

# Eco-Innovation

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Eco-innovation refers to “the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives”. Eco-innovation has been used as a synonym for “environmental innovation”, “green innovation,” and “sustainable innovation” depending on the author and the outlet where the research is published.

eco-innovation performance

open innovation

corporate sustainability

## 1. Background

The changing and complex nature of the current business context has positioned innovation as a cornerstone of a firm's long-term competitive advantage [1][2]. In recent years, the increasingly visible effects of climate change, the ecological aspects of infectious diseases (e.g., the Ebola and Cholera crisis in Africa and more recently the COVID-19 pandemic), the degradation of ecological systems, and the higher expectations of customers in relation to the role of business in society, have dramatically increased corporate awareness about the importance of developing innovations capable of connecting the firm's strategy with environmental value creation [3][4]. Moreover, there is growing evidence that organizations that implement environmentally-driven innovations—better known as eco-innovations—can improve their financial performance and strengthen their competitive position (i.e., doing well by doing good) [5][6][7][8]. Therefore, in order to develop stronger competitive strategies, firms—either large, medium or small—must understand what can drive successful eco-innovation.

Previous literature has identified different drivers of eco-innovation, including regulation pressures, corporate strategy, technological availability, and collaborative activities between stakeholders [9][10][11][12][13]. Due to the complex nature of environmental value creation [14], scholars have recognized that eco-innovation needs information to be gathered from outside the firm's boundaries [5][15]. Thus, how firms organize their time and resources to collaborate with stakeholders has become a strategic challenge [16]. Firms can respond to this challenge by adopting an open innovation model, which embraces the integration of complex external knowledge to create innovations that are beneficial both for the firm and the system wherein they participate.

Open innovation is defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” [17] (p. 1). Open innovation includes both inbound (utilization of external sources) and outbound (external use of a firm's knowledge) flows of

knowledge to boost innovations [18][19]. An increasing number of studies have probed the effective role of open innovation in creating eco-innovation, which entails a greater focus on inbound strategies (i.e., the more external knowledge sources a firm uses, the better eco-innovation results they obtain) [5][13][15][20]. The sources utilized by organizations to implement inbound open innovation strategies can be institutional, professional, and market-driven [21]. However, extant research has primarily focused on aggregated open innovation strategies, with a lack of theorizing about what particular sources can stimulate organizations to improve eco-innovation performance.

Of all external sources used by organizations in open innovation activities, market-driven sources are essential to implement eco-innovations [11], because collaboration with different stakeholders is necessary to develop a business strategy aimed at creating environmental and/or social value [3][22]. When eco-innovation is part of the firm's strategy, the interests of different stakeholders are somewhat integrated in the value proposition [23]. Thus, the market can be more open to engage in collaboration and provide crucial information to both design and sustain this form of innovation over time [24]. Unfortunately, we still know little about the role of different market sources in eco-innovation performance. We address this gap by answering the following question: what market knowledge sources relate to eco-innovation performance? In so doing, we investigate the effect of individual market categories, namely clients, suppliers, competitors, and consultants [25], and explore how each might enhance organizations' eco-innovation performance.

## 2. Market Knowledge Sources on Eco-Innovation

Innovation scholars have recognized the relevance of organizations' capability to access market sources that would provide new resources and ideas to innovate successfully [21][26]. For example, firms pursuing the development of eco-innovations will likely face technological problems that require a breadth of knowledge that is difficult to find within the boundaries of the company [27]. Four market sources that have been positively associated with boosting innovations are clients, suppliers, competitors, and consultants, which provide different but complementary knowledge for both value creation and value capture [28][29].

Collaboration with clients is essential for increasing the flow of knowledge—to the firm—that helps to enhance the value proposition as well as the process of value capture [10][30]. Von Hippel [28], for example, has emphasized the importance of clients in developing successful technological innovations, as clients provide useful information about their needs and preferences. Similarly, clients can push to create new processes that enhance customers' experience and increase their satisfaction with the firm [31][32]. In the case of eco-innovations, clients' willingness to pay will depend on the direct benefits they can get from these types of innovations, which can range from the betterment of product and services to the enhancement of individuals' self-image or social identity [33][34][35]. Finally, clients can be one step ahead regarding environmental expectations (especially younger generations and citizens from developed countries) and, consequently, can offer useful information about future needs and trends.

Suppliers can contribute to the refinement and improvement of new products [36][37], or to the improvement of a firm's processes to achieve higher levels of efficiency and effectiveness. For example, firms can work closely with suppliers to develop new technologies embedded in the production process [38], propose new materials or

components that can improve the quality of products and services [39], and conduct joint search activities aimed at improving the efficiency of product elaboration and even the whole supply chain [35]. Strategically, collaboration with suppliers is mostly important for the process of value creation [40][41], as eco-innovations driven by this market source are primarily oriented to manage the risks of the value chain, increase efficiency, and differentiate products [8].

Compared with other types of innovations, eco-innovation usually requires firms to collaborate even with competitors [24], as the goal is not only economic performance, but the creation of positive environmental impact [3]. In this case, successful collaboration with competitors is based on a shared vision of the future, where the betterment of the ecological environment is considered a necessary business practice and even an ethical obligation [42][43][44]. Although an eco-innovation strategy works better with collaborative interactions, open innovation with competitors is not always based on collaboration and usually involves the imitation of new processes and products/services [45]. Collaborating with competitors can impact both value creation and value capture, depending on the nature of the relationship and the knowledge that is shared by firms [46][47][48].

Finally, consultants can provide information related to processing knowledge—specific to the firm—that is obtained indirectly from competitors and other relevant stakeholders [49][50]. In the case of eco-innovations, firms can get systematic knowledge and a variety of information from other industries that face similar environmental challenges [20]: governmental agencies that drive environmental regulations [51], and NGOs that are devoted to creating a positive environmental impact in the communities in which the firm operates [52], among others. Due to the breadth of knowledge than can be obtained from consultants, collaboration with them can be useful for both value creation and value capture, depending on the nature of the relationship and the services that are required by the firm.

Based on the arguments presented above, we hypothesize:

**Hypothesis 1 (H1a):**

*Client knowledge sources are positively associated with eco-innovation performance.*

**Hypothesis 1 (H1b):**

*Supplier knowledge sources are positively associated with eco-innovation performance.*

**Hypothesis 1 (H1c):**

*Competitor knowledge sources are positively associated with eco-innovation performance.*

**Hypothesis 1 (H1d):**

*Consultant knowledge sources are positively associated with eco-innovation performance.*

### 3. Combined Market Knowledge Sources on Eco-Innovation

Managers who seek useful knowledge from different stakeholders need to avoid spending valuable time and financial resources targeting external sources that provide duplicated information [53][54]. To create an effective open innovation strategy, firms need to work closely with different external sources to create synergies that enhance the likelihood of achieving successful innovations [55]. The literature on open innovation stresses the need to seek complementary information from different or distant pairs of sources, such as the use of internal and external sources for boosting process innovation [56]. Positive interactions can also arise from pairs of external sources close to each other that are differentiated by key attributes, such as the positive effect of collaborating with scientific and supply-chain partners to make product innovation [16]. Therefore, we propose that combining knowledge from complementary market sources has a positive effect on eco-innovation performance.

From the four market sources discussed previously, clients' needs and requirements are usually at the center of any innovation intention. The client's perspective is important because it informs the essence of the value proposition [30], which can be enriched and enhanced by adding the viewpoint of suppliers, competitors, and consultants. By gathering information about the customer's needs, as well as their view (or desire) of a better future regarding environmental and green issues, the firms can transform these ideas on specific eco-innovations that would help to sustain a competitive performance.

By combining the information provided by clients with insights coming from suppliers, firms can connect streams of knowledge from the two extremes of the value chain [57][58]. Thus, managers may integrate pull-force needs that shed light on improvements in value proposition/capture (the client perspective) with push-forces that can help to create new processes or use emergent materials that could match customers' environmental needs (i.e., value creation) [59]. Similarly, managers may compare and contrast customer feedback about green aspirations and demands with competitors' practices regarding eco-innovations, as well as consultants' knowledge about environmental needs, environmental regulations, and industry benchmarks. This type of analysis can offer firms strategic insights to introduce a greater number and variety of eco-innovations, especially if the knowledge coming from the different market sources can be complemented to improve both value creation and value capture.

Finally, another dimension by which firms achieve synergies in their search strategies is by combining more tacit and explicit knowledge [60] with theoretical knowledge [49]. This synergy is achieved by using, in particular, client and consultant knowledge sources. Firms looking for positive performance on eco-innovations can learn from different customer expectations about what would make an organization a leader in environmental performance in its industry (i.e., experienced-based knowledge) and combine this information with theoretical frameworks and organized knowledge about eco-innovation trends and practices provided by consultants. This search strategy might also work with the other two collaborative pairs (i.e., client-supplier and client-competitor), but to a lesser degree, as suppliers and competitors primarily offer experienced-based knowledge.

Based on the arguments presented above, we offer a second set of hypotheses:

**Hypothesis 2 (H2a):**

*There is a complementary effect between client and supplier knowledge sources on eco-innovation performance.*

**Hypothesis 2 (H2b):**

*There is a complementary effect between client and competitor knowledge sources on eco-innovation performance.*

**Hypothesis 2 (H2c):**

*There is a complementary effect between client and consultant knowledge sources on eco-innovation performance.*

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