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How to embed environmental sustainability: The role of dynamic capabilities and managerial approaches in a life cycle management perspective

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Abstract

Life cycle management (LCM) is a managerial framework to embed a holistic environmental sustainability logic inside organizations. Despite its long tradition, the implementation of LCM is little explored. In this study we observe how sensing, seizing, and reconfiguring capabilities together with managerial approaches to environmental sustainability help organizations embed LCM in their practices. We performed a multinomial logistic regression using a sample of 187 medium and large enterprises. Our findings show that sensing and seizing capabilities and an integrative approach to sustainability help embed LCM in presence of complex environments. Among dynamic capabilities, reconfiguring does not appear to help organizations embed LCM. This study contributes to the literature on LCM and dynamic capabilities.

KEYWORDS
business strategy, dynamic capabilities, environmental sustainability, integrative approach, life cycle management

1 | INTRODUCTION

Traditionally, businesses have adopted environmental strategies if economically convenient to their bottom line (Ambec & Lanoie, 2008; Miroshnychenko et al., 2017), such as eco-efficiency practices. In doing this, firms have adopted a myopic view over the environmental performance of their products, considering only what happens inside firms, that is, the production phase. Focusing on greening internal operations, while temporarily beneficial, leads to shifting the burdens from one phase to the other, or in other words, from one firm to another in the product supply chain (Balkau & Sonnemann, 2010; Ehrenfeld, 2004; Nilsson-Lindén et al., 2018; Welford, 2003). Firms now recognize that they do not operate in a vacuum and are required to assess their environmental performance beyond organizational boundaries, where environmental impacts really matter (see, e.g., Bianchi et al., 2021; Jourdaine et al., 2021; Nilsson-Lindén et al., 2019). As a result, a holistic approach to environmental sustainability is now part of strategic management choices (Elias Mota et al., 2020; Primc & Čater, 2016).

In this respect, experts identified life cycle management (LCM) as a holistic approach to environmental management, as it strategically takes into consideration all phases and actors involved along a product life cycle (see, e.g., Baumann & Tillman, 2004; Hunkeler et al., 2003; Nilsson-Lindén, Diedrich, & Baumann, 2020; Sonnemann & Margni, 2015). As Bey puts it, it can "also be referred to as Sustainability Management" (Bey, 2018, pp. 523–524).

Despite this, the complex organizational fields and dynamic contexts in which firms operate, as well as organizational barriers, make it challenging to embed a holistic environmental sustainability approach inside firms which are tied to their existing structures and practices (Bettis & Prahalad, 1995; Zietsma et al., 2002). To develop such an approach, major changes are required at the strategic and operational levels (Bianchi et al., 2021; Fortis et al., 2018; Nilsson-Lindén et al., 2020; Waddock & McIntosh, 2009; Zietsma et al., 2002).

From a strategic point of view, companies should overcome focusing on win-win solutions that may allow to pursue economic and environmental benefit only in the short term (Flammer & Bansal, 2017). Recently, scholars have theorized that by adopting an integrative view, economic and environmental tensions are recognized as sustainability elements are interconnected (Hahn et al., 2014; Van der Byl & Slawinski, 2015). However, whether the adoption of an integrative lens is able to support a change in organizational responses to environmental issue is still empirically unexplored.

Additionally, in their efforts to change towards a life cycle environmental sustainability, new organizational capabilities may play a major role in enabling firms to achieve their intended aims (Dosi et al., 2000) and overcome barriers (Testa et al., 2016). Drawing from the dynamic capabilities theory, new capabilities entail the capacity to identify new opportunities and challenges, seize opportunities, and transforming assets and competences to address complex environments (Teece, 2007; Teece et al., 1997). Several are the scholars who noted how dynamic capabilities help organizations change and embed environmental sustainability in their strategy and operations (Darmani et al., 2017; Kabongo & Boiral, 2017; Lieberherr & Truffer, 2015; Mousavi et al., 2018). Despite this, the role of dynamic capabilities in relation to environmental sustainability management is little explored (Daddi et al., 2018; Essid & Berland, 2018) and more so when adopting an LCM lens (Vermeulen & Seuring, 2009).

To contribute to the literature on environmental sustainability and dynamic capabilities, we explore to what extent dynamic capabilities and an integrative lens to corporate sustainability favor LCM embeddedness in firms by using data collected by means of a questionnaire-based survey which involved more than 200 Italian manufacturing firms. By taking into account that adoption is not synonym with embeddedness (Testa, Boiral, & Iraldo, 2018), we define LCM embeddedness when firms which have adopted LCM practices are able to overcome barriers and implement LCM for the long term.

The paper is structured as follows. First, the theoretical backgrounds of LCM are explored. We then introduce the dynamic capabilities theory, which is used to develop the conceptual framework and the hypotheses of the study. After discussing our research design, we present and discuss the findings. Finally, we conclude the study with limitations and avenues for future research.

2 | THEORETICAL BACKGROUND

2.1 | Life cycle management

LCM involves managerial tasks aimed at operationalizing sustainable development in organizations (Bey, 2018; UNEP, 2012). Despite dating back to the 1980s, it is only recently that LCM gained international attention. On one side, an interest in LCM has been advanced by institutional stakeholders, such as the United Nations and the European Commission to help enable the green transition (Testa et al., 2016). On the other side, consumers are increasingly interested to understand how their buying choices affect the environment throughout their life cycle (Baden et al., 2009; Testa et al., 2021). Because a considerable part of a product environmental impact is outside the boundaries and control of a single firm, LCM forces firms to think holistically and consider its business partners when making business decisions (Sonnemann & Margni, 2015). Organizations that implement LCM do not limit themselves to computing the environmental footprint of their products or modifying them. Such organizations instead embrace a life cycle logic by orienting any business function in using a life cycle perspective that integrates environmental issues into their decisions.

Acknowledging the complexity of embedding LCM in practice, scholars have provided contributions on diverse LCM practices which encompass several phases and actors in the product life cycle (Nilsson-Lindén et al., 2020; Sonnemann & Margni, 2015; Vermeulen & Seuring, 2009). For example, Remmen (2007) noted the importance of adopting environmental criteria when choosing business partners such as suppliers and distributors. Many scholars point to role of collaboration with internal and external stakeholders along a product life cycle as a key success factor of a business strategy (Bianchi et al., 2021; Linnanen, 1995; Remmen, 2007; Seuring & Müller, 2008; Strothmann et al., 2015). Besides, life cycle assessment (LCA) was recently acknowledged as a practice for its fundamental contributions to move efficiently and sustainably towards more responsible consumption and production patterns (Life Cycle Initiative, 2020).

However, for organizations to work successfully with an environmental life cycle perspective, LCM must be embedded in the business strategy and operations (Fava, 1997; Linnanen, 1995; Remmen, 2007). This implies that it should not just be "a separate add-on strategy that might even contradict the company's overall business strategy" (Nilsson-Lindén et al., 2018, p. 1372).

Despite this, the literature shows that there are several barriers that limit the integration of environmental sustainability or corporate social responsibility in business operations. Bey et al. (2013) found that the main obstacles to implement environmental strategies related to a lack of information on environmental impacts and expert knowledge, as well as a lack of allocated resources. In their study, Bianchi et al. (2021) explored the internalization of LCM in five organizations and observed the barriers encountered throughout their change towards environmental sustainability. They found that lack of knowledge, ad hoc resources, and a resistance to change were critical obstacles inside organizations and among key business partners, together with a lack of support from the broader institutional context. Another study examined the integration of green supply chain management and identified 47 barriers divided in five main categories: outsourcing, technology, knowledge, financial, and involvement and support (Govindan et al., 2014). From the literature, it emerges then that both internal and external barriers can pose great constraints to an organization.

2.2 | Managerial approaches to environmental sustainability

Scholars emphasized the role of managerial approaches for embedding environmental sustainability in the organization (Demers &

Gond, 2020; Gond et al., 2017; Xing & Starik, 2017). In the last decade, scholars focused on managerial value and attitudes by showing how personal factors influence the adoption of environmental practices (Boiral et al., 2017; Papagiannakis & Lioukas, 2012; Testa et al., 2020). Environmental commitment or ethical values are found to increase the probability of a company to integrate environmental issues into daily practices (Henriques & Sadorsky, 1996; Testa, Boiral, & Heras-Saizarbitoria, 2018; Wee & Quazi, 2005).

However, these studies underlined that environmental and economic objectives can be divergent and a positive environmental attitude of managers may be irrelevant into a decision to adopt an environmental practice. The institutional environment where a company operates is characterized by different stakeholders which exert different and, in some cases, conflicting pressures (Diouf & Boiral, 2017; Testa, Boiral, & Iraldo, 2018).

Recently, scholars have adopted a cognitive perspective (e.g., Grewatsch & Kleindienst, 2018; Hahn et al., 2014; Sharma, 2000; Van der Byl & Slawinski, 2015) on corporate sustainability recognizing that managers are confronted with increasing complexity which is intrinsic to the notion of sustainability (Dahlmann & Grosvold, 2017; Slawinski & Bansal, 2015). Therefore, managerial approaches towards environmental sustainability can help shape how they interpret and how they respond to environmental issues. Drawing from previous works (Hahn et al., 2014; Van der Byl & Slawinski, 2015), an integrative approach gives equal weight to three pillars of sustainability and supports a holistic approach to sustainability (Van der Byl & Slawinski, 2015). Managers recognize the potential tensions that the three objectives can generate and decide to pursue them by focusing on the interconnected constituents. There is not a choice of priorities and a goal is not sacrificed for reaching another goal. An integrative approach stands opposite to a trade-off approach that prioritizes economic impacts over environmental or social concerns (Slawinski & Bansal, 2015). In light of this, we argue that an integrative approach to environmental sustainability favors the adoption of LCM as a holistic approach to environmental sustainability.

2.3 | Dynamic capabilities

The dynamic capabilities theory describes dynamic capabilities as internalized patterns of organizational activities through which an organization acquires and modifies its operating routines to enhance its effectiveness (Zollo & Winter, 2002). This theory acknowledges the importance of being able to recombine internal resources in order to thrive in fast changing contexts (Teece et al., 1997). The versatility of such theory makes it applicable to any new initiative carried out in the organization that requires resource reconfiguration (Albort-Morant et al., 2016; Ramachandran, 2011). Given the complex and dynamic nature of a holistic approach to environmental sustainability, the dynamic capabilities lens seems appropriate to study its embedding in business strategy and operations (Scarpellini et al., 2020).

Dynamic capabilities have been described by Teece (2007, p. 1319) as "the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets." In an approach similar to Mousavi et al. (2018), in our study, we investigated the influence of sensing, seizing, and reconfiguring as separated concepts but pertaining to the same construct of dynamic capabilities.

Sensing capabilities are a set of activities composed of scanning, learning, and interpretation of new opportunities. In this sense, scholars argue that organizations that proactively scan for external sources of knowledge are better placed to innovate sustainably (Segarra-Oña et al., 2016). Furthermore, the failure to identify external opportunities to innovate, including in collaboration with business stakeholders, represents a critical barrier to finding new opportunities for eco-innovation (Dangelico et al., 2017; Frey et al., 2013). Overall, sensing helps organizations gather information on a product life cycle coming from different phases and those responsible for them. As a result, sensing capabilities may help organizations to overcome barriers for LCM and embed LCM in their strategy and operations.

In the context of LCM, *seizing capabilities* refer to the successful development of competences and organizational practices needed to develop a sustainable product throughout its entire life cycle. Some examples of activities for seizing life cycle opportunities include using LCAs in the design phase, environmental key performance indicators in R&D, acquiring external knowledge but also training employees, and collaborating along a product life cycle with external partners. Seizing capabilities can thus help firms exploit life cycle environmental opportunities and help firms embed LCM in their operations.

Reconfiguring capabilities refer to the ability of a firm to reconfigure its resources through strategic renewal in order to thrive and shape the dynamic environment in which it operates. Mousavi et al. (2018) stressed that the ability of organizations to rearrange and upgrade their skills, assets, and structures in response to their contexts helps organizations remain innovative in dynamic environments. A high degree of reconfiguring capability will advantage organizations to adjust and reconfigure their assets and resources in line with the opportunities, and challenges, emerged through a product life cycle.

2.4 | Hypothesis development

Through the conceptual lenses of dynamic capabilities, we aim to investigate to what extent sensing, seizing, and reconfiguring together with an integrative approach towards environmental sustainability play a role in helping organizations embed LCM. In other words, we argue that organizations with a low adoption of LCM practices can be facilitated by their dynamic capabilities and integrative approach to environmental sustainability to further implement LCM practices and integrate an LCM logic into their operations. However, we also expect that low barriers to LCM implementation describe a relatively static

environment, in line with the assumption of De Giacomo et al. (2019). Therefore, in the presence of low barriers, only some dynamic capabilities, within an integrative approach, are necessary to move an organization to a more embedded configuration. In opposition, for organizations that operate in dynamic environments characterized by high barriers to LCM, dynamic capabilities play a more important role for the adoption of LCM, together with an integrative managerial approach.

For organizations that operate in a favorable context where low barriers to LCM exist, we do not expect a higher level of dynamic capabilities to environmental sustainability to contribute to stimulate LCM embeddedness, regardless of their managerial approach. In particular, organizations may sense new opportunities but are not stimulated to seize them nor to reconfigure their existing assets to embed them. We thus hypothesize that:

> **H1.** *In the presence of low barriers, the extent of sensing, seizing, and reconfiguring capabilities an organization owns will have a low influence on the level of LCM embeddedness, together with the prevailing managerial approach towards environmental sustainability.*

A high degree of dynamic capabilities will enable firms to adopt and embed LCM in their operations through reducing the internal and external barriers they face. In particular, firms will be better positioned to sense new opportunities along their life cycle chain and seize them, by reconfiguring their assets if necessary. Therefore, we hypothesize that:

> **H2.** *In the presence of high barriers, the extent of sensing, seizing, and reconfiguring capabilities an organization owns will influence its level of LCM embeddedness, together with an integrative managerial approach towards environmental sustainability.*

2.5 | Conceptual model

Our research aim is to understand how internal capabilities and managerial approaches influence the probability of an organization to embed LCM within its operations, given the level of barriers organizations face. By taking into account the different levels to which organizations can adopt LCM practices, we define organizations as having embedded LCM practices, when they account for other phases (or actors) of the production process—besides those done in-house—in their decision-making, whereas a low level of LCM practices embeddedness indicates that organizations are intentioned to adopt LCM practices into their operations but have not implemented them yet. Then, we focused on the barriers that prevent organizations to implement LCM practices, by considering their overall intensity (i.e., high or low). By cross-analyzing LCM practices and the barriers that impede organizations to implement LCM practices, we define the four profiles shown Figure 1.

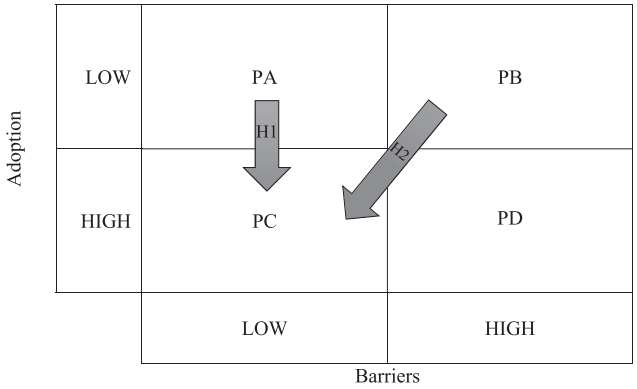

FIGURE 1 Four profiles on life cycle management (LCM) embeddedness

2.5.1 | Profile A: Unconcerned organizations towards an LCM logic

This profile describes those organizations that are confronted with a low degree of barriers to implement life cycle practices. Therefore, it is a favorable context, where external barriers are low and organizations have the internal resources and expertise to adopt practices based on LCM. In spite of this, there is a low adoption of LCM practices among these organizations. This being said, it is worthwhile to explore whether some among these organizations have identified the opportunity to implement LCM practices and are planning to adopt them in the near future. In light of this, we need to comprehend the potential evolution of organizations in Profile A to adopt LCM practices, given the low barriers they face, as put forward in Hypothesis 1 and shown in Figure 1.

2.5.2 | Profile B: Unskilled organizations failing to embrace an LCM logic

This profile is characterized by organizations facing high barriers for the adoption of LCM practices. Organizations are faced with high institutional and contextual barriers, but they also lack internal resources and skills towards environmental sustainability. As such, organizations in this profile have a low degree of adoption of LCM practices. This can be due to lacking critical resources to spot opportunities for LCM adoption. Profile B represents another profile that is worthwhile investigating as the basis for organizations that evolve towards LCM embeddedness. This represents another interesting profile to examine under Hypothesis 2.

2.5.3 | Profile C: Proactive and outbound organizations mastering their evolution towards LCM

There is a high level of LCM adoption as organizations are faced with a relatively low level of barriers. Organizations which evolved towards this profile are effective in their implementation of LCM, as they may

have changed to adjust to the new environmental logic, acquired internal resources, and learnt how to deal with adverse external barriers. As a result, we want to explore the probability of organizations evolving from Profiles A and B (H1 and H2) to this profile as depicted in Figure 1.

2.5.4 | Profile D. Outbound organizations trying to evolve towards LCM

Organizations in this profile operate in a complex and dynamic context, characterized by a high degree of barriers that affect the level of LCM implementation. Organizations pertaining to this profile are trying to implement LCM practices despite the barriers they face. In this respect, these barriers could be linked to the new organizational layout or business strategy that LCM promoted. In other words, whenever there is a strategic change, organizations are faced with barriers on several levels (Lawrence et al., 2005). Their evolution towards LCM embeddedness is not complete, but they are amidst their implementation process. This profile falls out of our research intentions.

3 | METHODS

3.1 | Sample

To fulfill our research intentions, we used data collected by means of an empirical survey conducted within the scope of the European project EFFIGE funded by the LIFE Unit of the European Commission under the 2016 call. The main aim of this action was to identify actual and potential needs and barriers faced by firms when conducting life cycle studies in order to better enable the dissemination of the European Product Environmental Footprint (PEF) among Italian and European firms. PEF is a method of computing the environmental footprint of products and services promoted by the European Commission with the Recommendation 179/2013/UE. Data were collected over a period of 2 months from June to July 2019 through an online questionnaire. In line with Maguire (2001), we deemed this to be the most effective tool to reach multiple and geographically sparse recipients and gather data to fulfill our research aims.

We targeted medium and large firms based in Italy and operating in the manufacturing sectors, with the exception of the tobacco industry, that consisted in a total of 2985 firms. The reason behind our choice is twofold. First, these two groups altogether represent approximately 50% of the Italian employees in industrial sectors (ISTAT, 2020). Second, Testa et al. (2016) have recently argued that the lack of skills and resources still represents a significant impediment for conducting an LCA and embracing an LCM logic. Therefore, a focus on SMEs can be more efficiently executed by adopting a qualitative approach. We then proceeded to retrieve a certified email address for each of the identified firms on the regional websites of the relevant Chambers of Commerce. In June 2019, we first contacted each firm via email, which contained a link to the questionnaire, administered through a web-survey platform. The invitation email was used as a cover letter, providing recipients with a brief introduction on the aim of the survey and a reference to the LIFE EFFIGE project. We also underlined that participation was on a voluntary basis, and confidentiality was guaranteed as respondents remained anonymous.

The first deadline for completion was set in 2-week time since the sending of our first email. The second reminder was sent in July 2019, giving another 2-week window to complete our questionnaire. No significant difference was found between early and late respondents. The system stored answers of every survey taker, irrespective of their completion level.

The first section of our questionnaire was designed to gather sociodemographic information about firms, such as origin (region in Italy), size (50–249; 250–1000; 1001–4999; over 5000), clients (b2b; b2c; public administration; retailer; other), and turnover (less than €500,000; €500,001–€1,000,000; €1,000,001–€2,000,000; €2,000,001–€10,000,000; €10,000,001–€50,000,000; over €50,000,000). We then included sections on the following: dynamic capabilities, namely, sensing, seizing, and reconfiguring abilities; organizational practices pertaining to LCM; barriers that firms perceived while trying to adopt life cycle practices; and managerial approach to sustainability. The questionnaire contained other sections which were used for other studies. Respondents were reassured that all answers were collected anonymously. Our survey was designed with a simple layout and only the buttons necessary to state preferences to avoid any influence or confusion (Olinzock et al., 2015).

In total, we gathered 367 answers, representing the 12.3% of the entire population. Due to incompleteness, we retained 187 questionnaires, representing approximately 6% of the overall number of large and medium Italian manufacturing firms. Regarding the size of the organizations in our sample, 45% of them have between 50 and 249 employees; 35% organizations belonged to the category 251–1000 employees; the 12% had between 1001 and 4999, while the remaining 8% have more than 5000 employees.

Even if the response rate, compared with the study's population, is in line with previous studies on green management (see, e.g., Darnall et al., 2008), we checked the presence of selection bias by performing the approach described by Armstrong and Overton (1977). As suggested by the authors, late respondents have similar characteristics of nonrespondents. Therefore, considering the temporal distribution of answers and the e-mail reminders, we identified the two groups of early and late respondents (31 and 35, respectively), and several *t*-tests were conducted of the questions on LCM practices which are may be related to an organization's interest in participating to the survey. All comparisons did not reveal any significant difference, so we can conclude that a nonresponse bias is not present.

3.2 | Variables

In order to create the four profiles of our conceptual model, we measured two constructs, namely, the adoption of LCM practices in organizations and the perceived barriers to LCM practices adoption.

The first construct measures the adoption of LCM practices by the organizations in our sample. It is composed of 10 items measured by a 5-point Likert scale, ranging from 1 ("not taken into consideration") to 5 ("successfully adopted"). Taking inspiration from seminal research on green supply chain management (Srivastava, 2007; Testa & Iraldo, 2010; Zhu et al., 2005), we built up items according to the main phases and actors that have an impact on the product life cycle: the choice of suppliers and raw materials (three items); internal practices in the organization (two items); the relationship with clients (two items); and logistics and distribution (three items). The Cronbach's alpha value at 0.859 led us to accept this construct, since it was higher than the acceptability threshold of 0.7 (Nunnally, 1978) for the reliability of a single-factor measure.

The second construct is an index of the barriers perceived or encountered by organizations when adopting LCM practices. It is composed of 20 items adapted from Govindan et al. (2014), measured through a 5-point Likert scale, where one meant "not important" and five stood for "very important." Barriers are divided in the following categories: lack of external support, such as institutional support (two items); financial barriers (two items); obstacles related to suppliers or distributors, such as willingness to disclose information or collaborate to reduce the environmental impacts of a product over its life cycle (five items); the lack of adequate assets, such as technology or human resources (four items); the lack of knowledge and skills inside the organization or among business partners (four items); and the lack of involvement, for example, from top management or among business units (three items). The Cronbach's alpha for this construct was higher than the acceptability threshold of 0.80 (Nunnally, 1978); therefore, we deemed our measure of barriers to LCM practices as reliable single-factor construct (alpha = 0.916).

Following the approach used by other scholars (c.f., Boiral & Amara, 2009; De Giacomo et al., 2019), we combined the two aforementioned constructs, namely the adoption of LCM practices and the perceived obstacles to adopt LCM practices and developed four organizational profiles towards LCM embeddedness.

Regarding the independent variables, we, first, operationalized dynamic capabilities by dividing them into three main conceptual categories of capabilities according to several studies (c.f. Kabongo & Boiral, 2017; Teece, 2007). In relation to *sensing* capabilities, we asked managers to rank on a 5-point Likert scale, where 1 was "never" and 5 was "regularly," how frequently their organization would carry out activities aimed at identifying new products or processes. The activities that were used to measure sensing capabilities were grouped into four main categories: market and technology monitoring (four items), brainstorming (two items), trial and error (two items), and experiential learning (two items). The Cronbach's alpha for this construct was 0.890, beyond our acceptability threshold.

Then, for what concerns *seizing* capabilities, we asked respondents to rate on a 5-point Likert scale, where 1 was equal to "strongly disagree" and 5 to "strongly agree," the extent to which their organizations would take actions after having identified opportunities, by grouping seizing capabilities into three main categories: strategic planning (five items), business model flexibility (two items), and openness to collaborate (three items). The Cronbach's alpha for this construct was 0.905, beyond our acceptability threshold.

Finally, *reconfiguring* capabilities were measured by asking respondents how many times they implemented changes to pursue identified opportunities, through a 5-point Likert scale, where 1 was "poorly implemented" and 5 "perfectly implemented." We grouped reconfiguring capabilities in three main categories, such as organizational restructuring (two items), technological changes (three items), know-how acquisition (two items), and process and practice reconfiguration (three items). The Cronbach's alpha for this construct was 0.858, beyond our acceptability threshold.

Then, we conceptualized the *managerial approach* to environmental sustainability following previous works in the literature (c.f. Hahn et al., 2014; Van der Byl & Slawinski, 2015). In order to avoid a social desirability bias, where respondents could answer favorably to make a good impression, we operationalized this variable through reverse coded items. In other words, we asked participants to rate on a 5-point Likert scale, from 1 as "strongly disagree" and 5 as "strongly agree," to what extent they agreed to five statements pertaining to a trade-off approach (i.e., (i) the biggest concern for a company is to generate profit for the respect of the interests of the company and its employees; (ii) if the investors or owners are not satisfied, nothing else takes precedence; and (iii) it is not wise to ask a company to contribute to solving environmental problems, because it would be distracted from its main purpose, which is to satisfy its investors and clients). As mentioned in paragraph 2.1.3., a trade-off stands in contrast to an integrative approach which favors the integration of environmental concepts in the organization. The Cronbach's alpha was 0.622, and alpha scores between 0.6 and 0.8 are considered sufficient for measures that have not yet been tested in the literature (Nunnally, 1978).

Finally, we used several variables as controls, such as size, external environment, and geographical scope of the market. First, we controlled for an organization's size, that is, the number of employees, according to the classes mentioned in the paragraph 3.1. Then, we measured the external context in line with the literature on dynamic capabilities and sustainability management (see, e.g., Bansal & Roth, 2000). Finally, we asked participants to indicate the main market where they sell their products selecting among: global, European, national and local.

The detailed questionnaire is included in the Appendix.

4 | RESULTS

To test our hypotheses, we developed a model to investigate whether sensing, seizing, and reconfiguring together with integrative approach to environmental sustainability are able to move or hamper an organization from a low level to a higher level profile in terms of LCM embeddedness, in other words considering Profile A and Profile B as starting point.

$$(\text{Log}\,(P_t - P_{1-t})) = \beta_0 + \beta_1\,\text{Sensing} + \beta_2\,\text{Seizing} + \beta_3\,\text{Reconfiguring} + \beta_4\,\text{Trade} - \text{off} + \beta_5\,\text{External environment} + \beta_6\,\text{Geographical Market} + \beta_7\,\text{Size}.$$

where β ($I = 0, 1, 2, \ldots 7$) are the coefficients.

The dependent variable (Log (Pt-P1-t)) represents the ratio between the probability that an organization belongs to a "profile," entailing a high level of LCM embeddedness and the probability of belonging to a profile with a low level of LCM embeddedness.

Table 1 includes the results of the two profile models estimating the influence of the investigated factors in moving organizations from Profile A to Profile C and from Profile B to Profile C. In detail, Model 1 tests the effect of dynamic capabilities and a trade-odd approach from a configuration where an organization is experiencing a low rate of LCM adoption and low barriers to a configuration where the level of LCM adoption is high. On the contrary, Model 2 tests the effect of the same variables but starting from a less favorable context where an organization is experience high barriers to LCM. The effect of sensing capabilities in pushing an organization from a favorable context with low barriers (Profile A) to a more pervasive integration of LCM (Profile C) is positive and significant (β in Model 1 is 1.427, $p = 0.014$). Similarly, Model 2, focused on organizations operating in an unfavorable context with high barriers, revealed that sensing capabilities are able to support the transition towards high LCM embeddedness configuration ($\beta = 1.444$, $p = 0.015$).

On the contrary, seizing capabilities seem to be unable to help an organization integrate LCM logic when it operates in a favorable context with low barriers (Profile A) ($\beta = 0.989$, $p = 0.121$). However, if an organization operates in a setting with high perceived barriers (Profile B), seizing capabilities can support the integration of a LCM logic. The coefficient is positive even if the level of significance is not high ($\beta = 1.166$, $p = 0.068$). Finally, the two models reveal that reconfiguring capabilities do not nurture the integration of LCM logic in an organization regardless of the operating context. In both models the β coefficients are not significant.

With respect to the effects that the approach to sustainability can have on the transition process from a low LCM integration to a high LCM integration, the empirical model emphasizes that a managerial approach that attributes a priority to economic goals as opposed to environmental goals can impede the LCM integration process. In both models, β coefficient is negative and significant. In particular, this negative effect is higher when an organization operates in an unfavorable context with high barriers (Profile B as starting configuration). In Model 2, β coefficient is equal to -1.529 and highly significant.

Regarding the control variables included in the models, as expected, an organization size positively affects the transition process from both starting profiles, whereas a national-based geographical market help that transition. For what concerns the external context, Model 1 and Model 2 highlight that the external environment can help an organization move from a low embeddedness profile to a high embeddedness profile, both if an organization operates in a favorable and unfavorable context.

To evaluate the robustness of the results, collinearity was then analyzed by computing the tolerance and variance inflation factors (VIFs) for variables. The results showed a VIF of less than 5 and low VIFs (<2.0), confirming that multicollinearity does not represent a

TABLE 1 Estimated models of factors affecting the profiles on LCM embeddedness

Dependent variable	Low LCM adoption and low barriers/high LCM adoption & low barriers	Low LCM adoption and high barriers/high LCM adoption and low barriers
	From Profile A to Profile C (Model 1)	From Profile B to Profile C (Model 2)
Independent variables	Coeff. β (std. error)	Coeff. β (std. error)
Sensing capabilities	1.427** (.583)	1.444** (.591)
Seizing capabilities	0.989 (.638)	1.166* (.640)
Reconfiguring capabilities	0.589 (0.518)	0.134 (0.519)
Trade-off approach	−0.766* (0.446)	−1.529*** (0.463)
Control variables		
Size	0.942** (0.405)	0.940** (0.407)
External environment	0.770** (0.377)	0.799** (0.373)
Geographical site	−0.851* (0.491)	−0.0942 (0.407)
Constant	−0.705 (2.354)	−3.604* (2.117)
N. 187		
LR Chi square 98.59		
Prob. > Chi square 0.0000		
Pseudo R^2 0.1907		

Abbreviation: LCM, life cycle management.
*Significance at 90% level.
**Significance at 95% level.
***Significance at 99% level.

concern in the model (Kennedy, 2008). We also checked for the existence of common method variance by performing Harman's single-factor post hoc test (Podsakoff & Organ, 1986). Three distinct factors were identified with an eigenvalue higher than 1.0, and the largest explained for about 33% of variance. As any single factor emerged and the general factors did not account for the most of covariance among the variables (Steensma et al., 2005), we can confirm that common method variance was not an issue.

5 | DISCUSSIONS

Drawing from the LCM literature, this study focused on the practices rooted in LCM that organizations embed in their practices, beyond tools, while studying the main barriers that can undermine LCM embeddedness. This reasoning follows the rationale that the implementation of LCM does not include only technical issues but also organizational ones (see Nilsson-Lindén et al., 2020).

Starting with our first hypothesis, we can affirm that our results partly confirmed H1. In particular, we found that only sensing capabilities, among dynamic capabilities, play an influence over the embeddedness of LCM in organizations. As originally anticipated, in the presence of low barriers, firms may have the capabilities to spot new LCM opportunities but are not enough stimulated to seize them and, therefore, not even reconfigure their existing assets. In fact, seizing and reconfiguring capabilities were found to be not meaningful for firms that operate in favorable environments. This may be the case as the external context and barriers can prevent firms from developing new skills and making changes (Schilling & Kluge, 2009). Therefore, organizations that operate in stable (or favorable) contexts are not stimulated to change and are victim of "organizational inertia" (De Giacomo et al., 2019). We then found that an integrative approach towards environmental sustainability can help firms spot environmental opportunities. Despite not previously anticipated, this is in line with previous research (see, e.g., Frey et al., 2013; Gusmerotti et al., 2020), highlighting that organizations where managers place importance on the environmental pillar, as well as the economic one, have better opportunities to identify environmental opportunities for innovation. Our research adds that such firms are more likely to spot environmental opportunities beyond their boundaries, along a product lifecycle.

For what concerns our second hypothesis, our results confirm H2 with a minor exception. More specifically, sensing and seizing capabilities play an important role for firms that are in unfavorable contexts where barriers to LCM are high (Profile B) and want to embed LCM in their operations and strategy. This is because such firms can identify new lifecycle opportunities and have the ability to act on them by implementing LCM practices. On the other hand, reconfiguring capabilities did not seem to be influential in the journey of these firms towards LCM. While reconfiguring requires an organization to change its assets, these firms may have already had some experience with environmental initiatives; therefore, they did not require to change their asset base. This being said, in the long run, changes at the organizational level may be required (Fortis et al., 2018) in order to fully integrate the logics and interests of other stakeholders, such as suppliers and consumers to name some, in the business routines and strategy (Bianchi et al., 2021).

Instead, an integrative approach to environmental sustainability was found to be significant. This confirms our initial hypothesis, as firms operating in unfavorable contexts may need strong drivers, including attitudes and values, to overcome barriers and be able to embed LCM.

In light of our findings, several contributions stem from this study. First, our empirical study contributes to the theoretical knowledge on LCM. Our research represents an initial attempt to shed some lights on the implementation of LCM through the conceptual lenses of dynamic capabilities. As underlined in Nilsson-Lindén et al. (2020), the implementation of LCM is rarely empirically explored, as scholars tend to focus their efforts on LCAs studies. However, a more complex environment requires companies to go beyond their boundaries in order to face sustainability issues in a life cycle perspective (Greenwood et al., 2011). Competing logics can be managed by enlarging management perspective and understand product chain dynamics in an integrative way.

Second, the work contributes on the emerging debate on how to push business transformation for addressing the circular economy challenge. Taking into consideration the most valuable contributions on circular economy business models, the logic of moving out organization boundaries and implement actions in the downstream and upstream stage is pivotal for closing the loops and preventing resource use (Bocken et al., 2016; Lewandowski, 2016; Urbinati et al., 2017). For that reason, LCM and practices may represent a *conditio sine qua non* for firms starting a business model transformation for a circular economy and preventing greenwashing (Testa, Miroshnychenko, Barontini, & Frey, 2018). And dynamic capabilities may trigger an internal change and nurture a system thinking and a life cycle perspective in managers and decision makers.

Third, the study is in line with the academic discourse on the role of organizational capabilities in designing and implementing effective responses to institutional demands (Pache & Santos, 2010; Sharma & Vredenburg, 1998). To embed LCM in organizations, the activation of some dynamic capabilities is crucial, such as sensing and seizing, according to the barriers an organization faces. In other words, the relation between organization and sustainability issues cannot be investigated in a static way but dynamic capabilities are necessary to face and overcome criticalities emerging from an unfavorable environment. To face a complex organization field, organizations need to be flexible and resilient in order to increase their efficiency and, at the same time, gather external opportunities (Hahn et al., 2016).

Finally, this study contributes to the growing debate on the managerial approach to corporate sustainability. As recent works have theorized (Hahn et al., 2016; Slawinski et al., 2019; Van der Byl & Slawinski, 2015), managers should avoid to contrapose economic and environmental issue by selecting environmental actions that are beneficial only from an economic viewpoint. On the contrary, in order to overcome difficulties and barriers, managers should embrace an integrative approach where environmental and economic issues are not

viewed as conflicting logics but shall be managed in an interconnected way without prioritization.

We believe that the results have managerial implications for both managers and policy makers.

More and more companies, operating in several sectors, have started to adopt LCAs for computing the environmental footprint of their products and communicate it to external stakeholders (Bianchi et al., 2021). However, the simple adoption of an LCA is not sufficient to embed an LCM logic within an organization. LCA should represent the starting point of a journey which should bring a company to integrate a LCM view in all business factions. Moreover, firms need to invest in the development of capabilities to increase the organizational resilience and their capacity to face difficulties. Some examples of initiatives that firms could take in this direction include involving experts, customers, or suppliers to develop ideas for new products and engaging in networking with regulatory other stakeholders. Embedding an LCM logic requires a relevant organizational change where internal capabilities may trigger a change of the business model. Moving beyond organizational boundaries and embracing a life cycle perspective implies a radical change in how a company competes on the market and interfaces with suppliers and clients. Searching for symbiotic relations with suppliers by scanning opportunities and sharing information can lead an organization to identify the most efficient solution that reduces the environmental footprint of a product and increases a product's value. Moreover, investing in dynamic capabilities can create a fertile environment to move towards circular business models which integrates a life cycle perspective by focusing on preventing use of resources (such as increasing product durability and using renewable resources) or closing the loops (by recycling materials, reusing refurbishing, etc.).

At the policy level, it is manifest that LCA methodologies are becoming the cornerstone of the European strategy on supporting a green single market and the transition towards a circular economy (Sassanelli et al., 2019). For instance, the Product Environmental Footprint, known as PEF, is an LCA-based methodology developed by the European Commission (European Commission, 2013) to bridge the informational gap among producers and consumers on product environmental performance. A common methodological approach, such as the PEF, can enable European firms to identify, communicate, and benchmark the environmental performance of their goods and services. However, public institutions could enforce the message that a simple application of the computational method is not enough to experience the benefits related to LCM. Policy makers should be more explicit to state that a paradigm change is necessary in an organization. LCA is the method that can increase awareness and knowledge on environmental impact but a life cycle perspective should influence any business decisions.

6 | LIMITATIONS AND FUTURE RESEARCH

While offering theoretical and managerial contributions, our paper is not free from limitations which set out promising avenues for future research. First, the sample of our study is based in Italy. Future studies could replicate our study in different geographical settings. We also focused on medium and large enterprises; therefore, our findings cannot be generalized to the majority of manufacturing firms in Italy, which are small and medium enterprises. Given the stark contrast between these categories, an ad hoc study may be required in order to highlight how dynamic capabilities and managerial approaches influence LCM embeddedness in small and medium enterprises.

Second, another limitation in our study lies in the construct to measure LCM practices (see Appendix). While trying to be as comprehensive and general as possible with a reasonable amount of items, our items does not focus on the adoption of specific tools, such as LCA, in several life cycle stage as product design or communication. Despite it could be argued that such a practice is mainly employed in virtuous organizations (see Bianchi et al., 2021) and still limited in the study's context (Testa et al., 2016), future research could address this shortcoming and develop an encompassing measure for lifecycle management practices mainly focused on LCA tools in order to capture the forthcoming progress also on the pushes from institutional pressures (i.e., the European New Circular Economy Action Plan COM/2020/98). In addition, our study is based on the assumptions tied to our multinomial model. With such model, dynamic phenomenon is derived from a static data. Therefore, despite performing all statistical measures to verify the robustness of our data and findings, a more in-depth approach could provide invaluable insights. For example, a longitudinal multiple case study could be used to address this limitation, to test our findings and inductively explore the internal dynamics that favor the embeddedness of LCM practices in organizations.

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APPENDIX A.

Please find below (Tables A1–A6) the items for our dependent and independent variables.

TABLE A1 Life cycle management practices

Life cycle management practices	
Question	Has your organization adopted the following practices?
Scale	A 5-point Likert scale, ranging from 1 (“not taken into consideration”) to 5 (“successfully adopted”)
Items	
Choice of suppliers	For the choice of suppliers, their environmental impact is one of the criteria that guides our choice
	Choosing suppliers who prefer the use of products with waste materials, secondary, or whose origin is certified
	We incorporate the interests of your suppliers into your business decisions
Internal practices in the organization	We use tools that facilitate internal communication on company environmental initiatives (intranet, newsletter, balance sheet, etc.)
	Function managers receive training on environmental issues
Logistics and distribution	Working with distributors to reduce the environmental impact of product distribution (e.g., reverse logistics)
	We try to reduce environmental impacts during transport by working with our distributors
	We are seriously considering investing in electric transportation
Relationship with clients	We incorporate the interests of your customers into business decisions
	Working with customers/consumers to develop your products

TABLE A2 Barriers to life cycle management

Life cycle management barriers	
Question	Has your organization experienced or perceived any of the following barriers?
Scale	A 5-point Likert scale, ranging from 1 ("not important") to 5 ("very important")
Items	
External support	Lack of institutional support to adopt environmental practices
	Lack of availability of loans to encourage products or processes with less environmental impact
Financial constraints	Financial constraints
	High investments to implement environmental practices and insufficient foreseen return on investment
Suppliers/distributors	Difficulty in measuring and monitoring environmental practices and supplier/distributor processes
	Problems to maintain a lasting relationship between suppliers/distributors with a low environmental impact
	Difficulty convincing suppliers/distributors to exchange information
	Poor willingness to cooperate to find alternatives to current processes with lower environmental impact
	Lack of cooperation from companies in their supply chain
Lack of assets	Lack of machinery, technology, and processes to implement alternative practices with minor environmental impact
	Difficulty in identifying the required environmental parameters
	Lack of personnel to work on projects to reduce the environmental impact of products/processes
	Difficulty in developing products for their reuse/recycling
Lack of knowledge	Lack of knowledge on environmental issues within the organization
	Lack of technical knowledge on downstream/upstream processes
	Difficulty in identifying partners or alternative processes with low environmental impact
	Lack of confidence in the announced benefits caused by practices with lower environmental impact
Lack of involvement	Lack of training, consultancy, institutions to train, and guide specific progress for each sector
	Lack of top management support to adopt good practices with reduced environmental impact along the product chain
	Poor exchange of information between the different units within the organization

TABLE A3 Sensing capabilities

Sensing capabilities	
Question	How frequently does your organization carry out activities aimed at identifying new products or processes?
Scale	A 5-point Likert scale, ranging from 1 ("never") to 5 ("regularly")
Items	
Market and technology monitoring	We identify customer needs
	We track new market trends in our industry
	We analyze our competitors' actions
	We observe technological developments relevant to our industry
Brainstorming	We organize brainstorming sessions or involve a group of experts to develop ideas for new products
	We involve customers, suppliers, or other stakeholders in new product development
Trial and error	We undertake R&D activities to create new knowledge or to solve technical problems (for developing new or significantly improved products or process)
	We undertake R&D activities to increase the stock of knowledge (trying out new ideas having strategic/operational implication)
Experiential learning	We assess the potential environmental impacts of our future products or processes
	We engage in networking with regulatory other stakeholders, such as institutions and research centers

TABLE A4 Seizing capabilities

Seizing capabilities	
Question	To what extent does your organization take actions after having identified new opportunities?
Scale	A 5-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree")
Items	
Strategic planning	We are competent in formulating a strategy for the development of new products
	We are efficient in finding strategic partners for the development of new products
	We are efficient in planning investments related to R&D for new products
	We are efficient in capital budgeting related to manufacturing plant, advanced machinery, or other fixed assets for the development of new products
	We are efficient in planning requisite human resources for the development of new products
Business model flexibility	We are competent in redesigning our existing business models whenever necessary for the development of new products
	We are efficient in restructuring our governance structure (e.g. hiring, promoting, transferring of CEO, top managers) whenever necessary for the development of new products
Openness to collaborate	We collaborate with universities, research institutes, or consultants to acquire requisite knowledge and skills for the development of new products
	We collaborate with partners, suppliers, other organizations to acquire technology or other resources for the development of new products
	We engage our employees in interdepartmental cooperation for the development of new products

TABLE A5 Reconfiguring capabilities

Reconfiguring capabilities	
Question	How has your organization implemented changes to pursue opportunities?
Scale	A 5-point Likert scale, ranging from 1 ("poorly implemented") to 5 ("perfectly implemented")
Items	
Organizational restructuring	Merger with or acquisition of another organization
	Induction of a new or changed organizational structure (e.g. elimination or addition of a division)
Technological changes	Slight modifications in existing technology or machinery
	Induction of a new or significantly improved technology or production process
	Acquisition of a new manufacturing plant, advanced machinery (to be used for new or significantly improved products or production process)
Know-how acquisition	In-house or outsources training to employees (related to newly acquired manufacturing plants or for the introduction of significantly improved production processes)
	Acquisition of existing know-how, copyrighted works, patented and nonpatented inventions etc. from other organizations (for the development of new or significantly improved productions processes)
Process and practice reconfiguration	New business practices for organizing procedures (e.g., business re-engineering, knowledge management, lean production, quality management, etc.)
	New methods of organizing external relations, work responsibilities, and decision-making (e.g. partnerships, outsourcing, teamwork, decentralization, etc.)
	New or significantly improved logistics, delivery or distribution methods for inputs or products

TABLE A6 Trade-off approach to environmental sustainability

Trade-off approach	
Question	Please rate the following considerations
Scale	A 5-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree")
Items	
Trade-off	The biggest concern for a company is to generate profit for the respect of the interests of the company and its employees
	If the investors or owners are not satisfied, nothing else takes precedence
	It is not wise to ask a company to contribute to solving environmental problems, because it would be distracted from its main purpose, which is to satisfy its investors and clients