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Digital Strategizing and Green Innovative Competitive Advantage: The Mediating Role of Circular Economy and Sustainability Culture

Abstract

Despite growing pressure to align strategy and sustainability, executing joint digital strategizing is nontrivial. Organizations face uncertainty about the resource bundles to invest in (and the resources to deploy them) to develop an organization-wide digital strategizing capability that supports circular economy principles and, in turn, yields green innovative competitive advantage. To explore this issue further, we developed a research model which relied on partial least squares structural equation modeling applied to survey data from 391 senior-level executives drawn from firms in Brazil and France. The results of our work show that stronger digital strategizing capability enhances green innovative competitive advantage through the mediation of circular economy principles under a sustainability culture across both developing and developed competitive contexts. These findings empirically validate the proposed model and outline avenues for advancing sustainable performance by operationalizing circular strategies through digital strategizing.

Keywords: Digital strategizing capability; circular economy principles; green innovative competitive advantage; resource orchestration theory; sustainable-oriented culture

1. Introduction

Strategic management literature identifies that competitive advantage is defined by continual change (Mintzberg, Ahlstrand, and Lampel 2009; Porter 1998). Competitive strategy research highlights the role of digital technologies in enabling effective strategic action in complex environments (Dias et al. 2023), giving rise to information system (IS) strategizing, information technologies (IT) strategizing, and digital strategizing (Chanias, Myers, and Hess 2019; Henfridsson and Lind 2014; Marabelli and Galliers 2017; Morton, Amrollahi, and Wilson 2022; Teubner 2013) as a set of organizational capabilities that support the pursuit of competitive advantage under sustainability challenges (Baptista, Wilson, and Galliers 2021; Morton et al. 2022). The resource orchestrate theory (ROT) contemplates how management capital combines the types of organizational resources necessary for developing digital strategizing capability (DSC). This study of DSC combines the interactions between digital technologies and individuals across various organizational levels in processes that develop, communicate, execute, maintain, and support strategy work (Baptista et al. 2021; Morton et al. 2022; Volberda et al. 2021). Hence, it contemplates how management capital combines the types of organizational resources necessary for developing digital strategizing capability (DSC) (Baptista et al. 2021; Morton et al. 2022; Volberda et al. 2021), even more related to digital sustainable issues (Falcke et al. 2024). .

A firm's ability to sustain superior performance depends on achieving a sustainable competitive advantage (Peçanha and Ferreira 2025), which can be supported by implementing circular economy principles (CEP) (Osei et al. 2024). CEP represent a novel approach that focuses on utilizing resources for as long as possible during the production and delivery of goods and services (Lopes de Sousa Jabbour et al. 2022;

Reim, Tabares, and Parida 2025). It aims to create strategies that recover the value of what is produced and consumed, support the reuse of resources, and encourage green innovation (Ellen Macarthur Foundation 2015; Marsh, Velenturf, and Bernal 2022).

Enterprises should cultivate a sustainability-oriented culture (SOC) by acquiring knowledge of environmental practices from stakeholders and facilitating the exchange of green information among employees (Zhang et al. 2025). These actions support DSC and CEP, ultimately enabling the achievement of green innovative competitive advantage (GICA). GICA refers to how enterprises achieve superior outcomes over their competitors by delivering higher-quality, innovative green products and services at competitive prices (Hayat and Qingyu 2024). Existing research also remains limited in explaining how SOC shapes the implementation of CEP in fostering green innovation (Kwarteng, Simpson, and Agyenim-Boateng 2022), highlighting a clear need for future studies to systematically investigate this underexplored relationship.

Despite its fundamental role, theorizing in strategic management and digital technologies remains contested under complex external environmental conditions (Dias et al. 2023), including in relation to DS (Cui et al. 2017), and its role in how firm's achieve sustainability performance. Additionality, the strategy-making and the environment literatures reveals a critical problem concerning the extent to which competitive strategy shapes the implementation of CEP as a pathway to corporate sustainability (De Angelis, Morgan, and De Luca 2023; Osei et al. 2024). Strategizing is intrinsically connected to digital technologies, as demonstrated by strategy-making research that examines the use of digital tools by organizational actors in the strategy-making process (Jarzabkowski and Kaplan 2015; Li and Jarzabkowski 2025; Morton et al. 2022). Nevertheless, further research is required to clarify how digital technologies can influence strategizing by reconfiguring organizational forms and practices through their dynamic interactions (Faraj and Leonardi 2022), and to further leverage green innovation (Osei et al. 2024)

This empirical research addresses the identified problem in the current literature (Dias et al. 2023; Faraj and Leonardi 2022; Kwarteng et al. 2022; Morton et al. 2022; Osei et al. 2024) by positing that digital technologies are essential for strategizing the implementation of CEP to achieve GICA within a SOC. The first research question is thus proposed.

RQ1. Does DSC enable CEP to leverage GICA under sustainability-oriented culture?

This study compares Brazil and France as representatives of developing and developed economies, respectively, advancing prior research agendas (Danso et al. 2019; Kareem and Kummitha 2025; Mosgaard, Kristensen, and Bocken 2025) by elucidating how regional environmental challenges shape green innovation and sustainability-oriented business strategies. The OECD highlights the diverse development paths of Brazil and France (Pain et al. 2025). Brazil's consumption-driven but volatile growth (3.4% in 2024, slowing to 2.1% in 2025 and 1.6% in 2026) contrasts with France's stagnation, weak investment, and policy uncertainty, highlighting divergent development paths shaped by trade dependencies and structural constraints. Moreover, while France's environmental pressures are partly mitigated by its low-carbon nuclear energy mix, challenges persist in transportation, agriculture, air quality, biodiversity loss, and climate adaptation. In contrast, Brazil faces more systemic pressures, including deforestation-driven emissions, air pollution from burning, biodiversity decline, and high climate vulnerability, exacerbated by weak governance and enforcement. Additionality, Kareem and Kummitha (2025) call for future research to examine multiple industries and diverse cultural settings, in order to better understand how digital technologies shape sustainable practices and green innovation across different organizational and geographic contexts. Consequently, this study explores the following research questions to address the lacuna of literature.

RQ2. Does the national context inherently influence or condition the relationships specified in the proposed research model?

This paper advances the literature on strategic management, digital technologies and sustainability by applying the ROT, examining how capital management orchestrates the organizational resources of tangible and intangible resources, and as DSC to contribute to proximate and distal sustainable outcomes under different regional contexts. Hence, the empirical study conceptualizes value creation through digital technologies that support strategizing, enhance digitization to reinforce strategic practices, facilitate CEP, and promote a GICA within a sustainability-oriented culture.

2. Theory and Hypotheses Development

The strategic management literature argues that enterprise competitive advantage is achieved through strategies that exploit organizational resources to develop capabilities in challenging contexts (Barney 1991). Organizational resources encompass tangible, human, and intangible assets that firms own, control and that are expected to generate economic benefits (Grant 1991). The resource-based view (RBV) posits that competitive advantage arises from organizational capabilities that are developed through the effective deployment of valuable resources (Amit and Schoemaker 1993). The dynamic capability theory (DCT) emerge to complement RBV emphasizes how firm enable resources to develop capacity to integrate and reconfigure internal and external capabilities in response to rapid environmental change (Teece, Pisano, and Shuen 1997). However, these two theoretical perspectives offer limited guidance on how firms should actively manage resources within the strategy-making process (Cui et al. 2017). Building on this view, Chirico et al. (2008) emphasize the critical role of effective management resource utilization in enabling participative strategies that influence firm performance. Advancing this line of reasoning, Sirmon et al. (2011) introduce the concept of resource orchestration theory (ROT), which not only explains how firms choose and deploy their assets (RBV and DCT), but also underscores that the efficient use and management of assets are more essential than the assets themselves.

The ROT, grounded in the role of managerial capital, argues that an enterprise is developed and sustained through the structuring, bundling, and deployment of resources to create and sustain competitive advantage (Chirico et al. 2008; Sirmon et al. 2011; Sirmon, Gove, and Hitt 2008). Because possessing such enterprise resources alone is insufficient (Li and Chan 2019; Zhou and Verburg 2023) organizations need to integrate management resources to enable strategizing process (Chanias et al. 2019; Volberda et al. 2021) and managers must skillfully orchestrate them to translate strategy in potential advantages into superior performance (Sirmon et al. 2008; Wang et al. 2023).

The ROT provides an appropriate theoretical basis, as well as strategic knowledge about the digital technology resources a firm must manage, to support strategy work aimed at gaining a competitive advantage. The associations between information systems (IS) and strategic management are well established, with IS scholars having examined its strategic aspects for several decades (Chan 1997; Galliers et al. 2012;

Moeini et al. 2020; Whittington 2014). As organizations rapidly adopt digital technologies, and recent strategizing literature recognizes the critical role of information technology in shaping and executing organizational strategy (Baptista et al. 2021; Volberda et al. 2021; Yoshikuni, Dwivedi, Tito, et al. 2025). Prior research of IS/IT strategizing (Chanias et al. 2019; Henfridsson and Lind 2014; Marabelli and Galliers 2017; Teubner 2013) and more recent studies of digital strategizing (Baptista et al. 2021; Morton et al. 2022) emphasize the importance of digital technologies in supporting strategy work. In this view, digital strategizing centers on the interplay between digital technologies and organizational actors at different levels through processes that form, transmit, implement, host, and support strategy.

The empirical study adopts the resource orchestration framework, suggesting that resource management involves structuring tangible resources (digital technologies) and human resources (direct and indirect strategy practitioners), bundling strategic resources through stabilizing, enriching, and pioneering processes, and leveraging intangible resources by mobilizing, coordinating, and deploying digital strategizing capability (DSC) to create business value.

2.2 Conceptualizing a DSC

While numerous studies have investigated the combinations of information systems (IS) strategies and organizational strategy over the past decades (Chan 1997; Galliers et al. 2012; Moeini et al. 2020; Whittington 2014). Since the 1990s, IS has been recognized as a critical enabler of core strategic capabilities, playing a central role in value business creation (Chanias, Myers, and Hess 2018; Henfridsson and Lind 2014; Marabelli and Galliers 2017; Wade and Hulland 2004), here remains a paucity of research addressing the role of digital technologies within organizational strategizing contexts (Morton et al. 2022).

Based on the ROT perspective, the study has a central premise that strategizing and digital technologies build on the structuring, bundling and leveraging of a firm's resources to orchestrate organizational capabilities into strategy-making. Strategic management research highlights the role of diverse resource types in developing organizational capabilities (Burgelman et al. 2018; Kaplan and Norton 1992; Wolf and Floyd 2017), by three categories: tangible (e.g., physical, technologies, and financial assets), human (e.g., individual and management knowledge and skills), and intangible (e.g., organizational synergy and culture, coordination, and strategic orientation) (Grant 1991). Previous studies argue that tangible, human, and intangible IT resources generate capabilities that create IT business value (Aral and Weill 2007; Bharadwaj 2000; Bhatt and Grover 2005; Melville, Kraemer, and Gurbaxani 2004) and emerging research on digital technologies emphasizes how these three resources jointly contribute to competitive advantage under a challenging environment context (Boerner, Wiener, and Guenther 2024; Conboy et al. 2020; Kristoffersen et al. 2021; Mikalef and Gupta 2021; Steininger et al. 2022).

Therefore, from a ROT perspective, this study argues that the presence of these managerial capabilities within strategic capital enables the orchestration of digital technologies (tangible) and complementary strategic resources (human and intangible), thereby increasing the likelihood of successful strategic work that enhances corporate performance. Therefore, DSC arises when strategic management capital integrates organizational structures and effectively bundles tangible and intangible assets for strategy-making. Simply identifying optimal asset bundles is not enough; leveraging capabilities to coordinate and synchronize these resources is equally essential (Sirmon et al. 2011; Wang et al. 2023).

Recent studies on digital technologies related to tangible resources include data, technologies, and basic assets that enable firms' capabilities to enhance proximate and distal outcomes under conditions of environmental uncertainty, complexity, and turbulence (Boerner et al. 2024; Conboy et al. 2020; Gupta and George 2016; Kristoffersen et al. 2021; Mikalef and Gupta 2021; Steininger et al. 2022). In this vein, strategic management literature (Grant 1991) and prior studies on how information systems enable strategy-making argue that data, technologies, and financial resources are essential for firms to develop strategizing capabilities and achieve competitive advantage under environmental challenges (Jarzabkowski and Kaplan 2015; Knight, Paroutis, and Heracleous 2018; Volberda et al. 2021; Whittington 2014). Moreover, Morton et al. (2022) argue that digital technologies support strategizing in practice through shared behavioral routines, including norms and procedures for strategic work; thus, they enable the direct and indirect participation of strategic practitioners in the strategy process, which constitutes strategic activities in actual practice. Therefore, human resources in DSC encompass both strategy practitioners and non-strategy practitioners (Mantere and Whittington 2021; Morton et al. 2022; Splitter, Seidl, and Whittington 2024; Whittington et al. 2017). Additionally, leveraging DSC requires mobilizing, coordinating, and deploying strategic intangible resources as organizational capital through digital culture and strategy alignment. Prior and recent studies of strategic management show that strategy alignment is essential for firms to disseminate strategy across all organizational levels to achieve competitive advantage (Amrollahi et al. 2025; Kaplan and Norton 1992; Mintzberg et al. 2009; Morton and Iglesias Ruiz 2024; Wolf and Floyd 2017) through digital technologies (Baptista et al.

2021; Morton et al. 2022; Yoshikuni, Dwivedi, Tito, et al. 2025). Therefore, enterprises need to develop the capability to structure and bundle tangible and human resources to support the strategy process and leverage strategizing capabilities by mobilizing, coordinating, and deploying digital culture as an intangible resource. Hence, this study, by the lens on ROT, proposes the following definition for DS capability (Figure 1):

A digital strategizing capability refers to a firm's management ability to effectively orchestrate digital technologies, and complementary organizational resources across multiple organizational levels in processes that shape, communicate, implement, embed, and sustain strategizing to achieve defined organizational and societal objectives.

[Insert Figure 1 here]

2.2.1. DSC of tangibles resources

Building on prior research (Sirmon et al. 2011) this study conceptualizes tangible resources as the bundled integration of data, technologies, and financial assets (Wade and Hulland 2004), aligning with recent works on IT-enabled capabilities and resource orchestration (Huynh, Nippa, and Aichner 2023; Kristoffersen et al. 2021; Wamba et al. 2024). Data, by drawing on strategic management research (Henfridsson and Lind 2014; Lundgren-Henriksson and Sorsa 2023), is recognized as a fundamental resource for enabling strategizing through both prescriptive and emergent strategizing approaches (Marabelli and Galliers 2017; Teubner and Stockhinger 2020; Yoshikuni, Dwivedi, Tito, et al. 2025). It supports analytical decision-making under uncertainty and turbulence by integrating insights from internal and external environments (Mintzberg et al. 2009; Morton 2023; Volberda et al. 2021; Wolf and Floyd 2017; Yeh et al. 2025).

Consistent with recent studies on digital transformation, the effective orchestration of high-quality data underpins the deployment of advanced digital technologies such as Artificial Intelligence (Mikalef and Gupta 2021), Big Data Analytics (Günther et al. 2017), Business Intelligence an Analytics (Yoshikuni, Dwivedi, Filho, et al. 2025), Machine Learning (Volkmar, Fischer, and Reinecke 2022), and others emergent technologies (Øvrelid, Bygstad, and Hanseth 2024; Queiroz and Wamba 2024; Volberda et al. 2021). Therefore, strategizing involves the use of diverse digital technologies to support strategic activities (Morton et al. 2022; Tavakoli, Schlagwein, and Schoder 2017; Yoshikuni, Dwivedi, Tito, et al. 2025). Organizations employ spreadsheets, BI platforms, and presentation tools to analyze, communicate, and monitor strategic plans (Knight et al. 2018; Seidl, Ma, and Splitter 2024; Whittington et al. 2017). Collaboration and visualization technologies further enable real-time coordination and data-driven decision-making across teams (Morton et al. 2022; Morton, Wilson, and Cooke 2020; Tavakoli et al. 2017). Beyond investing in data and digital technologies, organizations must allocate sufficient time, human resources, and financial resources to ensure that strategic initiatives mature and deliver expected outcomes (Grant 1991; Mintzberg et al. 2009; Porter 1998). Effective resource allocation, therefore, requires integrating financial planning with strategy (rational and emergent strategizing) to fund and staff initiatives capable of achieving their objectives (Bolisani and Bratianu 2017; Yoshikuni, Dwivedi, Tito, et al. 2025).

2.2.2. DSC of human management resources

This study, based on strategy-making and digital strategizing literature, management capital combines strategy and non-strategy practitioners. Strategy practitioners are individuals directly engaged in strategic activities, embodying the practices of strategizing (Mantere and Whittington 2021; Seidl et al. 2024; Wolf and

Floyd 2017). Conversely, non-strategy practitioners, such as employees, customers, and stakeholders, contribute indirectly through their interaction with information technologies that enhance human capital and strategic engagement (Chanias et al. 2019; Kaplan and Norton 1992; Morton et al. 2022).

Management capital arises through strategy practitioners [senior executives (e.g., CEO, CIO, CTO)], coordinate efforts of who both shape strategic vision and ensure alignment between IT and business strategies work (Gerow et al. 2014; Johnson and Lederer 2013; Queiroz et al. 2020). Leadership expertise in digital technologies enables organizations to respond effectively to dynamic environments (Dias et al. 2023; Vial 2019). Middle managers implement strategic plans, utilizing IT to support processes for control and adaptation (Hortovanyi, Szabo, and Fuzes 2021; Yoshikuni, Dwivedi, Tito, et al. 2025). Additionally, business strategy teams—comprising analysts, planners, and executives—utilize technologies to analyze markets, finances, and performance, thereby refining strategies and enabling new initiatives (van den Broek and Gander 2024; Morton et al. 2022).

While non-strategy practitioners contribute indirectly to strategy work through digital technologies that foster interaction and transparency across organizational levels (Azad and Zablith 2021; Morton 2023). Digital tools such as dashboards, wikis, and online platforms promote inclusion and collaboration among cross-functional teams and external experts (Baptista et al. 2021; Gritt, Forsgren, and Pandza 2024; Morton et al. 2022; Ortner et al. 2024), enriching strategic initiatives with diverse perspectives and specialized insights (Henfridsson and Lind 2014; Tavakoli et al. 2017).

2.2.4. DSC of intangible resources

The intangible resources are considered the most difficult for competitors to replicate and are particularly critical in contexts characterized by uncertainty and market volatility (Helfat, Kaul, and Ketchen 2023; Sirmon et al. 2011). The intangible resources vary significantly across organizations, shaped by the distinctive blend of organizational history, human capital, internal processes, and contextual conditions that define each organization. The domain of DS by ROT, key enterprise resources identified include the coordination and deployment of a strategy firm alignment (Sirmon et al. 2011) in which more people are mobilized in strategy work (Morton 2023; Morton et al. 2022; Splitter et al. 2024; Whittington 2025), and digital culture that supports strategy-making (Jarzabkowski and Kaplan 2015; Morton et al. 2022) to leverage the organizational capabilities to achieve firm performance (Kaplan and Norton 1992).

Mobilizing, coordinating, and aligning strategic initiatives are central to successful strategy-making success (Hristov et al. 2024; Jarzabkowski, Seidl, and Balogun 2022; Wolf and Floyd 2017). Effective communication of a shared strategic vision across departments fosters alignment (Wadström 2022) and purposeful engagement among employees (Jaiswal and Thaker 2024; Jarzabkowski and Kaplan 2015; Kaplan and Norton 1992). Leadership reinforces this strategy alignment by modeling desired behaviors and promoting participation throughout the organization (Bryson et al. 2025; Nevalainen et al. 2025). Through continuous coordination and learning, strategizing sustains alignment between practitioners and non-practitioners, enhancing organizational adaptability in dynamic environments (Jarzabkowski and Kaplan 2015; Li and Jarzabkowski 2025).

A digital technology–driven culture built on collective learning is essential for effective digital strategizing (Chanias et al. 2018; Morton et al. 2022; Vial 2019). The success of such initiatives depends on high-quality data and interactive technologies that enhance employees' engagement with strategic objectives (Azad and Zablith 2021; Morton et al. 2022). Beyond technical adoption, digital transformation necessitates alignment between technological and strategic objectives (Chanias et al. 2019), promoting daily practices that enhance efficiency and informed decision-making (Warner and Wäger 2019). Ultimately, the effectiveness of these technologies' rests on the organization's strategic culture and its capacity for collaboration, data sharing, and continuous learning (Aubert and Chan 2024; Baptista et al. 2021).

2.3 Effects of DSC and circular economy principles on green innovative competitive advantage

Although a unified definition is lacking, the circular economy is generally regarded as an umbrella concept encompassing various definitions and principles (Kristoffersen et al. 2021). A consistent feature of circular economy initiatives is the aim to tackle structural waste while simultaneously generating new value opportunities and minimizing value loss and destruction. The CEP is an emerging framework that emphasizes extending the lifecycle and value of resources across industries, including design, product, service, manufacturing, and delivery (Chiappetta Jabbour et al. 2020). Organizations facing environmental pressure (Jugend et al. 2024) to generate business value through green innovation should develop a strategy that contemplates the CEP (Lopes de Sousa Jabbour et al. 2022). These strategies aim to restore the utility of production and consumption outputs by promoting circular resource flows to achieve green innovation (Gaur, Pandey, and Hungund 2024; Kristoffersen et al. 2020). As a result, organizations must align strategies (Osei et al. 2024) to reconfigure their operational capabilities to achieve a sustainable competitive advantage (Jugend et al. 2024).

In line with recent research, the study adopted the CEP from the ReSOLVE framework, composed of six dimensions (Chiappetta Jabbour et al. 2020; Jugend et al. 2024; Lopes de Sousa Jabbour et al. 2022). Hence, the ReSOLVE framework contemplates, Regenerate, Share, Optimize, Loop, Virtualize and Exchange, in the developing strategy moving towards circular flows of resources and operational capabilities (Ellen Macarthur Foundation 2015). Strategy work aligned with CEP contemplates regenerative cycles that prioritize renewable resources (De Angelis et al. 2023), sharing models designed to extend product lifespans, and optimization efforts aimed at reducing waste, looping to close resource flows, virtualization through the adoption of dematerialized services, and exchange facilitated by disruptive technologies that transform products and services (Osei et al. 2024).

Various strategic approaches have been developed to support organizations in integrating CEP into their business strategies and practices (Mosgaard et al. 2025). For instance, the ReSOLVE framework incorporates CEP into business strategies that focus on narrowing, slowing, and closing resource flows (Ellen Macarthur Foundation 2015). Chiappetta Jabbour et al. (2020) describe that the ReSOLVE framework comprises six distinct business models that are equally relevant across organizational contexts, which can be summarized as follows: (1) Regenerate focuses on replacing nonrenewable inputs with renewable and biodegradable resources that restore natural systems; (2) Share emphasizes extending product lifecycles and enabling access through product-as-a-service models; (3) Optimize aims to improve resource and energy efficiency by reducing waste and digitally managing material flows; (4) Loop keeps materials circulating through reuse, repair, remanufacturing, and recycling; (5)

Virtualize replaces physical products with digital or service-based alternatives; and (6) Exchange relies on disruptive technologies to substitute obsolete technologies and nonrenewable materials with more sustainable solutions. Consequently, these strategies now encompass the regeneration of resource flows as well as the integration of digital technologies-enabled resource management approaches (Kristoffersen et al. 2020, 2021; Sarius and Sundberg 2024).

In digital strategizing work, the CEP offers an alternative to the linear model by promoting regenerative and sustainable production chains (Mosgaard et al. 2025) to achieve green innovation (Ellen Macarthur Foundation 2015). This approach seeks to integrate digital technologies and strategy work with the objective of balancing organizational competitiveness and socio-environmental responsibility. Advancing the CEP requires aligning business strategy (Osei et al. 2024) enabled by digital technologies (Blomsma et al. 2019; Cheng et al. 2024) to reconfigure capabilities (De Angelis et al. 2023; Wardeberg et al. 2024) to prioritize design for reuse and extend service and product life cycles to achieve green innovative competitive advantage (GICA) (Sarius and Sundberg 2024; Ünal and Shao 2019). Thus, it contends that when firms adopt strategizing capabilities enabled by digital technologies, they can deliver CEP, involve replacing non-renewable with renewable resources, extending product lifespans through repair and upgrades, minimizing waste with innovative methods, reusing and recycling components, creating digital service-based solutions, and modernizing technologies for greater efficiency to create green innovation. Thus, it proposes the following hypothesis:

H1. The DSC enables the CEP.

An enterprise's competitive advantage refers to a significant edge over competitors through organizational resources to develop operational capabilities that drive immediate and long-term outcomes (Grant 1991). Therefore, the business strategies adopted for holding the competitive advantage through green activities are to build operational capabilities to create green products and service innovation. In this study, GICA is characterized as a firm’s superior ability over competitors developed by stronger capabilities in management, innovation, and environmental R&D to achieve competitive costs and deliver higher-quality green products or services (Hayat and Qingyu 2024). The integration between strategy and CEP emerges as a fundamental axis for sustaining innovative competitive advantage in contexts of high socio-environmental pressure (Osei et al. 2024; Zhu et al. 2023). The transition towards a circular economy requires that firms' DSC, which challenges the linear logic of value creation that is still endemic across most industries. In turn, the transition from linear to CEP involves the rethinking of strategic decision-making processes to achieve competitive advantage of green innovation (De Angelis et al. 2023; Gaur et al. 2024). Moreover, Morton et al. (2022) state that practice-based studies in digital strategizing should further investigate sustainability goals and competitiveness to provide deeper insights. Therefore, building on these arguments, the study proposes hypotheses suggesting that DSC facilitates the adoption of CEP and enhances green innovation–driven competitive advantage.

H2. The CEP mediates the relationship between DSC and GICA**.**

2.4 Effects of sustainability-oriented culture

A sustainability-oriented culture (SOC) refers to the shared values and beliefs that shape organizational behaviors, procedures, and processes in support of a firm’s sustainability strategy (Baumgartner 2009; Engert, Rauter, and Baumgartner 2016). Previous research suggests that organizational culture plays a central role in shaping sustainability-related activities within firms (Joon, Nugroho, and Ramachandaran

2025) and that such contextual factors influence overall competitive strategy (Osei et al. 2024). Moreover, existing studies highlight organizational culture as a key determinant of both the strategy-making process and strategic decision-making (Amrollahi et al. 2025). Hence, the enterprise should embed an environmental sustainability orientation into its organizational philosophy, culture, and strategic activities, guiding operational capabilities to achieve long-term sustainability goals (Danso et al. 2019; Engert et al. 2016; Osei et al. 2024).

The organizational culture concerns stakeholders' participation, communication, and engagement in the strategy process (Wolf and Floyd 2017), and SOC influences how employees perceive and respond to strategic priorities, with a specific focus on environmental sustainability as a shared value embedded in everyday operations (Baumgartner 2009; Kareem and Kummitha 2025). In the sustainability literature, such involvement is described as a defining characteristic of the organizational environment, and SOC has been shown to facilitate the implementation of corporate strategies. Because CEP implementation is a strategic issue, the organization's cultural underpinnings must be carefully assessed (Kwarteng et al. 2022). Accordingly, within a circular economy context, stronger employee participation and involvement, effective leadership by top management, and commitment to the organization's mission and goals are required (Peçanha and Ferreira 2025). Based on these arguments, the following hypotheses are proposed:

H3. SOC positively influences CEP.

H4. The relationship between DSC and CEP is moderated by SOC.

A GICA is achieved when organizations build operational capabilities driven by environmental knowledge, enabling them to compete effectively in sustainable markets

(Ali et al. 2024).Organizations establish procedures to collect knowledge about environmental practices from stakeholder to employees facilitate the exchange of green information (Zhang et al. 2025) to implement CEP (Chiappetta Jabbour et al. 2020) and enhance GICA through digital technologies (Yang, Chen, and Sun 2025). Prior studies demonstrate that implementing CEP enables firms to systematically build operational capabilities by reconfiguring production processes, optimizing resource use, and integrating environmental knowledge into routine activities (Mosgaard et al. 2025; Olekanma et al. 2024). Through SOC, enterprise development practices that promote resource recovery, reuse, redesign, and closed-loop systems enable firms to build coordination, learning, and process-integration capabilities that support the generation of green innovations (Kareem and Kummitha 2025). Hence, these practices enhance firms' ability to develop environmentally sustainable products, services, and business models, thereby strengthening green innovation outcomes and competitive advantage. Therefore, enterprises seeking to achieve green innovation through CEP should develop a sustainability-driven strategy and culture (Peçanha and Ferreira 2025), engage strategic employees (Osei et al. 2024) and partners in collaboration and co-creation (Olekanma et al. 2024; Wardeberg et al. 2024), supported by digital technologies (Yang et al. 2025) to build the strategic skills necessary to effectively achieve a green competitive advantage (De Angelis et al. 2023). Based on this reasoning, the following hypotheses are proposed.

H5. The relationship between CEP and GICA is moderated by SOC.

2.5 Effects of geographical moderation

Strategic management identifies contingency factors, including geographic location, competitive pressures, and industry context, as influential determinants of proximate and distal organizational outcomes (Wolf and Floyd 2017). Research IT business value has shown that variables such as the competitive environment and geographic context significantly influence the relationship between short-term and long-term organizational outcomes (Melville et al. 2004; Steininger et al. 2022). Similarly, the sustainability literature contends that both internal elements (such as organizational knowledge and skills, a sustainability-oriented culture, leadership style, and organizational characteristics) and external factors (such as regional and cultural contexts, technological developments, market dynamics, environmental pressures, and network relationships) play a significant role in the firm's operations and performance (Danso et al. 2019; Reim et al. 2025). There are significant differences between Brazil and the France, as mentioned in the CIA World Factbook report (CIA 2025) and OECD report (Pain et al. 2025). The main distinctions between the two countries lie in their geography, economy, demographics, and government structures. Geography dimension, Brazil covers about 8,515,770 km² in South America with the Amazon rainforest, vast river basins, and a 7,491 km Atlantic coastline, while France spans about 643,801 km² (including overseas territories) in Western Europe with plains, coasts, and mountains such as the Alps and Pyrenees—making Brazil roughly 13 times larger than France in land area. Brazil's population is roughly 3 times larger and notably younger compared to France, with about 218.7 million people (2023) characterized by higher fertility and strong ethnic diversity (45% mixed race, 43% white, 10% black, Indigenous and Asian minorities), while France has about 65–70 million people, an older population with slower growth and officially less emphasis on ethnic classification. Brazil is a major emerging economy with a gross domestic product (GDP) of about $4.1 trillion in 2023, supported by agriculture, mining, energy, services, and industry. It faces challenges, including inequality and reliance on commodities. In contrast, France's GDP is approximately $4.8 trillion; as a developed, high-income nation, France features advanced services, a strong industry, and deep EU integration, resulting in a much higher income per person than Brazil, despite Brazil's larger resource base.

Finally, Brazil is a federal presidential republic, where the president serves as both head of state and head of government, supported by a bicameral national congress (federal senate and chamber of deputies), while France is a semi-presidential republic, combining a strong president with a prime minister accountable to a bicameral parliament (senate and national assembly), reflecting Brazil's federal, more decentralized structure versus France's unitary system with greater centralization through the EU.

Consequently, regional and cultural contexts shape ideas and perspectives that are influenced by corporate strategy, sustainable issues, and geographic setting, as well as the leveraging of digital technologies (Steininger et al. 2022; Yoshikuni, Dwivedi, Filho, et al. 2025). Similarly, geography, economic capacity, and governance can affect competitive advantages through the management of natural resources, technological investment, and governmental support for green innovation. Grounded in this reasoning, the study puts forward the following hypothesis.

H6: The proposed model designates geographical regions as a moderating variable in the relationship under investigation to achieve a GICA.

The literature review has outlined key concepts associated with DSC, CEP, SOC, and GICA under natural geography region. Figure 1 shows the research model.

[insert Figure 2 here]

3. Methodology

3.1 Scale

The research model incorporates established constructs identified in recent literature and introduces original constructs, which were designed and validated using a newly developed measurement instrument. Distinctive constructs, namely DSC and SOC, were introduced based on a synthesis of existing literature and assessments from industry professionals and academic scholars. This study adhered to established measurement development guidelines by MacKenzie, Podsakoff, & Podsakoff (2011), in line of recent studies of development scale (Bani-Melhem et al. 2025; Goldmann, Schäfer, and Altendorfer 2025; Hernandes et al. 2026; Yoshikuni et al. 2023; Zhao, Wang, and Kou 2025).

First, the conceptualization of the novel constructs is described in the theory and hypotheses development through the theoretical and literatures foundations to cover DSC construct. Conceptual research and the adaptation of pre-existing elements from conceptual and empirical research in the areas of strategic management and digital technologies led to the creation of the innovative construct of DSC. In line with its conceptualization, DSC was specified as a higher-order formative construct. Benitez et al. (2020) distinguish between two types of formative constructs: composite and causal-formative. Jarvis et al. (2003) illustrate the nature of the belief structure construct, which can be modeled as a second-order composite formative construct in which dimensions such as price, taste, decay, and breath are combined as components that together form the overall belief rather than acting as independent causal drivers. From this perspective, a construct is a configuration of components that produces a particular organizational artifact. In contrast, causal-formative constructs assume that observed indicators give rise to the latent variable. In this study, DSC is modeled as a composite construct, reflecting the assumption that organizations develop unique configurations of digital strategizing capability through idiosyncratic processes of resource orchestration and leverage. Building on this emerging body of research, the formative nature of the DSC construct is further articulated. Drawing on the strategic management literature as well as prior research on IT capability, big data analytics capability, and AI capability, which are grounded in the resource-based framework [e.g., (Grant 1991; Hussinki 2022; Mikalef and Gupta 2021)], this study conceptualizes digital strategizing capability (DSC) as a multidimensional construct comprising three core resources dimensions: tangible, human, and intangible. Therefore, given the proposed literature's resource-based framework (tangible, human, and intangible), no single dimension is sufficient to capture the essence of DSC, suggesting that these resources represent foundational attributes rather than mere reflections of the capability. This suggests that omitting any single dimension would substantially undermine the construct's integrity, as the dimensions are non-substitutable. For instance, excluding the intangible dimension cannot be readily offset by tangible or human resources alone. In this regard, Helfat et al. (2023) emphasize that firm-specific intangible strategic resources, alongside tangible and human resources, play a critical role in achieving sustained competitive advantage. Additionally, as a formative construct, DSC does not require covariation among the three dimensions of organizational resources (Hair et al. 2022). Accordingly, the empirical analysis computes variance inflation factor (VIF) values to assess whether multicollinearity poses a concern for each formative dimension (Hair et al. 2018). The results of this analysis are reported later in the study. Finally, the three underlying dimensions of the DSC construct have fundamentally different antecedents. Tangible resources (e.g., data, technology, and basic resources), human resources (e.g., strategy and non-strategy practitioners), and intangible resources (e.g., digital culture and strategy alignment) are developed through distinct processes and depend on different sets of predictors. Moreover, the sub-dimensions from which these dimensions are formed are conceptually and empirically heterogeneous. Consequently, the higher-order DSC construct conforms to the criteria established in the formative measurement literature (Benitez et al. 2020; Hair et al. 2018; Jarvis et al. 2003). The same logic was applied when specifying the lower-order sub-dimensions, such as the conceptualization and measurement of strategy and non-strategy practitioners within the higher-order human management resources construct. All the first-order constructs are modeled as reflective, whose indicators are interchangeable manifestations of the same underlying concept, are expected to covary, share the same antecedents and consequences, and change because of variations in the latent construct rather than causing it with minimum three assertive items, as recommended by Jarvis et al. (2003) and Hair et al. (2022). Reflective constructs were estimated using consistent partial least squares to correct for measurement error (Hair et al. 2022). In a two-stage procedure, latent variable scores from first-order constructs were used to form their corresponding second-order constructs (e.g., tangible resources: data, technology, and basic resources; human resources: strategy and non-strategy practitioners; and intangible resources: digital culture and strategy alignment). Subsequently, the third-order DSC construct was created from the latent variable scores of these second-order constructs. Building on this reasoning, given the broad scope of digital technologies and strategizing, it is more appropriate to conceptualize DSC construct as formative rather than reflective. The SOC construct is specified as a first-order reflective construct, consistent with prior sustainability culture literature (Baumgartner 2009; Kareem and Kummitha 2025; Kwarteng et al. 2022), because its indicators are conceptualized as observable manifestations of a single underlying latent orientation. Changes in the level of SOC are expected to be reflected uniformly across its indicators, which are theoretically interchangeable, highly correlated, and share common antecedents and consequences, thereby satisfying the core criteria for reflective measurement.

Second phase, content validity was evaluated, verifying that the items of a measurement instrument adequately represent the construct domain in terms of relevance, representativeness, and technical quality (Boateng et al. 2018). The evaluation of content validity incorporated both qualitative and quantitative approaches to ensure the adequacy of the measurement items (Lewis, Templeton, and Byrd 2005). Experts employed judgment-based assessments to provide qualitative evaluations, considering business objectives when commenting on item clarity and difficulty, and offering recommendations for refinement, including additions, modifications, or removals of items. A qualitative validation phase was conducted with three academic researchers and four senior industry executives, utilizing the q-sort methodology and content validity ratio analysis. Quantitatively, the Q-sort technique and the content validity ratio (CVR) were jointly applied to assess item validity. In addition, senior experts were asked to select the most appropriate measurement items for each construct attribute to calculate the item placement ratio (HIT ratio), which indicates the proportion of measurement items correctly assigned to their intended attributes.

The last stage involved conducting a pretest with 60 cases, exceeding the minimum threshold of 15 cases suggested by Malhotra (2010), to obtain empirical evidence on the scale’s measurement properties. A controlled sample was used to assess the scale's suitability for examining convergent, discriminant, and nomological validity (MacKenzie et al. 2011). The outcomes of this analysis are reported in a subsequent section. Consequently, questionnaire items that did not correspond with the expected classifications were either revised or removed from the final DSC and SOC constructs.

The CEP and GICA measures were adopted by current sustainable literature. CEP as a reflective latent variable, drawing on recent research, it was conceptualized as a first-order reflective construct with six indicators, in accordance a previous studies (Chiappetta Jabbour et al. 2020; Jugend et al. 2024). GICA is a first-order reflective construct, and the indicators adopted by Hayat and Qinyu (2024).

Control variables included company size, firm age, and industry sector. Company size was defined by the number of employees: small (up to 49 employees), medium (50–499 employees), and large (over 500 employees). Firm age was categorized into three groups: young (up to 9.9 years), medium (10 to 19.9 years), and mature (20 years or older). The industry sectors were classified as agribusiness, commerce, finance, industry, service, or government, following Yoshikuni et al. (2025). Control variables were represented through dummy coding, while latent constructs were assessed using a seven-point Likert scale, with 1 indicating strong disagreement and 7 indicating strong agreement. In accordance with the methodological guidance of Malhotra (2010), a pilot study was conducted with a sample of 55 organizations. Insights from this stage led to minor adjustments to enhance the precision of instructions, clarity of item wording, and labeling of the instrument. The final version of the survey instrument is provided in Appendix A for reference.

3.2 Collect data

The sample comprised Brazilian and French firms of varying sizes and industries to capture a wide range of organizational contexts and capabilities. Importantly, although different recruitment channels were used in each country, the same theoretical and operational sampling criteria were applied across both contexts. Therefore, in

Brazil and France, respondents were required to be senior executives actively involved in strategic decision-making and green or sustainability-related activities. This common eligibility framework ensured functional equivalence of the target population across countries, thereby supporting the comparability of the two subsamples.

To further enhance data quality and construct validity, all respondents received identical survey instruments and standardized instructions, including explicit guidance to consult knowledgeable executives within their organizations when answering items outside their direct areas of expertise. This procedure reduced the risk of informant bias and ensured that responses reflected organizational-level practices rather than individual perceptions.

In Brazil, organizations were identified through the Technology and Analytics in Management, Accounting, and Finance (TAMAF) research group directory and recruited via multiple complementary channels, including personal networks, professional associations, mailing lists, online forums, and business directories. Such multi-channel executive recruitment strategies are well established in information systems and management research for targeting hard-to-reach senior decision-makers (Gunasekaran et al. 2017; Mikalef and Gupta 2021; Yoshikuni, Dwivedi, Filho, et al. 2025).

In France, the same eligibility criteria were operationalized through a market research service provider that maintains a rigorously profiled global pool of corporate decision makers. Market research service screening procedures ensured that only executives matching the same role, industry, and strategic responsibility criteria used in Brazil were invited to participate. The use of professional panel providers for executive sampling is widely accepted in cross-national management and information systems research and has been shown to yield samples comparable in quality and reliability to those from traditional network-based recruitment (Kristoffersen et al. 2021; Wamba et al. 2017, 2020).

A total of 391 valid responses were collected, exceeding the minimum sample size required for PLS-SEM analysis (Hair et al. 2022). A total of 391 valid responses were obtained, surpassing the minimum sample size required for PLS-SEM analysis. PLS-SEM guidelines recommend a sample size requirement of 10 times the maximum number of arrows pointing to any latent variable in the proposed model. In this study, this criterion corresponds to a minimum threshold of 50 cases (Hair et al. 2022). The dataset includes respondents representing a range of managerial positions, age groups, industry sectors, and firm sizes. Firms from Brazil and France were sampled, each exhibiting distinct demographic characteristics.

In Brazil, 52% of respondents were C-level executives and 48% were senior executive managers. In France, the corresponding figures were 53% and 47%. Mature firms represented 56% of the Brazilian sample and 44% of the French sample. In Brazil, the industrial sector was primarily composed of financial services (20%), manufacturing (21%), and services (36%). In contrast, French firms were engaged mainly in commerce (24%), financial services (24%), and other services (52%). Large firms accounted for 54% of the Brazilian sample, while the French sample was more evenly distributed between medium-sized (45%) and large-sized (41%) companies. See Table 1.

[Insert Table 1 here]

3.3 Statistical technique

The suggested research framework was analyzed using PLS-SEM due to several methodological advantages. First, it is robust against deviations from multivariate normality, as demonstrated by the Shapiro-Wilk test (see Table 2, p-value<0.001). Second, it effectively handles complex structural models and is suitable for smaller sample sizes. Third, PLS-SEM accommodates both reflective and formative latent variables. Fourth, it was used to a predictive and theory-development orientation, aiming to explain variance and explore complex relationships among constructs rather than solely confirm established theory. Fifth, it enables the assessment of indirect and total effects, facilitates comparison of path coefficients through multi-group analysis, and enhances model precision by examining relationships among multi-item constructs, reducing potential measurement errors. (Hair et al. 2022). Finally, PLS-SEM is more appropriate than covariance-based SEM for this study because the proposed model is oriented toward theory development, prediction, and the analysis of complex capability configurations rather than strict theory confirmation. PLS-SEM is particularly suitable when research involves formative constructs, hierarchical component models, and exploratory relationships, as it focuses on maximizing explained variance rather than reproducing a covariance matrix (Chin 1998; Hair et al. 2022; Henseler, Ringle, and Sinkovics 2009).

3.4 Common method bias

Common method bias (CMB) was addressed at the study's design stage to strengthen the reliability and validity of the research findings. Several procedures were implemented to improve response accuracy, including the careful selection of participants capable of providing well-informed answers, the formulation of precise and unambiguous item statements, the application of counterbalancing techniques to mitigate order effects, and the assurance of respondent anonymity (Sekaran 2016). Furthermore, a measured latent marker variable (MLMV) was employed to evaluate the minimal correlations between the MLMV construct and GICA. The MLMV construct consists of four formative indicators, as defined by Yoshikuni and colleagues. (Yoshikuni, Dwivedi, Filho, et al. 2025; Yoshikuni, Dwivedi, and Dwivedi 2024). The explained variance (R^2) was evaluated with and without the MLMV measure. The change in explained variance for GICA was less than 1%, indicating that common method bias (CMB) was not a significant concern in this analysis. Moreover, the full collinearity-variance inflation factor (VIF) approach was applied, indicating that all VIF values were below the recommended threshold of 3.1, suggesting that common method variance does not threaten the validity of the model estimates. Furthermore, potential non-response bias was assessed by analyzing respondents' roles across all constructs using the Independent Samples T-Test. This analysis revealed no systematic variations, as presented in Table 2.

[Insert Table 2 here]

3.5 Endogeneity test

The endogeneity test involved analyzing Gaussian copula model parameters, referencing latent variable coefficients estimated by PLS-SEM as outlined in Hult et al. (2018). To satisfy the assumptions of the Gaussian copula model, researchers must confirm that variables suspected of endogeneity deviate from a normal distribution (Becker, Proksch, and Ringle 2022; Yoshikuni, Dwivedi, Tito, et al. 2025). The Shapiro-Wilk test results, presented in Table 2, indicate that all examined variables exhibit significant deviations from a normal distribution (Sarstedt and Mooi 2014). Detailed results are provided in Appendix B, indicating that none of the Gaussian copulas tested (i.e., TD, TT, TB HP, HNP, IDC, ISA, CEP, and SC) were statistically significant (all p-values > 0.05). Specifically, when considering GICA's nine predictor constructs as potentially endogenous, the estimated Gaussian coefficients were 0.021 for C_{TD} (p-value = 0.137), -0.006 for C_{TT} (p-value = 0.943), 0.012 for C_{TB} (p-value = 0.936), 0.001 for C_{HP} (p-value = 0.995), -0.337 for C_{HNP} (p-value = 0.111), -0.023 for C_{IDC} (p-value = 0.814), 0.027 for C_{ISA}(p-value = 0.820), -0.062 for C_{SC} (p-value = 0.688), and 0.041 for C_{SC} (p-value = 0.751). Furthermore, additional analyses that considered all other combinations of Gaussian copulas within the model confirmed the absence of significant copula effects (Appendix B). As a result, endogeneity is not present in this study, which supports the robustness and validity of the structural model results (Sarstedt, Ringle, and Ting 2020).

3.6 Measurement model

The reflective measurement model was evaluated for construct reliability, indicator reliability, convergent validity, and discriminant validity. Results are provided in Table 3 and Appendix A. Composite reliability (CR) and Cronbach's alpha (CA) were used to assess internal consistency and construct reliability. All constructs exceeded the 0.70 threshold for CR and CA, demonstrating strong reliability of the reflective latent variables. Convergent validity was assessed using the average variance extracted (AVE), with all values exceeding 0.50, which supports the convergent validity of the constructs (Hair et al. 2022).

[insert Table 3 here]

The constructs' discriminant validity was assessed using three methods: the cross-loading technique, the Fornell-Larcker criterion, and the Heterotrait-Monotrait ratio (HTMT). As illustrated in Appendix A, all retained indicators exhibit loadings greater than 0.70, confirming adequate reliability. Additionally, HTMT values for the reflective constructs remained below the 0.89 threshold, validating the constructs' discriminant validity (Henseler et al., 2015). To evaluate model fit, multiple fit indices were employed, including the standardized root mean square residual (SRMR), and normed fit index (NFI), following recommendations by Hair et al. (2022). The SRMR value was 0.057, remaining below the 0.080 threshold, while the NFI value was 0.781, which, although below the ideal 0.95 benchmark, indicated an acceptable model fit.

[insert Table 4 here]

The DSC construct, structured as a third-order reflective-formative model, was analyzed for multicollinearity and the statistical significance of its indicator weights. The variance inflation factor (VIF) was used to assess multicollinearity, with all measures yielding a maximum value of 2.76 (Table 5), which is below the acceptable threshold of 5 (Hair et al. 2022).

[insert Table 5 here]

3.7 Structural model

Figure 2 presents the structural model generated from PLS-SEM analysis. The assessment of the model involved evaluating the coefficient of determination (R^2), path coefficients (β), and the effect sizes of predictor variables (f^2). Statistical significance of the parameter estimates was assessed using a bootstrapping procedure with 5,000 resamples. The model explained 50.7% of the variance in CEP (R^2=0.507), and 53.1% in GICA (R^2=0.531), indicating strong predictive capability (Henseler et al., 2009). The path coefficient analysis indicates that DSC has a significant direct effect on CEP (DSC→CEP: f^2 = 0.239, β = 0.437, T = 8.293, p-value<0.001), supporting hypothesis H1. Furthermore, CEP exerts a significant influence on GICA (CEP→GICA: f^2=0.090, β=0.245, T=8.980, p-value<0.001), which supports hypothesis H2. Mediation analysis shows that CEP fully mediates the relationship between and GICA, as the direct effect is not statistically significant (DKSP→SUP: f^2=0.008, β=-0.034, T=0.632, p-value > 0.05), supporting hypothesis H3. The direct effect of SC exerts a significant influence on CEP (SC→CEP: f^2=0.171, β=0.362, T=6.083, p-value<0.001), confirming hypothesis H3. However, the results indicate that SC moderation is not significant in the relationships between DSC and CEP (f^2 = 0.000, β = -0.009, T = 0.261, p-value > 0.05) and between CEP and GICA (f^2=0.000, β=-0.039, T = 1.387, p-value > 0.05), providing no support for hypotheses H4 and H5.

[insert Figure 3 here]

The effect size (f^2) analysis showed that all direct effects exceeded the established thresholds of 0.09 for moderate and 2.39 for substantial effect sizes. Furthermore, the control variables industry sector, firm size, and company age were tested and found not to be statistically significant, as their p-values were greater than 0.05.

Prior to multi-group partial least squares (MGA-PLS), the measurement invariance of the composite model (MICOM). The results indicate that compositional invariance was supported by most first-order constructs (p-value > 0.05), with only IDC showing a p-value < 0.05. The second-order construct of tangible, human, and intangible resources (of which IDC is part) and the third-order construct of DSC supported compositional invariance (p-value > 0.05). Therefore, partial invariance was achieved, allowing comparison of path coefficients for the higher-order constructs across groups. MGA-PLS procedure was used to evaluate regional moderation effects by comparing data from Brazilian (n = 203) and French (n = 188) organizations. The analysis revealed statistically significant differences in path coefficients and explained variance (R^2) between these groups. Specifically, significant differences in path coefficients ($p < 0.05$) were found for the relationships between CEP and GICA, as well as SOC and CEP. In contrast, the path coefficient from DSC to CEP did not differ significantly ($p > 0.05$). The R^2 values for CEP and GICA also differed significantly between groups ($p < 0.01$), as shown in Table 6.

[insert Table 6 here]

The mean differences of the first-order constructs were initially assessed using an independent samples t-test (Table 7) to compare Brazil and France. The Shapiro-Wilk normality test indicated a violation of the normality assumption ($p < 0.05$), so the non-parametric Mann–Whitney U test was used instead. This test revealed statistically significant differences ($p < 0.05$) between Brazilian and French organizations, with TD, TT, HP, IDC, ISA, and CEP being stronger in Brazilian companies. In contrast, TB, HNP, SC, and GICA did not show statistically significant differences ($p > 0.05$) between the countries. These findings, supported by both the MGA-PLS and independent samples t-test, indicate differences in path coefficients and construct means between countries, thus supporting hypothesis H6.

[insert Table 7 here]

3.8 Post hoc Analysis

The results offer a deepened understanding of the relationships among DSC, CEP, GICA and SOC. Figure 2 presents a summary of the statistical analysis of the proposed model. While the theoretical framework posits that higher levels of SOC should positively moderate the relationships between DSC and CEP, as well as between CEP and GICA, the PLS-SEM results indicate that SOC does not exert a statistically significant linear moderating effect on these paths. The post hoc analysis aims to assess whether this absence of statistically significant moderation effects in the PLS-SEM model may be related to functional form restrictions rather than to the absence of conditional relationships per se. PLS-SEM evaluates linear moderation effects based on product terms and estimates average conditional effects. However, the strategic management and sustainability literature suggests that the influence of sustainable culture may operate in a nonlinear or threshold-based manner (Chiappetta Jabbour et al. 2020; Danso et al. 2019; Osei et al. 2024; Yang et al. 2025; Zhang et al. 2025).

Accordingly, the post hoc analysis does not aim to replace or contradict the PLS-SEM results, but rather to examine whether potential nonlinear conditional patterns may have been insufficiently approximated by linear interaction terms. This reasoning follows established precedent in the literature. In particular, Wamba et al. (2020) and Yoshikuni and colleagues (Yoshikuni, Dwivedi, Filho, et al. 2025; Yoshikuni et al. 2024) document theoretically expected moderation effects that were not supported in PLS-SEM and subsequently conduct post hoc nonlinear analyses to explain these unexpected results. Our use of GAM is conceptually aligned with this approach and is explicitly presented as exploratory and diagnostic, not confirmatory. Unlike PLS-SEM, which relies on linear specifications and captures only the conditional mean of the dependent variable, GAM provides the flexibility to uncover potential nonlinear moderation effects that may have been missed in the original model (Wood, Goude, and Shaw 2015). Moreover, recent methodological research emphasizes that GAMs are particularly suitable as diagnostic tools when theoretically expected effects are not detected under linear specifications, as they allow researchers to assess whether null findings stem from genuine absence of relationships or from functional form misspecification (Failenschmid et al. 2025).

The model equation will take the form given in (1) and (2):

$$GICA = s(CEP) + s(SOC) + t.e.(CEP, SOC) \qquad (1)$$

$$CEP = s(DSC) + s(SOC) + t.e.(DSC, SOC) \qquad (2)$$

Where, $s(\cdot)$ are univariate smoothers (e.g, penalized splines) and $t.e.(\cdot)$ are bivariate surfaces (tensor products) that capture nonlinear moderation. To this end, we used Python.

The results from the GAM reconcile theory with the data by allowing for a more flexible functional form than that assumed in PLS-SEM. The results show that DSC→CEP path, the effect of DSC is nonlinear (s(DSC), EDoF=12.0***), and the interaction with SOC is significant (te(DSC,SOC), EDoF=5.0***), while SOC alone showed only a marginal effect (s(SOC), EDoF=10.9*). Similarly, for the CEP → GICA relationship is nonlinear (s(CEP), EDoF=12.3***) and that the interaction between CEP and SOC is significant (te(CEP,SOC), EDoF=5.9***), highlighting that sustainable culture moderates this relationship in a contingent manner. These findings contrast with the PLS-SEM analysis, which did not detect statistically significant moderating effects in these relationships.

The 3D plot (Figure 4) was constructed using GAM predictions across a mesh grid of CEP and SOC values (and DSC, and SOC values). At each point of the grid, the predicted level of GICA (and CEP) was estimated. The resulting surface provides a visual representation of how different combinations of CEP and SOC (DSC and SOC) jointly shape the predicted values of GICA (CEP).

[insert figure 4 here]

[insert figure 5 here]

The surface (Figure 5) reveals that, while SOC on its own does not exhibit a strong curvilinear effect, the interaction between CEP and SOC (DSC and SOC) is nonlinear and significant, as indicated by the GAM. The contour of the surface shows that the impact of CEP (DSC) on GICA (CEP) intensifies in contexts with higher levels of SOC, confirming that sustainable culture functions as a contingent moderator, but in a nonlinear way. Thus, the 3D plot visually demonstrates the curvilinear moderation that the PLS model failed to capture. In addition, the 2D plot (Figure 6) was built by tracing the effect of CEP (DSC) on GICA (CEP) at three representative levels of SOC (low, medium, and high). For each fixed SOC level, the GAM predicted GICA (CEP) values across the CEP (DSC) range, enabling a direct comparison of the slopes.

[insert figure 6 here]

Figure 7 shows that at low levels of SOC, the slope of CEP on GICA is smaller, whereas at higher levels of SOC, the slope becomes steeper and more pronounced. This demonstrates that sustainable culture amplifies the effectiveness of adopting CEP, but in a nonlinear fashion: marginal gains are strongest at intermediate to high SOC levels. These results underscore that SUC does not act uniformly, but rather as a contingent moderator that conditions the strength of the CEP and GICA relationship.

[insert figure 7 here]

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4. Discussion

This study examines prior research on the determinants of CEP and GICA to elucidate the role of DSC in addressing SOC across developing and developed economies. Grounded in strategic management, digital technologies, and sustainability literature, it formulates two research questions, proposes a theoretical framework, and empirically tests the resulting hypotheses. The results reveal that DSC acts as a significant predictor of firms' adoption of CEP, which, in turn, enhances GICA through the influence of SOC on CEP. These findings address the first research question (RQ1) by demonstrating that DSC has a direct positive effect on CEP and an indirect effect on GICA. Moreover, CEP exhibits a stronger sensitivity to SOC. However, SOC does not significantly moderate the relationship between DSC and CEP, nor between CEP and GICA. The analysis corresponding to the second research question (RQ2) suggests that geographic region has a substantial effect on how the relationships among the model's constructs manifest across contexts. These results provide several theoretical and managerial implications.

4.1 Theoretical contribution

The findings present several theoretical implications.

Firstly, this study integrates digital technologies to facilitate strategizing through the DSC framework. A firm's capability for digital strategizing has been recognized as a key mechanism for advancing sustainable practice and leverage competitive advantage (Baptista et al. 2021; Morton et al. 2022). While, existing research has yet to thoroughly investigate how firms' adoption of specific competitive strategies can leverage digital strategizing to integrate CEP and thereby enhance their sustainability performance (Morton et al. 2022; Osei et al. 2024). Accordingly, this study advances the literature on strategic management, digital technologies, and sustainability by identifying DSC as a crucial factor in fostering GICA through the implementation of CEP. At the same time, the findings show that these relationships are not universal but contingent on national and organizational contexts: differences in firm size, sectoral composition, and managerial experience between Brazil and France indicate that identical digital strategizing and sustainability capabilities are embedded in structurally distinct organizational environments. The more pronounced effects observed in Brazil, a developing economy, suggest a regulatory environment that places greater emphasis on sustainability, higher natural-resource dependence, and a larger presence of agribusiness and manufacturing dominated by large and mature organizations, reflecting an industrial and primary-sector orientation in which DSC is more closely aligned with circular-economy implementation. In contrast, in developed economies such as France, where firms are more concentrated in commerce and where there is a slightly higher presence of government and mid-sized enterprises, digital technologies tend to be oriented toward efficiency and compliance rather than toward transformative circular innovation. These contextual variations shape how DSC is mobilized, how CEPs are enacted, and how sustainable culture operates, thereby influencing the capacity of firms to generate green innovation through DSC-built CEP, consistent with the dynamic view of digital transformation and organizing, as discussed by Faraj and Leonardi (2022) and Osei et al. (2024).

Secondly, the results show that SOC has no significant effect on the relationships between DSC and CEP and between CEP on GICA. However, the strategic management and sustainability literature in the field suggests that such an SOC effect should be present in the relationships (Chiappetta Jabbour et al. 2020; Danso et al. 2019; Osei et al. 2024; Yang et al. 2025; Zhang et al. 2025). Therefore, the study results contribute by integrating existing arguments on DSC, CEP, and GICA under varying degrees of SOC. It acknowledges that the resource-based framework suggests that linear effects are insufficient to address the influence of sustainable culture moderators. The nonlinear role of SOC may arise because organizational culture depends on how strategy is enacted in practice, shaping employee participation, leadership commitment, and shared sustainability values. Theoretically, this suggests that SOC functions as an enabling context rather than a simple linear moderator, accounting for why similar digital capabilities can yield different sustainability outcomes across organizations. The findings suggest that the absence of moderation in PLS does not invalidate the theory; instead, it highlights a functional misspecification that fails to capture curvature and slope changes that the GAM can reveal (Zhang et al. 2020), thereby contributing to the extant literature on structured equational modeling. Therefore, these results revealed that higher levels of SOC influence the effects of DSC on CEP and CEP on GICA, extending by demonstrating that sustainable culture acts as a nonlinear enabling context, shaping the effectiveness of DSC, CEP, and GICA in developing and developed economies. Moreover, this empirical study addresses the research gaps identified by Kwarteng et al. (2022), by examining how specific conditions of SOC shape circular economy implementation and, in turn, foster green innovation.

Finally, the empirical findings indicate that regional context plays a decisive role in shaping the maturity of DSC, particularly in the adoption of data practices, digital technologies, strategy practitioners' engagement, digital culture, and strategic alignment, as well as CEP, with enterprises in Brazil exhibiting higher levels of maturity than those in France in leveraging these capabilities to enhance GICA. These differences may be justified by structural and contextual characteristics between the two countries: Brazil's vast geographic scale, abundance of natural resources, younger and larger population, and emerging-economy profile generate stronger strategic pressures for firms to align sustainability objectives with digital transformation and innovation by agribusiness and manufacturing enterprises. In contrast, France's smaller territorial scale, older demographic structure, higher per capita income, and more mature, institutionally embedded economic system, closely integrated with European Union regulations, tend to promote more standardized, incremental sustainability practices in commerce and government enterprises. Therefore, empirical evidence shows that Brazilian firms are more responsive to organizational culture and strategic engagement as mechanisms for translating sustainability orientations into green innovation outcomes. Accordingly, this study advances theory at the intersection of digital technologies, strategic management, and sustainability by addressing prior calls for research (Kareem and Kummitha 2025) that examine multiple industries and culturally diverse contexts, thereby offering a more nuanced understanding of how digital technologies influence sustainable practices and green innovation across varied organizational and geographic settings. Therefore, the empirical study shows that developing economies can be more effective than developed economies when emerging economies have abundant natural resources and incorporate sustainable development issues into their government policies.

4.2 Management implications

In addition to its theoretical implications, this study offers several actionable recommendations for practitioners. The findings indicate that management capital orchestrate digital technologies (tangibles) combined with other organizational assets (intangibles) are strategic resources to enable DSC, as well as for developing CEP, which are crucial for achieving GICA under SOC in developed and developing countries. GICA plays a pivotal role in developed and developing dynamic markets, encouraging firms to invest in digital technologies, thereby enhancing strategizing processes among C-level, senior, and middle managers seeking to sustain competitiveness. However, enterprises need to develop programs that disseminate a SOC across all organizational levels, ensuring a consistent understanding of green initiatives among employees and stakeholders. French managers should utilize digital tools to enhance strategic work and enable CEP, achieving GICA gains like those seen in Brazilian enterprises. Moreover, the French government can implement public policies to incentivize local enterprises to adopt green programs and initiatives, thereby leveraging the GICA in mature markets, like Europe.

Finally, for policymakers, the research underscores the critical facets of capacity development that are essential to systematically advance the United Nations Sustainable Development Goals (SDGs). As evidenced by previous studies, balancing CEP across developed and developing economies remains a priority and a challenging task for achieving GICA. The findings indicate that digitally enabled strategizing can support firms in pursuing these dual objectives by enabling CEP implementation and enhancing GICA through the orchestration of organizational resources (tangible, human, and intangible) to address sustainability-related opportunities and challenges effectively. Accordingly, policymakers can promote equitable policy frameworks and more effective regulatory mechanisms, such as green taxation and mandatory corporate social responsibility requirements (Badra, 2024), as well as targeted government incentives that encourage firms to adopt strategic approaches incorporating corporate social responsibility considerations.

4.3 Limitations and future studies

While the study contributes to literature of digital technologies, strategic management and sustainability, it offers avenues for deeper investigation. However, Brazil and France exemplify emerging and advanced economies; their distinct structural factors may limit generalizability. Future research should evaluate the model in other countries, including developed and developing economies, and examine how the unique characteristics and sustainability challenges specific to each context influence the results to leverage competitive advantage. Further research can also develop a qualitative methodology that investigate why, when, where, and how enterprises in countries such as Brazil and France develop differing levels of maturity in DSC and sustainability-oriented practices. Such studies would enable deeper, contextually grounded insights into the underlying organizational, cultural, and institutional mechanisms that shape digital strategizing and sustainable engagement, thereby extending and enriching the findings of this initial study. Second, firms in a different regional context may take on specific competitive orientation strategies. Therefore, it suggests that future studies should examine competitive strategy (e.g., low cost, differentiation, and focus (Porter 1998), and prospector, analyzer, defender, and reactor by Miles and Snow (1978), investigating how a firm's competitive strategy influences the digital strategizing to address sustainable issues and improve competitive advantage. Third, although the paper contributes to research on digital strategizing and sustainability, the evidence centers on three constructs (CEP, SOC, GICA). Future studies should broaden the scope by testing the role of DSC across proximal outcomes (e.g., decision-making performance, business-process performance, organizational agility, strategy momentum, strategic flexibility, dynamic and process capabilities for radical vs. incremental innovation, etc.) and distal green outcomes (e.g., green exploration and exploitation, green ambidexterity, environmental and social performance, corporate reputation, etc.), and by explicitly modeling contingency factors (e.g., environmental turbulence and uncertainty, environmental pressure, digital intensity, etc.). Fourth, structural equation modeling effectively generated predictive evidence for the proposed model (Hair et al. 2022), and generalized additive models provided complementary insights. Future research could adopt additional nonlinear approaches [such as tests for U-shaped (or inverted

U-shaped) effects, quantile regression, and fuzzy-set qualitative comparative analysis (fsQCA)] to better capture heterogeneity and configurational pathways.

5. Conclusion

Evidence shows that DSC, by ROT lens, catalyzes CEP and elevates GICA when firms operate under SOC, regardless of whether the economy is advanced or emerging. Specifically, DSC impacts GICA both directly and indirectly through CEP, and these relationships hold across both economic contexts. Moreover, SOC exerts a strong effect on CEP, and higher levels of DSC, CEP, and GICA are positively associated with higher levels of SOC. Furthermore, Brazilian firms have higher DSC (TD, TT, HP, IDC, ISA) and CEP than French firms, along with larger estimated effects for SOC→CEP and CEP→GICA. The combined use of structural equation modeling and generalized additive models proved robust and effective for operationalizing the proposed research model. Data were collected from 203 Brazilian and 188 French enterprises across diverse industries, organizational sizes, and stages of development. Grounded in the strategic management, digital technologies, and sustainability literature, the study addresses key problems identified in prior research. In doing so, it informs scholarships and practice by clarifying how organizations in developing and developed economies can leverage digital tools to build CEP and, in turn, achieve GICA within SOC.

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Figure 1. Digital strategizing capability construct

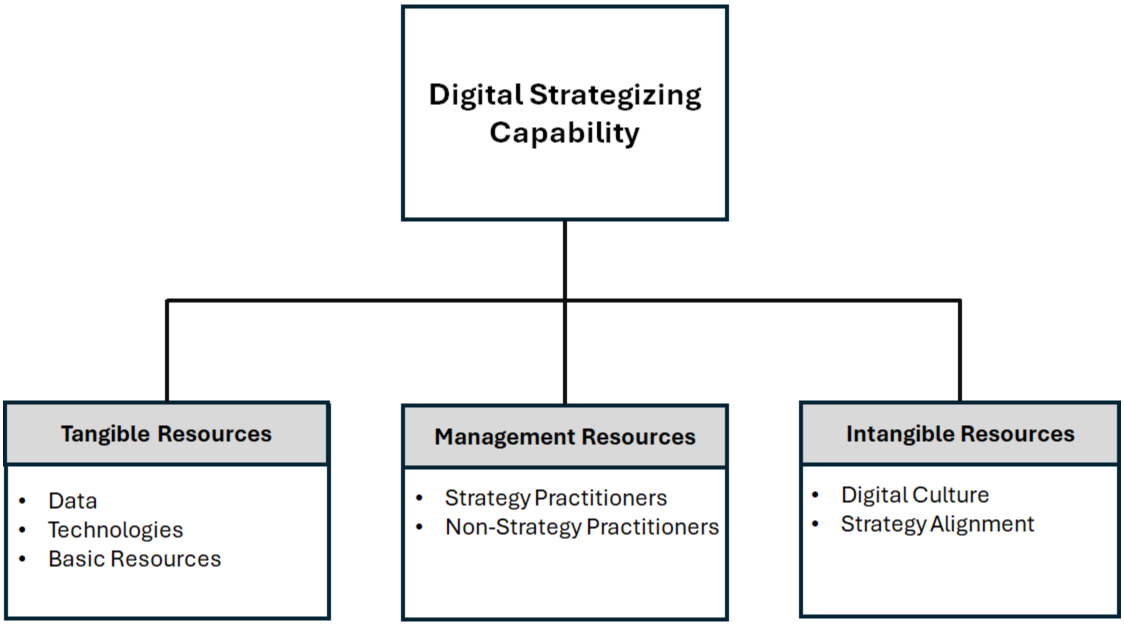


Figure 2. Proposed model

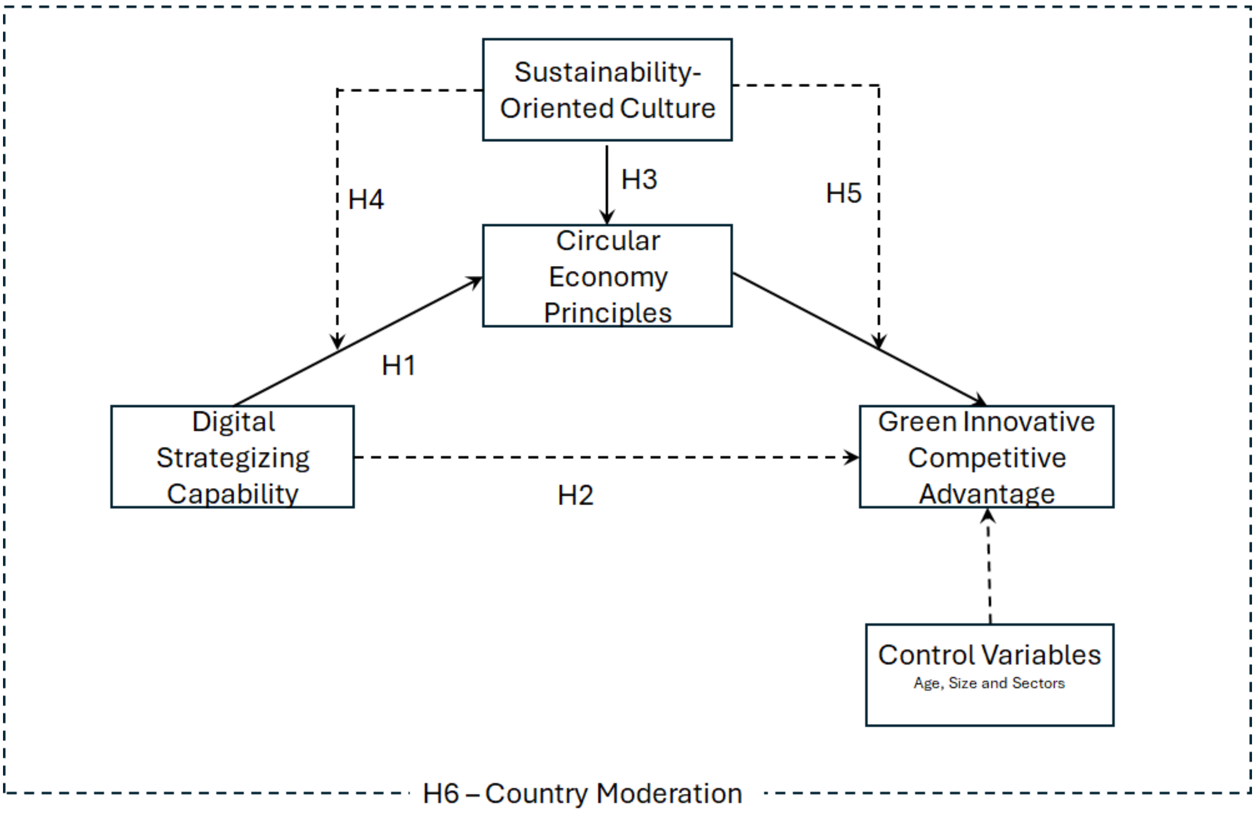
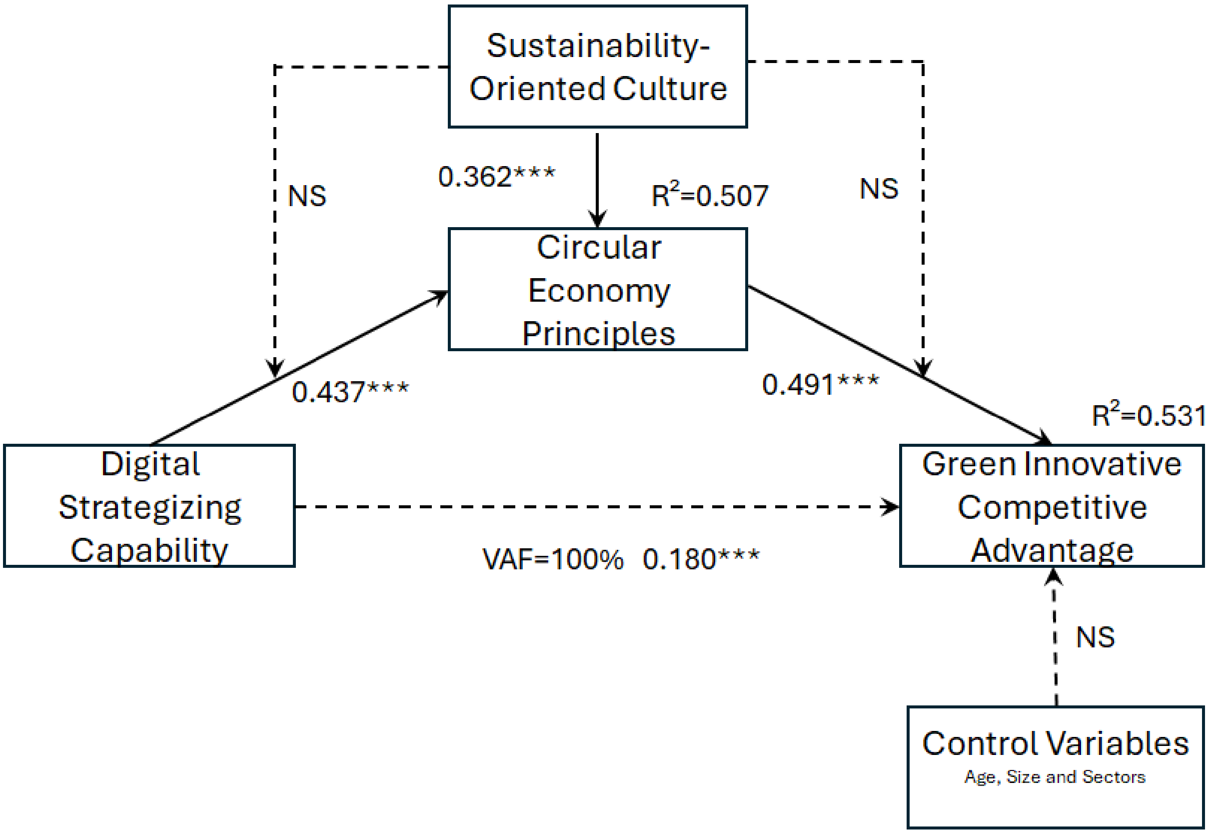


Figure 3. Structural Model



Note: Figure 3 depicts the structural model tested using PLS-SEM, highlighting the hypothesized relationships among constructs. The model was assessed based on path coefficients and explained variance (R^2).

Note 1: P-value < 0.05*, p-value< 0.01**, p-value< 0.001***, VAF: variance account for, NS: no significant.

Figure 4. Interaction surface of DSC x SOC → CEP (GAM)

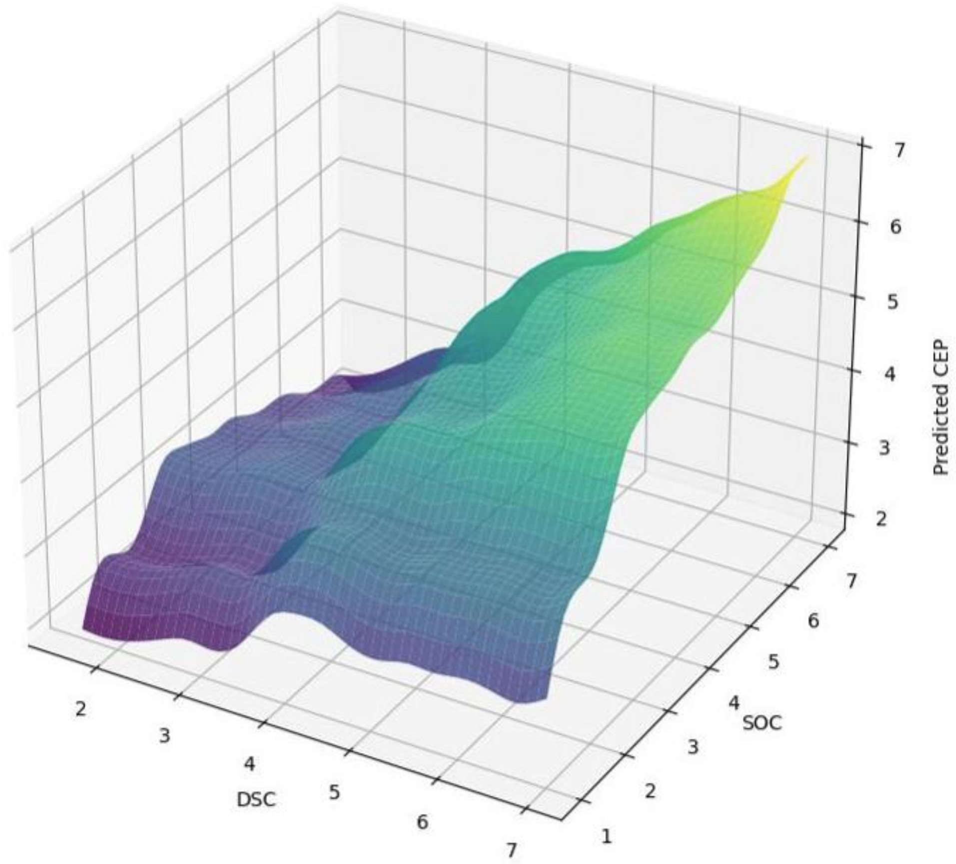


Figure 5. Interaction surface of CEP x SOC → GICA (GAM)

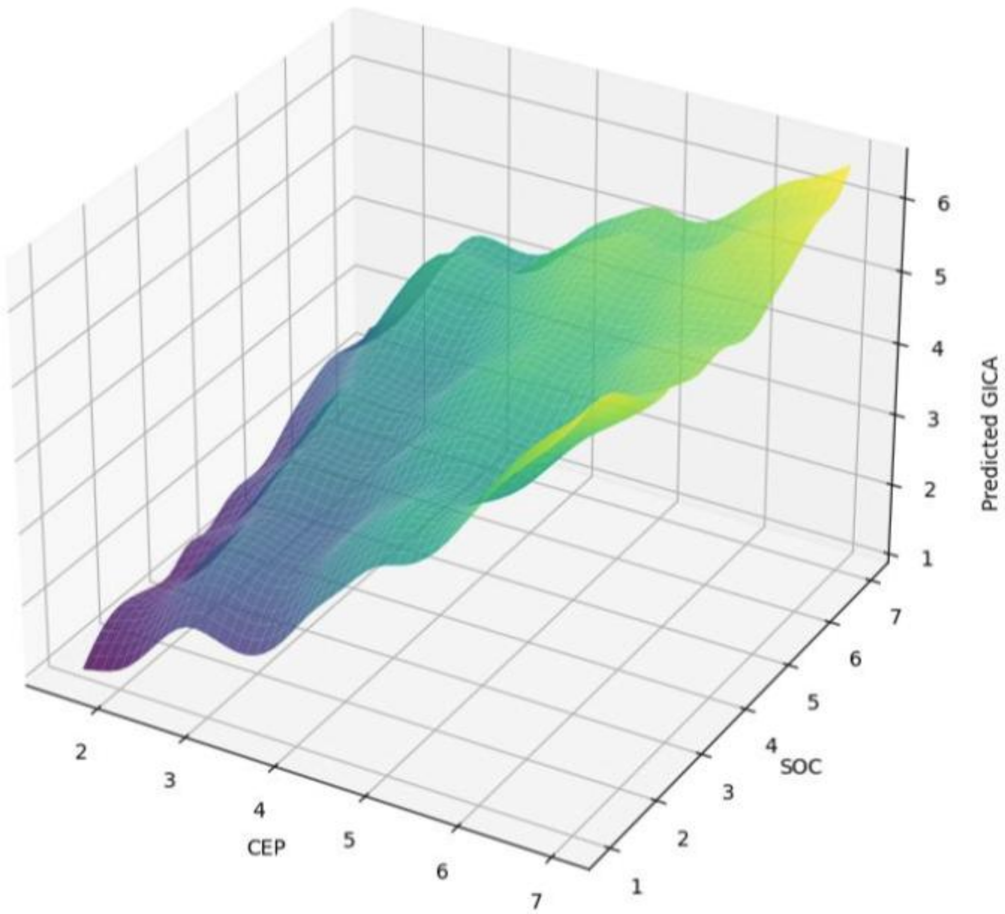


Figure 6. Effect of DSC on CEP at different levels of SOC (GAM)

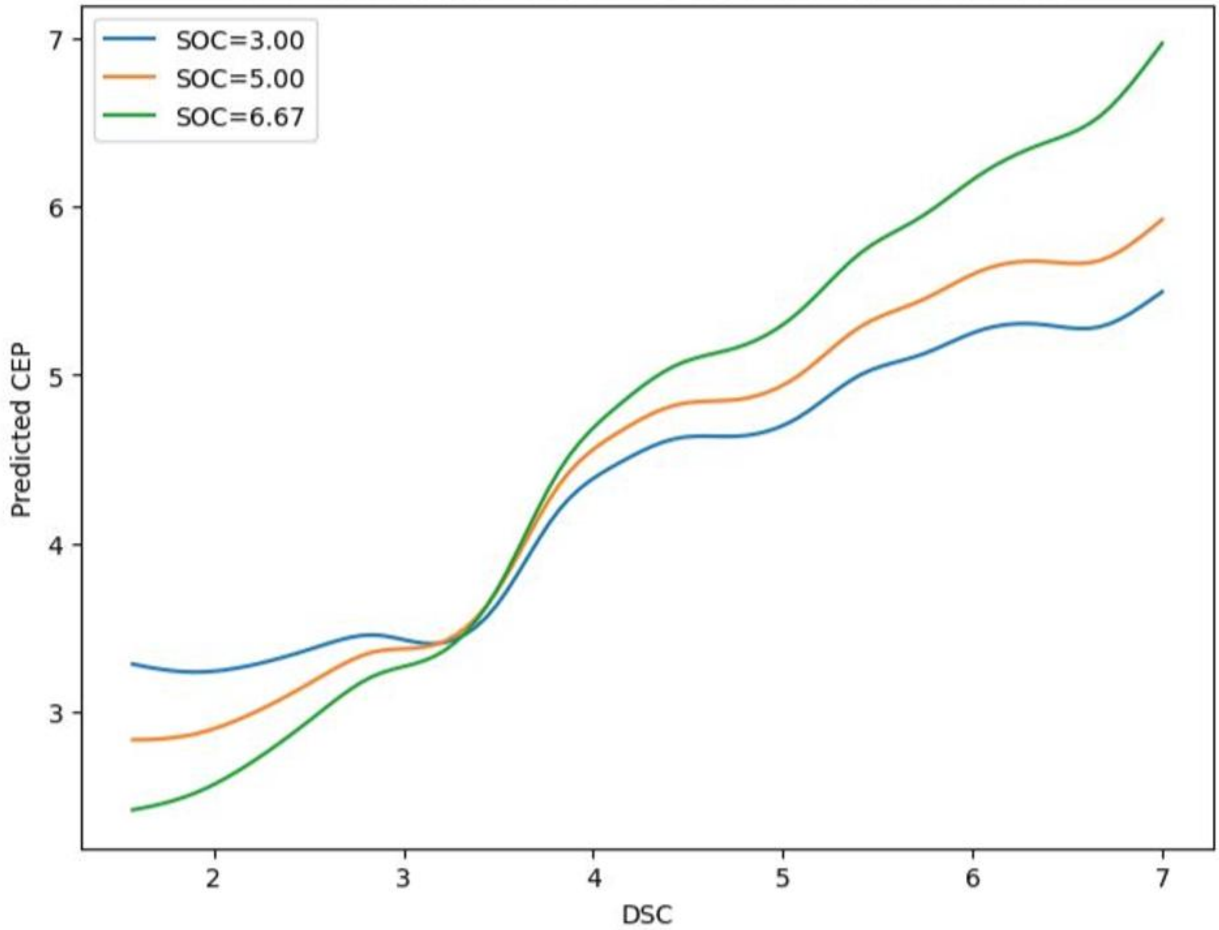


Figure 7. Effect of CEP on GICA at different levels of SOC (GAM)

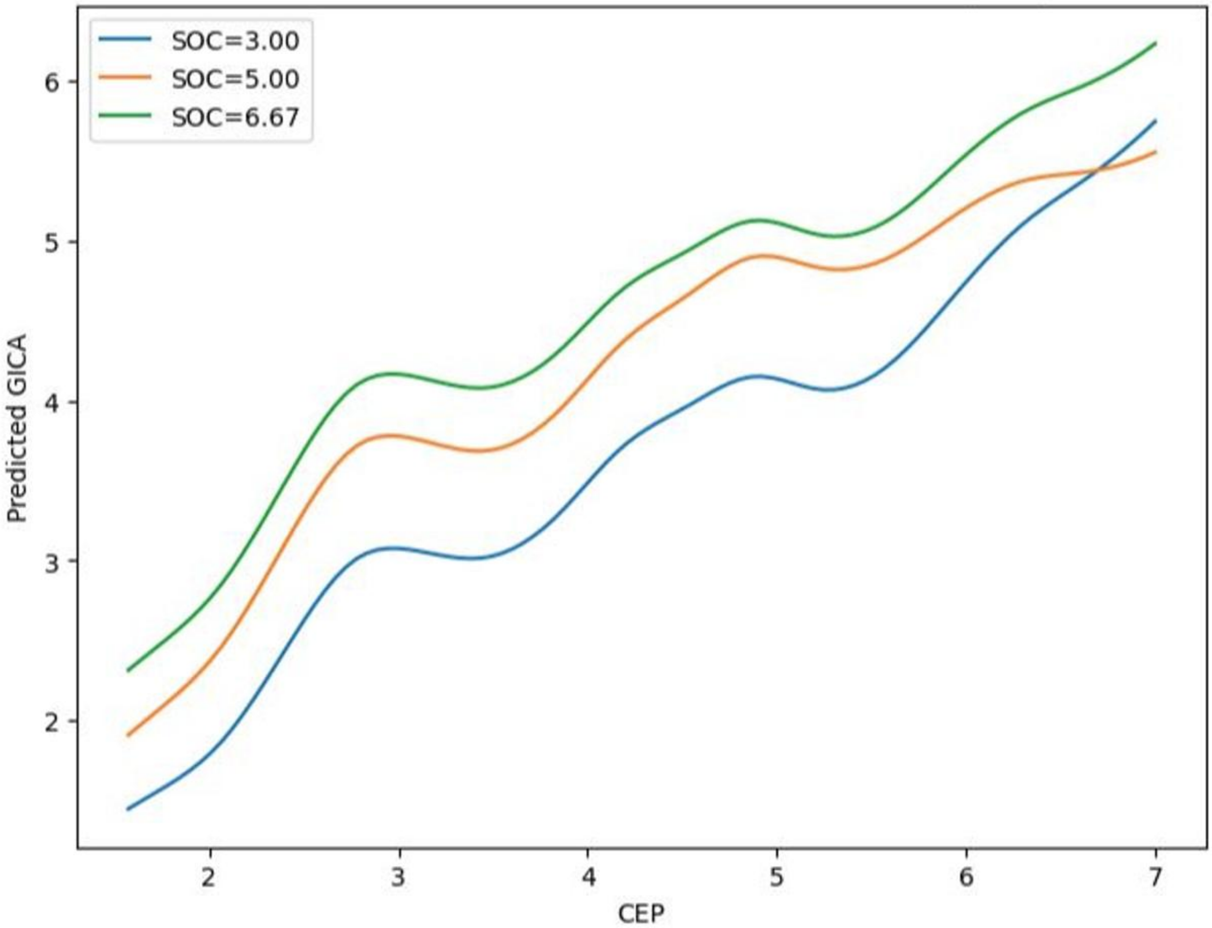


Table 1
Demography characteristics

Characteristics		Brazil	%	France	%
Position of respondent	Senior/executive manager	391	193%	89	47%
	C-level executive	106	52%	99	53%
Age	Young (until 9.9)	62	31%	63	34%
	Medium (10 until 19.9)	28	14%	43	23%
	Maturity (above 20)	113	56%	82	44%
Sector	Agribusiness	23	11%	1	1%
	Commerce	17	8%	45	24%
	Financial	41	20%	46	24%
	Manufacturing	43	21%	31	16%
	Services	73	36%	54	29%
	Government	6	3%	11	6%
Firm Size (number of employees)	Small (until 49)	60	30%	26	14%
	Middle (50 until 249)	34	17%	84	45%
	Large (above 250)	109	54%	78	41%

Table 2
Independent samples T-Test

					95% CI	
		Statistic	p-value	Mean difference	Lower	Upper
TD	Mann-Whitney U	18610	0.683	-2.78e−5	-0.250	0.250
TT	Mann-Whitney U	18271	0.475	5.8E-05	-6.71e−5	0.250
TB	Mann-Whitney U	17980	0.329	6.4E-06	-2.44e−5	0.333
HP	Mann-Whitney U	18129	0.401	2.28E-05	-0.250	0.250
HNP	Mann-Whitney U	18779	0.797	3.6E-05	-0.333	0.333
IDC	Mann-Whitney U	17425	0.140	0.333	-2.93e−5	0.333
ISA	Mann-Whitney U	18859	0.854	8.6E-05	-0.250	0.250
CEP	Mann-Whitney U	18257	0.469	0.167	-0.167	0.333
GICA	Mann-Whitney U	18551	0.704	3.7E-05	-0.250	0.250
SOC	Mann-Whitney U	17116	0.080	3.33E-01	-2.06e−5	0.667

Note: H_a Senior ≠ Middle respondent
Note: TD: Tangible of data, TT: Tangible of technology, TB: Tangible of basic resource, HP: Human of strategy practitioners, HNP: Human of non-strategy practitioners, IDC: Intangible of digital culture, ISA: Intangible of strategy alignment, CEP: Circular economy principles, GICA: Green innovative competitive advantage, SOC: Sustainability-oriented culture, CI: Confidence interval.
Note.Statistic shows $p<0.05$ suggests a violation of the assumption of normality

Table 3
Descriptive analysis and evaluation of convergent and discriminant validity in reflective constructs

Constructs	1	2	3	4	5	6	7	8	9	10
1.TD	0.80									
2.TT	0.65	0.78								
3.TB	0.64	0.47	0.84							
4.HP	0.68	0.61	0.66	0.80						
5.HNP	0.59	0.48	0.62	0.70	0.82					
6.IDC	0.62	0.55	0.56	0.69	0.61	0.87				
7.ISA	0.60	0.46	0.59	0.68	0.59	0.65	0.82			
8.CEP	0.55	0.48	0.49	0.58	0.58	0.56	0.53	0.76		
9.SOC	0.49	0.36	0.51	0.51	0.54	0.47	0.55	0.61	0.88	
10.GICA	0.39	0.31	0.41	0.41	0.46	0.38	0.40	0.67	0.61	0.87
Mean	5.24	5.55	5.04	5.24	4.94	5.26	5.31	5.11	4.75	4.88
Standard deviation	1.08	1.12	1.18	1.13	1.16	1.25	1.13	1.16	1.35	1.39
Shapiro-Wilk W	0.96	0.94	0.97	0.97	0.98	0.95	0.96	0.97	0.96	0.96
Shapiro-Wilk p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Cronbach's alpha	0.8	0.78	0.78	0.81	0.75	0.85	0.84	0.85	0.85	0.89
Composite reliability	0.81	0.79	0.78	0.81	0.77	0.85	0.84	0.86	0.85	0.89
AVE	0.63	0.6	0.7	0.64	0.67	0.76	0.67	0.58	0.77	0.75

Note: TD: Tangible of data, TT: Tangible of technology, TB: Tangible of basic resource, HP: Management capital by strategy practitioners, HNP Management capital by non-strategy practitioners, IDC: Intangible of digital culture, ISA: Intangible of strategy alignment, CEP: Circular economy principles, GICA: Green innovative competitive advantage, SOC: Sustainability-oriented culture, and AVE: Average variance extracted..

Table 4
HTMT analysis

Constructs	1	2	3	4	5	6	7	8	10
1.TD									
2.TT	0.81								
3.TB	0.81	0.60							
4.HP	0.84	0.76	0.83						
5.HNP	0.75	0.61	0.80	0.89					
6.IDC	0.75	0.68	0.69	0.83	0.76				
7.SC	0.59	0.44	0.63	0.61	0.68	0.55			
8.ISA	0.73	0.57	0.73	0.82	0.73	0.77	0.65		
9.CEP	0.66	0.58	0.58	0.69	0.71	0.65	0.73	0.61	
10.GICA	0.46	0.37	0.49	0.48	0.55	0.43	0.70	0.47	0.78

Note: TD: Tangible of data, TT: Tangible of technology, TB: Tangible of basic resource, HP: Management capital by strategy practitioners, HNP Management capital by non-strategy practitioners, IDC: Intangible of digital culture, ISA: Intangible of strategy alignment, CEP: Circular economy principles, GICA: Green innovative competitive advantage, SC: Sustainability-oriented culture.

Table 5
Collinearity analysis

Construct	Measures	Weight	P-value	VIF	R^2_a
Tangibles	TD	0.449	0.001	2.318	0.62
	TT	0.382	0.001	1.740	
	TB	0.338	0.001	1.724	
Human	HP	0.629	0.001	1.953	0.73
	HNP	0.453	0.001	1.953	
Intangibles	IDC	0.503	0.001	1.723	0.74
	ISA	0.597	0.001	1.723	
Digital strategizing capability	Tangibles	0.433	0.001	2.765	0.60
	Human	0.323	0.001	3.218	
	Intangibles	0.327	0.001	2.734	

Note: TD: Tangible of data, TT: Tangible of technology, TB: Tangible of basic resource, HP: Management capital by strategy practitioners, HNP Management capital by non-strategy practitioners, IDC: Intangible of digital culture, ISA: Intangible of strategy alignment.

Table 6
MGA-PLS results from Brazil and England region

Variables relationship	Global (391 Cases)	BR (203 cases)	FR (188 cases)	Path Coefficients Diff. |BR - FR|	Bootstrap MGATest Diff.	Parametric Test Diff.	Welch-Satterthwai Test Diff.
DSC→CEP	0.437***	0.361***	0.516***	0.155	NS	NS	NS
CEP→GICA	0.491***	0.595***	0.362***	0.233	Sig*	Sig*	Sig*
SOC→CEP	0.362***	0.476***	0.170*	0.305	Sig**	Sig**	Sig**
DSC→GICA	-0.034	-0.061	0.026	0.087	NS	NS	NS
Sector→GICA	-0.089	-0.241	-0.157	0.084	NS	NS	NS
Age→GICA	-0.006	0.027	-0.010	0.037	NS	NS	NS
Size→GICA	0.125	0.168	0.134	0.034	NS	NS	NS
R^2 (CEP)	0.507	0.576	0.403	0.173	Sig**	Sig**	Sig**
R^2 (GICA)	0.531	0.627	0.412	0.215	Sig**	Sig**	Sig**

Note: DSC: Digital strategizing capability, CEP: Circular economy principles, GICA: Green innovative competitive advantage, SC: Sustainability-oriented culture.
Note: p< 0.05 *, p<0.01** and p<0.001***

Table 7
Mean difference of constructs from Brazilian and English organizations

Construct	Brazil (Means)		France (Means)		Statistic	P-value	Mean difference	95% CI	
			England			P-value		Lower	Upper
TD	5.45	1.19	5.02	0.91	14030	<.001	0.50	0.25	0.75
TT	5.90	1.13	5.17	1.00	10771	<.001	0.75	0.75	1.00
TB	5.12	1.29	4.96	1.03	17030	0.065	0.33	-5.91e−6	0.33
HP	5.39	1.20	5.09	1.02	15835	0.004	0.25	0.00	0.50
HNP	4.90	1.28	4.99	1.02	18520	0.613	-1.63e−5	-0.33	0.33
IDC	5.40	1.38	5.11	1.06	15563	0.002	0.33	0.00	0.67
ISA	5.46	1.28	5.16	0.94	15291	<.001	0.50	0.25	0.75
CEP	5.21	1.33	5.01	0.94	16211	0.010	0.33	0.00	0.50
GICA	4.75	1.49	4.74	1.19	18917	0.949	0.00	-0.25	0.25
SC	4.86	1.59	4.74	1.19	18596	0.662	0.00	-0.33	0.33

Note: DSC: Digital strategizing capability, CEP: Circular economy principles, GICA: Green innovative competitive advantage, SC: Sustainability-oriented culture.