chin, 1998) to test the reliability and validity of the research instrument.

3. Results

Firstly, individual item loadings were used to evaluate individual item reliability. According to Chin (1998), individual items with loadings greater than 0.7 are considered acceptable. Results of item reliability indicated that all items exceeded the suggested threshold (see Table 2), indicating that the survey instrument was sufficient for measuring each construct individually.

Table 2. Item loadings

	Eco-orientation	Market inf. Sources	Process-orientation	Product-orientation
objet13	0.924			
objet12	0.908			
objet11	0.903			
source3		0.880		
source4		0.798		
source2		0.741		
objet8			0.882	
objet10			0.841	
objet9			0.838	
objet7			0.802	
objet6			0.748	
objet4				0.905
objet5				0.882
objet3				0.862
objet1				0.757
objet2				0.730

Secondly, Cronbach's alpha and Composite Reliability (CR) were used to evaluate the internal consistency for each construct. According to Nunnally (1995) the minimum acceptable alpha or CR level is 0.7 for each item loading. Results in Table 3 show the constructs had Cronbachs alpha and CR values greater than the minimum threshold.

Table 3. Reliability measurements

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
Eco-orientation	0.831	0.937	0.540	0.898	0.831	0.229
Market information sources	0.653	0.849		0.733	0.653	
Process-orientation	0.678	0.913	0.244	0.882	0.678	0.164
Product-orientation	0.689	0.917	0.273	0.885	0.689	0.186

Finally, convergent validity was tested using the average variance extracted (AVE). The AVE, which measures the variance captured by the indicators relative to the measurement error, should be greater than 0.5 in order to justify the use of a construct (Chin, 1998). To justify discriminant validity, the corresponding AVE has to be greater than the square of the estimated correlation between the latent variables (Fornell and Larcker, 1981). For the four latent variables, AVE values surpassed the 0.5 level (see Table 3) showing that measures that should be related are in reality related. Moreover, the square root of AVE was greater than the correlations between latent variables (see Table 4) indicating that each latent variable relates more strongly to its own measures than to others. Thus, convergent and discriminant validity was adequately demonstrated and the measurement model was assessed with confidence. This outcome also constitutes a measure of the validity of the questionnaire used to capture the four latent dimensions.

Table 4. Matrix of correlation between latent variables

	Eco-orientation	Market information sources	Process-orientation	Product-orientation

Eco-orientation	**0.912**			
Market inf. sources	0.548	**0.808**		
Process-orientation	0.589	0.494	**0.823**	
Product-orientation	0.682	0.522	0.519	**0.830**

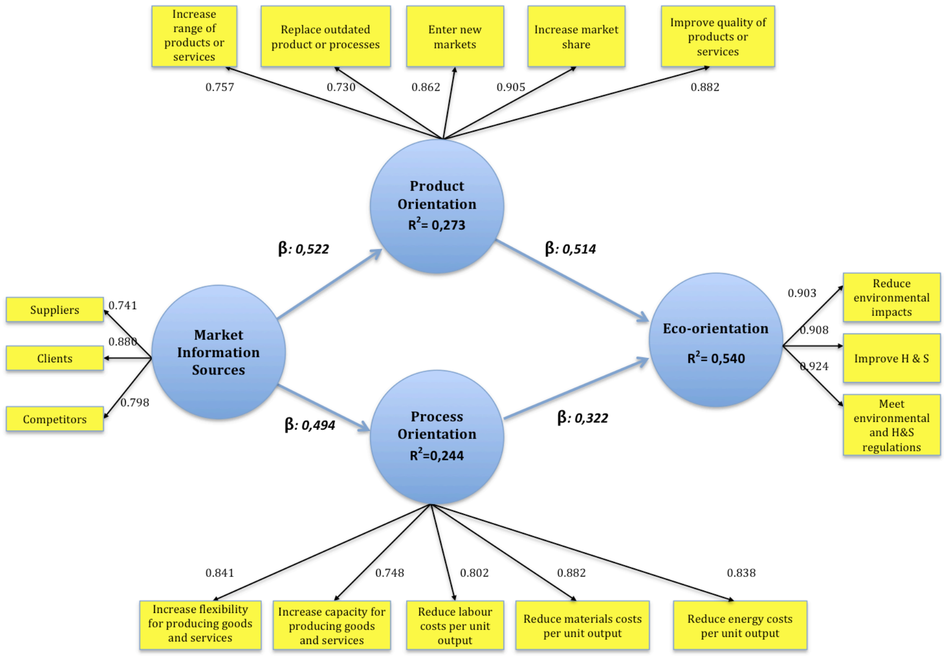
Note: Square root of AVE on diagonals in bold.

3.1 Structural model assessment

The structural model proposed to test the four basic assumptions was estimated by the partial least squares method, using the application SmartPLS. Other constructs that were identified in the preliminary work were dismissed because of their null relation, the environmental orientation, or because the small impact on explaining the environmental orientation of the firm. Thus, a more parsimonious model which explains most of the variance was looked for, rather than a complicated model with multiple relations and constructs that don't focus on the key factors that are affecting the eco-orientation of the construction firms. Figure 1 shows (observable) questionnaire items from the PITEC database in rectangles and unobservable latent factors with circles. The arrows indicate regression relationships, showing the relationships of items with latent factors (measurement model) and between latent factors (structural model). Corresponding partial regression coefficients are indicated next to the arrows and, inside the circles, corresponding to endogenous variables, the coefficient of determination for the corresponding regression.

The results obtained for the model confirm the choice of indicators. An analysis of overall effects, shown in Table 5, underscores the dependence existing between the latent variables and confirms the directionality of the initial hypotheses in the model.

Figure 1. Estimated structural equation model



Own source using SmartPLS 2.0

To confirm the theoretical assumptions, Table 5 shows the regression coefficients between latent factors, their t-statistics and p-values, estimated by bootstrapping with 5000 samples. The four proposed relations (direct effects) have significant values, confirming the hypotheses in their various concretions.

Table 5. Effects on endogenous variables.

Effects on endogenous variables	Total Effects	Standard Error	T Statistics	R^2	Q^2
Product-orientation				27.3%	0.174
Market Information Sources	0.494	0.081	6.081***		
Process-orientation				24.4%	0.143
Market Information Sources	0.522	0.075	6.919***		
Eco-orientation				54%	0.446
Product-orientation	0.514	0.088	5.828***	35.05%	
Process-orientation	0.322	0.101	3.179***	18.95%	
Market Information Sources[a]	0.428	0.069	6.218***		

*** Significant at $p<0.001$ [a] indirect effect.

The results indicate that the variables *process-orientation* and *product-orientation* had a positive effect on *eco-orientation*. The path coefficient between *process-orientation* and *eco-orientation* was 0.322, which was significant at $p<0.001$. In addition, product-orientation was significantly related to eco-orientation (β= 0.514, $p<0.001$). Thus, H1 and H2 were supported.

In regards to the *market information sources* construct, results show that this variable contributed to a significant positive effect on both *product-orientation* and *process-orientation*. In other words, the importance of the information from suppliers, competitors and clients in the innovation process has a significantly positive effect on the product-orientation (β= 0.522, $p<0.001$) and on the process-orientation (β= 0.494, $p<0.001$) of the construction firms while innovating. Therefore, H3 and H4 were also supported. Furthermore, the positive effect of the *market information sources* while innovating on the *eco-orientation* (β= 0.428, $p<0.001$) through the mediation of *product* and *process-orientation* has been confirmed

On the other hand, to confirm the research model the squared multiple correlation (R^2) for each endogenous variable was used (Tenenhaus et al. 2005). The value of R^2 measures the percent of variance explained of each construct in the model. As shown in Table 5, the R^2 coefficients associated with latent variable regressions are significant, with values greater than 0.1 in all cases (Falk and Miller, 1992). More specifically, the independent construct representing the importance of market information sources in firms innovation explained 27.3 % of the variance in product-orientation and 24.4% in process-orientation. Product-orientation and process-orientation innovations explained 54 % of the variance in the eco-orientation of the construction firms. Nevertheless, product-orientation explained a substantial amount the variance (35.05%) compared to process-orientation (18.95%), indicating that product-orientation represents a best predictor of eco-orientation than process-orientation in the construction industry.

Finally, following the propositions,of Barclay et al. (1995), Tenenhaus et al. (2005) and Henseler et al. (2009) the strengthening of this analysis with the cross-validated redundancy index (Q^2) or Stone-Geisser test (Stone, 1974; Geisser, 1975) was considered. The Stone-Geisser test givesa measure of goodness with which the values observed are reconstructed by the model and its parameters (Chin, 1998); it is generally accepted that a model has predictive relevance when Q^2 is greater than zero (Henseler et al., 2009). Q^2 can be measured utilising procedures of the blindfolding type (Tenenhaus et al, 2005) and is only applicable to latent variables that are incorporated in a reflective measurement model (Henseler et al., 2009), as in this study.

Table 5 shows the Stone-Geisser test (Q^2) utilizing blindfolding procedure. Results show that the model has predicted relevance, as Q^2 results for each construct are greater than zero.

Then, the structural model was used to test the independent relationships among the variables proposed in this study. The strength of the causal relationships between the constructs has been evaluated, calculating the path coefficients or standardised betas, and Figure 1 and Table 5 illustrate support for positive relationships for the proposed hypotheses. Finally, the structural model indicates how well the structural model predicts the hypothesised relationships.

4. Discussion and conclusions.

The purpose of this study was to identify some determinants behind the environmental orientation of the construction firms while innovating. Specifically, this paper assesses the environmental drivers of the construction industry which will affect the decrease of environmental risks and the development of public policies related to the reduction of the environmental impact of the innovations adopted by firms in the industry. Results showed that product and process-orientation and the importance of market information sources are the key factors determining *eco-orientation*. Using the software package, SmartPLS 2.0, the measurement model was confirmed with sufficient reliability and validity for all of the constructs in the research model. Furthermore, the structural model demonstrated that all the path coefficients were directionally supported and statistically significant.

Evidence appears to support the notion that companies are more likely to be environmentally oriented while innovating if they are process-oriented while innovating. That is, to look for more flexibility and capacity and to reduce the costs (labour, materials and energy) per product when innovating, positively affects the environmental orientation of the construction firms. Secondly, construction organizations tend to be environmentally-oriented if, in their innovation processes, they are orientated to increase the quality or the number of products, to penetrate in new markets or to increase market share. This product-orientation, while they are innovating positively affects their eco-orientation.

In addition, the relationship between the importance of market information sources and product and process-orientation was assessed. These relationships were supported, suggesting that construction companies that rely on information from suppliers, competitors and clients for the innovation process are more likely to orientate their innovation to the product or the processes. Consequently, this relation will also affect the environmental orientation of the innovation. The conceptual model disentangles the relationship established between the market (on both sides, information sources and market-oriented strategy) and the sustainable orientation of firms. The link between corporate social responsibility and competitive advantage (Porter and Kramer, 2006) has been empirically analyzed in this paper. On one hand, the fact that being oriented to the market and being innovative while considering ethical-sustainable principles and objectives is reflected in the presented model. On the other hand, the closeness to the suppliers, clients and competitors, called "market information sources" has been proven. Those elements are a link between the firm´s and their communities which promotes an enriching win-win approach, as established by the stakeholder´s theory (Freeman, 1994).

This study highlights the relation between eco-orientation and firm's innovative characteristics is the construction industry. The research model provides a cogent framework for understanding why some organizations may or may not be environmentally-oriented while innovating. Our model assessed innovative characteristics, such as *product and process-orientation* and the *importance of the market information sources* in the innovation process as they apply to the *eco-orientation*. This approach attempted to explain the determinants of the environmental orientation of construction companies.

It was shown that firms with a clear product and process-orientation in the innovation process have a better understanding of the benefits of an environmental approach. Moreover, these organisations rely heavily on information sources when they are innovating. In other words, construction companies need to seize of innovation activities and properly orientate the innovation process in an attempt to become more environmentally-oriented and gain a competitive advantage over their competitors. Results may also lead both, managers and policy-makers to attempt greener construction-related activities, by enhancing eco-innovation. At the end of the day, eco-innovation is part of social innovation and, therefore, helping the construction industry to move towards a more sustainable innovation pattern is also helping society.

As with any empirical research, limitations to the study exist. Measurements adopted, used in PITEC, potentially caused a limitation of constructs that could serve as a potential limitation to this study. A few factors influencing the eco-orientation were focused on, seeking a more parsimonious model. Therefore, more research needs to be conducted to identify other potential factors impacting eco-orientation of firms while innovating.

A cross-sectional design limits the robustness of the findings since observations occur at one point in time rather than over time. To diminish this limitation was run the model for the same companies with data from 2009, and this led to similar results.

Furthermore, the use of a single database to collect data is a limitation because it may not be representative of an entire industry. However, the use of the PITEC database, which is the reference statistical instrument for studying the innovation activities of Spanish firms over time, overcomes this liability to a large extent.

The generalisability of this study may be increased by expanding the research to include other countries' firms and more specific contexts (economic crisis, new regulations, etc). The latter should help academicians uncover industry-specific relationships undetermined in this study.

Future research should look into how eco-orientation is introduced (e.g., the mechanisms and processes employed), the most efficient way to disseminate this new culture and how an organisation can modify its behaviour to reflect a new orientation, as this study did not investigate the effects of external variables that can affect environmental orientation, such as, legislation changes or consumer behaviour about environmental products or labels.

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