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TECHNOLOGICAL POSTURE AND CORPORATE SOCIAL RESPONSIBILITY: EFFECTS ON INNOVATION PERFORMANCE

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Abstract

Interest in the relationship between innovation and Corporate Social Responsibility (CSR) has grown considerably in the last few years. The aim of this paper is to analyze the relationship between a company's technological posture and CSR, as one of the main determinants of technological innovation performance. From knowledge-based and stakeholders' theories a structural equations model of relationships was established and statistically tested through Smart PLS on a sample of Spanish firms from the renewable energy sector. Our findings suggest that in these kinds of industries, leadership postures (proactive strategies) lead firms to engage in high levels of CSR commitment. Moreover, CSR activities are positively related to innovation performance, which suggests that the higher the level of a firm's engagement in CSR activities, the greater the possibility of achieving further innovation derived from the exploitation of its stakeholders' knowledge.

Key words: corporate social responsibility, innovation performance, PLS, Spain, technological posture

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1. Introduction

The interest in the relationship between innovation and Corporate Social Responsibility (CSR) has significantly grown in the last few years in the field of sustainability (Surroca et al., 2010). In general, it is argued that CSR should be integrated into business management models since it is useful for justifying strategic choices and allows the company to generate valuable intangible strategic assets in order to achieve competitive advantages and a high level of financial performance (Hart and Sharma, 2004; McWilliams and Siegel, 2000; Padgett and Galán, 2010; Surroca et al., 2010).

In this paper, we study the connection between the decisions concerning a firm's technological posture (as a strategic choice) and its level of CSR commitment. Although the relationship between CSR and innovation has been analysed and found to be positive in several papers (e.g., McWilliams and Siegel, 2000; Padgett and Galán, 2010; Wagner, 2010), CSR existing research has not yet clearly shown the nature of the relationship (Surroca et al., 2010). Moreover, there is a lack of research indicating how a company's *innovation strategy* can be connected to CSR to improve innovation performance levels. Our study is thus articulated around two main research questions: (1) is the company's innovation strategy (represented by its technological posture) related to its level of CSR commitment, expressed by the number and intensity of its CSR activities? And, (2) can this level of CSR commitment be reflected in a higher level of innovation performance?

In general, CSR literature has considered a firm's innovation effort as a variable that contributes to explain more accurately the relationship between CSR activities and financial performance (Surroca et al., 2010; Wagner, 2010). For instance, McWilliams et al. (2006) suggested that R&D investment is a

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necessary aspect for a firm seeking to improve its financial performance through the use of CSR as a differentiation strategy. Hull and Rothenberg (2008) also stated that innovation may moderate variables that affect financial performance, such as a firm's CSR, thereby amplifying its final outcome. There are also particular elements of CSR that have been studied with respect to their relationship with innovation, such as specific initiatives developed by firms with the aim of improving their environmental innovation performance (Carrión-Flores and Innes, 2010). For instance, Frondel et al. (2007) found that environmental CSR helps the firm to develop strategic capabilities that enables it to be more innovative, benefiting both stakeholders and the firm itself through the development of cleaner production technologies. Recently Guoyou et al. (2013) concluded, from research developed in a sample of manufacturing firms from China, which the demands from particular stakeholders directed these firms towards developing more proactive CSR activities, which in turn resulted in green innovation.

In short, innovation strategies oriented towards CSR facilitate new ways of enhancing corporate responsibility through rebuilding the relationship between organizations and their stakeholders, along with the development of an understanding of the knowledge that exists within the communities which an organization serves (Bartlett, 2009; Guoyou et al., 2013). Although evidence seems to suggest that both innovation and CSR should be considered important determinants of a firm's performance indicators, studies empirically addressing their joint effects on performance are uncommon (Mahmoud and Hinson, 2012). Hence, this paper proposes and tests a model of the relationships between technological postures (innovation strategies), CSR activities and innovation performance in a sample of renewable energy firms in Spain. Specifically, we establish that those companies which are technological leaders have important incentives to extensively develop CSR practices since knowledge that arises from relationships with stakeholders form an important input towards improving their level of innovation performance.

In addition, the renewable energy sector in Spain is a relatively new industry greatly influenced by innovative and CSR activities. This is a very dynamic and innovative sector, and highly sensitive to social and environmental aspects (Frondel et al., 2007; Mihic et al., 2014), in which social reputation and innovation play pivotal roles for firms as sources of differentiation and competitive advantages (McWilliams et al., 2006).

Hence we find this industry highly suitable for our study. Moreover, as Mishra and Suar (2010) point out, a specific sector can provide a high level of homogeneity for a study since firms are equally affected by environmental conditions such as technology changes or legal and political issues.

The structure of the paper is as follows. First, we theoretically establish the relationship between technological posture, CSR activities and innovation performance. Next, we statistically test, through the Smart PLS technique, the model of relationships between these variables in a sample of Spanish companies in the renewable energy industry. Finally, we present the results of the study, and the theoretical and managerial implications along with a conclusion.

2. Theoretical background and hypotheses

2.1. Technological posture and CSR

Decisions of companies on innovation usually entail important CSR and ethical issues (Guadamillas and Donate, 2011; Wagner, 2010). Scientific and technological development requires an effort by companies to ensure their innovative activities comply with environmental and social laws, in order to contribute to society welfare. Moreover, innovation developed by companies frequently contributes to the achievement of some of their stakeholders' objectives as the company generates products, services and technologies that satisfy their specific needs (Hart and Sharma, 2004).

Frequently, in high-intensity, competitive markets, companies need to offer additional features to their products to achieve differentiation, and in the last few years a number of customers have come to value company social actions or environmental activities and processes as a way of avoiding negative consequences to their welfare (Miles et al., 2004). To this end, companies need to be innovative by developing activities which contribute to differentiate their products and services through CSR. Moreover, adopting CSR practices can help companies to retain their most qualified employees, necessary to maintain leadership positions (Guadamillas and Donate, 2011) and improve their innovative capacity (Surroca et al., 2010). In addition, companies are also introducing CSR innovations in processes in order to remain competitive by lowering the final cost of products (e.g., new processes that generate energy savings or lower waste disposal costs). Furthermore, socially responsible behaviour can ensure that companies maintain or even improve legitimacy with regard to their stakeholders, who could become involved more actively in the innovation development process (Guadamillas and Donate, 2011). For instance, the well-known 3M Multinational Corporation has recently set up a technological centre in Spain exclusively dedicated to managing relationships with its main customers (businesses, final clients). The final aim is to take advantage of the knowledge generated by the interactions developed between the firm and its stakeholders in order to be (more) innovative. In this case, CSR activities oriented to create high value for customers are directly linked to a proactive innovation strategy for supporting a leadership posture in the marketplace. The need for innovation propels the development of new CSR initiatives.

A number of empirical studies positively connect innovation activities to CSR (e.g., McWilliams et al. 2006; Padgett and Galán, 2010; Wagner, 2010). But there is a lack of research that analyzes the effect of innovation strategies (strategic choices) on CSR, especially technological postures. This innovation strategy is based on taking decisions about the level of technological effort (higher or lower) and the technological "attitude" of firms –i.e., first-mover *versus* follower positions (Min et al., 2006). Although technological leaders (technologically more aggressive, first-movers) can achieve advantages which are unavailable to followers, this requires large and continual investment efforts in order to maintain leading positions (Spital and Bickford, 1992). Moreover, to move first is not always the best technological option (e.g., customers can need to learn how to use the new technology; switching costs to the new technology; unavailability of complementary resources or facilitating technologies). Nevertheless, for technological leaders CSR offers a new approach to get access to valuable knowledge and find new ways to take advantage of this kind of knowledge.

In this regard, we propose that companies with a greater tendency to lead technology changes will have a higher inclination to develop CSR activities than firms which tend to be technological followers (i.e., with more reactive or defensive innovation strategies) as these activities will help them to reinforce their innovative leadership positions. Hence, the search for technological leadership will force the firm to seek more actively to improve relationships with its main stakeholders through CSR actions, in order to collect valuable knowledge that can be useful for the exploitation of new opportunities by means of innovation in products, processes and/or services. From these arguments, we offer the following hypothesis:

H1: The more a firm is oriented towards a position of technological leadership, the greater its level of commitment to CSR activities.

2.2. CSR and innovation performance

In dynamic environments, the ability to identify new opportunities and exploit them through technological innovation is a key issue for achieving competitive advantages (Haleblian et al., 2012). New opportunities can arise from different sources, and CSR is a fertile field in which to identify changes in customers' needs, environmental challenges or solve social issues through innovation (Porter and Kramer, 2006). For instance, McWilliams et al. (2006) stated that innovation leading to social benefits (e.g., green innovation) is driven, in a strategic sense, by the CSR activities of companies. The adoption of certain CSR practices can become a source of continual innovation that causes new market opportunities to arise and flourish (Chang, 2011; González-Moreno et al., 2013). For instance, in environmentally sensitive industries, CSR activities can contribute to the achievement of innovative outcomes reflected in a more efficient use of energy, pollution prevention, waste recycling, design of green or organic products, and environmental management, among other aspects (Chen et al., 2006).

In recent years, environmental management and investments in the field of sustainability are gaining importance due to both global environmental dynamism and stakeholder pressure (Guoyou et al., 2013). Nevertheless, the benefits from investment efforts in environmental activities beyond legal and society pressure are not clear for a number of firms in industries sensitive to CSR (Sparkes and Cowton, 2004). Furthermore, from social and economic CSR activities, responsible companies can improve their attractiveness with regard to image and reputation to attract funds, partners and highly-qualified employees (Tsoutsoura, 2004). From this perspective, CSR efforts can help companies to retain talent and creativity (Porter and Kramer, 2006). Moreover, as specific stakeholders (e.g., suppliers, customers) can provide valuable information and knowledge about their needs and preferences to trusted companies, innovation is likely to arise as a response to these opportunities.

In this connection between a company and its stakeholders, CSR activities will offer firms access to networks and provide a different view of the marketplace, giving early warning about shifts in preferences, needs and values (Mahmoud and Hinson, 2012). Since these networks are sources of information, being open to the new ideas provided by this knowledge flow is a key predictor of a firm's innovative performance (Fey and Birkinshaw, 2005). Thus, firms may gain competitive advantage from the acquisition and utilization of new knowledge they have accessed through their engagement (Hart and Sharma, 2004).

When changes in needs are perceived by firms, they will search for technological solutions through innovation in order to exploit sales/financial advantage of the new opportunities while defending themselves from environmental threats. As D'Amato and Roome (2009: 423) point out, "CSR is understood to arise from an increased awareness that change outside the company requires management attention", which means that CSR initiatives will result in innovations in products, services and processes that generate maximum social benefits (Bartlett, 2009).

Overall, knowledge from the stakeholders' utility functions can enhance the company's ability for innovation (in product and process), and the creation of new inter-organizational relationships to access new knowledge (Barringer and Harrison, 2000). Our viewpoint is that companies highly committed to CSR will be able to establish and maintain better relationships with stakeholders than non-committed companies, thereby allowing them to benefit from more opportunities to technologically innovate, both in processes and products. The following hypotheses are thus offered:

H2: CSR commitment is positively related to a company's product innovation performance.

H3: CSR commitment is positively related to a company's process innovation performance.

3. Methods and analyses

3.1. Sampling

The study's population includes 726 companies related to renewable energy activities in Spain. Specifically, six activities were considered: (1) energy generation; (2) manufacturing of technological components; (3) marketing and export of components; (4) engineering activities; (5) energy consulting; and (6) installation and maintenance activities. Secondary data from these companies were obtained from two Spanish specialized directories (IDEA - Institute for Diversification and Energy Saving; and the Specialized Business Directory of Renewable Energy Firms from the Spanish Industry Ministry). There are two main reasons for using this set of related activities in this study: (1) Renewable energy activities are very sensitive to CSR activities since their products, processes and services have major impacts in economic, social and environmental terms; (2) their great importance for the Spanish Economy, where the contribution to GDP was around 1% in 2012.

From an extensive literature review, we designed a questionnaire with different measures for technological posture (innovation strategy), CSR and innovation performance. We launched an on-line survey in September 2012. An e-mail was sent to the companies within the population along with an invitation to participate in the study and a direct link to the questionnaire to which a representative from senior management was encouraged to respond. By December 2012 we had collected 76 valid questionnaires, representing a response rate of 10.47% (Table 1). Finally, in order to test for non-response bias, differences between respondents and non-respondents were examined for the study. T-tests did not show significant differences either in relation to size (t= 0.698; p< 0.91) or age (t= 0.802; p< 0.74).

3.2. Measures

3.2.1. Technological posture

For this measure, four items were adapted from the scales developed by Zahra and Das (1993) and Zahra and Bogner (1999). This measure tries to reflect the innovation strategy proactivity of the company, including aspects such as being the first to market technologies rather than being a follower or late mover, the innovation proactivity or the efforts dedicated to gain a reputation of being a technological first-mover in the market (see appendix for the list of items).

3.2.2. Corporate Social Responsibility activities

CSR measurement has been elaborated from the most accepted dimensions by literature –environmental, economic and social–. For the *environmental* dimension of CSR, nine items were taken and adapted from the measures elaborated by Bansal (2005) and Chow and Chen (2012). This scale included aspects related to efforts for reducing negative impacts from the company's activities, selection of responsible suppliers, or the use of environmental friendly inputs. For the *economic* dimension, eight items were adapted from the measure designed by Bansal (2005).

In this case, the scale tried to include aspects relative to benefits for stakeholders derived from the company's business activities, such as benefits for employees (e.g., training, fair human resource practices), or value creation for customers arising from final products and services. Finally, for the *social* dimension, six items were adapted from the measure designed by Chow and Chen (2012). The scale, among other issues, tried to reflect the company's social commitment with regard to the community, rights protection or the efforts dedicated to learn from the needs of its stakeholders (appendix for the complete list of items).

3.2.3. Innovation performance

For innovation performance, both process and product results have been considered in this paper. Zahra and Bogner (1999) recommend considering both absolute and relative items (e.g. as compared with competitors, previous time periods or the industry average) in order to have a more complete picture of the constructs. In this sense, for *product innovation performance* the scale developed by Zahra and Das (1993) was used (4 items); and for *process innovation performance*, 6 items from the measures developed by Zahra and Das (1993) and Delgado et al. (2011) were taken and adapted for our study (see appendix for the list of items).

3.2.4. Control variables

Size was measured through the natural logarithm of the number of employees. Size was included in the model as a control variable since innovation performance is usually affected by a firm's size (Zahra and Das, 1993; Zahra and Bogner, 1999). Efforts in CSR could be also influenced by size, as the firm has to satisfy a greater number of stakeholders' goals (Carroll, 1999).

3.3. Statistical analysis

We utilized the Partial Least Squares (PLS) approach to Structural Equation Modeling (SEM) to test the hypotheses of the study. The PLS path method is typically applied in two stages: (1) The analysis of the measurement model; and (2) the analysis of the structural model. The measurement model is estimated using confirmatory factor analysis in order to assess reliability and validity of the theoretical constructs, while the structural model is estimated to analyze the associations hypothesized in the research path model. In this study, we used the statistical software Smart PLS 2.0, developed by Ringle et al. (2005).

3.3.1. Measurement model

In this paper we consider all the constructs as reflective except CSR, which is measured as a second order construct (a reflective-formative type, as classified by Jarvis et al., 2003). Following the PLS methodology, first of all we need to check the reliability and convergent and discriminant validity of the reflective constructs (Tenenhaus et al., 2005). This analysis tries to verify whether the theoretical concepts are properly measured by the observed variables or not.

3.3.2. Reliability of the reflective constructs

The reliability indicators are shown in Table 2. Both the composite reliability index (CRI) and Cronbach α offer acceptable values, exceeding the recommended levels of 0.8 and 0.7 respectively (Gefen and Straub, 2005).

3.3.3. Convergent and discriminant validity of the reflective constructs

Convergent validity is considered to appear for indicators when each item of the construct is strongly correlated with its original theoretical construct (Gefen and Straub, 2005). In this model, convergent validity is analyzed by means of the loading weight of each indicator (item) on the latent variable (Chin, 1998; Tenenhaus et al., 2005) and the average variance extracted (AVE). The higher the indicator's loading is, the greater the evidence of the construct's validity. In this paper we removed six CSR items (CSReco3, CSReco4, CSReco5, CSRsoc1, CSRenv4 and CSRenv8) (The removed items are marked with an asterisk in the appendix section) since they did not meet the convergence validity criteria of being above 0.6 (Falk and Miller, 1992). Regarding the AVE, all the values are above the recommended threshold of 0.5 (Table 2). Convergent validity is thus assured for the study model. For discriminant validity assessment, Fornell and Larcker (1981) suggested the criteria that the square root of the AVE of a latent variable should be greater that the correlations between the rest of latent variables. As Table 3 shows, discriminant validity is confirmed for our model, as the square root of the AVE for each construct was greater than the correlations involving the construct, as values range from 0.625 to 0.784.

3.3.4. Validity of the formative constructs

In contrast to reflective constructs where colinearity between indicators is required, in formative constructs the presence of high correlations between the indicators is not desirable (Chin, 1998).

Table 1. Technical characteristics of the study

Population	Spanish companies in the renewable energy sector (726 firms)
Geographical area	Spain
Sample size	76 firms
Collection method	Online questionnaire and phone contact
Response rate	10.47%
Sample error	10.64%
Reliability level	95%; z= 1.96; p=q=0.5
Date of fieldwork	September- December 2012

Table 2. Measurement model: Reliability and convergent validity

Variables	*Cronbach α*	*CRI*	*AVE*
Technological posture	0.9086	0.9357	0.7845
Environmental CSR	0.9158	0.9331	0.6668
Economic CSR	0.8465	0.8919	0.6252
Social CSR	0.8686	0.905	0.656
Product innovation performance	0.8633	0.8822	0.6576
Process innovation performance	0.9144	0.9335	0.7007

Table 3. Descriptive statistics, correlations and AVE (square root)

	Mean	*S.D.*	*Tech. posture*	*Envir. CSR*	*Social CSR*	*Economic CSR*	*Prod. inn. perf.*	*Proc. inn. perf.*
Tech. posture	4.08	1.01	**0.8857**					
Environmental CSR	3.77	1.17	0.4878	**0.8166**				
Social CSR	3.42	1.21	0.3792	0.748	**0.8099**			
Economic CSR	3.54	1.17	0.4537	0.6426	0.7856	**0.7907**		
Prod. inn. performance	3.35	1.18	0.5606	0.2375	0.3376	0.2941	**0.8109**	
Proc. inn. performance	3.42	1.03	0.5217	0.3941	0.4977	0.5249	0.6374	**0.8371**

Diagonal: square root of the average variance extracted (AVE) Off-diagonal elements: correlations between constructs

To check colinearity for the formative constructs, some scholars suggest the use of variance inflation factors (VIF), which measure the effect of colinearity between the predictor variables in a regression model (Diamantopoulos and Siwau, 2006). For formative constructs, acceptable VIF values should be lower than 5 (Hair et al., 2013). In our study, all the values are below 5, with the highest VIF value for CSR (social dimension) being 3.52.

3.3.5. Structural model

To assess the structural model it is necessary to estimate the path coefficients or standardized regression weights (*β*), which shows the significance and strength of relationships between independent and dependent variables. The structural model validity is usually checked in three ways: (1) Student's t statistics: (2) significance levels of path coefficients; and (3) R^2 value for each dependent variable (Fig. 1). Path coefficients exceed the value of 0.3 for the relationships established in the first and third hypotheses.

These results support the existence of a close relationship between technological posture, CSR and process innovation performance. In addition, these hypotheses are supported with $p< 0.001$. Therefore, the more a firm is oriented towards a technological leadership posture, the greater its CSR commitment is (path coefficient= 0.492, $p< 0.001$). Moreover, the results show that the greater the company's CSR commitment is, the higher its process innovation performance is (path coefficient= 0.481, $p< 0.001$).

However, the second hypothesis is accepted with $p< 0.05$, the path coefficient being lower than 0.3. This hypothesis is thus moderately supported, meaning that the effect on process innovation performance is stronger (for technological leaders assuming high levels of CSR commitment) than on product innovation performance (path coefficient= 0.292, $p<0.01$). Regarding the predictive power of the model, goodness of fit is determined by the strength of each structural relationship, analyzed by means of the R^2 value (Falk and Miller, 1992). In Fig. 1 we can see all the dependent variables with R^2 values higher than 0.1, which seems to indicate that the model has enough predictive power (Chin, 1998). In this regard, technological posture explains 24.2% of the CSR's variance; and CSR in turn explains 11.7% of the variance of product innovation performance and 30% of the variance of process innovation performance.

In order to assess the model's predictive relevance it is also necessary to apply the Stone-Geisser test (Q^2). According to Chin (1998), a construct predictive power is relevant if the test offers values of $Q^2 >0$, which is confirmed for the three dependent variables of our model (Table 4). Finally, size (measured as the logarithm of the company's number of employees) was included in the model as a control variable. The results show that size has a significant influence for process innovation performance ($β= 0.188$, $p< 0.05$) although it is not found to be significant for product innovation performance. Considering that many companies in the Spanish renewable energy sector are SMEs, it could be the case that the small companies had a greater tendency to develop product innovation while larger firms were more oriented to developing process innovation.

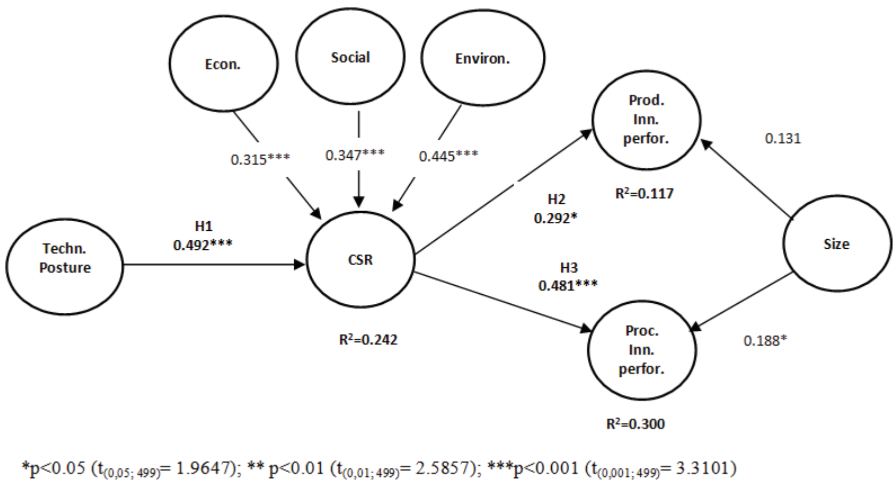

Fig. 1. Research model and results

Table 4. Relevance of the predictive model

Dependent variable	R^2	Q^2
CSR	0.242	0.2099
Product innovation performance	0.117	0.0301
Process innovation performance	0.300	0.1791

Anyway, the inclusion of company size into the model does not modify the significance of the relationships between technological leadership, CSR and innovation performance for this study.

4. Discussion

The main contribution of this paper is the proposal and testing of a model of relationships between a company's innovation strategy (technological posture) and CSR, in which both variables are connected in order to achieve further technological innovation.

From the knowledge based-view of the firm, it can be pointed out that knowledge collected from relationships with stakeholders enable the firm to be more innovative, mainly deriving from the exploitation of knowledge (from those relationships) that is oriented to the identification of new market opportunities. But the study also shows that those firms that are more strongly involved with innovation are also more committed to making greater efforts in CSR activities.

Therefore, the results of this study are in line with those that recently show a positive relationship between CSR and innovation (e.g., Guoyou et al., 2013; Padgett and Galán, 2010; Surroca et al., 2010). Moreover, our study goes further by showing that the deliberate effort to be innovative, which is reflected in a technological leadership posture, force the company to actively search for new innovation sources, such as those coming from CSR (D'Amato and Roome, 2009). This paper thus shows how CSR can in turn play an instrumental role in finding out new opportunities for technological innovation for companies, both in new processes and products.

Good relationships with stakeholders are thus proven to be essential for innovative firms (Guoyou et al., 2013). In this regard, the study shows that CSR has a *mediating role* between technological posture and innovation performance. Indeed, CSR has a positive effect on innovation, but CSR efforts depend on the firm's technological proactivity. It is likely that less proactive companies (at least for CSR sensitive industries) are unable to take full advantage of benefits from innovation since they do not perceive the development of CSR activities or strategies as an important source of technology development. Moreover, firms that try to be technological leaders without a solid CSR commitment will never reach such a position as they would not be able to retain highly-talented employees or establish and maintain good relationships with other stakeholders such as suppliers, clients or community institutions (Guadamillas and Donate, 2011).

An important managerial implication of this study is that CSR should be considered as an essential part of innovation and business strategies, especially in environmental and social sensitive industries. For instance, in renewable energy related industries (e.g., energy production, equipment and materials, distribution), a great number of technological innovations are focused on reducing negative impacts of activities on the environment, such as the optimization of waste disposal, or processes oriented to reducing pollution levels. In this regard, the consideration of environmental and social aspects in business strategies requires a company to have a proactive attitude to anticipate or respond flexibly to market changes and stakeholders' needs, values and preferences. In the long term, only those responsible and innovative companies which are capable of adopting CSR within their strategies will survive and thrive in these kinds of industries.

As a limitation of this study we can point out the following. Firstly, the necessity to obtain primary data from questionnaires implies research design to be cross-sectional. This can render unobservable the long-term effects of CSR on innovation. Although we tried to solve this problem by including a three year consideration for all the independent variables, the problem of causality concerning the hypothesized relationships has to be taken into account. Future research might address this issue by using a longitudinal design to establish causal inferences between CSR and innovation performance.

The research has also focused on Spanish companies and cultural limitations may exist, so future studies could focus on a broader context (additional industries, countries) to try to validate and generalize the results obtained in this paper. Future papers could also consider other variables in the model, such as environmental dynamism, corporate reputation or financial performance, which can have important consequences in the sector under analysis.

5. Conclusions

The results of this study show the positive relationship between proactivity as a technological posture and CSR commitment in the renewable energy sector in Spain. It tries to highlight the importance of developing CSR initiatives to improve the stakeholder engagements in order to be more innovative.

Knowledge collected from the stakeholders, which is motivated by the company's intention to be a technological leader in the marketplace, can allow it to identify new opportunities to be exploited by means of both new processes and products.

In this regard, technological leaders should introduce CSR as a part of its business and innovation strategies, as long term survival and competitive advantages depend strongly on its valuation as a firm's strategic asset.

Appendix 1: Questionnaire

Corporate Social Responsibility (CSR). (Likert scale. From 1-very low to 5-very high).

CSR (Environmental). Importance given by the company in the last three years to:

CSRenv1… ensuring that the final product will reduce its negative impact on the environment, as compared to previous years or competitors.
CSRenv2… the use of less environmentally harmful inputs, as compared with previous years and with its competitors.
CSRenv3… the choice of inputs from renewable sources versus non-renewable materials or chemical components.
CSRenv4… reducing the likelihood of environmental accidents through process improvements.*
CSRenv5… reducing waste emission through streamlining processes.
CSRenv6… using some waste materials as inputs for their own processes.
CSRenv7… responsibly disposing unusable waste.
CSRenv8… the handling and storage of toxic waste materials responsibly.*
CSRenv9… choosing suppliers which meet environmental requirements.

CSR (Economic). Importance given by the company in the last three years to:
CSReco1… strengthening relationships with the community and the government (through philanthropic activities, volunteer programs, disclosure of social and environmental practices, etc.), in order to reduce legislative demands and protect their interests.
CSReco2… reducing input costs for a similar manufacturing level.
CSReco3… reducing waste management costs for a similar manufacturing level.*
CSReco4… differentiating their products by promoting their environmental concern.*
CSReco5… selling waste materials.*
CSReco6… increasing productivity and employee loyalty by offering them fair wages and equality opportunities.
CSReco7… increasing productivity and employee loyalty by offering them training and promotion opportunities.
CSReco8… increasing sales and customer loyalty by carrying out truthful advertising, selling safe products, paying attention to complaints and researching in order to achieve high-quality products.

CSR (Social). Importance given by the company in the last three years to:
CSRsoc1… taking into account the needs of its stakeholders when making investment decisions by establishing a formal dialogue with them.*
CSRsoc2… communicating the risks and the environmental impact of its activities on the community.
CSRsoc3… helping to improve the community's health and safety.
CSRsoc4… protecting the local community's rights and claims.
CSRsoc5… improving the visual appearance of the firm's facilities with the aim of integrating them into the environment in which it operates and to improve citizens' perception.
CSRsoc6… recognizing and responding to the need to raise funds for local community initiatives.

Technological posture. (Likert scale. From 1-very low to 5-very high). Importance given by the company in the last three years to:
Tech1… marketing new (or improved) technologies (products or processes).
Tech2… being the first to introduce new or improved products on the market.
Tech3… gaining a (good) reputation in the industry of leading changes or product improvements.
Tech4… developing skills to introduce new (or enhanced) products or develop new (or enhanced) processes before competitors.

Innovation performance (Likert scale. From 1-very low importance to 5-very high importance).
Product innovation. Assessment of the technological performance obtained by the company in the last three years in relation to:
Prodinn1… new product development.
Prodinn2… the modification or improvement of existing products.
Prodinn3… the introduction of more new or improved products than its main competitors.
Prodinn4… the introduction of more new or improved products than three years before.

Process innovation. Assessment of the technological performance obtained by the company in the last three years in relation to:
Procinn1… new methods and process development.
Procinn2… improved methods and process development.
Procinn3… the introduction of more and better methods and new (or improved) processes than its main competitors.
Procinn4… the introduction of more and better methods and new (or improved) processes than three years before.
Procinn5… the implementation of new processes that have shortened the manufacturing cycle or improved production flexibility.
Procinn6… the implementation of new processes that have reduced production costs for the firm.

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