Review of Managerial Science (2023) 17:1125–1146
https://doi.org/10.1007/s11846-022-00549-1

ORIGINAL PAPER

Translating the environmental orientation of firms into sustainable outcomes: the role of sustainable dynamic capability

Lara Bartocci Liboni[1] · **Luciana Oranges Cezarino**[2] · **Marlon Fernandes Rodrigues Alves**[3] · **Charbel José Chiappetta Jabbour**[4] · **V. G. Venkatesh**[5]

Received: 24 June 2021 / Accepted: 23 March 2022

Abstract
Emerging social and environmental demands drive organisations to seek management capabilities to reach sustainability outcomes. Despite relative efforts, there is still a need for works that empirically address the main antecedents and outcomes of sustainable dynamic capabilities (SDC). Focusing on the case of Brazil, we examine the mediating effect of SDC between environmental orientation and firm performance related to green innovation, green competitive advantage and environmental adaptability and find that SDC significantly mediates the effect of environmental orientation on green innovation. However, mediation between environmental orientation and green competitive advantage only obtains partial support. SDC and environmental adaptability do not present significative correlation, opening new discussions about adaptability as a direct consequence of SDC. These results contribute to the design of green innovation and green competitive advantage strategies as positive drivers of sustainability outcomes.

Keywords *Environmental adaptability · Green innovation · Green competitive advantage · Sustainable dynamic capability*

JEL classification M1 business administration · Q01 sustainable development

1 Introduction

An ongoing concern, the dominant economic development (business) model is based on unsustainable production and consumption patterns, leading to the depletion of natural resources (Meadows et al. 1992). With the current recognition that 'global

Extended author information available on the last page of the article

warming, ozone depletion, water pollution, and deforestation are now commonly recognised as global environmental problems' (Cheng and Shiu 2012, p. 329), there is a growing need for new policies and management practices that drive sustainability with a new outlook (e.g. Albort-Morant et al. 2018). Perhaps unsurprisingly, given this new focus, several studies have asserted that firms should incorporate sustainability principles into their business models (Russo and Harrison 2005; Porter and Siggelkow 2008; Arevalo et al. 2011; Cezarino et al. 2019). This argument has triggered a complete reorchestration of business models and industry characteristics (Schrettle et al. 2014).

However, research on sustainability tends to be underlined by a static view, with an initial focus on developing social and environmental practices. The literature is now shifting towards advancing the debate on the best strategies to uphold sustainable practices over extended periods, especially under changing and uncertain conditions (Cheng and Shiu 2012; Mas-Tur et al. 2020). Sustainability is increasingly considered a dynamic capability (Teece and Pisano; Zollo and Winter 2002), and this new perspective allows companies to build and maintain sustainable practices over time as essential resources (Beske 2012; Schrettle et al. 2014; Leonidou et al. 2015; Amui et al. 2017). In this field, a dynamic capability is often equated to making decisions, resolving problems, identifying opportunities and threats and modifying existing resources (Barreto 2010).

Understanding the complexity of such environments becomes possible via a new sustainability paradigm, which has, by necessity, undergone several changes and adaptations to become a dynamic capability with the ability to readapt over time (Cezarino et al. 2019). Nevertheless, many organisations attempt to achieve sustainability as a dynamic capability (Amui et al. 2017), often referred to as sustainable dynamic capabilities (SDC). Additionally, firms are often keen to make significant organisational changes during their sustainability journey, which can result in green competitive advantages over the long term (Bansal and Song 2017; Bansal et al. 2018).

However, the existing literature lacks a discussion of how such changes can be accomplished (Crubellate et al. 2008). The resource-based view (RBV) suggests that companies that develop competitive advantages, not simply those with the best available resources, make the best use of their resources (Barney 2001). This heterogeneity in terms of available resources prompts each firm's unique process of designing dynamic capabilities (Helfat and Peteraf 2003). Socio-environmental practices can be considered sources of competitive advantage (Russo and Harrison 2005). Similarly, SDC is a dynamic process that allocates resources and changes organisations' learning curve towards sustainability (Zollo and Winter 2002).

Nevertheless, there is a knowledge gap in understanding the organisational factors contributing to SDC. More precisely, few empirical studies examine SDC (Beske 2012; Schrettle et al. 2014; Leonidou et al. 2015), resulting in a lack of clarity regarding the antecedents and consequences of SDC for organisations. Therefore, there is a need for research that contributes to explaining those practices, routines and outcomes that can assist companies in dealing dynamically with the challenge of sustainability (Schrettle et al. 2014; Amui et al. 2017). As a result, we identified the main antecedents and outcomes of SDC. We then asked the following question:

What is the influence of internal organisational environmental orientation factors on SDC in promoting green innovation, green competitive advantage and environmental adaptability?

We use the structural equation modelling (SEM) method to understand these relationships (i.e. green innovation, environmental adaptability, and green competitive advantage), which have never previously been studied in a single model. This paper also makes some significant contributions to the sustainability literature. First, to the best of our knowledge, this is the first study to examine the transition path of innovation in companies' sustainability journeys under the dynamic capability view. Second, it provides insights into internal and external factors and their interactions, which provide critical inputs for designing operating guidelines to gain competitive advantage. The managerial implications shed light on the consequences of SDC from the perspective of competitiveness. We empirically scrutinise how SDC can be a competitive factor for organisations to help managers achieve superior performance.

2 Literature review

Organisations' strategic choices on their sustainability journey continue to evolve amidst uncertain and competitive environments. Such choices are often interrelated in a way that enables a firm to adapt to and even shape its environment (Augier and Teece 2008) to maximise its competitive advantage (Helfat et al. 2007). Institutional and business demands influence the transformation journey (Michaelis et al. 2020), and, in some cases, firms may find it challenging to meet their targets, primarily due to financial objectives, reducing their competitiveness (Klassen and Whybark 1999). Amongst this challenging trade-off situation, firms attempt to innovate and focus on producing new forms of sustainable value creation, transcending the boundaries of this perversive trade-off for enabling competitive advantage (Inigo et al. 2017).

In this vein, the theory of dynamic capabilities is a strategic approach that can explain the road to achieving competitive advantage in highly complex, constantly changing environments through their ability to create and recombine resources in new ways (Helfat et al. 2007). This theory has therefore become one of the most vibrant themes in business strategy and has received growing attention from academics and practitioners (Peteraf et al. 2013; Schilke et al. 2018). Defined as 'the capacity of an organization to purposefully create, extend and modify its resource base' (Helfat et al. 2007, p. 4), dynamic capabilities have long been regarded as the primary enterprise-level explanation of superior performance over time (Teece et al. 1997). Wang and Ahmed (2007) find the essence of dynamic capabilities in a firm's behaviour in reconfiguring and recreating resources in response to external stimuli. Moreover, they emphasise that this dynamism aims to achieve or maintain a competitive advantage. The theory of dynamic capabilities can be viewed as an extension of the RBV, as this approach lacks clarification of how companies can obtain a competitive advantage in a changing environment (Michaelis et al. 2020).

Furthermore, Teece (2007) points out that, for analytical purposes, dynamic capabilities can be classified into three types of capability: (1) ability to sense and shape opportunities and threats; (2) ability to seize opportunities; and (3) ability to maintain

competitiveness by reinforcing, combining, protecting and, where necessary, reconfiguring tangible and intangible organisational assets. On the other hand, Eisenhardt and Martin (2000) suggest an alternative classification for dynamic capabilities: (1) ability to integrate resources; (2) ability to reconfigure resources within the company; and (3) ability to gain and lose resources. Undertaking a review of the relevant literature, Wang and Ahmed (2007), in turn, identify three factors: (1) ability to adapt; (2) ability to absorb; and (3) ability to innovate.

Over the last twenty years, a large body of empirical work has shaped our understanding of the effects of dynamic capabilities in explaining heterogeneity in firm performance (Schilke et al. 2018). This body of literature can be grouped into two distinct clusters, which centre around the perspectives adopted by Teece et al. (1997) and Eisenhardt and Martin (2000) (Peteraf et al. 2013). The first cluster emphasises an economic view of dynamic capabilities as high-level generic capabilities that concern complex routines. The second emphasises an organisational view of dynamic capabilities as bundles of specific patterns and processes. This study follows Eisenhardt and Martin's (2000) view. Dynamic capabilities' processes are groups of related activities and practices that support the same organisational functions (Helfat et al. 2007). Therefore, considering that they operate across varied and specific business processes (Eisenhardt and Martin 2000), authors have identified several dynamic capabilities. For instance, Zahra and George (2002) conceive of absorptive capacity as a dynamic capability dedicated to absorbing external knowledge, while Schilke and Goerzen (2010) propose a dynamic capability of alliance management focused on inter-organisational relationships.

Meanwhile, literature is still being developed to understand the factors that drive sustainability as a dynamic capability, or as we call it, SDC. In this sense, some existing works attempt to clarify various organisational aspects and their possible relations with competitiveness. Several studies seek to understand how sustainability can become a capability, allowing an organisation to adapt, change and innovate towards new sustainable approaches (Reuter et al. 2010; Peters et al. 2011; Beske 2012; Schrettle et al. 2014; Leonidou et al. 2015). Thus, the formation of an SDC can be understood as involving processes for specific tasks that are organised in such a way as to facilitate capability in the long term, in a dynamic way (Amui et al. 2017).

For sustainability to be incorporated into the overall business strategy, it is necessary to change businesses' behaviours, culture and concerns (Mebratu 1998). Sustainability needs to be at the core of the business and facilitate innovation (Pacheco et al. 2018). Success will depend on finding innovative solutions that address global societal challenges while meeting stakeholder needs. Consequently, Beske (2014) proposes eight literature-based capabilities: knowledge assessment, knowledge acquisition, capacity development, search, selection and integration of partners, supply chain link foundations, product development, relationship management and intuitive control. These capabilities can be applied generally, but when used to address the specific challenge of sustainable production, for example, they can facilitate the development of sustainable production into a dynamic capability.

In other words, if resources cause changes in the business environment or assist in the adaptation to sudden changes, then SDC can be created (Beske 2012). The study of SDC is essential for explaining why certain companies engage in sustainability

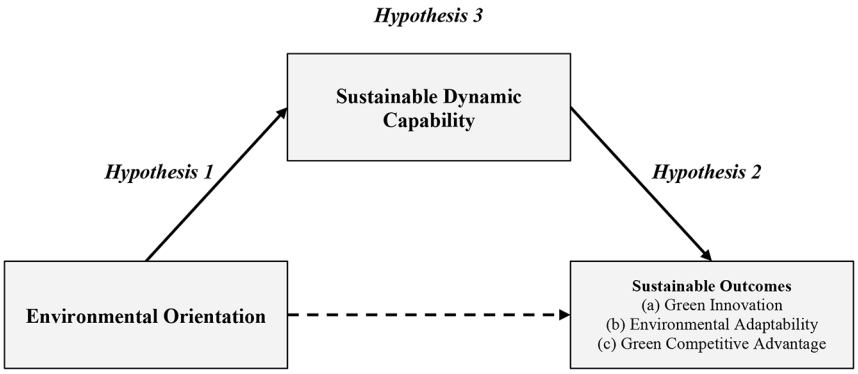

Fig. 1 Theoretical Framework

strategies while others do not (Schrettle et al. 2014), but more importantly, studying SDC can help us to understand the practices that help companies cope better with the challenge of sustainability (Cezarino et al. 2019). Further, Pacheco et al. (2018) suggest that a company can develop a capability based on its interactions with the natural environment. Several studies, including Beske et al. (2014), Rashid et al. (2014) and Amui et al. (2017), provide essential contributions concerning how dynamic capabilities can assist organisations in building a sound sustainability strategy. However, most studies on SDC are based on theoretical research, leaving a gap and an opportunity for empirical studies on the subject.

More recently, using qualitative data, Amui et al. (2017) have conducted an extensive review of the literature, working towards elaborating SDC. Cezarino et al. (2019), via an in-depth case study, identify three essential elements of SDC: (1) integrative strategy, (2) sustainable culture and (3) organisational routines for innovation. Conversely, Leonidou et al. (2015) develop their theory of SDC based on the following dimensions: (1) organisation of learning, (2) shared vision, (3) relationship building, (4) cross-functional integration and (5) technology sensing and response. This work attempts to further narrow this research gap by exploring the antecedent factors that stimulate SDC and examining how this relates to outcomes such as green innovation, environmental adaptability and green competitive advantage, which is then combined into a generalisable framework.

2.1 Conceptual framework and hypotheses development

This section describes the theoretical underpinning of our research hypotheses, grounded in the relevant literature, to explain the antecedents and outcomes of SDC. Figure 1 summarises our research framework and the underlying hypotheses.

In line with the assertions of RBV, dynamic capabilities theory also proposes that organisations can incorporate internal factors into their regular practices to create positive changes in the environment. With most studies focusing on environmental orientation and firm orientation, no comprehensive approach has revealed the factors influencing greening strategies (e.g. Leoncini et al. 2019). However, the extant lit-

erature recognises two groups of variables into which the organisational antecedents of SDC can be categorised: exogenous (external) and endogenous (internal) factors (Schrettle et al. 2014; Gabler et al. 2015). Together, these factors compose the construct of environmental orientation as a driver of SDC. This capability can facilitate knowledge creation, transfer and diffusion. Thus, firms gain direct or indirect competitive advantages due to their knowledge absorption capability (Pacheco et al. 2018). Three underlying processes (external resource integration, internal resource integration and resource building and reconfiguration) influence the change and renewal of sustainability-oriented ordinary capabilities (Dangelico et al. 2017). For Gabler et al. (2015), to build a strategy towards sustainability, it is necessary to have an environmental orientation that involves both external pressure and internal strategic, human and technical aspects. Thus, we hypothesise that: ***Hypothesis 1 (H1): Environmental orientation is positively associated with a sustainable dynamic capability.***

Green innovation involves reducing energy consumption and pollution emissions, recycling wastes, the sustainable utilisation of resources and green product designs (El-Kassar, and Singh 2019); it also enables companies and countries to move towards more sustainable societies (Albort-Morant et al. 2018). It can reduce negative environmental impacts or promote potential environmental benefits while also creating market value (Albort-Morant et al. 2018; Pacheco et al. 2018; Dutt and Mitchell 2020). Studies in green innovation have been concerned with the state of the art and the formalisation of concepts concerning the relationship of green innovation with business performance (e.g. Horbach et al. 2012). Further research has been devoted to exploring factors that interfere with green innovations within organisations (Wong 2013). However, green innovation is not always directly linked to production technology. One of the most straightforward strategies used by the SME as a green innovation is the creation of supplier selection criteria, which is more oriented to environmental protection (Gupta and Barua 2017). Thus, ***Hypothesis 2a (H2a): Sustainable dynamic capability is positively associated with green innovation.***

'Organizational level adaptation leads organizations to modify their existing form in an attempt to enhance their fitness' (Levinthal 1997, p. 935). From this definition, we may observe that, first, firms change to cope with environmental shifts. More specifically, firms that change and develop processes that are more aligned with the environment can outperform competitors committed to previous strategies (Teece 2007). Second, organisations may adapt to environmental change differently. Our study focuses on modifying existing processes to address environmental shifts (Teece et al. 1997; Wong 2013), as processes are central to coordination and knowledge accumulation in organisations (Zollo and Winter 2002). Environmental adaptability demonstrates how capable organisations are of transforming sustainability into a DC. It describes a company's ability to respond to the vulnerabilities of its socio-environmental context and to support the reconfiguration of business processes to incorporate new environmental principles and market requirements, i.e. alternative energy use (Chen et al. 2012; Dutt and Mitchell 2020). Thus, adaptability refers to reconfiguring processes to meet new environmental needs quickly.

A mounting body of research suggests that dynamic capabilities are positively associated with adaptation (cf. Schilke et al. 2018). More broadly, the way sustainability is incorporated into an organisation's practices can explain the company's

greater or lesser capacity for environmental adaptation. Sustainability as a dynamic capability can promote greater adaptability to socio-environmental issues, where environmental adaptability includes (1) market responsiveness, (2) adaptation speed and (3) reaction time (Wong 2013). This process leads to a greater alignment in operations and strategy. Thus, we posit that: ***Hypothesis 2b (H2b): Sustainable dynamic capability is positively associated with environmental adaptability.***

Many organisational practices are sources of competitive advantage (Shanley and Peteraf 2006; Helfat and Peteraf 2009), and multiple studies have promoted socio-environmental practices as sources of competitive advantage (Shrivastava 1995). Hart (1995) proposes the natural resource-based view, which claims that the global challenges posed by the scarcity of natural resources will inevitably limit economic activity. However, management choices for sustainability may be transformed into competitive organisational advantages (Hart 1995). The strategic and dynamic choice of sustainability creates differentials that promote competitive advantages. Therefore, socio-environmental practices attempt to respond to the challenges posed by the scarcity of natural resources and promote competitive factors (Shrivastava 1995).

This response can be implemented through low-cost or differentiation strategies. The efficient use of natural resources, such as the reduction of waste in the production process, for example, can provide advantages linked to costs, while green innovations can generate differentiation advantages, stimulated by external factors, such as regulatory pressure (Dangelico et al. 2017; Albort-Morant et al. 2018; Pacheco et al. 2018). The competitive advantages created by the dynamic integration of sustainability and business strategy constitute so-called green competitive advantages. In general terms, the green competitive advantage also includes the search for market leadership and continuous improvement of quality in services and products in such a sustainable scenario (Leonidou et al. 2015). Accordingly, we present the following hypothesis: ***Hypothesis 2c (H2c): Sustainable dynamic capability is positively associated with a green competitive advantage.***

When studying corporate sustainability initiatives, it is necessary to assess the extent to which dynamic capabilities are developed in a company and, more importantly, whether these resources can provide a competitive advantage (Zollo et al. 2013). This dynamic capability is a multidimensional construct that articulates itself in the ownership, application and use of resources that reduce ecological impact, create value and increase company performance. For Zollo et al. (2013), the debate on corporate sustainability must address whether the ability to change and adapt operational routines helps or hinders the adaptation and innovation needed for the transition to sustainable business models. Thus, SDC can be an essential mediator for organisations to achieve high adaptation, innovation and competitive advantage. Accordingly, we present three new hypotheses to demonstrate this relationship, as can be seen below.

Regarding green innovations, we agree that to implement long-term sustainable development, companies must innovate and use new technologies (Chen et al. 2012; Abdullah et al. 2016). There is a trend towards developing new products in green sectors such as energy conservation, recycling, renewable energy and pollution reduction (Albort-Morant et al. 2018; Pacheco et al. 2018; Dutt and Mitchell 2020). Although innovation processes are directly related to management decisions and strategy,

some studies rely on exogenous pressure as an essential driver of green innovation (Pacheco et al. 2018). External drivers such as environmental regulations and buyer behaviour are as important as internal stimuli (Horbach et al. 2012). An appropriate combination of internal and external forces to address stakeholders' interests reinforces the creation of green innovativeness (Gabler et al. 2015). SDC can moderate the relationship between environmental orientation and green innovation when we accept the concept of a deliberate learning trajectory, as proposed by Zollo and Winter (2002), taking SDC as a flow that works by inputting external information into the organisation's system and outputting green innovation outcomes. Thus, ***Hypothesis 3a (H3a): Sustainable dynamic capability mediates the association between environmental orientation and green innovation.***

Environmental adaptability refers to the company's ability to respond to socio-environmental vulnerabilities by adjusting current processes to meet new demands. Firm-specific factors such as stakeholder pressure and strategic, human and technical aspects might be particularly relevant for proactive or reactive responses to environmental issues (Chen et al. 2012). New managerial processes need to be implemented to achieve this adaptability, as shown by Albort-Morant et al. (2018). However, the link between the stock of resources from environmental orientation and environmental adaptability is neither given nor automatic. Research suggests that higher expertise in a given area might result in greater cognitive entrenchment (Henderson and Cockburn 1994). As mental representations grow more elaborate, managers become more stable and resistant to change, constraining their ability to update their mental representations to match novel environmental demands (Levitt and March 1988).

Similarly, as expertise grows, managers can develop a positive bias toward past successful solutions: as they accumulate experience concurrently with performance improvements, their preference for current practices increases. Consequently, organisations can fall into competency traps because 'favourable performance with an inferior procedure leads an organisation to accumulate more experience with it, thus keeping experience with a superior procedure inadequate to make it rewarding to use' (Levitt and March 1988, p. 322). In conditions where the natural environment requires change, this becomes a severe potential threat to organisational adaptation and survival. For example, managers may only invest in activities that have led to prior success, while the value of their experience has deteriorated (Levitt and March 1988; Henderson and Cockburn 1994). However, dynamic capabilities mediate this relationship because they entail sensing new opportunities for change (Teece 2007; Leonidou et al. 2015). Dynamic capabilities allow the firm to learn from the environment, absorb new information and mobilise resources to reconfigure its processes (Eisenhardt and Martin 2000; Michaelis et al. 2020). Consequently, we develop ***Hypothesis 3b (H3b): Sustainable dynamic capability mediates the relationship between environmental orientation and environmental adaptability.***

The foremost theorists on dynamic capabilities (Teece et al. 1997; Eisenhardt and Martin 2000; Zollo and Winter 2002) understand that performance and competitive advantage derive from the reconfiguration of resources in response to the environment through changing organisational processes. Further, Barney (1991) asserts that competitive advantage arises from unique and irreplaceable resources and capabilities that a company controls, including management competencies, processes, organ-

isational routines and knowledge. Management choices for sustainability can be transformed into a competitive advantage (Hart 1995). In general terms, green competitive advantage includes the search for market leadership and continuous quality improvement in terms of services and products in such a scenario (Leonidou et al. 2015). Therefore, we test the moderating effect of SDC on the relationship between environmental orientation and green competitive advantage. We question whether SDC can enable environment-oriented companies to achieve superior market performance or competitive advantage. This relationship emerges since SDC can determine the ability of companies to absorb external pressures and translate them into green innovations. Our final hypothesis is thus ***Hypothesis 3c (H3c): Sustainable dynamic capability mediates the relationship between environmental orientation and green competitive advantage.***

In sum, attempting to understand how to transform sustainability into a dynamic capability through external and internal factors is an objective that may help to promote green innovation, environmental adaptability and green competitive advantage (Russo and Harrison 2005; Reuter et al. 2010; Peters et al. 2011; Beske 2012; Schrettle et al. 2014; Leonidou et al. 2015).

3 Methodology

This study employs a quantitative methodology, combining a survey and structural equation modelling to measure the influence among the theoretical constructs of the proposed framework.

3.1 Sample and data collection

We selected the Brazilian manufacturing industry as the research context because the country has global relevance in the fight against climate crises. Brazil is a biodiversity vault, with a wide array of species throughout the country; it is the country with the most extensive amounts of preserved rainforest, which acts as the carbon sink of the planet (Maia et al. 2020; Heinrich et al. 2021). Among its resources is the Amazon moist forest, an ecosystem constantly pressured by business-as-usual models and one of the climate tipping points: a boundary that, once crossed, will trigger cascading effects that impact the global climate (Pinto and Voivodic 2021). Alongside its environmental prowess, the country faces many inequality-based and socioeconomic challenges, such as providing public infrastructure and sanitation to half of its population, maintaining its universal health system and reversing diminishing income inequalities (Rocha et al. 2021). This scenario, worsened by the COVID-19 pandemic, comprises an amalgamation of factors that challenge the viability of business models within Brazil's biosphere boundaries.

This setting is particularly interesting for the purposes of our study for three main reasons. First, dynamic capabilities enable firms to cope with market and institutional shifts (Zollo and Winter 2002). The current status of corporate sustainability in Brazil fits this description, with sustainability-related pressures from consumers' demands, regulations and natural resources restrictions relatively new to Brazilian

firms. Conversely, these concerns date back at least as far as the 1980s for firms in developed countries (Bansal and Song 2017). Thus, rather than adhering to normative practices, Brazilian firms are either coping with unfamiliar changes or investing in sustainability to disrupt the sector. Second, we focus on manufacturing firms to avoid cross-industry effects since service and manufacturing firms differ in many ways, for instance, in terms of capital intensity and product development strategy (Kirner et al. 2009). Third, most of the literature on dynamic capabilities focuses on the manufacturing industry (cf. Helfat et al. 2007); thus, by focusing on the same industrial area, we can use previous studies as an appropriate baseline to understand how SDC differs from traditional dynamic capabilities.

For the purposes of our study, we established a target sample size a priori, with the support of the software package G*Power 3 (Faul et al. 2007). Our target sample size was 85 respondents, considering the following parameters: F-test, linear multiple regression (fixed model), R^2 deviation from zero, effect size $f^2 = 0.15$, $\alpha = 0.05$ and power (1-β error probability) = 0.80. The sample was randomly selected from a mailing list provided by the Brazilian Association of Machinery and Equipment Industry (ABIMAQ). We collected 86 valid questionnaire responses using an online survey sent by email to top-level executives at Brazilian manufacturing firms. This number is not only enough to fulfil our theoretical model but is also in line with existing literature in the field. For instance, studies by Pacheco et al. (2018) and Vachon and Klassen (2008) use 78 and 84 respondent samples, respectively. Thus, we confirm that our sample size is appropriate for this study.

3.2 Measurement of the constructs

All measurement items used in this research have been validated in previous studies. We specifically address SDC as the series of organisational processes regulating the transition towards sustainable development (Zollo and Winter 2002). The measurement of SDC includes (1) organisation of learning, (2) shared vision, (3) relationship building, (4) cross-functional integration and (5) technology sensing and response (Leonidou et al. 2015).

Moreover, the measurement of environmental orientation defines it as a conjunction of factors that drive SDC (Schrettle et al. 2014; Gabler et al. 2015); we measure it here in (1) external factors (external pressure from the environment) and (2) internal factors (strategic, human, and technical aspects; Gabler et al. 2015). The measurement of green innovation consists in identifying how the mobilised resources materialise in solutions able to pave the way towards sustainability in the organisations in a wide array of ways, such as reducing waste generation, energy consumption or carbon footprint. We measure it here as (1) new products/services, (2) new practices and (3) new solutions (Wong 2013).

Additionally, the measurement of environmental adaptability involves (1) market responsiveness, (2) adaptation speed and (3) reaction time (Wong 2013). Finally, the measurement of green competitive advantage includes (1) market leadership and (2) service/product quality (Leonidou et al. 2015). All measurement items were evaluated on a 7-point Likert scale ranging from ‘totally disagree’ (1) to ‘totally agree’ (7). Table 1 summarises the variables used in this study.

Table 1 Construct details

Construct	Definition	Item	Scale	Source
Sustainable Dynamic Capability (SDC)	The bundle of stakeholder-driven processes that enables a firm to purposefully create, extend and modify its resource base	8	1–7	Leonidou et al. (2015)
Environmental Orientation (EO)	The presence of internal competencies and resources combined with external market pressures to generate, disseminate and respond to sustainability	12	1–7	Gabler et al. (2015)
Green Innovation (GI)	Firm innovativeness in developing environmentally responsible products/services and adopting new environmental practices	5	1–7	Wong (2013)
Environmental Adaptability (EA)	The ability to respond to new and changing market demands and environmental requirements	3	1–7	Wong (2013)
Green Competitive Advantage (GCA)	A firm's strategic fitness based on environmentally responsible policies that lower costs in the long run and/or help differentiate products/services	3	1–7	Leonidou et al. (2015)

To guarantee the quality of our measurement instruments, we used translation and back-translation of the original scales with the support of a professional service. Subsequently, the questionnaire was evaluated by two academic experts and one industry expert to ensure the content was straightforward and accurately represented the intended meaning. The entire final version of the questionnaire is available from the authors upon request.

3.3 Response bias

Standard method bias can influence validity because both independent and dependent variables were self-reported by the respondents in our survey. We first designed the questionnaire to have a specific section for each variable to reduce this concern. Second, we guaranteed participants' anonymity, both for their firm and personal details. Finally, we reassured them that there were no right or wrong answers in the questionnaire. Despite these a priori measures taken to control common method bias, we also verified the extent to which our findings are susceptible to this issue using Harman's one-factor test (Podsakoff et al. 2003). The data would demonstrate a problem with standard method bias if a single factor were responsible for a large percentage of the variation in the resulting factors from the exploratory factor analysis (EFA). Based on the criterion of an eigenvalue greater than 1, no single factor emerged from the EFA, nor does an individual factor account for most of the covariance among the variables. Thus, common method bias is unlikely to impact our results.

Additionally, we performed an SEM version of this test. We allocated all constructs to a single factor, with this single factor representing all the effects of the method. The results indicate an inferior model fit, supporting the claim that common method bias is not a significant problem in the present study.

3.4 Data analysis

We verified the research model and tested the hypotheses using partial least squares (PLS) path modelling, a technique of the variance-based SEM method (Hair 2014).

Table 2 Measurement model: Descriptive statistics, intercorrelations and discriminant validity

Construct	Mean	SD	DCS	EO	GI	EA	GCA
SDC	4.748	1.695	**0.853**				
EO	4.917	1.784	0.949	**0.850**			
GI	4.981	1.853	0.855	0.826	**0.855**		
EA	5.388	1.853	0.755	0.741	0.674	**0.955**	
GCA	4.558	1.976	0.867	0.860	0.815	0.630	**0.913**

Note: Fornell-Larcker criterion: diagonal elements in bold represent the square root of AVE; non-diagonal elements (non-bold) are the correlations among constructs

Specifically, we applied the SmartPLS 3.2.9 software to calculate empirical results. Several features of PLS-SEM have led to its increased use in strategy, operations and sustainability research (e.g., Pacheco et al. 2018). In our case, we considered three main factors in adopting this methodology. First, PLS-SEM is well suited to testing predictive models in the early stages of theoretical development, rather than well-established complex frameworks (Hair 2014). This feature characterises our research: to the best of our knowledge, no empirical research has previously addressed the relationships proposed in our research model. Second, PLS-SEM has advantages over other techniques, such as linear models, for small sample sizes. This study, with a sample size of 86, is considered a small sample (Reinartz et al. 2009). Finally, PLS-SEM does not require that data have a normal distribution, which is the case with our sample data (Hair 2014).

4 Results

4.1 Measurement model

The measurement model describes how the observable variables measure the constructs. We verified both validity and reliability to evaluate our measurement model. Discriminant validity intends to assess to what extent similar constructs differ. For this, we used the Fornell-Larcker criterion: the square root of the average variance extracted (AVE) for each construct (diagonal elements) should be higher than the correlation matrix of the constructs (off-diagonal values in rows and columns; Hair 2014). The results in Table 2 suggest that our model satisfies this criterion. We also examined the cross-loading comparisons between variables to further support discriminant validity and obtained similar results.

Convergent validity indicates the relations of a construct to each alternative indicator. We evaluated this factor using AVE. Table 3 shows that each construct's AVE is greater than the threshold value of 0.50. Further, all indicators' outer loading values are more significant than 0.707. Therefore, we conclude that the variance due to measurement error is not greater than the variance due to the construct (Hair 2014). Internal consistency measures how much the observable indicators support the constructs. Although it is common to use Cronbach's alpha as a measure of internal consistency, composite reliability is the most appropriate method in an SEM context (Hair 2014). According to Table 3, all constructs present internal consistency since

Table 3 Measurement model: Convergent validity and composite reliability

Construct	Average Variance Extracted	Composite Reliability	Cronbach's Alpha
SDC	0.727	0.955	0.946
EO	0.723	0.963	0.957
GI	0.732	0.931	0.908
EA	0.912	0.969	0.952
GCA	0.834	0.938	0.900

Table 4 Structural model results

Outcome	Relationships	Main Effects	Mediation	Conclusion
Green Innovation	EO → GI	0.831*** (20.879)	0.174^{ns} (0.792)	
	EO → SDC		0.948*** (93.383)	H1 supported
	DCS → GI		0.690*** (3.332)	H2a supported
		$R^2_{GI}=0.687$	$R^2_{GI}=0.727$; $R^2_{DCS}=0.898$	
Environmental Adaptability	EO → EA	0.755*** (14.032)	0.282^{ns} (1.089)	
	EO → SDC		0.948*** (96.477)	H1 supported
	DCS → EA		0.490^{ns} (1.833)	H2b not supported
		$R^2_{EA}=0.565$	$R^2_{EA}=0.572$; $R^2_{DCS}=0.897$	
Green Competitive Advantage	EO → GCA	0.861*** (32.242)	0.379* (2.103)	
	EO → SDC		0.949*** (94.005)	H1 supported
	DCS → GCA		0.507** (2.802)	H2c supported
		$R^2_{GCA}=0.739$	$R^2_{GCA}=0.760$; $R^2_{DCS}=0.899$	

Note: *t*-statistics in parentheses

* < 0.05; ** < 0.01; *** < 0.001; ^{ns} not significant (based on t(4999), two-tailed test)

Bootstrapping based on n = 5,000 subsamples

both the Cronbach's alpha and composite reliability values for each construct greatly exceed the minimum value of 0.70 (Hair 2014).

4.2 Structural model

The structural model allows for verification of how well the empirical data support the theoretical model. Tables 4 and 5 describe the variance explained (R^2) of the endogenous variables and the path coefficients for the three constructs (outcomes) under study. Bootstrapping (with 5,000 resamples) generates standard errors and *t*-statistics.

First, we investigated the antecedents of SDC and found strong support for Hypothesis 1: environmental orientation is positively associated with SDC ($\beta = 0.948$, $p. < 0.001$). Second, we hypothesised that three outcomes would be affected by SDC: green innovation, environmental adaptability and green competitive advantage. Our results endorse Hypothesis 2a and Hypothesis 2c; we found a positive and direct effect of SDC on green innovation ($\beta = 0.690$, $p. < 0.001$) and on green competitive

Table 5 Indirect effects of environmental orientation

Outcome	Mediator	Indirect Effect	Confidence Interval	Conclusion
Green Innovation	SDC	0.654*** (3.247)	0.269; 1.044	H3a supported
Environmental Adaptability	SDC	0.465^{ns} (1.835)	–0.104; 0.920	H3b not supported
Green Competitive Advantage	SDC	0.481** (2.799)	0.146; 0.803	H3c supported

Note: *t*-statistics in parentheses

* < 0.05; ** < 0.01; *** < 0.001; ^{ns} not significant (based on t(4999), two-tailed test)

Bootstrapping based on n = 5,000 subsamples

advantage (β = 0.507, *p*. < 0.01). However, we did not find support to hypothesis 2b: SDC is not positively associated with environmental adaptability (β = 0.490, *n.s.*).

Third, we suggested a mediating role played by SDC between environmental orientation and sustainable outcomes in three hypotheses. The empirical evidence offers different levels of support for these hypotheses. We found support for full mediation regarding Hypothesis 3a; thus, there is an indirect effect of environmental orientation on green innovation through SDC (β = 0.654, *p*. < 0.001), and the direct effect is shown to become insignificant with the introduction of the mediator (β = 0.831, *p*. < 0.001 versus β = 0.174, *n.s.*). Regarding Hypothesis 3c, we found support for partial mediation: there is an indirect effect of environmental orientation on green competitive advantage through SDC (β = 0.481, *p*. < 0.01) and a concurrent direct effect (β = 0.379, *p*. < 0.05). In contrast, the indirect effect of environmental orientation on environmental adaptability was statistically significant (β = 0.465, *n.s.*). Thus, we did not find support for Hypothesis 3b. Considering that Hypothesis 2b was not supported, this result was not surprising.

The predictive power of our models (measured by R-squared) is worth mentioning. According to Chin (1998), 0.67 is substantial; 0.33 is moderate; 0.19 is weak. In general, our models provide substantial predictive power – the highest for SDC, followed by green innovation and green competitive advantage with similar values. Only environmental adaptability displays a lower R-squared but is still considered moderate. Therefore, our theoretical model is supported by empirical evidence and displays substantial predictive power, except for environmental adaptability.

5 Discussion

Dynamic capabilities have recurrent and feedback relations with sustainability practices and the overall organisational sustainability performance at different levels (Gruchmann et al. 2021) in a wide array of industries and sectors (Siems et al. 2021). First, the research findings show that environmental orientation influences SDC (H1). Our results also imply that external and internal factors, composed of competencies and resources combined with market pressures (Gabler et al. 2015), affect the level to which companies can generate, disseminate and respond to sustainability-related concerns. In other words, companies found in highly demanding markets tend to respond better to environmental challenges. This result corroborates the finding that environmental orientation is an antecedent for SDC. Second, we support the idea that SDC promotes green innovation and green competitive advantage (Zhang et al.

2019; Bocken and Geradts 2020). Both outcomes demonstrate that SDC promotes innovativeness in developing environmentally friendly products and services, as proposed by Wong (2013), and provides strategic benefit for strategies that differentiate products and services by environmental concerns (Leonidou et al. 2015), enhancing competitive market positioning (Hart 1995). This result aligns with the suggestions of Beske (2012) and Cezarino et al. (2019), both of whom point out that companies can make financial gains and improve performance indicators through SDC, not only by addressing the stakeholders' interests.

The moderating role of SDC is also valid in the relationships with green innovations and green competitive advantage (H3a and c). This finding implies that SDC forms a link between environmental orientation (the presence of resources, competencies and a highly demanding market) and outcomes, as proposed in our model. SDC can be considered a concept that orientates management practices to create a learning trajectory (Zollo and Winter 2002), enabling companies to achieve the sustainability outcomes of green innovation and green competitive advantage. Dynamic capabilities are developed under various levels related to sustainable integration (Gruchmann et al. 2021). Having framed SDC as a moderator variable, we understand it as a complex construct involving external and internal factors (i.e., environmental orientation) as initial inputs. However, it is also moderated by the level of learning (Zollo and Winter 2002) and knowledge absorptivity (Pacheco) provided by the interactions between these factors, interacting recursively within companies' and markets' boundaries.

Developing ideas from Horbach et al. (2012), we affirm that improved green innovativeness results from the interaction between external and internal forces and how an organisation builds capabilities. Similarly, we corroborate that companies can achieve competitive advantage through the organisational choices they make around their resources and competencies (Barney 1991). Moreover, companies with a high level of environmental orientation will be more likely to deliver superior performance in markets with higher sustainability-related demands (Demirel and Kesidou 2019).

One novel result emerging from the model was provided via the rejected hypothesis. We expected that environmental orientation would influence the level of SDC and that SDC could moderate the results regarding the adaptability of environment-oriented companies. However, by looking deeply into the literature, we may find clues as to why this relationship was not supported. This finding follows Zollo and Winter's (2002) or Eisenhardt and Martin's (2000) view of dynamic capabilities: a bundle of specific routines and processes that are constantly being improved. To Wong (2013), organisational adaptability is composed of market responsiveness, adaptation speed and reaction time. If dynamic capabilities require constant changes in routines, it is logical to observe adaptability as a response to dynamic capabilities.

Therefore, we infer that companies can develop SDC but fail to adapt to the responsiveness and speed they learn from their interactions with the environment. They can develop this capability by obtaining environmental orientation, i.e. adequate resources and competencies, but the results reveal that they may not develop adaptability immediately. Theoretically, adaptability requires time sensing (Bansal et al. 2018) and absorptive capacity (Zahra and George 2002) and cannot operate independently of the organisation's level of assertiveness in responding to environmental

pressures. Companies have different methods and speeds in adapting their environmental orientation to different markets and various organisational imperfections.

6 Conclusions

This research advances knowledge on the construct of SDC, following a methodological path that explores the subject without pretensions, making progress towards more robust and conclusive research methods within the Brazilian context. The findings corroborate existing theories on dynamic capabilities. To incorporate sustainability into firms' business strategies, it is necessary to change behaviour, culture and interests (Mebratu 1998), centring sustainable practices within their innovation strategy (Pacheco et al. 2018). Success will depend on designing innovative solutions that address global issues while satisfying stakeholder demands. The rejection of the hypothesis of environmental adaptability as an outcome by which SDC moderates the relationship between environmental orientation and adaptability reveals that SDC is a concept that requires deliberate learning and time-sensing from organisations to optimise the treatment of those factors that compose environmental orientation. That adaptability is a response to SDC that depends on the maturity level of companies as open systems.

6.1 Theoretical contributions

These findings include notable contributions to the sustainability literature and pave the way for future research on SDC. As our first theoretical contribution, our discussion advances the theoretical bridge between RBV and dynamic capabilities in the sustainability literature. RBV proposes the optimal use of competencies and resources to achieve better performance (Barney 2001). Dynamic capabilities similarly hold that this use must be aligned with market demands, constructing a learning trajectory for companies (Eisenhardt and Martin 2000; Zollo and Winter 2002). From this perspective, the RBV of the firm (Barney 1991; Sheehan and Foss 2007) fails to explain the reality that some companies are proactive while others are more reactive or even hesitant when it comes to sustainability approaches. For this purpose, SDC is an extension of dynamic capabilities theory because it proposes the same learning trajectories for companies.

Second, the study contributes to the understanding that companies can experience hardships adapting to the sustainability learning trajectory despite the requisite resources, competencies and highly demanding markets that compose the environmental orientation construct. Some companies do not present adaptability responses, even though they may achieve superior performance in sustainability innovation and competition.

Third, environment-oriented companies do not consolidate their environmental adaptability through SDC. The capability to adequately identify and implement the appropriate changes regarding the environment is a matter of optimising learning and time variables into strategic management practices rather than simply allocating resources and competencies. In certain circumstances, we believe that achieving

market benefits (i.e. green innovations and green competitive advantage) and having the requisite environmental orientation components may not be enough to achieve adaptability.

6.2 Managerial implications

In addition to its theoretical contributions, this study also presents a few notable implications for practice. First, companies may benefit from this study by recognising the value that SDC could generate for their business, especially aggregating value and translating it into a competitive advantage and green innovation. This study elucidates the importance of pursuing SDC as a dynamic organisational capability for sustainability outcomes. We inform managers that environmental orientation is fundamental to developing SDC and achieving green innovativeness and competitive advantage. One suggestion is that companies generally still have a developing level of competitiveness in this area. Any sustainability-related action can generate a competitive advantage by not dissociating isolated actions from long-term strategic sustainability plans. This approach would help companies design, structure, and reorient their strategic planning.

According to practical indicators, companies tend to value sustainability when it improves operational quality and service delivery. However, it may not improve them in competitive ways, such as developing a larger market share or finding a new business niche. Companies should invest in obtaining the required resources and competencies, especially when facing buyer pressure or legal regulations. Beyond this, companies should examine their organisational dynamics to identify the sources of adaptability, focusing on time sensing (Bansal et al. 2018), absorptive capacity (Zahra and George 2002) and market responsiveness (Wong 2013). These perspectives can address investments, technological issues, human resource qualification training and even mergers and acquisitions operations.

6.3 Limitations and suggestions for future research

A study of this scope inexorably has limitations and provides future research directions. First, we employed a cross-sectional data collection method, which provides only a snapshot of SDC in action. While we followed a rigorous methodological design, our conclusions are limited to the correlational relationships between select study variables. Therefore, any sort of causality suggested in our findings needs to be interpreted on this basis. Second, SEM merely concerns the level of factor influences related to SDC and organisational results, showing that their contribution is more focused on innovation and competitive advantage. Third, the parameter *green competitive advantage* is a comparative measure, leading to different results based on context. In the case of Brazil, where corporate environmental practices and strategies are still embryonic, organisations can achieve competitive environmental advantages with little environmental orientation effort, without the need to integrate sustainability into business strategies or achieve dynamic capabilities that promote sustainability. The other measures of green innovation and corporate environmental adaptability are not comparative measures, but they denote individual results of practical construc-

tion in the environmental field. Finally, the prevalence of scarce resources, competencies and an undemanding market environment may bias the respondents' answers since they may prematurely perceive green outcomes.

Future studies can overcome this limitation by leveraging laboratory or field experiments to incorporate temporal dynamics and causality-based evidence (Schilke et al. 2018). This direction promises a better understanding of the dynamics of change in organisations. Particularly concerning environmental adaptability, the results may be deeply explored in longitudinal studies that involve the period between adaptability and other SDC outcomes. Based on these research findings, there is a clear opportunity for studies to use the same protocols and models for other specific sectors. Thus, future research can analyse dynamic capabilities according to the activity sector, evaluating whether they have a statistical influence on results and act as mediators. It is also suggested that future studies explore green innovation in more complex contexts, such as in circular (Hina et al., 2022) and sustainable chains (Mani et al., 2020), family firms (Clauß et al. 2022; Bouncken and Kraus 2022), or business incubators (Fonseca and Jabbour 2012).

References

Abdullah M, Zailani S, Iranmanesh M, Jayaraman K (2016) Barriers to green innovation initiatives among manufacturers: The Malaysian case. Rev Manag Sci 10:683–709. https://doi.org/10.1007/s11846-015-0173-9

Albort-Morant G, Leal-Millán A, Cepeda-Carrion G, Henseler J (2018) Developing green innovation performance by fostering of organizational knowledge and cooperative relations. Rev Manag Sci 12:499–517. https://doi.org/10.1007/s11846-017-0270-z

Amui LBL, Jabbour CJC, Jabbour ABL, de Kannan S D (2017) Sustainability as a dynamic organizational capability: A systematic review and a future agenda toward a sustainable transition. J Clean Prod 142:308–322. https://doi.org/10.1016/j.jclepro.2016.07.103

Arevalo JA, Castelló I, de Colle S et al (2011) Introduction to the special issue: Integrating sustainability in business models. J Manag Dev 30:941–954. https://doi.org/10.1108/02621711111182466

Augier M, Teece DJ (2008) Strategy as evolution with design: The foundations of dynamic capabilities and the role of managers in the economic system. Organ Stud 29:1187–1208. https://doi.org/10.1177/0170840608094776

Bansal P, Kim A, Wood MO (2018) Hidden in plain sight: The importance of scale in organizations' attention to issues. Acad Manage Rev 43:217–241. https://doi.org/10.5465/amr.2014.0238

Bansal P, Song H-C (2017) Similar but not the same: Differentiating corporate sustainability from corporate responsibility. Acad Manag Ann 11:105–149. https://doi.org/10.5465/annals.2015.0095

Barney J (1991) Firm resources and sustained competitive advantage. J Manag 17:99–120. https://doi.org/10.1177/014920639101700108

Barney JB (2001) Is the resource-based 'view' a useful perspective for strategic management research? Yes. Acad Manage Rev 26:41–56. https://doi.org/10.5465/AMR.2001.4011938

Barreto I (2010) Dynamic capabilities: A review of past research and an agenda for the future. J Manag 36:256–280. https://doi.org/10.1177/0149206309350776

Beske P (2012) Dynamic capabilities and sustainable supply chain management. Int J Phys Distrib Logist Manag 42:372–387. https://doi.org/10.1108/09600031211231344

Beske P, Land A, Seuring S (2014) Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature. Int J Prod Econ 152:131–143. https://doi.org/10.1016/j.ijpe.2013.12.026

Bocken NM, Geradts TH (2020) Barriers and drivers to sustainable business model innovation: Organization design and dynamic capabilities. Long Range Plann 53:101950

Bouncken RB, Kraus S (2022) Entrepreneurial ecosystems in an interconnected world: emergence, governance and digitalization. RMS 16(1):1–14
Clauß T, Kraus S, Paul J (2022) Sustainability in family business: Mechanisms, technologies and business models for achieving economic prosperity, environmental quality and social equity. Technological Forecasting and Social Change 176 (2022): 121450
Cezarino LO, Alves MFR, Caldana ACF, Liboni LB (2019) Dynamic capabilities for sustainability: Revealing the systemic key factors. Syst Pract Action Res 32:93–112. https://doi.org/10.1007/s11213-018-9453-z
Chen Y, Chang C, Wu F (2012) Origins of green innovations: The differences between proactive and reactive green innovations. Manag Decis 50:368–398. https://doi.org/10.1108/00251741211216197
Cheng CC, Shiu EC (2012) Validation of a proposed instrument for measuring eco-innovation: An implementation perspective. Technovation 32:329–344. https://doi.org/10.1016/j.technovation.2012.02.001
Chin WW (1998) The partial least squares approach to structural equation modeling. In: Marcoulides GA (ed) Modern methods for business research. Lawrence Erlbaum Associates Publisher, Mahwah, pp 295–336
Crubellate JM, Pascucci L, Grave PS (2008) Contribuições para uma visão baseada em recursos legítimos. Rev Adm Empres 48:8–19. https://doi.org/10.1590/S0034-75902008000400002
Dangelico RM, Pujari D, Pontrandolfo P (2017) Green product innovation in manufacturing firms: A sustainability-oriented dynamic capability perspective: Sustainability-oriented dynamic capabilities. Bus Strategy Environ 26:490–506. https://doi.org/10.1002/bse.1932
Dutt N, Mitchell W (2020) Searching for knowledge in response to proximate and remote problem sources: Evidence from the U.S. renewable electricity industry. Strateg Manag J 41:1412–1449. https://doi.org/10.1002/smj.3159
El-Kassar AN, Singh SK (2019) Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices. Technol Forecast Soc Chang 144:483–498
Faul F, Erdfelder E, Lang A-G, Buchner A (2007) G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods 39:175–191. https://doi.org/10.3758/BF03193146
Fonseca SA, Jabbour CJC (2012) Assessment of business incubators' green performance: A framework and its application to Brazilian cases. Technovation 32(2):122–132
Gabler CB, Richey RG Jr, Rapp A (2015) Developing an eco-capability through environmental orientation and organizational innovativeness. Ind Mark Manag 45:151–161. https://doi.org/10.1016/j.indmarman.2015.02.014
Gruchmann T, Timmer V, Gold S, Geßner C (2021) Dynamic capabilities for sustainable change in the food processing industry: A multilevel perspective. J Clean Prod 311:127534
Gupta H, Barua MK (2017) Supplier selection among SMEs on the basis of their green innovation ability using BWM and fuzzy TOPSIS. J Clean Prod 152:242–258
Gupta H, Kusi-Sarpong S, Rezaei J (2020) Barriers and overcoming strategies to supply chain sustainability innovation. Resources, Conservation and Recycling 161:104819
Hair JF (ed) (2014) Multivariate data analysis, 7th edn. Pearson, Harlow
Hart SL (1995) A natural-resource-based view of the firm. Acad Manage Rev 20:986–1014. https://doi.org/10.5465/amr.1995.9512280033
Heinrich VH, Dalagnol R, Cassol HL, Rosan TM, de Almeida CT, Junior CHS, Aragão LE et al (2021) Large carbon sink potential of secondary forests in the Brazilian Amazon to mitigate climate change. Nat Commun 12:1–11
Helfat CE, Finkelstein S, Mitchell W et al (2007) Dynamic capabilities: Understanding strategic change in organizations. Wiley
Helfat CE, Peteraf M (2003) The dynamic resource-based view: Capability lifecycles. Strateg Manag J 24:997–1010. https://doi.org/10.1002/smj.332
Helfat CE, Peteraf M (2009) Understanding dynamic capabilities: Progress along a developmental path. Strateg Organ 7:91–102. https://doi.org/10.1177/1476127008100133
Henderson R, Cockburn I (1994) Measuring competence? Exploring firm effects in pharmaceutical research. Strateg Manag J 15:63–84. https://doi.org/10.1002/smj.4250150906
Hina M, Chauhan C, Kaur P, Kraus S, Dhir A (2022) Drivers and barriers of circular economy business models: Where we are now, and where we are heading. Journal of Cleaner Production, 333, p.130049

Horbach J, Rammer C, Rennings K (2012) Determinants of eco-innovations by type of environmental impact — The role of regulatory push/pull, technology push and market pull. Ecol Econ 78:112–122. https://doi.org/10.1016/j.ecolecon.2012.04.005

Huang YC, Chen CT (2022) Exploring institutional pressures, firm green slack, green product innovation and green new product success: Evidence from Taiwan's high-tech industries. Technol Forecast Soc Chang 174:121196

Inigo EA, Albareda L, Ritala P (2017) Business model innovation for sustainability: Exploring evolutionary and radical approaches through dynamic capabilities. Ind Innov 24:515–542. https://doi.org/10.1080/13662716.2017.1310034

Khattak SI, Ahmad M, Ul Haq Z, Shaofu G, Jiang HANG (2021) On the goals of sustainable production and the conditions of environmental sustainability: Does cyclical innovation in green and sustainable technologies determine carbon dioxide emissions in G-7 economies. Sustainable Production and Consumption

Kirner E, Kinkel S, Jaeger A (2009) Innovation paths and the innovation performance of low-technology firms—An empirical analysis of German industry. Res Policy 38:447–458. https://doi.org/10.1016/j.respol.2008.10.011

Klassen RD, Whybark DC (1999) The impact of environmental technologies on manufacturing performance. Acad Manage J 42:599–615. https://doi.org/10.5465/256982

Kusi-Sarpong S, Gupta H, Sarkis J (2019) A supply chain sustainability innovation framework and evaluation methodology. Int J Prod Res 57:1990–2008

Leoncini R, Marzucchi A, Montresor S et al (2019) 'Better late than never': The interplay between green technology and age for firm growth. Small Bus Econ 52:891–904. https://doi.org/10.1007/s11187-017-9939-6

Leonidou LC, Leonidou CN, Fotiadis TA, Aykol B (2015) Dynamic capabilities driving an eco-based advantage and performance in global hotel chains: The moderating effect of international strategy. Tour Manag 50:268–280. https://doi.org/10.1016/j.tourman.2015.03.005

Levinthal DA (1997) Adaptation on rugged landscapes. Manag Sci 43:934–950. https://doi.org/10.1287/mnsc.43.7.934

Levitt B, March JG (1988) Organizational learning. Annu Rev Sociol 14:319–338. https://doi.org/10.1146/annurev.so.14.080188.001535

Maia VA, Santos ABM, de Aguiar-Campos N, de Souza CR, de Oliveira MCF, Coelho PA, Dos Santos RM et al (2020) The carbon sink of tropical seasonal forests in southeastern Brazil can be under threat. Sci Adv 6:eabd4548

Mani V, Jabbour CJC, Mani KT (2020) Supply chain social sustainability in small and medium manufacturing enterprises and firms' performance: Empirical evidence from an emerging Asian economy. International Journal of Production Economics, 227, p.107656

Martínez-Fernández J, Banos-González I, Esteve-Selma M (2021) An integral approach to address socio-ecological systems sustainability and their uncertainties. Sci Total Environ 762:144457

Mas-Tur A, Kraus S, Brandtner M et al (2020) Advances in management research: A bibliometric overview of the Review of Managerial Science. Rev Manag Sci 14:933–958. https://doi.org/10.1007/s11846-020-00406-z

Meadows DH, Meadows DL, Randers J (1992) Beyond the limits: Global collapse or a sustainable future. Earthscan Publications, London

Mebratu D (1998) Sustainability and sustainable development. Environ Impact Assess Rev 18:493–520. https://doi.org/10.1016/S0195-9255(98)00019-5

Michaelis B, Rogbeer S, Schweizer L, Özleblebici Z (2020) Clarifying the boundary conditions of value creation within dynamic capabilities framework: A grafting approach. Rev Manag Sci. https://doi.org/10.1007/s11846-020-00403-2

Pacheco LM, Alves MFR, Liboni LB (2018) Green absorptive capacity: A mediation-moderation model of knowledge for innovation. Bus Strategy Environ 27:1502–1513. https://doi.org/10.1002/bse.2208

Peteraf M, Di Stefano G, Verona G (2013) The elephant in the room of dynamic capabilities: Bringing two diverging conversations together. Strateg Manag J 34:1389–1410. https://doi.org/10.1002/smj.2078

Peters NJ, Hofstetter JS, Hoffmann VH (2011) Institutional entrepreneurship capabilities for interorganizational sustainable supply chain strategies. Int J Logist Manag 22:52–86. https://doi.org/10.1108/09574091111127552

Podsakoff PM, MacKenzie SB, Lee J-Y, Podsakoff NP (2003) Common method biases in behavioral research: A critical review of the literature and recommended remedies. J Appl Psychol 88:879–903. https://doi.org/10.1037/0021-9010.88.5.879
Porter M, Siggelkow N (2008) Contextuality within activity systems and sustainability of competitive advantage. Acad Manag Perspect 22:34–56. https://doi.org/10.5465/AMP.2008.32739758
Rashid N, Jabar J, Yahya S, Shami S (2014) Dynamic eco innovation practices: A systematic review of the state of the art and future direction for eco innovation study. Asian Soc Sci 11:8. https://doi.org/10.5539/ass.v11n1p8
Reinartz W, Haenlein M, Henseler J (2009) An empirical comparison of the efficacy of covariance-based and variance-based SEM. Int J Res Mark 26:332–344. https://doi.org/10.1016/j.ijresmar.2009.08.001
Reuter C, Foerstl K, Hartmann E, Blome C (2010) Sustainable global supplier management: The role of dynamic capabilities in achieving competitive advantage. J Supply Chain Manag 46:45–63. https://doi.org/10.1111/j.1745-493X.2010.03189.x
Russo MV, Harrison NS (2005) Organizational design and environmental performance: Clues from the electronics industry. Acad Manage J 48:582–593. https://doi.org/10.5465/AMJ.2005.17843939
Schilke O, Goerzen A (2010) Alliance management capability: An investigation of the construct and its measurement. J Manag 36:1192–1219. https://doi.org/10.1177/0149206310362102
Schilke O, Hu S, Helfat CE (2018) Quo vadis, dynamic capabilities? A content-analytic review of the current state of knowledge and recommendations for future research. Acad Manag Ann 12:390–439. https://doi.org/10.5465/annals.2016.0014
Schrettle S, Hinz A, Scherrer -Rathje M, Friedli T (2014) Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance. Int J Prod Econ 147:73–84. https://doi.org/10.1016/j.ijpe.2013.02.030
Shanley M, Peteraf M (2006) The centrality of process. Int J Strateg Change Manag 1:4–19
Sheehan NT, Foss NJ (2007) Enhancing the prescriptiveness of the resource-based view through Porterian activity analysis. Manag Decis 45:450–461. https://doi.org/10.1108/00251740710745070
Shrivastava P (1995) The role of corporations in achieving ecological sustainability. Acad Manage Rev 20:936–960. https://doi.org/10.5465/amr.1995.9512280026
Teece DJ (2007) Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. Strateg Manag J 28:1319–1350. https://doi.org/10.1002/smj.640
Vachon S, Klassen RD (2008) Environmental management and manufacturing performance: The role of collaboration in the supply chain. Int J Prod Econ 111:299–315. https://doi.org/10.1016/j.ijpe.2006.11.030
Wang CL, Ahmed PK (2007) Dynamic capabilities: A review and research agenda. Int J Manag Rev 9:31–51. https://doi.org/10.1111/j.1468-2370.2007.00201.x
Wong CWY (2013) Leveraging environmental information integration to enable environmental management capability and performance. J Supply Chain Manag 49:114–136. https://doi.org/10.1111/jscm.12005
Zhang L, Cao C, Tang F, He J, Li D (2019) Does China's emissions trading system foster corporate green innovation? Evidence from regulating listed companies. Technol Anal Strateg Manag 31:199–212
Zahra SA, George G (2002) Absorptive capacity: A review, reconceptualization, and extension. Acad Manage Rev 27:185–203. https://doi.org/10.5465/AMR.2002.6587995
Zollo M, Cennamo C, Neumann K (2013) Beyond what and why: Understanding organizational evolution towards sustainable enterprise models. Organ Environ 26:241–259. https://doi.org/10.1177/1086026613496433
Zollo M, Winter SG (2002) Deliberate learning and the evolution of dynamic capabilities. Organ Sci 13:339–351. https://doi.org/10.1287/orsc.13.3.339.2780

Authors and Affiliations

Lara Bartocci Liboni[1] · Luciana Oranges Cezarino[2] · Marlon Fernandes Rodrigues Alves[3] · Charbel José Chiappetta Jabbour[4] · V.

G. Venkatesh[5]

✉ Charbel José Chiappetta Jabbour
cjcjabbour@gmail.com

Lara Bartocci Liboni
lara.liboni@gmail.com

Luciana Oranges Cezarino
luciana.cezarino@unive.it

Marlon Fernandes Rodrigues Alves
marlon.fr.alves@gmail.com

V. G. Venkatesh
vgv1976@gmail.com

[1] Western University, Ivey Business School, Canada; University of Sao Paulo, São Paulo, Brazil

[2] Department of Management, Ca' Foscari University of Venice, Venezia, Italy

[3] SKEMA Business School, Université Côte d'Azur (GREDEG), Suresnes, France

[4] EMLYON Business School, France; Affiliate Professor at University of Lincoln, Lincoln International Business School, Lyon-Ecully, France

[5] EM Normandie Business School, Metis Lab, Le Havre, France