

# The interplay between corporate social responsibility and knowledge management strategies for innovation capability development in dynamic environments

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## Abstract

**Purpose** – This paper aims to analyze unexplored connections between economic, environmental and social dimensions of corporate social responsibility (CSR) and knowledge management (KM) strategies (exploration, exploitation), also considering environmental dynamism as an influencing variable on these connections. The predicted CSR-KM interplay suggests, from stakeholder and knowledge-based views of the firm, the existence of ideal configurations between CSR and KM strategies that generate differentiated impacts on companies' innovation capabilities, especially in dynamic environments.

**Design/methodology/approach** – Structural equation modeling by means of the partial least squares technique was used to test the study's hypotheses after collecting survey data from Spanish companies of the renewable energy sector.

**Findings** – The study findings show that in highly dynamic environments, companies will tend to commit prominently in CSR, although their orientation (economic, environmental, social) and effects on innovation capabilities will depend mainly on the selected KM strategies. Social and environmental CSR are found to be highly related to KM exploration, whereas economic CSR is highly related to KM exploitation. Nevertheless, while a significant indirect effect of economic CSR by means of the KM exploitation strategy on innovation capabilities is found, the proposed indirect effect of both environmental and social CSR through the KM exploration strategy on innovation capabilities is not significant.

**Practical implications** – The results suggest that company managers should be aware of the advantages of following specific paths of investment in KM and CSR initiatives in highly dynamic environments, as there is a potential payoff in terms of innovation capability improvement. The results also suggest that "good" relationships with stakeholders, built from specific CSR investments, make firms able to get valuable knowledge that it is useful to develop KM strategies for innovation capability development.

**Originality/value** – Previous studies do not consider the interplay between KM strategies and CSR as a catalyzer for developing a firm's innovation capabilities. This paper contributes to the KM and innovation literatures by introducing CSR into the conversation about how to improve innovation capabilities in dynamic and sustainable industries by using configurations of KM strategies and specific CSR investments in economic, social and environmental areas.

**Keywords** Environmental dynamism, Knowledge management strategies, Knowledge exploration, Knowledge exploitation, Corporate social responsibility, Innovation capabilities, Renewable energy sector

**Paper type** Research paper

## 1. Introduction

Corporate social responsibility (CSR) is considered nowadays a key factor for the competitive success of companies worldwide (Saha *et al.*, 2020). Investments in CSR activities have a direct impact on the operations and strategies of firms, aspect exacerbated by the COVID-19 outbreak and the postpandemic era, which has demanded

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companies' commitment to their stakeholders and the well-being of society (Ahmed *et al.*, 2021). This new situation has even generated great opportunities for businesses to shift toward more genuine and authentic CSR and contribute to address urgent global social and environmental challenges by means of innovation (He and Harris, 2020, p. 334). A classic definition by Carroll (1999) puts forward CSR as a commitment of firms to develop their activities according to societal values and expectations along with fulfilling stakeholders demands, setting the triple bottom line of CSR performance as environmental, social and economic. In the past few years, CSR is also increasingly being considered by many firms as an integrating part of their business and, especially, innovation strategies (Barauskaite and Streimikiene, 2021; Kraus *et al.*, 2020). Innovation and CSR interplay can thus become a strategic aspect to be managed by firms. For example, stakeholders' demands about new but highly sustainable products or the consideration of employees' wellness by introducing innovative initiatives of human resource management (e.g. teleworking, flexible timetables, healthier workplaces) can have a positive impact on a company's competitive advantage by means of talent retention (human capital) and the reinforcement of innovative behaviors (Muñoz *et al.*, 2022). Hence, the understanding of CSR and innovation strategies integration and relationships becomes an essential aspect to study as it has important repercussions on industry dynamics and firm-level competitive advantages, especially in an increasingly globalized, knowledge-based and sustainable economy (Ratajczak and Szutowski, 2016).

This paper focuses on configurations between CSR and innovation strategies based on knowledge management (KM), as in dynamic environments, knowledge on environmental, social or economic issues collected from the needs and goals of a company's stakeholders can be a competitive source for innovative responses based on knowledge exploration and exploitation strategies (González-Ramos *et al.*, 2018). Moreover, the dynamic capabilities approach suggests that firms can align and configure their operational resources and capabilities to meet the challenges generated by changing environments, so dynamic capabilities developed by a firm will be dependent on environmental dynamism (Teece *et al.*, 1997). By engaging with stakeholders, firms can develop stakeholder-focused dynamic capabilities that can assist them in managing sustainability issues. CSR activities create links to a firm's stakeholders, who can support the firm to create favorable social networks that represent valuable resources difficult to imitate by competitors (Sun and Cui, 2014). Companies could thus use CSR to create dynamic capabilities impacting on economic, social and environmental performance (Achi *et al.*, 2022). Moreover, the research on the relationship between CSR and innovation strategies often considers environmental dynamism as a contingent variable (Achi *et al.*, 2022). To our knowledge, there is a lack of academic papers showing a direct link between environmental dynamism and CSR-innovation connections (Zhang *et al.*, 2021). In this paper, we follow a cognitive-decision approach to suggest that managers' perceptions of environmental dynamism have an impact on their decisions on CSR investments in environmental, social and economic areas, which will have an important effect on innovation capability development but guided by KM strategies. Thus, this paper will consider environmental dynamism as an antecedent of CSR, having an important role on the selection of a firm's KM strategies.

Knowledge is the most important strategic resource for companies (Zack, 2005). The formulation of a KM strategy should guide a firm to create competitive advantages by developing, acquiring and exploiting knowledge resources (Donate and Guadamillas, 2011). KM literature highlights the importance of both exploiting existing knowledge and technologies for short-term innovation performance and also exploring new knowledge and technologies to enhance long-term innovation performance (Benner and Tushman, 2015). However, managing KM exploration and exploitation strategies becomes challenging when sustainability requirements are introduced into business strategies (Demir *et al.*, 2021). Innovation and KM allow a firm to achieve economic rents, but in sustainable contexts, they should also support the firm to find solutions for fulfilling stakeholders' needs (Mishra, 2017). Thus, collecting knowledge about stakeholders' objectives and needs would be an

additional requirement to orientate innovation efforts toward exploration or exploitation ambits (Shafique *et al.*, 2021). Moreover, a firm should be able to manage the duality between short-term and long-term preferences, considering its available organizational systems and future requirements for sustainable innovation. This study thus seeks to deepen and enrich the understanding of the relationship between CSR, KM strategies and innovation capability development from a dynamic capabilities' perspective.

This paper specifically proposes that economic CSR will influence KM exploitation strategies to a greater extent than KM exploration strategies. As a firm tries to fulfill short- and medium-term objectives based on making the firm profitable, KM exploitation strategies will prevail against KM exploration strategies. Moreover, social and environmental CSR may need a highly radical approach to innovation when the company is searching for new sources of differentiation (Hadj, 2020; Heikkurinen and Bonnedahl, 2013; Van Marrewijk and Werre, 2003). This does not mean that existing knowledge cannot be used to develop new solutions based on environmental or socially oriented products, processes or services, but for a firm, sensing new ideas on changes in the environmental, social, political or legal context can make exploratory strategies to be more relevant than exploitative strategies to improve its innovation capabilities.

To summarize, this paper aims to address the following research question:

*RQ1.* how does a firm's CSR commitment contribute to get sustainable advantages by being connected to specific KM strategies in a highly dynamic environment?

In doing so, this paper revolves around two objectives:

1. The analysis of the impact of managers' perceptions of environmental dynamism on the company's commitment in CSR; and
2. The analysis of the interrelations between the three dimensions of CSR and specific KM strategies (exploration and exploitation) oriented to improve innovation capabilities.

By establishing these objectives, this paper tries to contribute to the research on the interrelationships between CSR and KM strategies as determinants of innovation capabilities from a strategic dynamic capabilities approach. Moreover, this study focuses on the renewable energy industry, which it appears to be an appropriate context to examine strategic options for firms that are affected by similar environmental factors (Mishra and Suar, 2010). This is a highly dynamic and innovative industry, and it is very sensitive to social and environmental aspects (Frondel *et al.*, 2007), playing innovation a pivotal role in achieving competitive advantages (McWilliams *et al.*, 2006).

The structure of the paper is as follows. First, we establish the theoretical relationship between environmental dynamism, CSR dimensions, exploratory/exploitative KM strategies and innovation capabilities from stakeholder and dynamic capabilities views of the firm. Next, we statistically test a model of relationships between these variables in a sample of Spanish companies of the renewable energy sector. Finally, we present the results of the study and its theoretical and managerial implications, along with the main conclusions, limitations and future lines of research.

## 2. Theoretical background and hypotheses

### 2.1 Environmental dynamism and corporate social responsibility

Environmental dynamism refers to the intensity, regularity and unpredictability of environmental changes in an industry (Zhang *et al.*, 2021). Dynamic environments are characterized by technological discontinuity, changes in customer preferences, the entry of new competitors and fluctuations in product demand or the supply of raw materials, among other factors (Bierly and Daly, 2007). Spital and Bickford (1992) point out that environmental dynamism depends critically on the speed of change for product technology or

technological advances in processes. [Wijbenga and Van Witteloostuijn \(2007\)](#) also consider changes in customers' preferences and competitor technologies as main features of dynamic environments, which suggests that customer and competitors' actions are more difficult to predict in dynamic than in stable environments.

The type of environment in which the company operates affects managers' choices related to CSR and innovation strategies ([Bierly and Daly, 2007](#); [Jansen et al., 2009](#); [Wijbenga and Van Witteloostuijn, 2007](#); [Zhang et al., 2021](#)). [Haleblian et al. \(2012\)](#) assert that, in dynamic environments, the ability to identify new opportunities and to exploit them through technological innovation is a key issue for achieving competitive advantages. Since technological advancements usually disseminate quickly to competitors in dynamic industries, firms must repeatedly search for new opportunity windows to be successful in the long term ([Bierly and Daly, 2007](#)). According to the dynamic capabilities approach, companies can shape their operational capabilities to meet the needs of changing environments ([Teece et al., 1997](#)), so this paper proposes that CSR could be helpful to companies to get knowledge about their stakeholders' needs and preferences, using this knowledge to explore new opportunities for developing new products/processes.

Previous research suggests that a company's CSR commitment and performance depend on the context in which CSR is performed ([Achi et al., 2022](#); [Martinez-Conesa et al., 2017](#)). When a firm's environment is highly dynamic, technological changes will make its existing knowledge rapidly obsolete, thus reducing performance ([Sun and Cui, 2014](#); [Zhang et al., 2021](#)). By adopting green technical processes or, in general, CSR practices, firms can reduce manufacturing costs or they could benefit from differentiation advantages by integrating social and ecological concepts into manufacturing ([Sun and Cui, 2014](#)). However, when companies deal with low levels of technological dynamism, they can use an incremental approach to improve green and social innovation rather than implementing systematic change through green processes or CSR activities ([Zhang et al., 2021](#)). From this perspective, this paper considers that companies that expand their CSR commitment as a response to environmental change are able to establish highly solid relationships with stakeholders, which allows them to access to valuable knowledge that is difficult for competitors to imitate, to explore and exploit new business opportunities. For example, the adoption of green CSR practices denotes company's environmental responsibility, which may increase stakeholders' willingness to share more knowledge as a response to those positive efforts to improve a sustainability image ([Guoyou et al., 2013](#); [Shafique et al., 2021](#)). Cooperative links with stakeholders such as suppliers or consumers make it possible for firms to access a wide range of valuable knowledge that helps them to understand changes and deal with environmental uncertainty ([Sun and Cui, 2014](#)). CSR could thus be seen as a fertile ground for dealing with sustainability issues by means of innovation ([Porter and Kramer, 2006](#)).

Specific environmental elements, such as regulatory measures and customer pressures, can promote organizational responses by developing green innovation ([Huang et al., 2016](#); [Lin and Ho, 2011](#)). [Huang et al. \(2016\)](#) state that regulatory pressures have a positive impact on employees training and play a direct role in green innovation performance, while customer pressure has a positive impact on research and development (R&D) efforts and collaboration networks. In this regard, [Zhang et al. \(2021\)](#) assert that firms are reluctant to develop innovation efforts in relatively stable environments owing to inherent uncertainties and risks associated with green process innovation, referred as "the process innovation that is related to energy-saving, pollution prevention, waste recycling, or no toxicity." Similarly, our paper establishes that a stable environment does not especially motivate managers to develop CSR leading to increase costs and risks in the short term. However, when managers perceive rapid or/and unexpected changes in the environment, they could be highly committed to CSR practices as the company needs to obtain valuable knowledge from its stakeholders to understand those changes and adapt the firm to the new situation.

Research on organizational adaptation identifies interactions with specific stakeholders (e.g. customers and suppliers) as channels that allow firms to understand dynamic environments. According to [Zhang et al. \(2021\)](#), in a highly dynamic environment customers' preferences and demands, as well as competitors' market strategies, change quickly, requiring companies to pay considerable attention and allocate extensive resources to cope with these changes. In this context, companies adopt CSR practices to exploit short-term opportunities and to respond proactively to the changing marketplace. In addition, proactive CSR strategies confer environmental legitimacy to companies and improve their reputation, which are important social assets that reduce market fluctuations ([Achi et al., 2022](#); [Eiadat et al., 2008](#); [Rothenhoefer, 2019](#); [Sun and Cui, 2014](#)).

In contrast, when market dynamism is low, companies tend to make minor adjustments to manufacturing processes and marginal environmental commitments. A stable market environment allows companies to adopt standardized approaches to environmental decision-making and to rely on routinized methods for problem-solving. In other words, the routinization of business operations in stable markets makes it difficult for companies to develop highly proactive CSR practices. Moreover, if customer demand for environmentally friendly measures is relatively stable, the adoption of green process innovation can lead to high costs that are difficult to compensate by means of manufacturing. Consequently, high potential costs dissuade companies from adopting green processes and proactive CSR practices in stable markets ([Zhang et al., 2021](#)).

Pressures from external environments (e.g. market demands, green technologies or environmental regulation) are reported to have positive impacts on firms' commitment to green or environmental process ([Doś and Pattarin, 2021](#); [Lin and Ho, 2011](#); [Yu et al., 2017](#); [Zhang et al., 2021](#)). However, we also find other results on the relationship between environmental characteristics and CSR responses. For example, [Eiadat et al. \(2008\)](#) tried to justify that government environmental regulation, managerial environmental concerns and perceived importance of stakeholder pressures positively influenced environmental innovation strategies. However, they found a negative relationship between government environmental regulation and environmental innovation strategy, and they did not find significant effects of perceived stakeholder pressures on company green and social behaviors. Other studies even show environmental dynamism and volatility as barriers for green practices (CSR) adoption ([Achi et al., 2022](#); [Lin and Ho, 2011](#)). For example, [Lin and Ho \(2011\)](#) tried to prove that environmental factors (customer pressure, regulatory pressure, governmental support and environmental uncertainty) had a positive influence on green practice adoption for Chinese logistics companies. However, they found that environmental dynamism and uncertainty have significantly negative influences on companies' green practices adoption. An explanation of these results is provided by [Achi et al. \(2022\)](#), who assert that environmental volatility prevents firms from acquiring or enhancing the necessary resources to develop proenvironmental capabilities, such as those linked to CSR and green process innovation. Firms in these kinds of environments are forced to devote little time and effort to develop these capabilities, which, in turn, negatively affects organizational performance. In their research, they showed that perceived environmental volatility negatively moderates the effect of CSR on micro-, small- and medium-sized enterprises performance through green process innovation. For all the former reasons, the nature of the relationship between environmental dynamism and CSR practices demands further exploration.

The existing research on CSR highlights environment features as an important factor to consider when setting a particular CSR strategy ([Achi et al., 2022](#); [Nazri et al., 2020](#); [Sun and Cui, 2014](#); [Zhang et al., 2021](#)). Managers should thus pay attention to such features, and in particular, to dynamism, when they design the firm's strategy in terms of CSR ([Achi et al., 2022](#); [Zhang et al., 2021](#)). From the former arguments and following a cognitive-decision and a dynamic capabilities approach, this paper proposes that the more dynamic



is the perception about the business's environment, the stronger will be the firm's commitment on CSR since building strong relationships and social networks with specific stakeholders will allow it to gain valuable knowledge about changes to adapt the firm to the new situation. Companies could thus employ CSR to create dynamic capabilities to better adapt to changes in the environment. We, thus, formulate the following hypothesis:

*H1.* The higher the degree of perceived environmental dynamism by managers, the greater the company's commitment to CSR activities.

## *2.2 Corporate social responsibility, knowledge management strategies and innovation capabilities*

CSR integration into KM and innovation strategies is a dynamic process in which the implementation of socially responsible actions facilitates the detection, assessment and analysis of changes in a company's stakeholders' needs and expectations, generating positive effects such as conflict control, confidence improvement and risk reduction (Donate and Guadamillas, 2011; Ji *et al.*, 2019; Shafique *et al.*, 2021). Nevertheless, the relationship between CSR and KM strategies has rarely been analyzed by the management literature, especially the dilemma between the selection of exploratory and exploitative strategies and its relationship with CSR dimensions as a determinant of innovation capabilities development.

On the one hand, KM exploration refers to the search, acquisition and creation of new products, resources, knowledge and opportunities (Jensen and Clausen, 2017; March, 1991; McGrath, 2001). It is associated to radical changes, learning through experimentation and terms such as search, diversity, adaptability, risk-taking, experimentation, flexibility, innovation and long-term orientation (Eriksson, 2013, p. 334). KM exploitation, on the other hand, refers to the refinement and use of existing products, resources, knowledge and competencies (Jensen and Clausen, 2017; Stettner and Lavie, 2014), involving an alignment to existing company conditions and constraints, efficiency and short-term orientation (Eriksson, 2013, p. 334). Companies focused on KM exploration (i.e. the search of new knowledge) usually entail higher costs and risks than on KM exploitation, but their interest is in long-term success by creating new competencies and skills resulting in radical innovation (Benner and Tushman, 2015; Brix, 2020; Clauss *et al.*, 2021; McGrath, 2001). Nevertheless, firms focused on KM exploitation use their current competencies to generate revenues in the short term by improving existing products, services and processes (Brix, 2020; Lavie *et al.*, 2010). Firms need to adapt incrementally its products to customer needs, and their processes to technical and technological advances to maintain a steady flow of income from current markets. In any case, a company should be aware that an excessive focus on knowledge exploitation can result in short-term success but long-term stagnation and failure (Eriksson, 2013; Mathias *et al.*, 2018).

Managing knowledge exploitation and exploration becomes challenging when sustainability requirements and a firm's CSR commitment are introduced into its corporate and business strategies (Demir *et al.*, 2021). Innovation and KM can allow companies to generate economic rents, but in sustainable contexts, it should also support the firm to find solutions based on new processes, products and services to fulfill stakeholders' needs (Hull and Rothenberg, 2008; Mishra, 2017). From a stakeholder's view, business organizations should assume responsibility for the impact of their activities on customers, suppliers, employees, shareholders and communities, as well as the environment (Ismail, 2009; Kraus *et al.*, 2020). Knowledge on a company stakeholders' goals, needs and preferences should thus guide both exploration and exploitation processes to develop sustainable innovation capabilities (Shafique *et al.*, 2021). Moreover, a firm should be able to manage the duality between short-term and long-term preferences, considering its available organizational systems and future requirements for sustainable innovation (Minoja, 2012).

In the past few years, the interaction between CSR and KM strategies has been shown in several research papers. For example, [Costa et al. \(2015\)](#) developed a model in which CSR moderated the relationship between the firm's technological orientation and exploratory/exploitative innovation, and exploratory/exploitative innovation and export performance. Their findings revealed that while firm's commitment on CSR relates positively with exploratory innovation, the effect of on exploitative innovation is nonsignificant. Moreover, while CSR contributes to enhance the impact of exploratory innovation on export performance, there is a detrimental impact on the effect of exploitative innovation on export performance. More recently, [Shafique et al. \(2021\)](#) analyzed CSR as a moderating variable on the relationship between organizational ambidexterity and green entrepreneurial orientation, finding that the joint effect of CSR and ambidexterity broaden learning and innovativeness effects, encouraging green entrepreneurial orientations, especially in sustainable, high-intensive CSR contexts.

Other authors tried to be more specific by exploring the effect of individual types or categories of CSR on knowledge exploration and exploitation. For example, [Ji et al. \(2019\)](#) found that proactive CSR is related to exploratory innovation, while reactive CSR relates to exploitative innovation. The results seem to suggest that implementing proactive CSR helps firms to capture new market opportunities by addressing new environmental and social issues. Moreover, implementing reactive CSR (oriented to the short term and equated to the economic CSR dimension) helps firms to acquire legitimacy and reputation, which makes easier for them the access to external resources such as talent, along with financial and governmental support. These findings show that different approaches to CSR result in specific outcomes reflected in innovation "postures," which are needed for the survival of the firm both in the short- and the long-term.

In a similar vein to the research by [Ji et al. \(2019\)](#), our paper suggests that a KM focus on collecting, assimilating and exploiting knowledge from relationships with stakeholders will allow the company to improve its innovation capabilities. Moreover, by complying with the expectations of stakeholders and building shared values firms create effective channels to collect insights, information and trusted knowledge, which they can use to develop innovation capabilities by means of KM exploration and exploitation strategies. Our view is that the economic CSR dimension will have an impact on short-term innovation, while social and environmental CSR dimensions will rather impact long-term innovation. Thus, this paper posits that the economic dimension of CSR will be directly related to a KM exploitation strategy (focused on short-term goals and immediate innovation outcomes based on refining existing capabilities), while CSR social and environmental dimensions will be related to a KM exploration strategy (focused on long-term goals). The perceptions of stakeholders on environmental and social issues can be very useful for exploring new ways of satisfying their objectives by developing new technologies. Likewise, knowledge about stakeholders' preferences in the economic area can provide the firm with a short-term approach to innovation and lead the company to incrementally exploiting existing assets in current markets (for example, work- and family-life balance and teleworking are human resource management practices able to improve company's productivity). The economic dimension of CSR would be thus related to policies that have an important influence on employee and process improvement, being more likely to contribute to short-term productivity performance than long-term outcomes.

When a firm tries to achieve short- and medium-term objectives of sustainability, especially of financial nature, efforts on innovation are likely to be more oriented toward KM exploitative strategies than explorative ones (i.e. to take advantage of existing knowledge) ([Benner and Tushman, 2015](#); [Mathias et al., 2018](#)). Hence, by deploying economic CSR activities, responsible companies improve their image and reputation to raise funds, get partners and attract highly qualified employees. From this perspective, CSR efforts also help companies to retain talent and creativity ([Nyuur et al., 2022](#); [Porter and Kramer, 2006](#)),

accumulating human capital and improving innovation capabilities (Surroca *et al.*, 2010). Therefore, the economic dimension of CSR (e.g. reducing waste management costs, improving employees' working conditions, solving customers' complaints or improving product safety and quality standards) is related to KM exploitation initiatives.

"Good" relationships with stakeholders can thus be essential for innovative firms (Guoyou *et al.*, 2013) from a knowledge-based view of the firm. According to Guadamillas and Donate (2011), social and environmental issues are an essential part of innovation, along with KM strategies that involve proactive or exploratory attitudes of a company to respond flexibly to changes in the environment. In this regard, we propose that knowledge collected from stakeholders beyond traditional economic activities of the company, such as social and environmental areas of CSR, which need long-term investments (Sánchez and Benito-Hernández, 2015; Torugsa *et al.*, 2013) and a highly proactive vision from managers, will positively influence KM exploration in the firm. Conversely, companies focused on CSR aspects linked to the economic dimension (the most basic level of CSR), as for example, activities to reduce lawsuits, increase employee loyalty or improve customer loyalty by selling highly secure products, tend to influence to a greater extent KM exploitation, which is a strategy highly oriented toward short-term and low-risk goals achievement (Eriksson, 2013; Mathias *et al.*, 2018). From these arguments, we establish the following hypotheses:

- H2. A company's commitment to environmental CSR is positively related to a KM exploration strategy.
- H3. A company's commitment to social CSR is positively related to a KM exploration strategy.
- H4. A company's commitment to economic CSR is positively related to a KM exploitation strategy.

Literature on KM generally shows that there are positive effects of both knowledge exploitation and exploration on innovation capabilities (Donate and Guadamillas, 2011). In the ambit of CSR, previous studies show positive impacts of market knowledge acquisition (i.e. knowledge from employees, suppliers and customers) on innovation capability development (Bocquet *et al.*, 2013; Shafique *et al.*, 2021). Moreover, a company's ability to learn has long been recognized as a competitive imperative for innovation, especially in the context of strategic sustainability behavior (Brix, 2020).

As previously explained, CSR practices can be crucial sources of acquisition and development of strategic resources and capabilities, but they can have a different impact on performance in terms of strategic purpose, period of materialization and scope. In any case, strategic CSR should be proactive, including voluntary business practices related to economic, social and environmental dimensions (Torugsa *et al.*, 2013). The consideration of the three CSR dimensions provides a business model of value creation, which contributes to creating competitive advantages (Kraus *et al.*, 2020). This business model is based on the development of sustainable innovation by anticipating economic and social trends and external regulations (Groza *et al.*, 2011). The implementation of proactive CSR can thus help firms to capture new market opportunities (explore) and take advantage of the existing ones (exploit) by addressing economic, environmental and social issues. This will allow them to improve their innovation capabilities based on routines about how to explore and exploit knowledge collected about stakeholders' needs and goals. Company stakeholders can provide a firm with valuable information and knowledge about their needs, preferences and goals, so innovation is likely to emerge as a business response to these aspects. By creating links with its stakeholders by means of CSR activities, a firm has access to networks and new points of view about the marketplace (Mahmoud and Hinson, 2012). Since these networks are sources of information and knowledge resources, openness to knowledge flows is a predictor of a company's innovation performance (Fey and Birkinshaw, 2005). When companies perceive changes in their stakeholders' needs, they



will search for new solutions through KM exploration and exploitation strategies. As [D'Amato and Roome \(2009, p. 423\)](#) point out, "CSR is understood to arise from an increased awareness that change outside the company requires management attention," which denotes that commitment to CSR initiatives will lead the firm to develop innovation capabilities. In general, knowledge from a firm's stakeholders' utility functions can enhance its ability to develop innovation capabilities from KM exploration and exploitation strategies. We thus formulate the following hypotheses of the study:

- H5.* A company's commitment to environmental CSR improves innovation capabilities, but the effect is an indirect one, through its impact on KM exploration strategy.
- H6.* A company's commitment to social CSR improves innovation capabilities, but the effect is an indirect one, through its impact on KM exploration strategy.
- H7.* A company's commitment to economic CSR improves innovation capabilities, but the effect is an indirect one, through its impact on KM exploitation strategy.

### 3. Methods

#### 3.1 Sample

The study's population includes 726 companies related to renewable energy activities in Spain. Specifically, six activities were considered: energy generation; manufacturing of technological components; marketing and export of components; engineering activities; energy consulting; and installation and maintenance activities. Secondary data from these companies were obtained from two Spanish specialized directories (IDAE [1] and the *Directorio Especializado en Empresas de Energías Renovables* [2] from the Spanish Industry Ministry). There are three main reasons to use this set of related activities in this study:

1. this is a highly dynamic sector, intensive in innovation and knowledge, due to its technological focus on continuous product and process development ([APPA, 2021](#));
2. its activities are very sensitive to CSR activities since their products, processes and services have high impacts in economic, social and environmental terms; and
3. their great importance for the Spanish economy, in which their contribution to gross domestic product (GDP) [3] was 1.05% in 2020 ([APPA, 2021](#)).

These reasons, along with the importance of renewable energies to achieve sustainable development goals (e.g. within the context of the 2030 political agenda), and the interest and impact of these activities in respect of social welfare benefits, led us to select this sector as a favorable context to develop our research.

We designed a questionnaire after carrying out an extensive literature review, developing and adapting existing measures for perceived environmental dynamism, CSR, KM exploration and exploitation activities and innovation capabilities. An online survey was launched, and an e-mail was sent to the companies included in the population along with an invitation to participate in the study and a direct link to the questionnaire, which was encouraged to be responded by a member of the top management team. We collected 76 valid questionnaires, representing 10.47% of the response rate (see [Table 1](#)). Although it is not a large sample, we were limited by the population size due to the selection of a specific sector and the typical difficulty of getting access to targeted companies and top management. Moreover, the percentage of response is consistent with conventional research with surveys in management (10%–20%), where the target is normally the company's top managers, and there are not incentives to complete the questionnaire beyond cooperation in academic research ([Wijbenga and Van Witteloostuijn, 2007](#)); however, this does not suggest the presence of sampling biases ([Baruch and Holtom, 2008](#)). Likewise, as the study's main objective was to test a predictive model, and we had

**Table 1** Study's technical information

| Population        | Spanish companies of 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%; $z = 1.96$ ; $p = q = 0.5$                              |

enough observations (in comparison to the model's variables) to apply the Smart partial least squares (PLS) technique following the recommendation by [Hair et al. \(2012\)](#), we considered this size as suitable for our research purposes. Finally, and to test for nonresponse bias, differences between respondents and nonrespondents were examined regarding the control variable of the study. A *t*-test did not show a significant difference in relation to company size ( $t = 0.698$ ;  $p < 0.91$ ).

### 3.2 Measures

**3.2.1 Perceived environmental dynamism.** For this measure, five items were used from the scale developed by [Jansen et al. \(2009\)](#). Similar to that paper, we reversed the scale for the last item, to check the consistency of the responses given to the questions related to this construct (see [Appendix](#) for the list of items).

**3.2.2 Corporate social responsibility.** The CSR measurement was developed by considering the most accepted dimensions in management literature – environmental, economic and social (i.e. the triple bottom line). For the environmental dimension of CSR, nine items were adapted from the measures elaborated by [Spiller \(2000\)](#), [Bansal \(2005\)](#) and [Chow and Chen \(2012\)](#). The scale included aspects related to efforts for reducing negative impacts from the company's activities, the selection of responsible suppliers or the use of environmental-friendly inputs. For the economic dimension, eight items were adapted from the measure designed by [Spiller \(2000\)](#) and [Bansal \(2005\)](#). In this case, the scale included aspects that benefit 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 from final products and services. Finally, for the social dimension, six items were adapted from the measure originally designed by [Chow and Chen \(2012\)](#). The scale tries to reflect a company's social commitment regarding its community, rights protection or efforts dedicated to learning on the needs of its stakeholders, among other questions (see [Appendix](#) for the complete list of items).

**3.2.3 Knowledge management exploration and exploitation strategies.** For KM exploration and exploitation strategies, the scales developed by [Jansen et al. \(2009\)](#) were used. Each scale comprised seven items (see [Appendix](#)). According to these authors, exploratory strategies are based on the extent by which KM efforts are focused on developing radical innovation, while exploitative strategies are based on the extent by which a company focuses on existing knowledge to develop incremental innovation.

**3.2.4 Innovation capabilities.** The scales developed by [Zahra and Das \(1993\)](#) to measure product and process innovation capabilities were used by considering the inclusion of both absolute and relative items (i.e. a comparison to previous time periods, main competitors or the industry average) to offer a more complete representation of innovation capabilities (seven items). Moreover, three items from the measures developed by [Delgado-Verde et al. \(2011\)](#) were also included in the final scale (see [Appendix](#) for the list of items). We tried to measure the outcomes in the past three years of a company's innovation capabilities, considering the knowledge-based view of this study.

*3.2.5 Control variables.* Size (measured by means of the natural logarithm of the number of employees) was included in the model as a control variable since it can affect innovation capabilities. Hence, larger companies have access to more resources, and they normally have larger R&D budgets than smaller firms, and they are thus able to invest in new technology (products, processes) at higher levels (Zahra and Bogner, 2000).

### **3.3 Common variance method test**

The following solutions were used in this study to control the common method bias. First, by using multi-item scales without a reference to the constructs, we offered anonymity about independent and dependent variables to the respondents. We also used some reversed scales to prevent an excessive tendency to mark similar scale points by the respondents, to alleviate common method bias. Furthermore, the complex data relationships based on indirect and mediating effects that we propose in this study helped to alleviate possible common method bias concerns since the respondents were unable to guess the research hypotheses or respond in a socially desirable manner when they were completing the questionnaire, which would lead to spurious findings (Ko *et al.*, 2021). Finally, we used statistical remedies (Podsakoff *et al.*, 2003). A Harman test was applied to the questionnaire variables to assess the existence of common method bias for the data set. An exploratory factor analysis (principal components with a varimax rotation) was performed by considering the seven main constructs of the model (environmental dynamism, environmental CSR, social CSR, economic CSR, KM exploration, KM exploitation, innovation capabilities), with results showing the existence of eight factors with eigenvalues above 1, explaining 79.02% of the total variance. As the first factor only explains 37.17% of total variance, common method bias does not appear to be a significant concern for the research.

## **4. Analysis and results**

The PLS approach to structural equation modeling was used in this paper to test the hypotheses. The PLS approach is typically applied in two stages: analysis of the measurement model; and analysis of the structural model. The measurement model is established by means of a confirmatory factor analysis to assess the reliability and validity of the theoretical constructs, while the structural model is calculated to test the associations hypothesized in the research path model. In this study, we used the statistical software Smart PLS 3.3.2, developed by Ringle *et al.* (2015).

### **4.1 Measurement model**

In this paper, we considered all the constructs as reflective. Following the PLS methodology, we first checked construct reliability along with convergent and discriminant validity of the reflective constructs (Tenenhaus *et al.*, 2005). This analysis assesses whether the theoretical concepts are properly measured by the observed variables or not.

### **4.2 Construct reliability**

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

### **4.3 Convergent and discriminant validity**

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, the greater the evidence of the construct's

**Table 2** Measurement model: reliability and convergent validity

| Variables               | Cronbach $\alpha$ | CRI   | AVE   |
|-------------------------|-------------------|-------|-------|
| Environmental dynamism  | 0.764             | 0.850 | 0.588 |
| Environmental CSR       | 0.925             | 0.938 | 0.656 |
| Economic CSR            | 0.834             | 0.891 | 0.673 |
| Social CSR              | 0.864             | 0.902 | 0.648 |
| KM exploration          | 0.909             | 0.927 | 0.646 |
| KM exploitation         | 0.914             | 0.933 | 0.699 |
| Innovation capabilities | 0.917             | 0.931 | 0.578 |

Notes: CRI: composite reliability index; AVE: average variance extracted

validity. In this paper, we removed eight items (Dynam5, CSRenviron4, CSRreco1, CSRreco3, CSRreco4, CSRreco5, CSRsoc1 and Exploit6) [4] 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 (see Table 2). Convergent validity is thus assured for the study's model. Moreover, for the assessment of discriminant validity, we calculated the square root of the AVE of each latent variable, which it should be greater than the correlations between the rest of latent variables (Fornell and Larcker, 1981) (Table 3).

Furthermore, the heterotrait-monotrait ratio values, based on a comparison of the correlations "heterotrait-heteromethod" and the "monotrait-heteromethod," also show discriminant validity since all of them are below 0.9 (Henseler et al., 2015).

#### 4.4 Structural model

To assess the structural model, we calculated the path coefficients or standardized regression weights ( $\beta$ ). The structural model validity is usually checked by means of: student's T; significance levels of path coefficients; and  $R^2$  value for each dependent variable (Figure 1).

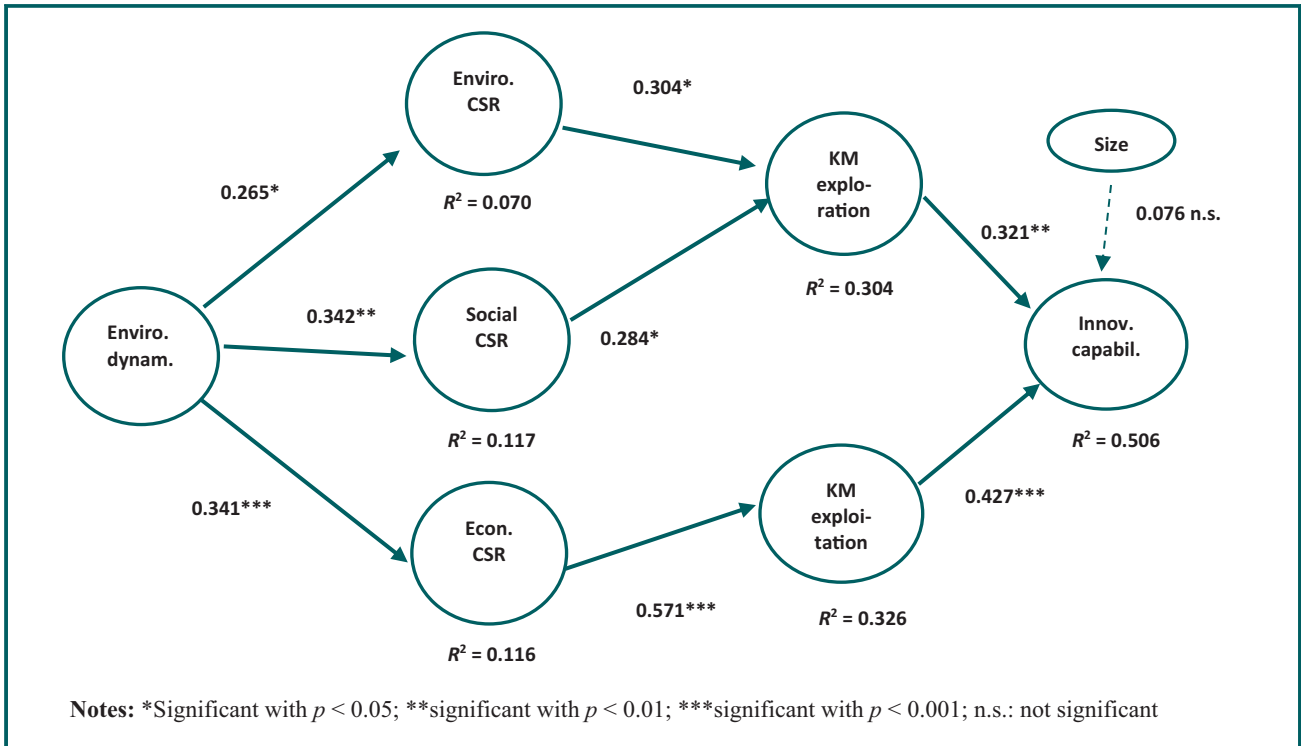
The results indicate a significant relationship between environmental dynamism and the three CSR dimensions, indicating that the higher is the level of environmental dynamism perceived by managers, the greater the company's economic, environmental and social CSR commitment will be. *H1* is thus supported. *H2* and *H3* are also supported, indicating that both environmental and social CSR commitment are significantly related to KM exploration strategies. *H4* is also supported by showing a significant association between economic CSR commitment and KM exploitation strategies. The indirect effects of environmental and social CSR on innovation capabilities by means of KM exploration are not significant, but there is a significant indirect effect of CSR (economic) on innovation capabilities through KM exploitation. Thus, *H5* and *H6* are rejected, but *H7* is supported.

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

| Variables               | Mean | SD   | Innovation cap. | Environm. dynamism | KM explorat. | KM exploitat. | Environ. CSR | Econ. CSR | Social CSR |
|-------------------------|------|------|-----------------|--------------------|--------------|---------------|--------------|-----------|------------|
| Innovation capabilities | 3.4  | 1.09 | 0.760           |                    |              |               |              |           |            |
| Environm. dynamism      | 3.63 | 1.18 | 0.462           | 0.767              |              |               |              |           |            |
| KM exploration          | 3.79 | 1.11 | 0.645           | 0.355              | 0.804        |               |              |           |            |
| KM exploitation         | 3.93 | 0.99 | 0.669           | 0.433              | 0.726        | 0.836         |              |           |            |
| Environm. CSR           | 3.77 | 1.17 | 0.355           | 0.265              | 0.519        | 0.446         | 0.810        |           |            |
| Economic CSR            | 3.55 | 1.18 | 0.464           | 0.341              | 0.500        | 0.571         | 0.589        | 0.820     |            |
| Social CSR              | 3.42 | 1.21 | 0.454           | 0.342              | 0.514        | 0.485         | 0.758        | 0.726     | 0.805      |

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

**Figure 1** Research model and results



Finally, size (control variable) does not show a significant influence on innovation capability development.

Regarding the predictive power of the model, the goodness of fit is determined by the strength of each structural relationship, analyzed by means of the  $R^2$  value (Falk and Miller, 1992) (Table 4). Figure 1 shows that the final dependent variable has a  $R^2$  value higher than 0.5, which indicates that the model has enough predictive power (Chin, 1998). To assess the model's predictive relevance, we calculated the Stone–Geisser test ( $Q^2$ ). According to Chin (1998), the predictive power of a construct is relevant if the test offers values of  $Q^2 > 0$ , which is confirmed for the six dependent variables of our model (Table 4). Finally, Table 5 shows direct and indirect effects of the relationships established in the model.

## 5. Discussion and conclusions

The aim of this research has been the analysis of the interplay between CSR dimensions – economic, social and environmental – and KM strategies and its influence on innovation

**Table 4** Predictive model's relevance

| Dependent variable      | $R^2$ | $Q^2$ |
|-------------------------|-------|-------|
| Environmental CSR       | 0.070 | 0.042 |
| Social CSR              | 0.117 | 0.057 |
| Economic CSR            | 0.116 | 0.069 |
| KM exploration          | 0.304 | 0.176 |
| KM exploitation         | 0.326 | 0.212 |
| Innovation capabilities | 0.506 | 0.282 |



**Table 5** Structural model: decomposition of effects

| Path   | Standardized coefficients |                  |
|--|---------------------------|------------------|
|  | Direct effects            | Indirect effects |
| Environmental dynamism → Environmental CSR       | 0.265*                    |                  |
| Environmental dynamism → Social CSR              | 0.342**                   |                  |
| Environmental dynamism → Economic CSR            | 0.341***                  |                  |
| Environmental CSR → KM exploration               | 0.304*                    |                  |
| Social CSR → KM exploration                      | 0.284*                    |                  |
| Economic CSR → KM exploitation                   | 0.571***                  |                  |
| KM exploration → Innovation capabilities         | 0.321**                   |                  |
| KM exploitation → Innovation capabilities        | 0.427***                  |                  |
| Environmental dynamism → Innovation capabilities |                           | 0.140**          |
| Environmental dynamism → KM exploration          |                           | 0.178*           |
| Environmental dynamism → KM exploitation         |                           | 0.194**          |
| Environmental CSR → Innovation capabilities      |                           | 0.098 n.s.       |
| Social CSR → Innovation capabilities             |                           | 0.091 n.s.       |
| Economic CSR → Innovation capabilities           |                           | 0.244***         |

**Notes:** \*Significant with  $p < 0.05$ ; \*\*significant with  $p < 0.01$ ; \*\*\*significant with  $p < 0.001$ ; n.s.: not significant

capability development, including managers' perceptions of environmental dynamism as an antecedent factor. From a theoretical point of view, this research generates evidence about strategic aspects that contribute to the development of innovation capabilities and broadens the literature on the relationships between CSR and innovation strategies (Bocquet *et al.*, 2013; Ji *et al.*, 2019; Shafique *et al.*, 2021). Previous research had already analyzed how firms undertake exploratory and exploitative innovation successfully (Gibson and Birkinshaw, 2004; Stettner and Lavie, 2014), but the role of specific dimensions of CSR on KM exploration and exploitation strategies for innovation capability development had not received too much attention to date. This is a major contribution of this paper. From this perspective, this study enriches this research line by proposing that CSR can be used as a strategic tool for innovation when the company is able to channel the accumulated knowledge collected from its stakeholders toward the development of new solutions based on technological products and/or processes.

The model of this study shows that, as expected, all the direct effects are significant, so *H1* has been supported. Environmental dynamism has an important impact on CSR commitment, so perceptions of managers about highly and quickly changing factors such as technology, competitors, regulations or customer preferences, lead firms to increase their CSR investments in the three dimensions of the bottom line. The goal is to establish high levels of cooperation with stakeholders such as suppliers or customers, which helps companies to deal proactively with uncertainty and turbulence (Sun and Cui, 2014). When market environments are dynamic, customers' preferences and demands, as well as competitors' market strategies, change rapidly, forcing companies to pay attention and allocate extensive resources to respond to these changes. In this context, companies adopt CSR practices to take advantage of short-term opportunities and to respond proactively to market changes. This result concurs with those of similar studies that provide a direct link between perceived environmental characteristics and CSR strategies (Yu *et al.*, 2017; Zhang *et al.*, 2021).

Our findings contribute to the research line of the CSR-innovation connection by showing how specific dimensions of CSR would be "ideally" linked to KM strategies when a firm is searching for innovation capability development (McWilliams and Siegel, 2000; Ratajczak and Szutowski, 2016). The premise is that environmental and social CSR postures need highly explorative perspectives to find demanding solutions for stakeholders in these ambits. Knowledge flows with stakeholders on environmental and social issues can be very useful for exploring new ways to meet their goals and needs through the development of

solutions based on new (or improved) technologies. Previous studies show that firms with highly proactive CSR strategies are more likely to enhance their innovation capabilities (Bocquet *et al.*, 2013; González-Ramos *et al.*, 2018; Shafique *et al.*, 2021), but these papers do not consider specific KM strategies through which CSR has a specific impact on innovation. Our results show that social and environmental CSR commitment of companies (the most proactive and long-term oriented initiatives) are positively related to KM exploration (rather oriented to the long term), supporting *H2* and *H3*, whereas the economic CSR commitment (the most reactive and short-term oriented initiatives) are positively related to KM exploitation (rather oriented to the short term), supporting *H4*. The economic dimension of CSR, based on activities to avoid lawsuits, reduce waste management costs, increase employee and customer loyalty or improve productivity by means of energy savings, is thus highly related to activities oriented to improve short term performance (also improving relationships with key stakeholders such as employees, customers and suppliers) than to long-term outcomes. Accordingly, our findings show the potential of CSR to improve the acquisition, absorption and recombination of strategic knowledge coming from a firm's stakeholders by developing and strengthening its social capital (i.e. relationship networks). "Good" relationships with stakeholders can provide the firm with future opportunities coming from strong links, trust and shared understanding and common vision (Adler and Kwon, 2002). Therefore, knowledge collected from stakeholders can enhance the company's ability to develop innovation capabilities from KM exploration and exploitation strategies.

Our findings also show that companies highly committed to making greater efforts on the economic dimension of CSR (a reactive CSR, and rather short-term oriented) enhance innovation capabilities by means of a KM exploitation strategy, supporting *H7*. Ji *et al.* (2019) also found a positive relationship between CSR and exploitative innovation. Nevertheless, these findings contradict previous research that stated that reactive CSR does not have an impact on innovation performance (Bocquet *et al.*, 2013; Sharma, 2000; Sharma and Vredenburg, 1998); nevertheless, these papers did not discriminate between exploitative and explorative innovation. These authors argued that the implementation of reactive CSR actions may contribute to continuous improvement, but they are often disconnected from the firm's overall strategy. Our paper, however, finds that companies focused on economic CSR seem to maintain their market position by means of KM exploitation, reducing variability, maximizing efficiency and control, and improving coordination associated with process management efforts (Benner and Tushman, 2015; Clauss *et al.*, 2021), and that this is a coherent strategic adjustment. Moreover, the concentration of resources on KM exploitation maximizes profits in the short term and improves efficiency (Molina-Castillo *et al.*, 2011).

The study's results also show that the indirect effect of both environmental and social dimensions of CSR on innovation capabilities are not significant, so *H5* and *H6* have been rejected. It is thus likely that both environmental and social CSR dimensions require a longer period of time to have an impact on innovation capabilities. Torugsa *et al.* (2013) did not find either in their study about the relationships between social and environmental CSR and financial performance significant associations, which may be a consequence of significant costs for the firm due to CSR implementation in the short term. According to that study's results, only the economic CSR dimension showed a direct association to financial performance in the short term. Other studies also find that environmental CSR has not a significant effect on short-term productivity performance, being likely that the effects are rather shown in the long term, as environmental CSR needs a clear strategic intent, resources and investments whose results are not immediately reflected in tangible outcomes (Sánchez and Benito-Hernández, 2015). These findings are a call to further future research to clearly elucidate the interplay between CSR, KM strategies and innovation capabilities.

## 5.1 Managerial implications

From a managerial point of view, this study offers useful insights about the benefits of simultaneously deploying CSR and KM strategies to improve innovation capabilities, especially when managers perceive a highly dynamic environment for their companies. A major implication is that CSR should be considered as an essential component of innovation and business strategies, especially in industries sensitive to environmental and social issues. For example, in renewable energy-related industries (e.g. energy production, equipment and materials, distribution), a great part of technological innovations are focused on recognizing and responding to the needs of stakeholders and reducing the negative impact of the company's activities on the environment, such as the optimization of waste disposal or the development of product and processes oriented to reduce pollution levels. In this regard, the consideration of environmental and social aspects of CSR in business strategies leads companies toward proactive attitudes toward KM exploration to anticipate or respond flexibly to market changes and their stakeholders' needs, values and preferences. Our study contributes toward managerial practice by showing that a focus on both KM exploration and exploitation strategies reinforces the firm's CSR strategy in its three dimensions, which can help the company to improve innovation capabilities, adapting it to highly dynamic environments. Furthermore, our study shows to managers that deliberate efforts on innovation, reflected in a KM exploration orientation, can make the company to find new opportunity sources coming from CSR activities adapted to its stakeholders (D'Amato and Roome, 2009). This paper thus emphasizes that CSR can play a critical role to identify new directions for innovation and the achievement of competitive advantages.

Finally, the results of this study identified positive relationships between CSR commitment and exploratory/exploitative KM as determinants of innovation capabilities in the renewable energy sector in Spain. It highlights the importance of developing CSR initiatives to improve stakeholders' engagement, allowing the firm to collect strategic knowledge from stakeholders' networks to be further innovative. This knowledge collected from stakeholders helps companies to detect new opportunities to be exploited and to reduce uncertainty when the environment is highly dynamic. In this regard, companies should introduce CSR to deal with environmental uncertainty and turbulence and develop KM strategies as a proactive response to social, economic and environmental issues.

## 6. Limitations and future research lines

As limitations of this study, we can point out, first, its cross-sectional research design. In this study, long-term effects of environmental and social CSR on innovation capabilities cannot be directly (and causally) observed. Thus, the causality issue concerning the hypothesized relationships must be considered as an important limitation. Future research could overcome this issue by using a longitudinal design to establish causal inferences between environmental dynamism, CSR, knowledge exploration and exploitation and innovation capabilities. Another limitation of this study is the sample representativeness. Since the sample is not very large, we must be cautious about the generalization of the study's findings to the entire population and other different industries. As it was previously pointed out, the response rate was limited by the size of the population (not too large due to the specific considered activities) and the survey as an instrument to collect information from companies' top managers. In future research studies, we could try to broaden the sample, for example, by including companies from other activity sectors or by considering similar activities in countries with a comparable level of development in their renewable energy industries. Future papers could also consider other variables in the model, such as corporate reputation, ambidexterity and financial performance, which may have important consequences on the innovation capabilities of companies in the analyzed sector.

## Notes

1. Instituto para la Diversificación y Ahorro de la Energía (Institute for Energy Diversification and Savings).
2. Specialized directory on renewable energy companies.
3. Spain's GDP was €1,118bn in 2020 (Spanish National Statistics Institute).
4. The removed items are highlighted with an asterisk in the [Appendix](#) section.

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## Appendix. Questionnaire

**Environmental dynamism.** Select your level of agreement from 1-very low to 5-very high. During the last three years...

Dynam1... environmental changes in our local market have been intense.

Dynam2... our customers regularly ask for new products and services.

Dynam3... in our local market, changes are taking place continuously.

Dynam4... in our market, the volume of products and services to be delivered change fast and very often.

Dynam5... our market has not changed too much.\*

**Corporate Social Responsibility (CSR).** (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 with its main competitors.

CSRenv2... the use of less environmentally harmful inputs, as compared with previous years and with its main 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 meeting 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, volunteering programs, disclosure of social and environmental practices, etc.), in order to avoid lawsuits 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 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 a truthful advertising, selling secure products, paying attention to complaints, and investing in R&D to offer them high-quality products.

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

CSRsoc1... considering 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 to the community.

CSRsoc3... helping to improve the community's health and safety.

CSRsoc4... protecting the local communities' rights and claims.

*(continued)*

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 initiatives of local communities.

**KM strategies** (From 1-very low to 5-very high)

**KM exploration strategy.** Importance given by the company in the last three years to:

Explor1... accepting demands that go beyond existing products and services.

Explor2... developing new products and services.

Explor3... experimenting with new products and services in the local market.

Explor4... commercializing products and services that are completely new to your organization.

Explor5... continuously exploring new opportunities in new markets.

Explor6... regularly using new distribution channels.

Explor7... regularly searching for new consumers in new markets.

**KM exploitation strategy.** Importance given by the company in the last three years to:

Exploit1... frequently refining the offer of existing products and services.

Exploit2... regularly implementing small adaptations to existing products and services.

Exploit3... introducing improved products and services to the market.

Exploit4... improving the efficiency of products and services supplying.

Exploit5... increasing scale economies in existing markets.

Exploit6... expanding products/services for existing customers.\*

Exploit7... reducing costs of internal processes.

**Innovation capabilities.** Assessment of the level of development of innovation capabilities by the company in the last three years in relation to:

InnCap1... development of new products.

InnCap2... development of new methods and processes.

InnCap3... development of improved existing products.

InnCap4... development of improved methods and processes.

InnCap5... the introduction of more new or improved products than its main competitors.

InnCap6... the introduction of more and better methods and/or processes than its main competitors.

InnCap7... the introduction of more new or improved products than three years ago.

InnCap8... the introduction of more and better methods and/or processes than three years before.

InnCap9... the implementation of new processes that have shortened the manufacturing cycle or improved manufacturing flexibility.

InnCap10... the implementation of new processes that have reduced costs for the firm.

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