Business Strategy and the Environment

WILEY | Business Strategy and the Environment

RESEARCH ARTICLE

Fostering Green Entrepreneurship: The Joint Impact of Innovation Capability, Knowledge Sharing and Circular Economy in SMEs in China

Fengsheng Chien[1,2] | Muhammad Sadiq[1,3] | Yunqian Zhang[1,4] | Haonan Lin[5] | Aisha Khan[3]

[1]Carbon Economics Research Institute, Fuzhou University of International Studies and Trade, Fuzhou, China | [2]Faculty of Finance, City University of Macau, Taipa, Macau | [3]School of Accounting and Finance, Faculty of Business and Law, Taylor's University, Subang Jaya, Malaysia | [4]Faculty of International Tourism and Management, City University of Macau, Taipa, Macau | [5]School of Management & Marketing, Taylor's University, Subang jaya, Malaysia

Correspondence: Yunqian Zhang (zhangyunqian@fzfu.edu.cn)

Received: 8 August 2025 | **Revised:** 11 November 2025 | **Accepted:** 17 November 2025

Keywords: circular business design | digital infrastructure | green entrepreneurship | innovation capability | knowledge sharing

ABSTRACT

The need and the emerging opportunity of green entrepreneurship have grown at a considerable pace particularly in the manufacturing and technology-driven small- and medium-sized enterprise sector. The sector should follow sustainable, environmentally friendly, and innovative practices to further reap the benefits of circular economy business approaches. This paper examines how innovation capability, knowledge-sharing culture, entrepreneurial ecosystem support, and circular business design have compound effects on green entrepreneur success in manufacturing and technology-related small- and medium-sized enterprises in China. The study, which is conducted on a population size of 550 small- and medium-sized enterprises and results based on PLS-SEM, establishes that knowledge transfer effectiveness and sustainability mindset are critical mediators and the quality of digital infrastructure is a critical moderator. Results verify an integrated framework that internal capabilities, ecosystem support, and synergy provided by the added impact of digitalization are the prerequisites to attain entrepreneurial sustainability results. These findings offer practical implications to policymakers and managers who may be interested in enhancing green entrepreneurship and future research on sustainable business model innovation.

1 | Introduction

As environmental concerns continue to rise and with the entire world needing to tackle the issue of climate, China stands on the edge of sustainable economic development, which is consistent with the goal of becoming carbon neutral by 2060 and the national strategy of ecological civilization (Geissdoerfer et al. 2022; Kanda et al. 2021). This highlights the importance of green entrepreneurship, especially in the vibrant manufacturing and technology-based small- and medium-sized enterprise (SME) sector, which is central to the promotion of sustainable and environmentally friendly practices and the ability to utilize the principles of a circular economy to gain competitive advantages (Akram et al. 2023). Although there has been increased scholarly and practical attention on green entrepreneurship, there are still important gaps in the knowledge regarding the integrated and context-specified mechanisms that influence sustainable entrepreneurial performance in China's vibrant SME sector. The literature tends to focus on innovation capability (INC), knowledge sharing, entrepreneurial ecosystem support (EES), and circular business design (CBD) as independent antecedents of sustainability performance, with little attempts to test them in a holistic model with empirical results (Lüdeke-Freund 2019; Santa-Maria et al. 2021). Besides, although previous studies recognize the significance of knowledge transfer and sustainability mindsets, their mediating functions in the relationship between organizational and ecosystem-level variables and green entrepreneurial success (GES) have been understudied, especially in terms of the rapid digitalization and transition to a circular economy that is occurring in China (Del Vecchio et al. 2020). Besides, despite the acknowledged importance of digital infrastructure as a contributor to innovation and sustainability, the moderating role of digital infrastructure in increasing the impact of knowledge transfer and sustainability attitudes on entrepreneurial outcomes has not been well understood (Le et al. 2022).

The rise in consumer interest in sustainable products and services, as well as the escalating problems with the scarcity of resources, implies that companies must reconsider the prevalent linear business models and consider more circular, knowledge-based, and even collaborative ones (Blok 2018; Castro Oliveira et al. 2021; Panait et al. 2022). This shift can be related to the resource-based view (RBV) and knowledge-based view (KBV) models, according to which special organizational competencies, including innovation and knowledge sharing, are essential to the attainment of sustainable competitive advantage in sustainability-driven markets (Cohen and Levinthal 1990; Grant 1996). The Chinese manufacturing and technology industry with such a high impact, size, and dynamics in this paradigm offers a significant test ground for GES and business model innovation theories (Mondal et al. 2023a).

Although research on green entrepreneurship is increasingly scholarly and practical, there remain critical gaps in the literature about how the factors at organizational and ecosystem levels interactively contribute to the realization of sustainable entrepreneurship in fast-changing industrial China. The literature at hand is more likely to separate the capacity for innovating, knowledge sharing, ecosystem support, and CBD as individual antecedents of sustainability performance and rarely adds to an integrative and empirically tested model (Lüdeke-Freund 2019; Santa-Maria et al. 2021). In addition, the interaction of these variables with each other through the mediation of knowledge transfer effectiveness (KTE) and entrepreneurial sustainability mindset (ESM) is underresearched, especially in the situation when digital transformation and the principles of a circular economy are converging rapidly. Furthermore, while digital infrastructure is becoming an increasingly popular facilitator of innovation and sustainability in China, the moderating impact of digital infrastructure on the outcomes of entrepreneurship is not well known (Le et al. 2022).

Integrated, context-specific understanding of how INC, knowledge sharing, EES, and CBD jointly drive GES in the dynamic industrial environment of China, especially with the impact of fast digitalization and CE transitions, is missing. The increasing rate of digitalization and the central position of ecosystem coordination make this challenge more difficult and offer opportunities and challenges to entrepreneurs, who must strike a balance between ecological, economic, and social goals (Castro Oliveira et al. 2021; Theodoraki et al. 2022). Despite the relevance of the individual capabilities or individual elements of the ecosystem being emphasized in past literature, very little has been mentioned in the context of the integrated effect or the conditionality of the role of digital infrastructure to transform knowledge and sustainability mindset into entrepreneurial success (Chaudhuri et al. 2022; Del Vecchio et al. 2020). The present study addresses this critical gap by offering a holistic model, which does not only combine these factors but also empirically confirm the interconnection and conditional influences in the very specific setting of Chinese SMEs, where digitalization and the concept of CE are quickly transforming the ways of entrepreneurship.

This paper fills these gaps, through the development and testing of an integrative framework that combines RBV, KBV, dynamic capabilities theory (DCT), entrepreneurial ecosystem theory (EET), and circular economy theory (CET). In contrast to earlier research, which either tends to be dimension specific or lacks any context-specific data, this study evaluates the synergistic relation of INC, knowledge-sharing culture (KSC), EES, and CBD, mediated by KTE and ESM and moderated by digital infrastructure quality (DIQ), in the context of the fast-changing Chinese SME scenario. This paper bases its theoretical framework on the RBV that underlines how firm-level resources and capabilities including innovation and knowledge sharing are critical factors that lead to sustainable competitive advantage in green entrepreneurship. In order to deepen this centralized view, complementary theories, including KBV, DCT, EET, and CET, are applied in the study to formulate a multidimensional model (see Figure 1) that is empirically tested and that includes the direct and mediated connections between organizational and ecosystem-level antecedents and green entrepreneurship outcomes, respectively. This study narrows down its scope on how internal capabilities are the catalysts of GES by making RBV the focal point, and the complementary theories add further insight into the knowledge processes, adaptive capabilities, ecosystem dynamics, and circular business practices.

This research undertakes three objectives that are theoretically based. First, based on RBV and DCT, it will empirically explore the individual and synergistic impact of INC, KSC, EES, and CBD on GES in Chinese SMEs under the hypothesis that the combination of these factors improves sustainable results. Second, based on KBV and EET, it analyzes the mediating functions of KTE and ESM between organizational and ecosystem-level antecedents and entrepreneurial performance and hypothesizes that these two mediators play a key role in converting capabilities into sustainable performance. Third, it uses the technology–organization–environment (TOE) framework to determine the moderating influence of the DIQ on the relationships between knowledge transfer, sustainability mindset, and GES by hypothesizing that a strong digital environment can enhance these effects. By considering these goals, this work contributes to the existing literature on sustainable entrepreneurship by offering a detailed, contextualized insight into the manner these variables interact to propel GES in China, in response to calls to develop more integrated and contextualized analyses in the study of sustainable entrepreneurship (Santa-Maria et al. 2021).

In numerous aspects, this work is very significant. Theoretically, it advances the field of sustainable entrepreneurship by introducing a multidimensional perspective of it, conceptualizing the RBV, KBV, DCT, EET, and CET into

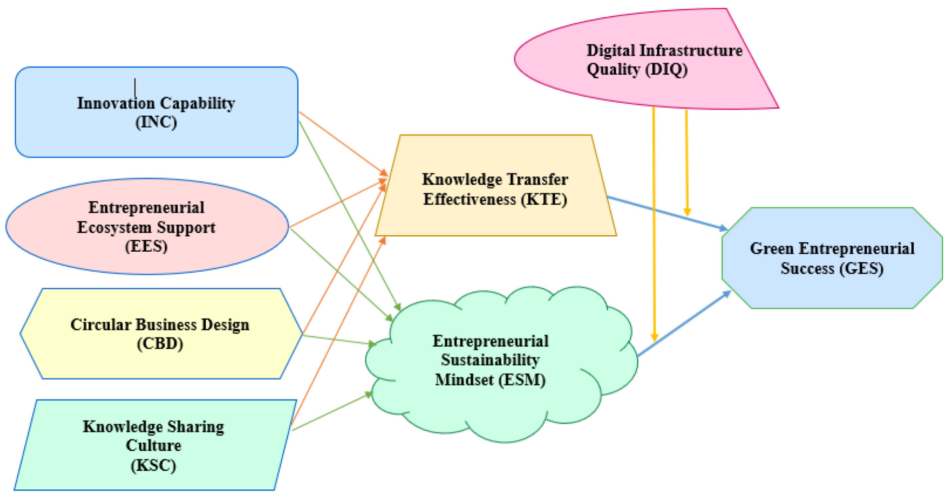

FIGURE 1 | Conceptual framework of green entrepreneurial success.

a single empirical mode. This holistic approach is a response to the calls in the literature for a more complex and contextualized approach to the study of the antecedents and processes of sustainable business model innovation (Lüdeke-Freund et al. 2019; Santa-Maria et al. 2021). In practice, the results provide practical implications to Chinese policymakers, ecosystem coordinators, and SME leaders who may want to improve green innovation, knowledge mobilization, and the adoption of circular business in the quest to achieve national sustainability objectives. The study also educates on digital transformation strategies that could hasten the low-carbon, CE transformation in China by emphasizing critical roles played by digital infrastructure and knowledge processes (Le et al. 2024; Li et al. 2023).

The rest of this paper is organized in the following way. Following the current introduction, the literature review summarizes the theoretical and empirical literature on green entrepreneurship, INC, knowledge sharing, entrepreneurial ecosystems, and CBD and the mediating and moderating processes involved in the presented model. The following methodology section outlines the research design, data collection, and analysis strategy used to test the model within the Chinese manufacturing and technology SME environment. The results section shows the findings of the structural equation modeling analysis, and the discussion puts the results into the context of the existing body of literature and examines their theoretical and practical implications and the limits and directions of future research. The paper ends with a conclusion and recommendations for policies, as well as a summary of the main contributions to the areas of sustainable entrepreneurship and circular business model innovation.

2 | Literature Review

2.1 | Theoretical Framework

This study combines RBV, KBV, DCT, EET, and CET to conceptualize the linkages between INC, knowledge sharing, EES, CBD, and green entrepreneurial outcomes. All these theories highlight the importance of firm-level resources, knowledge processes, adaptive capabilities, ecosystem interactions, and sustainable business model innovation in creating environmental and economic value (Cohen and Levinthal 1990; Grant 1996; Spigel 2017; Teece et al. 1997). Both RBV and KBV hold that firm-level resources, especially INC and KSC, are essential sources of competitive advantage in markets that are driven by sustainability (Cohen and Levinthal 1990; Grant 1996). Whereas RBV puts an emphasis on the importance of unique resources, including innovation skills, in the realization of excellent performance, KBV points to knowledge as a strategic resource, which contributes to the recognition of opportunities and eco-innovation (Zahra and George 2002). These theories when combined can explain how internal capabilities, INC and KSC, can help firms seize and exploit green opportunities using KTE and ESM. DCF is complementary to RBV and KBV because it deals with the capability of a firm to change and reorganize resources based on quickly evolving conditions (Hällerstrand et al. 2023). It makes INC a dynamic capability enabling eco-innovation and business model adjustment to connect internal resources to external opportunities. The theory is specifically applicable in China, which is experiencing rapid change in its industrial environment, wherein companies have to develop new ideas consistently in order to keep pace with the sustainability requirements (Li et al. 2023).

EET and CET move the emphasis to external motivators of green entrepreneurship. EET focuses on how networks, institutions, and resources can assist in entrepreneurial activity (Theodoraki et al. 2022). It highlights EES as an enabler of access and partnership of resources, which allows firms to break down sustainability barriers. CET adds to this by supporting CBD, which streamlines resource cycles and reduces environmental impact with closed-loop systems (Kirchherr et al. 2017). These theories, in combination, emphasize the role played by the networks of external and sustainable business models in enhancing the firm-level initiatives in the realm of GES. The ESM relies on the theories of sustainable entrepreneurship and entrepreneurial cognition, focusing on how the values and orientations of leaders can facilitate the coordination of innovation and ecosystem resources with environmental objectives (Hockerts and Wüstenhagen 2010). ESM mediates the connection between firm-level and ecosystem-level antecedents and GES and directs capabilities towards sustainable results. Equally, KTE, which is based on KBV, mediates by converting knowledge-sharing practices into actionable innovations (Makhloufi 2023).

This combined framework meets important research gaps by integrating internal (RBV, KBV, dynamic capabilities) and external (entrepreneurial ecosystem, CE) points of view into a unified framework. The conceptual framework in Figure 1 shows that the convergence of INC, KSC, EES, and CBD drives GES via KTE and ESM, and DIQ is one of the most important moderators. The model combines RBV and KBV in terms of how internal resources (INC, KSC) develop knowledge and sustainability mindsets, dynamic capabilities to indicate adaptive innovation, and EET and CET to indicate external support and sustainable business models. This unifying model is able to describe the interactions between organizational capabilities, the dynamics of ecosystems, and the enablement of digital technology to give a clear and holistic account of the success of green entrepreneurship in Chinese SMEs (see Figure 1).

2.2 | INC

Companies that have a greater INC are more capable of recognizing useful external information and incorporating the same into the company (Cohen and Levinthal 1990). This has a direct positive effect of enhancing the success of knowledge transfer since it lowers the barriers to assimilation. Innovative organizations develop new technologies and processes that act as boundary objects, which allow the syntactic, semantic, and pragmatic alignment of knowledge senders and receivers (Zhang et al. 2024). This minimizes the stickiness of knowledge and the cost of transfer across the organizational boundaries. Consequently, INC helps in streamlining and making knowledge flows more successful (Kowshik et al. 2025). Companies that have high innovation potential usually have reward systems that are based on learning and novelty that encourage employees to engage in behaviors that are associated with knowledge acquisition and sharing. Empirical studies indicate that the orientation to innovation plays an important role in enhancing the connection between knowledge-sharing processes and transfer performance (Truong et al. 2024).

Companies that are highly innovative have high possibilities to create eco-innovations, comply with environmental policies, and introduce sustainable market opportunities by taking the initiative (Shao et al. 2023). Borah et al. (2021) defined that the ability of green innovation that is built on knowledge acquisition and relational skills increases the success of new products. In the case of entrepreneurship, Albort-Morant et al. (2016) argue that dynamic capability, like innovation, is necessary to commercialize green innovations. RBV and DCT offer a hypothetical perspective of INC, which implies that the companies that possess distinctive innovational resources and capability to adjust to varying environments can attain long-lasting competitive advantages (Teece et al. 1997). Nevertheless, the literature does not have a cohesive framework that looks at the interaction of INC and knowledge processes and ecosystem support within a circular economy environment.

H1a. *INC positively influences KTE.*

H1b. *INC positively influences ESM.*

2.3 | EES

Ecosystems of entrepreneurship promote the culture of openness, two-way exchange, and speed of experimentation, contributing to the decrease of knowledge hoarding and increasing voluntary disclosure (Schnell and Berger 2025). Knowledge diffusion therefore takes place through ecosystem-wide norms. Entrepreneurial ecosystems offer essential tangible and intangible resources that lower knowledge acquisition barriers. It assists companies in acquiring greater absorptive capacity to better internalize external knowledge (Rossi et al. 2022). Government agencies, universities, and industry associations are the ecosystem players that establish formal systems that legitimize and simplify knowledge transfer by diminishing uncertainty in the exchange of knowledge between organizations (Barbini et al. 2021). Ecosystem support is therefore a facilitator of knowledge transfer because it empowers the recipient to identify, internalize, and use new knowledge.

Moreover, EES has a positive impact on ESM due to the availability of sustainability-oriented resources that develop cognitive frameworks of long-term, triple–bottom-line thinking. Entrepreneurs are introduced to knowledge and tools that are specific to sustainable practices, and mindsets towards profit-focused approaches are changed to planet-inclusive approaches through ecosystems providing green incubators, sustainability grants, and ESG training (Fichter and Hurrelmann 2021). Sustainability is also a strategic imperative that is legitimized by institutions, and therefore, the entrepreneurs have to rebrand it as a competitive need. Circular innovation tax credits and public procurement favoring green start-ups are a signal of institutional legitimacy, which leads to mimetic adoption of sustainability practices (Huo et al. 2025). Moreover, sustainability-oriented ethical networks enhance the standards of sustainability by social learning and peer validation. Within cleantech clusters or circular economy hubs, entrepreneurs develop sustainability mindsets through vicarious learning and identity integration with other like-minded individuals (Scott et al. 2022).

H2a. *EES positively influences KTE.*

H2b. *EES positively influences ESM.*

2.4 | CBD

CBD creates a setting that promotes the effectiveness of knowledge transfer by inculcating systemic collaboration, iterative learning, and shared value creation among the stakeholders. In particular, the restorative and regenerative purpose of circular models implies the necessity to maintain information flow among supply chain partners continuously to streamline material flows and reduce waste, facilitating faster tacit and explicit knowledge diffusion (Sadiq et al. 2024). Moreover, the multi-actor networks of the circular business models facilitate absorptive capacity and relational governance, which mediate the flow of complex sustainability-related knowledge. As Palmié et al. (2021) have discovered, circular design principles contribute immensely to reducing knowledge stickiness and enhance the results of transfer through formal feedback loops and digital traceability systems. Also, the product life extension and servitization of circular designs foster the longitudinal knowledge building and co-creation between manufacturers and consumers, increasing the transfer effectiveness (Pieroni et al. 2019).

Additionally, CBD helps in influencing an ESM to create long-term value and become an environmental steward. Circular models embraced by entrepreneurs transform the linear, take–make–dispose paradigms to new, innovative ways of reducing waste and maximizing resource circulation, which in turn develop a mindset towards resilience and ecological balance (Sadiq et al. 2024). This design philosophy fosters systemic thinking, in which sustainability is factored into business strategy, raising entrepreneurs' awareness of the effects on future generations and fostering proactive adjustment to environmental limitations (Kirchherr et al. 2017). Moreover, circular business models provide motivation to be sustainable intrinsically when profit is balanced with planetary boundaries, which is demonstrated in the example of firms gaining competitive advantages with the help of remanufacturing and product-as-service business models, which further strengthens the commitment of entrepreneurs to sustainable innovation (Abu-Bakar et al. 2024). The integration fosters an entrepreneurial orientation that is holistic and considers sustainability as a cost rather than as an aspect of long-term success (Rocha et al. 2023).

H3a. *CBD positively influences KTE.*

H3b. *CBD positively influences ESM.*

2.5 | KSC

KSC has an effect on KTE since it creates an atmosphere of openness, trust, and mutual support that can cause people to freely share tacit and explicit knowledge, lessening barriers to information sharing like withholding of information and increasing the reliability and speed of its transfer. As organizational norms facilitate voluntary contribution and collaboration, employees tend to participate in interactive activities such as mentoring or storytelling that enable learning complex knowledge that cannot be easily coded (Kodama 2025). The presence of a strong KSC is a strong predictor of elevated levels of KTE due to increased interpersonal trust and decreased hoarding behaviors (Sun et al. 2022). Moreover, cultures that focus on collective learning and systems of rewards based on sharing have been identified to enhance the cross-border flows of knowledge that result in quantifiable improvements in the outcomes of innovation and performance (Ozlen and Handzic 2021).

KSC in organizations creates a sustainability frame of mind by facilitating the fast spread of creative practices, resource-effective strategies, and long-term environmental and social thinking that are needed in sustaining ventures. The open sharing of knowledge on the topic of CE models or resilient supply chains fosters adaptive thinking, which focuses on the long-term sustainability perspective rather than short-term profits (Kodama 2025). Manohar (2024) opined that knowledge-sharing orientation is very strong in creating absorptive capacity, so firms can incorporate sustainability-oriented knowledge in their core competencies, which in turn consolidates an entrepreneurial mindset that aims at achieving triple–bottom-line results. KSCs are associated with increased pro-environmental practices and sustainable entrepreneurship because shared stories and co-creation of solutions entrench sustainability as a value (Ye et al. 2022). This mitigates the risks related to resource depletion and empowers the entrepreneurs to visualize and pursue projects that endure for a long time.

H4a. *KSC positively influences KTE.*

H4b. *KSC positively influences ESM.*

2.6 | KTE

KTE brings together the environmental technologies and green strategies that enable entrepreneurs to create competitive advantages in resource efficiency and market differentiation (Cohen and Levinthal 1990). Companies with high absorptive capacity have better chances to adopt green innovation because they are able to quickly convert sustainability-oriented knowledge into viable results (Zahra and George 2002). Knowledge-sharing networks facilitate resilience to entrepreneurship and lower the chances of failure in unstable markets where the environment is eco-friendly, as they help to access regulatory and technological knowledge in a timely manner (Del Rio et al. 2025). Additionally, there exists a direct linkage between the commercialization success of green innovations and the KTE, including mentorship programs and interorganizational alliances, highlighting the importance of innovation in transforming environmental intent into commercial products (Kiefer et al. 2019).

KTE plays a key mediating role between the relationship of INC, EES, CBD, KSC, and GES because it helps in translating various inputs into actual green outputs. To promote GES, INC uses effective knowledge transfer to spread eco-innovations across organizational boundaries to support the delivery of innovative ideas to promote organizational success (Cohen and Levinthal 1990). Fernando et al. (2019) discovered that KTE partially mediates the positive relationship between INC and GES because it facilitates the transformation of R&D outputs into commercially viable and environmentally friendly solutions. The connection between innovative green technologies and entrepreneurial success indicators like revenue increase and the reduction of environmental impacts is bridged by effective internal and external knowledge flows (Andreini et al. 2022). EES reinforces green ventures when the mechanisms of knowledge transfer mediate the effect of the ecosystem on sustainable outcomes (Cantner et al. 2021).

CBD relies on KTE to match stakeholders with closed-loop processes, which mediates its role towards green success by facilitating the practical implementation rather than the conceptual design (Kirchherr et al. 2017). Knowledge transfer can effectively absorb and reconfigure the insights of the circular design into the entrepreneurial capacities, improving GES (Odeyemi et al. 2024).

Companies that have better KTE can speed up the process of transforming the principles of a circular design into scalable green business models (Pieroni et al. 2019). The knowledge transfer can ensure that insights related to sustainability are processed efficiently and absorbed, through linking performance to cultural enablers (Truong et al. 2024). KTE converts tacit and explicit knowledge into practical competencies that directly promote GES as demonstrated by more resource-efficient processes, less environmental impact, and sustainable market advantages (Jilani et al. 2020). The high KTE organizations have better associations between the sharing norms and green performance, which validates its mediating role in the attainment of GES (Chen et al. 2025).

H5a. *KTE influences GES.*

H5b. *KTE mediates the relationship between INC, EES, CBD, and KSC and GES.*

2.7 | ESM

ESM affects GES by developing new business models that help reconcile profitability and planetary health. Entrepreneurs who reflect this approach place importance on triple–bottom-line performance, resulting in sustainable performance that appeals to the eco-conscious consumer and green investments, thus increasing competitiveness in the market and the sustainability of a venture (Dean and McMullen 2007). This mentality generates the identification of opportunities in environmental issues, where constraints can be converted to make green and viable ventures. The entrepreneurship, which is focused on sustainability, is more successful in terms of innovation and survival in the eco-markets than the traditional counterparts (Hockerts and Wüstenhagen 2010). In addition, it develops resilience by means of adaptive measures that reduce regulatory risks and take advantage of new green policies leading to an excellent financial performance and stakeholder confidence in sustainable start-ups (Schaltegger and Wagner 2011). Companies that are actively managed by people with a powerful sustainability attitude have higher GES and reputational capital, which highlight the importance of the sustainability mindset as a key precondition to succeed in the green economy (Khizar et al. 2021).

ESM is a critical intermediary between the INC, EES, CBD, and KSC and GES because it changes cognitive orientations concerning long-term ecological viability and resource efficiency. INC promotes GES when it is directed by the sustainability mindset where the environmental impact is more important than short-term benefits (Yodchai et al. 2022). ESM refocuses innovation activities to be consistent with the green performance indicators, including lower carbon footprints and a circular economy. Jansson et al. (2017) discovered that the sustainability mindset can justify the difference in the translation of technological and organizational innovations into sustainable competitive advantage. EES increases the viability of green ventures through an implicit sustainability culture that connects the external enablers with environmentally friendly decision-making (Rajpal and Singh 2024). When entrepreneurs become more sustainability minded, they tend to see signals of the ecosystem as an opportunity to act instead of a compliance mandate (Avelar et al. 2024). As a cognitive and behavioral aspect, ESM converts the inputs of the ecosystem into GES by matching the external resources to proactive and value-oriented decision-making (Ploum et al. 2018).

CBD propels GES by a sustainability culture that puts circularity at the center of its values, and not a compliance strategy (Klofsten et al. 2024). ESM helps entrepreneurs understand circular models as fundamental value-generating processes that promote adaptive capacity and alignment with stakeholders. Sustainability-oriented cognitions mediate the impact of circular practices on venture growth and reduction of environmental impact. An active sustainability attitude can assist companies in attaining high green performance indicators, including lower carbon footprints and increased profitability through circular products (Mehrotra and Jaladi 2022). In addition, KSC enhances GES through the diffusion of sustainability-related knowledge among stakeholders, but through the mediation of the ability of the mindset to make sense of and utilize common knowledge to drive regenerative objectives (Li et al. 2023). In particular, as KSC facilitates free trade of green technologies and sustainable practices, it develops cognitive frameworks in people, which attach more value to environmental viability in the long term and economic benefits, converting common knowledge to exploitative entrepreneurial actions that lead to green success (Shu et al. 2020). The sustainability attitudes improve the transfer of shared knowledge to new green initiatives, which results in the best performance (Jansson et al. 2017).

H6a. *ESM influences GES.*

H6b. *ESM mediates the relationship between INC, EES, CBD, and KSC and GES.*

2.8 | Moderating Effects: DIQ

DIQ offers powerful technological platforms that enhance information sharing, real-time cooperation, and decision-making based on data. Quality digital infrastructure improves KTE by minimizing communication latency and providing an opportunity to spread eco-innovative practices in a short period of time, improving the capacity to transfer sustainability-related knowledge into feasible green business opportunities (Cosa 2024). Virtual knowledge-sharing through digital tools increases the efficiency of the absorption and application of transferred knowledge, which results in a higher percentage of successful green product launches and market penetration than in cases with poor infrastructure (Kohtamäki et al. 2019). In contexts of high digital infrastructure, the knowledge transfer processes enable the entrepreneur to combine the complex knowledge of the environment more successfully, enhancing the impact of innovation and entrepreneurial performance (Cantner et al. 2021).

Companies that make use of advanced digital backbones are more efficient in the knowledge transfer to performance, particularly in sustainability-oriented settings where quick adaptation to regulatory and market changes is crucial (Nambisan et al. 2019).

Sustainability mindset makes entrepreneurs have the mental focus to make long-term environmental sustainability and economic objectives their priorities (Barrachina Fernández et al. 2021), and the ability to convert this mental focus into GES frequently depends on the availability of sophisticated digital technology. High-quality digital infrastructure allows monitoring the environment in real time, streamlining supply chain management, and collaborating with stakeholders, which reinforces the mindset–success connection (Brynjolfsson 2014). The high-level digital twins and IoT sensors allow entrepreneurs who hold a strong sustainability mindset to continuously improve low-carbon products, which is an affordance that is highly limited in the case of poor infrastructure (Tao et al. 2019). Idrees et al. (2025) discovered that the positive relationship between sustainability-oriented entrepreneurial cognition and firm-level green performance was much more prominent in regions with better digital connectivity. In the same manner, Kulp and Mrożewski (2025) have shown that the DIQ moderated the mindset–success relationship, meaning that green innovations powered by the mindset are more successful with the aid of high-quality digital infrastructure. On the other hand, bad digital infrastructure weakens the linkage by imposing frictional costs that compromise the entrepreneur in responding to sustainability insights (Zhai et al. 2023).

H7a. *DIQ positively moderates the relationship between KTE and GES, such that the relationship is stronger when DIQ is high.*

H7b. *DIQ positively moderates the relationship between ESM and GES, such that the relationship is stronger when DIQ is high.*

3 | Methods

The present research study used a quantitative research design to empirically examine the interactive relationship between the capability of innovation, KSC, EES, and CBD and GES of SMEs in both Chinese manufacturing and technology industries. The choice of these sectors is not random since they are key priorities of green transformation in China, enormously boost the economy of the country, and have already shown the propensity for digitalization and circular economy (Kanda et al. 2025; Li et al. 2023). This model of research, which is presented in Figure 1, was specified in terms of the multi-item scales, which are based on the previous literature sources but have been checked within the framework of theoretical consistency and empirical reliability.

3.1 | Sampling and Data Collection

The respondents of this empirical study of this exploration included managers, owners, and other senior decision-makers in manufacturing and technology-based SMEs in the four major industrialized provinces in China namely Guangdong, Jiangsu, Zhejiang and Shandong. The following regions were chosen because of their high rates of innovative SMEs and participation in national green development programs (Mondal et al. 2023b). The use of both stratification and purposive sampling methods enabled the study to obtain heterogeneity in terms of firm size, affiliation to a sector, as well as regional innovation ecosystem in general.

The information was collected via an online questionnaire, developed in a structured form and self-administered, and distributed in January–March 2025. The instrument was constructed in both Chinese and English languages and it was subjected to a strict back-translation process to ensure semantic equivalence and cultural suitability of the translated instrument (Brislin 1970). Twenty managers of SMEs were subjected to pretesting in order to improve question wording, form and clarity. All participants were aware of the confidentiality measures to be taken and duly gave informed consent before participating in the study. The last sample consists of a fair sample of manufacturing (56%) and technology (44%) SMEs, with different sizes of organizations and years of operation.

3.2 | Measurement of Constructs

Multi-item scales validated at the level of sustainability, innovation, and entrepreneurship research were used to operationalize all constructs. The four to five items measured INC, KSC, EES, and the CBD, and they were placed on a seven-point Likert scale (1 = strongly disagree; 5 = strongly agree) using items adapted by Bocken et al. (2016), Kanda et al. (2025), and Makhloufi (2023). Effectiveness in knowledge transfer and ESM were both gauged using four-item scales based on Nonaka et al. (1996) and Hockerts and Wüstenhagen (2010), respectively. GES as the dependent variable was operationalized as the five-item scale with both economic and environmental sides of performance measure (Akram et al. 2023). The moderator of the DIQ was also measured by a four-item scale based on Lacy and Rutqvist (2015) and Li et al. (2023).

In order to ensure high construct validity, each item was submitted to a panel of experts in the areas of entrepreneurship, circular economy, as well as innovation management. Preliminary exploratory factor analysis (EFA) was completed, which checked dimensionality and item loadings. Those with factor loadings of less than 0.60 or cross loadings of greater than 0.40 were dropped in order to enhance discriminant validity.

3.3 | Data Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used as the main analytical tool, which was provided through Smart PLS version 4.0. Since the theoretical model used in the study involves multiple mediators and moderators, it requires analyzing the model, the fact that PLS-SEM is easy to handle such complexity, its overall relative stability when researching with an SME sample, and the ability to estimate both reflective and formative constructs made the identification of a model selection in favor of PLS-SEM (Hair et al. 2019; Sarstedt et al. 2022). The research was a stepwise process in a two-step process. First, the measurement model was strictly tested in terms of reliability, convergent validity, and discriminant validity with the use of measures that include Cronbach alpha, composite reliability, the average variance extracted (AVE) ratios, and the Fornell-Larcker criterion. The structural model was then tested on the path coefficients, effect size, predictive significance (Q 2), and overall fit, which was in the form of root mean square residual (SRMR).

4 | Results

This section shows the empirical findings of the analyses. In accordance with suggested research in PLS-SEM, the chapter begins with an evaluation of construct measurement. All latent variables were initially checked in terms of their reliability and validity to guarantee the strength of further path analyses (Hair et al. 2019; Sarstedt et al. 2022). Table 1 explores the convergent validity under the consideration of the fact that the indicators of each construct have the adequate coverage of the underlying latent variable and that they have reasonable internal reliability.

Quantitative outcomes of determining constructs of labels to be convergent valid can be seen in Table 1. Both constructs have standardized factor loadings of above 0.70 (Hair et al. 2019) which indicates that each of the items included in each of the constructs presents a significant relationship with the construct that it is intended to measure. Internal consistency in constructs is demonstrated by Cronbach alpha and CR values which are above the standard acceptable value of 0.80. Besides, AVE of every construct is 0.60 or above which is considered the required degree of convergent validity and reliability of construct (Fornell and Larcker 1981). In combination, all these indices show that the measurement model meets generally accepted psychometric standards and it is worthy to investigate structural relationships. These results hence support the fact that the measurement framework realized in the study is strong and suitable to test the hypothesis through partial least squares structural equation modeling (PLS-SEM).

The current research performed Heterotrait-Monotrait (HTMT) ratio analysis, which is already considered a valid standard to assess the discriminant validity in structural equation modeling (Hair et al. 2019; Henseler et al. 2015). The resulting HTMT figures are in the range of 0.036 to 0.72, all of which are lower than the conservative figure at 0.85 detected in Henseler et al. (2015). Therefore, no significant skewedness of multicollinearity or overlap of construct occurred. These are the results that reinforce the discriminant validity of the measurement model and the fact that the central constructs, such as INC, KSC, EES, CBD, are unique in terms of concept and statistics, and the rest (see Table 2). The accuracy of the instrument of measurement is thus established and now it is time to conduct structural tests and hypotheses.

In the structural equation model in the study, discriminant validity was checked using Fornell-Larcker criterion (Fornell and Larcker 1981; Hair et al. 2019). This criterion assumes the square root of the Average Variance Extracted (AVE) per construct as demonstrated by the diagonal values in Table 3 should be more than the correlations that exist between that construct and the rest of the constructs. The diagonal component (0.782 to 0.836) is always greater than the elements of the

TABLE 1 | Convergent validity test.

Constructs	Items	Loading	Alpha	CR	AVE
CBD	CBD1	0.811	0.878	0.884	0.672
	CBD2	0.846			
	CBD3	0.785			
	CBD4	0.823			
	CBD5	0.833			
DIQ	DIQ1	0.87	0.842	0.889	0.673
	DIQ2	0.806			
	DIQ3	0.822			
	DIQ4	0.781			
EES	EES1	0.846	0.856	0.859	0.699
	EES2	0.808			
	EES3	0.846			
	EES4	0.843			
ESM	ESM1	0.799	0.801	0.802	0.626
	ESM2	0.785			
	ESM3	0.769			
	ESM4	0.811			
GES	GES1	0.776	0.841	0.841	0.611
	GES2	0.768			
	GES3	0.774			
	GES4	0.799			
	GES5	0.792			
INC	INC1	0.818	0.855	0.857	0.697
	INC2	0.848			
	INC3	0.825			
	INC4	0.848			
KSC	KSC1	0.811	0.875	0.88	0.666
	KSC2	0.82			
	KSC3	0.834			
	KSC4	0.81			
	KSC5	0.807			
KTE	KTE1	0.82	0.817	0.819	0.646
	KTE2	0.797			
	KTE3	0.814			
	KTE4	0.783			

TABLE 2 | HTMT ratio.

	CBD	DIQ	EES	ESM	GES	INC	KSC	KTE
CBD								
DIQ	0.07							
EES	0.056	0.054						
ESM	0.368	0.068	0.483					
GES	0.312	0.198	0.411	0.72				
INC	0.069	0.07	0.062	0.423	0.448			
KSC	0.036	0.057	0.041	0.377	0.382	0.039		
KTE	0.258	0.082	0.497	0.656	0.686	0.455	0.325	

TABLE 3 | Fornell–Larcker criterion.

	CBD	DIQ	EES	ESM	GES	INC	KSC	KTE
CBD	0.82							
DIQ	−0.033	0.82						
EES	0.049	0.022	0.836					
ESM	0.311	−0.028	0.401	0.791				
GES	0.272	0.175	0.35	0.592	0.782			
INC	−0.03	−0.043	−0.053	0.352	0.38	0.835		
KSC	−0.005	−0.039	0.011	0.317	0.33	0.021	0.816	
KTE	0.221	−0.047	0.416	0.531	0.57	0.383	0.275	0.804

row and column of the respective off-diagonal correlation coefficient showing that each construct has more variance with its respective indicators as compared to any other construct. These findings create good discriminant validity (Sarstedt et al. 2022). These results, together with those in the HTMT, give more evidence to the fact that all the constructs in this study such as INC, knowledge sharing, ecosystem support among others are statistically different, hence the reliability of the following structural analysis.

The use of the cross-loading analysis of discriminant-type validity is another attribute that adds evidence to the PLS-SEM model discriminative validity, as suggested by Hair et al. (2019) and Henseler et al. (2015). This is so as to make certain that each observed variable would load maximally to its target latent construct and loading must exceed loading on any other latent construct. The findings, presented in Table 4 indicate that all the items show their best loading on the construct to which they are supposed to be correlated with (e.g., CBD1 and CBD, DIQ1 and DIQ, and so forth). The rest of the cross-loadings are significantly less, thus demonstrating that every set of indicators uniquely relate to their possessing construct and is not closely related to the indicators of other constructs (Sarstedt et al. 2022). Indicative of that, when the HTMT ratio and Fornell Larcker methods are also considered, the set of findings provide conclusions that indeed, the measurement model is reliable, robust and therefore appropriate to be analyzed further within a structural analysis and hypothesis testing.

Figure 2 demonstrates the measurement model, which was tested through PLS-SEM, visualizing the interrelations of the latent construct and their indicators and providing a factor loading and the path coefficients. All of the items show large standardized loadings on the corresponding construct and are above the suggested 0.70 cut-off value of the standardized loading (Hair et al. 2019) and reenforce the reliability and convergent validity of this measurement instrument. The defending model fits are evidenced by the relatively high R 2 statistics of endogenous variables that signify the aspects of a large proportion of the variance in considered constructs established through their antecedents KTE (0.452), ESM (0.485), and GES (0.612) (Sarstedt et al. 2022). The path coefficients explain direct relationships of all constructs and confirm proposed structural relationships and the vast majority of them are meaningful and significant. Comprehensively, the outcomes support the validity and explicability of the measurement and structural model, making them equally appropriate and sound to establish future investigation and analysis on grounds of the hypothesis.

Table 5 shows the structural model in which the path analysis of the empirical study of the determinants of GES is represented. The effects of all the core antecedents, CBD, EES, INC, and

TABLE 4 | Cross loadings.

	CBD	DIQ	EES	ESM	GES	INC	KSC	KTE
CBD1	**0.811**	0.011	0.025	0.237	0.226	−0.054	0.01	0.175
CBD2	**0.846**	−0.043	0.037	0.263	0.245	−0.056	−0.009	0.178
CBD3	**0.785**	−0.060	0.030	0.216	0.166	−0.056	−0.029	0.149
CBD4	**0.823**	−0.048	0.040	0.271	0.252	0.048	−0.007	0.191
CBD5	**0.833**	0.001	0.067	0.279	0.216	−0.015	0.01	0.205
DIQ1	0.021	**0.870**	0.058	−0.001	0.190	−0.006	−0.031	0.012
DIQ2	−0.042	**0.806**	−0.023	−0.041	0.109	−0.035	−0.063	−0.037
DIQ3	−0.052	**0.822**	−0.029	−0.046	0.134	−0.027	−0.038	−0.099
DIQ4	−0.061	**0.781**	0.043	−0.018	0.118	−0.096	0	−0.053
EES1	0.054	0.038	**0.846**	0.333	0.312	−0.072	0.061	0.35
EES2	0.047	0.020	**0.808**	0.307	0.266	−0.034	−0.004	0.312
EES3	0.024	0.005	**0.846**	0.351	0.300	−0.043	−0.027	0.375
EES4	0.042	0.010	**0.843**	0.346	0.289	−0.029	0.007	0.352
ESM 1	0.241	−0.046	0.346	**0.799**	0.445	0.271	0.269	0.382
ESM 2	0.201	−0.074	0.318	**0.785**	0.492	0.363	0.205	0.466
ESM 3	0.243	0.018	0.288	**0.769**	0.441	0.214	0.289	0.4
ESM 4	0.300	0.015	0.315	**0.811**	0.493	0.259	0.243	0.432
GES1	0.217	0.111	0.309	0.447	**0.776**	0.319	0.225	0.408
GES2	0.216	0.191	0.268	0.466	**0.768**	0.294	0.258	0.462
GES3	0.236	0.113	0.243	0.462	**0.774**	0.303	0.246	0.45
GES4	0.253	0.120	0.286	0.498	**0.799**	0.292	0.27	0.456
GES5	0.138	0.148	0.259	0.438	**0.792**	0.278	0.291	0.449
INC1	−0.040	−0.055	−0.042	0.278	0.315	**0.818**	0.032	0.295
INC2	−0.038	−0.024	−0.069	0.318	0.312	**0.848**	0.025	0.316
INC3	0.017	−0.061	−0.039	0.296	0.299	**0.825**	0.003	0.317
INC4	−0.037	−0.008	−0.028	0.283	0.343	**0.848**	0.012	0.35
KSC1	0.012	−0.001	−0.009	0.233	0.268	0.029	**0.811**	0.212
KSC2	−0.035	−0.076	0.004	0.225	0.243	0.021	**0.82**	0.239
KSC3	0.028	−0.026	0.017	0.308	0.317	0.032	**0.834**	0.248
KSC4	−0.005	−0.027	0.022	0.261	0.24	0.005	**0.81**	0.223
KSC5	−0.028	−0.033	0.009	0.255	0.27	−0.003	**0.807**	0.196
KTE1	0.19	0.002	0.322	0.437	0.484	0.365	0.215	**0.82**
KTE2	0.212	−0.072	0.289	0.413	0.464	0.342	0.212	**0.797**
KTE3	0.143	−0.042	0.389	0.438	0.463	0.268	0.239	**0.814**
KTE4	0.165	−0.042	0.34	0.42	0.417	0.25	0.219	**0.783**

KSC, on all the mediators (ESM and KTE and the outcome variable GES, are all statistically significant) ($p < 0.001$).

EES has the most significant effect on ESM (0.402) and KTE (0.425) among the antecedents, hence reflecting the significant role of supportive entrepreneurial ecosystems in developing sustainability-oriented mindsets and inducing proper knowledge transfer processes (Chaudhary et al. 2023; Theodoraki et al. 2022). On the same note, both INC and KSC indicate significant impacts on mediators and GES, showing the importance of INC and knowledge sharing in generating green outputs (Makhloufi 2023; Shao et al. 2023).

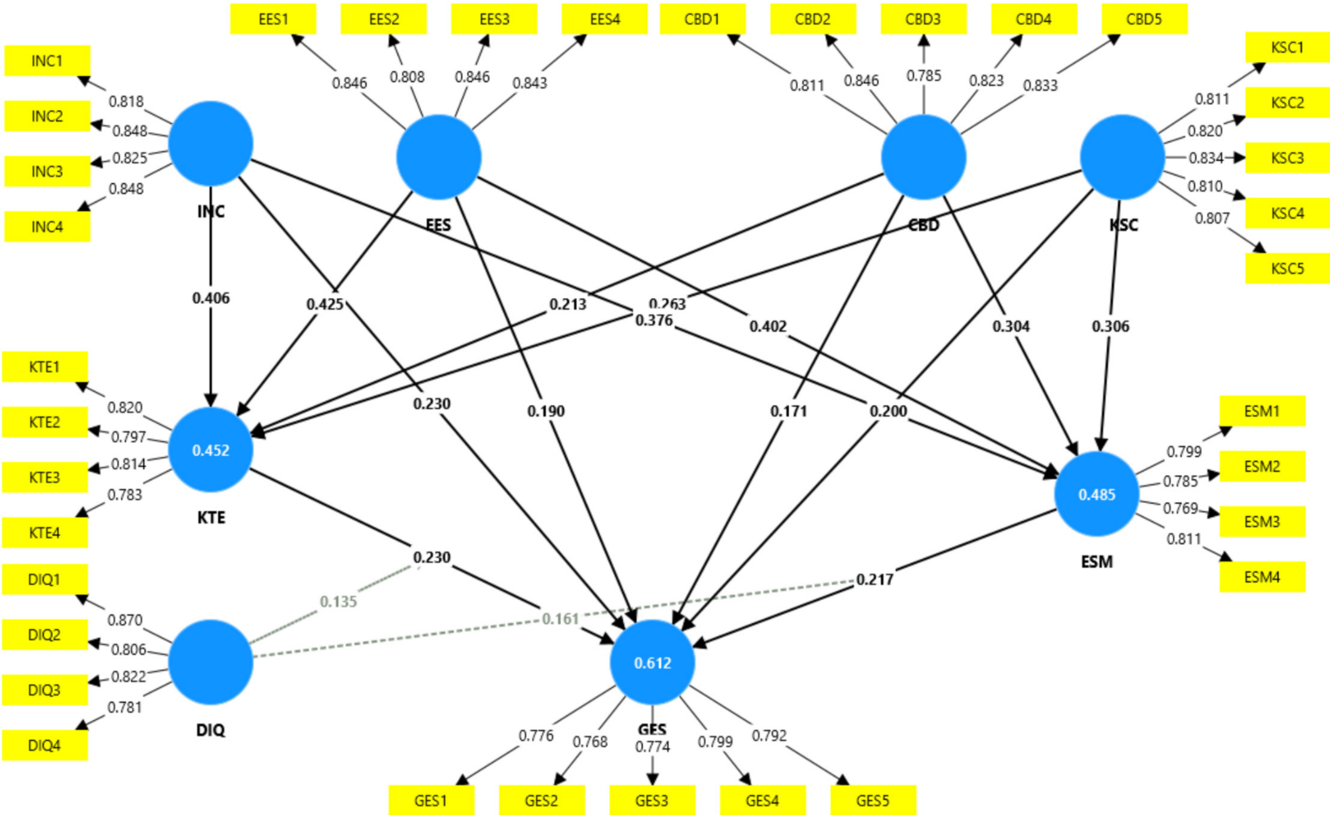

FIGURE 2 | Measurement model.

In terms of mediators themselves, the effect of ESM (0.217) and KTE (0.230) is a significant positive impact on the GES, which confirms their mediating role. Further, some of the indirect impacts are introduced: INC, KTE, and GES (beta = 0.093); EES, KTE, and GES (beta = 0.097); CBD, ESM, and GES (beta = 0.066). The presence of these indirect effects strengthens theories of knowledge-based capabilities and that of dynamic capabilities (Hockerts and Wüstenhagen 2010; Zahra and George 2002) and goes ahead to show that organizational capabilities are partially passed on through these intermediaries.

Further, the moderate associations between DIQ and GES are both positive and significant, supporting the two directions of the connections between KTE and ESM and GES, confirming that a sophisticated digital infrastructure promotes the conversion of knowledge and sustainability attitudes into green entrepreneurial performance (Le et al. 2022; Li et al. 2023). All the findings, together, empirically confirm the integrated solution and have practical implications regarding the theory and practice.

The structural model represented in Figure 3 was estimated using partial least-squares structural equation modeling (PLS-SEM), thus illustrating the direct relationship, indirect relationship, and moderating relationships between all constructs. The level and degree of significance of the different hypothesized effects are shown by standardized path coefficients with their respective t-values (indicated in the round brackets). Finally, EES and INC have been shown to have a more significant positive influence on KTE and ESM as denoted by high path coefficients and t-values (e.g., EES KTE: 0.425 [13.828]; INC ESM: 0.376 [12.272]). These results of the DIQ which profoundly mediates association with KTE, ESM, and GES collectively emphasize the role of the technological environment in developing sustainability outcomes (Le et al. 2022; Li et al. 2023). Collectively, the results substantiate the predictive capacity and the theoretical idea of the model.

5 | Discussion

This paper has proven that there exists a strong direct correlation between the INC, EES, KSC, CBD, ESM and KTE, thus highlighting the significance of the antecedents as the foundation of the research. These findings offer empirical evidence on the combined theoretical paradigm, which incorporates RBV, KBV, DCT, EET, and CET. In particular, the high impact of EES indicates the importance of the external networks, institutional support and collaboration with stakeholders to assist SMEs in the adoption of sustainable practices and knowledge transfer ability. This is in concordance with the previous literature which highlights the role of ecosystem orchestration as a force of sustainable entrepreneurship (Chaudhary et al. 2023). In the same manner, the importance of the ability of a firm to create eco-innovations and sustainability-focused orientations is emphasized by the high influence of INC in line with the RBV and KBV (Zahra and George 2002). Albeit somewhat less significant, KSC and CBD are supplementary. KSC promotes knowledge exchange among the internal environment and allows SMEs to determine and harness green opportunities (Makhloufi 2023). CBD also favors the implementation of efficient business models, which is in line with CET (Woldeyes et al. 2025).

TABLE 5 | Path analysis.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	*T* statistics (|O/STDEV|)	*ps*
CBD->ESM	0.304	0.304	0.029	10.627	0.000
CBD -> GES	0.171	0.170	0.029	5.983	0.000
CBD -> KTE	0.213	0.213	0.030	7.077	0.000
DIQ -> GES	0.234	0.235	0.031	7.660	0.000
EES -> ESM	0.402	0.402	0.028	14.613	0.000
EES -> GES	0.190	0.189	0.031	6.155	0.000
EES -> KTE	0.425	0.424	0.031	13.828	0.000
ESM -> GES	0.217	0.218	0.038	5.787	0.000
INC -> ESM	0.376	0.376	0.031	12.272	0.000
INC -> GES	0.230	0.231	0.032	7.261	0.000
INC -> KTE	0.406	0.407	0.031	13.172	0.000
KSC ->ESM	0.306	0.305	0.030	10.115	0.000
KSC -> GES	0.200	0.199	0.031	6.418	0.000
KSC -> KTE	0.263	0.264	0.030	8.868	0.000
KTE -> GES	0.230	0.228	0.038	5.976	0.000
DIQ × KTE -> GES	0.135	0.134	0.030	4.510	0.000
DIQ × ESM -> GES	0.161	0.160	0.035	4.593	0.000
CBD -> ESM -> GES	0.066	0.066	0.013	5.021	0.000
INC -> KTE -> GES	0.093	0.093	0.018	5.245	0.000
EES -> ESM -> GES	0.087	0.088	0.017	5.194	0.000
KSC -> KTE -> GES	0.060	0.060	0.012	4.902	0.000
INC -> ESM -> GES	0.082	0.082	0.016	5.220	0.000
KSC -> ESM -> GES	0.066	0.066	0.013	4.989	0.000
CBD -> KTE -> GES	0.049	0.049	0.010	4.666	0.000
EES -> KTE -> GES	0.097	0.097	0.018	5.423	0.000

The findings indicate that although EES and INC are major driving factors, KSC and CBD play crucial supplementary roles as they foster a culture of cooperation and sustainable business operations, respectively. Arroyave et al. (2025) emphasize that the intense engagement with stakeholders is a key to the improvement of the adoption of the CE practices as it aligns the operational strategy with environmental orientation (Arroyave et al. 2025). This is in addition to our observation that EES is a very strong predictor of KTE and ESM since the cooperation of the stakeholders in the ecosystems is likely to increase knowledge flows and sustainability-driven decisions. In contrast to the external stakeholder networks that Arroyave et al. (2025) are concentrating on, our research relates to internal organizational capabilities (INC and KSC) and their interaction with the ecosystem support. This implies that the synergistic impact implies internal KSCs and innovation capabilities as they are nurtured by collaborative stakeholder ecosystems will establish a strong support base of GES. The outcomes extend Arroyave et al.'s (2025) study by indicating that collaboration of stakeholders drives CE practices and translates the organizational capability into sustainable performance through ESM and KTE.

ESM and KTE became central intermediaries, which proved the point that the sustainability-minded mindset and efficient knowledge transfer mechanisms are the key assets to transforming organizational and ecosystem resources into GES. These mediators do not simply convey the impacts of antecedents but make important direct influences on GES which confirms their primary status as key channels of sustainable results. This is in line with Florez-Jimenez et al. (2025), who claim that organizational purpose improves team-level well-being and sustainability performance. Another idea that can be implied by their work is that a purpose-driven culture

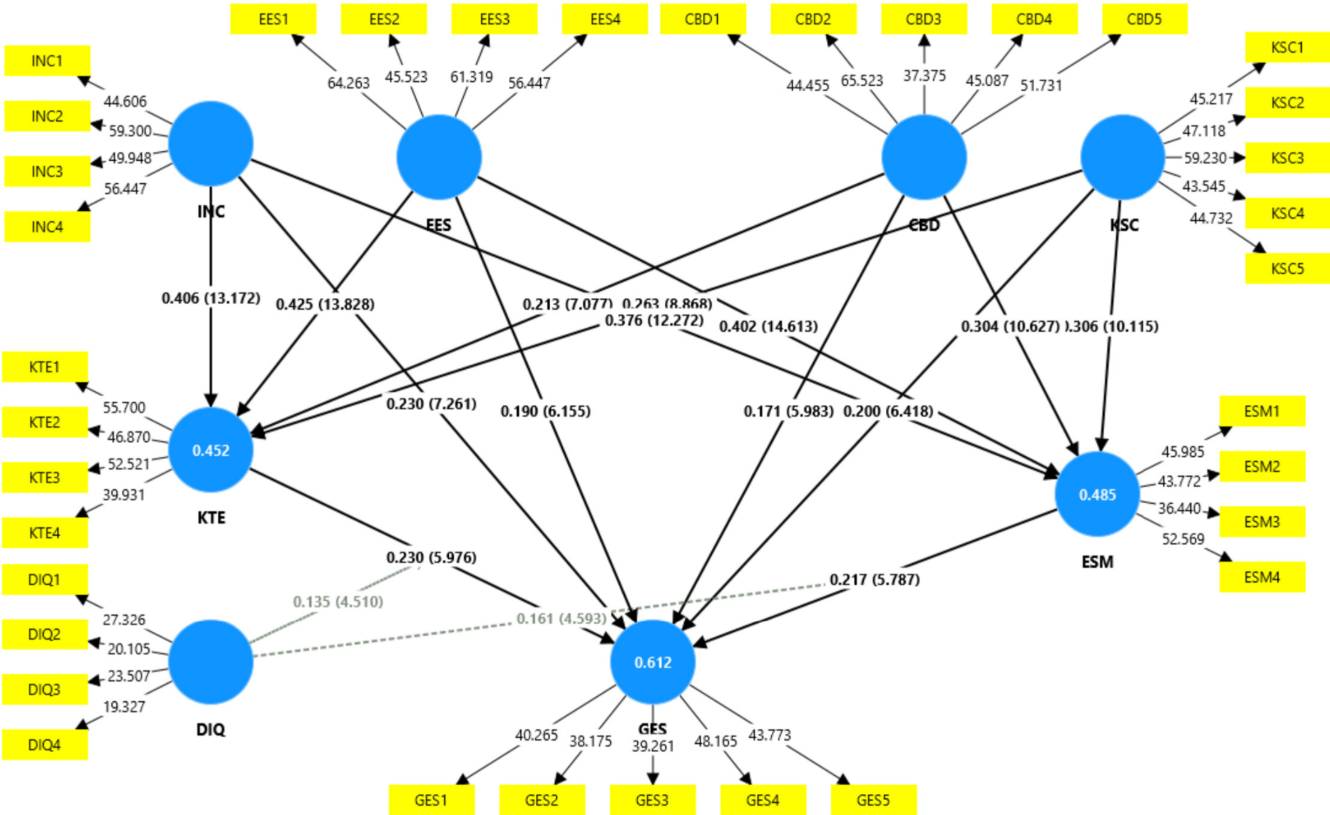

FIGURE 3 | Structural model.

induces intrinsic motivation and organizational dedication to sustainability, which corresponds with our result that ESM mediates between antecedents such as KSC and CBD and GES. Nonetheless, whereas Florez-Jimenez et al. (2025) address the dynamics and well-being of teams, our analysis extends the discussion to refer to firm-level green entrepreneurial performance through ESM in the context of mediator knowledge processes and facilitated by digital infrastructure. This combination points out that a sustainability mind set, instilled into a culture of knowledge sharing and supported by stakeholder cooperation, can lead not only to internal group cohesion, but also to external competitive and environmental success.

The moderation analysis found that DIQ has significant strengths in enhancing the relations between KTE, ESM, and GES. This confirms the previous study by Li et al. (2023), in which digital transformation was identified as a driver of sustainable performance in the industrial environment of China. The digital infrastructure of high quality contributes to the scalability of knowledge transfer and the efficiency of strategies oriented toward sustainability, as it allows the entrepreneurs to make their sustainability mindset concrete. This observation can also be put into context regarding Arroyave et al. (2025), who observe that online platforms help in the collaboration of the stakeholders by means of real-time sharing of data and coordination of activities between networks of the circular economy. This is elaborated by our findings that reveal DIQ is not only beneficial to stakeholder teamwork, but it also enhances the effectiveness of internal knowledge processes and sustainability-based attitudes to green entrepreneurial achievement. Digital tools could make the knowledge transfer across ecosystems and within firms more efficient, helping SMEs to leverage circular innovation using stakeholder insights.

Besides, the interdependence of stakeholder collaboration and the purpose of the organization, as explained by Arroyave et al. (2025) and Florez-Jimenez et al. (2025), highlights the relational and social motivators of circular entrepreneurship. The focus of our study on EES is consistent with the results of Arroyave et al. (2025) that stakeholder networks are essential to CE adoption but it also indicates that these networks can boost green results when paired with a robust organizational sustainability mindset and effective knowledge transfer. Likewise, the emphasis placed on organizational purpose by Florez-Jimenez et al. (2025) complements our results by offering that a purpose-driven strategy can enhance the mediating role of ESM, especially in cultivating an environmental and social value-generating culture. With a combination of these views, our study demonstrates that the success of green entrepreneurship in Chinese SMEs is not only determined by internal resources or e-infrastructure but also by the process of relationships of stakeholder cooperation and a mission-oriented organizational culture.

Although the results of the study clearly indicate the existence of the hypothesized relationships, a critical reflection on the results shows that there are some nuances. It is important to note that the direct impact of CBD on GES was statistically significant but quite weak in comparison with other antecedents, including EES and INC. This implies that even though the role of CBD in GES is real, its direct effect can be less significant than expected, potentially because the adoption of the circular business models in SMEs requires more resources or more time to yield real results (Blok 2018). This smaller effect might suggest that the action of CBD is better directed by mediators, such as KTE and ESM, which had larger indirect effects on GES. This observation highlights the need to consider the combination of CBD with knowledge processes and sustainability mindsets to fully exploit its contribution, instead of only looking at its direct effect.

Also, a surprising observation was that DIQ had a relatively small moderating impact on the relationship between KTE and GES as compared to its impact on ESM and GES. Considering the fast digitalization of the Chinese industrial environment, KTE was expected to be moderated more intensively, since digital tools are usually believed to improve the efficiency of knowledge transfer (Del Vecchio et al. 2020). This outcome can be attributed to the contextual conditions, including the differences in digital maturity among SMEs or the possible obstacles to implementing the new advanced digital infrastructure, including the price or technical skills (Chaudhuri et al. 2022). This indicates that although DIQ is an important enabler, it might have a weak influence on the transfer of knowledge in SMEs with low digital absorptive capacity that would benefit further research on these obstacles. These less strong or surprising results do not weaken the general model but point to the complexity and context-specificity of the success of green entrepreneurs. They also indicate that SMEs might require more specific assistance to take full advantage of the CBDs and digital infrastructure, especially in the environments that are resource-limited or less digitally advanced. The research may be expanded in the future by investigating certain impediments to the implementation of CBD or how online education and availability may amplify the moderating impact of DIQ. This reflection is critical and will lead to a more transparent analysis and is consistent with the need to have more contextualized research on sustainable entrepreneurship (Lüdeke-Freund et al. 2019).

5.1 | Research Implications

The results of this research have provided various important managerial implications to the leaders and decision-makers who aimed to improve GES, namely in the framework of SMEs that adjusted their approaches to sustainability and the principles of CE. The main lesson of this study is the significance of investing in digital infrastructure, which serves as an effective moderator in enhancing the effects of knowledge transfer and building an ESM. The managers need to consider the digital tools and platforms not only as the operational requirements, but also as the strategic facilitators that ensure smooth communication, real-time data exchange, and cross-organizational cooperation. As digital capabilities increase, companies might be able to hasten their innovation processes and become better connected in green business ecosystems, which would give them a competitive advantage in a market with increased environmental awareness.

Managers have to go out of their way to create an internal environment where openness, trust and cross-departmental and inter-hierarchical collaboration are appreciated. Knowledge management systems can turn tacit knowledge into a valuable resource that will lead to green innovation performance when they are implemented properly and accompanied by appropriate incentives to exchange information. The ability to use the support of the wider entrepreneurial ecosystem becomes an important strategy in the modern business environment where all businesses are interconnected. External ecosystem support through industry networks, government institutions, academic organizations and sustainability-focused platforms has a direct effect on success in terms of knowledge transfer and the development of entrepreneurial resilience. Managers have to vigorously pursue cooperation and partnership with joint ventures, incubators, public-private relationships, and other cooperative efforts. Such engagements will not only expand access to technical resources and funding but it will also open up new market opportunities and the best practices in sustainability.

Instead, the focus on developing capabilities of the firm has been very strong, and research has found it to be a powerful driver of sustainable mindset and green entrepreneurial results. Investment into research and development, ongoing training of employees, and testing of eco-innovative technologies are important. It is a strategy that will allow the firms to explore and implement the circular business models that do not only sustain the environmental goals but also create new business revenues and improve the reputation of the company in the market. It is also important to develop an internal capacity using customized training programs. In particular, SMEs are enjoying properly organized learning and development programs that facilitate long-term recognition of opportunities, green business modeling and ecological production activities. Such programs may be co-designed with academic institutions in order to incorporate the latest research or be supported by NGOs in order to fit into the global standards of sustainability. Such programs should also be aimed at improving the absorptive capacity of the firms, which is the capacity of the firm to establish assimilate, and utilize external knowledge as a force to initiate innovation in ways that are sustainable.

Also, managers must focus on the incorporation of the concepts of CBD, including the cycling of resources and minimization of waste in their business strategies in order to meet the national sustainability objectives and improve the ability to remain competitive in the long term. A policy environment that is enabling is also essential. Managers ought to have an active and proactive involvement with policy makers and regulatory authorities to promote, co-create and take advantage of specific incentives that reduce barriers to entry and spur the development of sustainable businesses. These multidimensional strategies not only enable firms to maneuver and negotiate the multidimensional and changing landscape of sustainability-driven markets, but also set the pace for providing long-term economic performance and positive environmental impact. This study has highlighted the importance of an enabling policy environment in the promotion of green entrepreneurship. The managers are to be actively and adequately involved in the policymakers' and regulatory bodies' advocacy to co-develop and capitalize on specific incentives to reduce barriers to entry and provoke the development of sustainable ventures. Organizations may collaborate with universities, NGOs, and community groups to promote strategies that incentivize CE practices at the local level.

These results are consistent with the 2060 carbon neutrality commitment made by China, which makes the nation a leader in sustainable development (Geissdoerfer et al. 2022). The relevance of CBD to the transition of China into a CE, which is a core of the carbon neutrality strategy, is highlighted by its importance in promoting GES. SMEs that embrace the idea of a circular business model can help curb carbon emissions and meet national goals of ecological civilization by encouraging resource efficiency and closed-loop systems. Moreover, the focus of the study on INC and EES is echoed by the Chinese industrial upgrading policies, which put more emphasis on technological progress and green production in such provinces as Guangdong, Jiangsu, Zhejiang, and Shandong. These areas, which are at the center of our investigation, are the areas where government-led programs, including the Made in China 2025 strategy, aim to introduce smart manufacturing and eco-innovation into the industrial processes (Li et al. 2023). KTE is a strong mediator, which means that knowledge-sharing platforms must be encouraged by providing government programs and SME innovation funds. These initiatives offer financial and technical assistance to SMEs, which allows them to create green technologies and sustainable business models. Also, the moderating effect of DIQ is compatible with the Digital Economy Development Strategy of China, which supposes the importance of digital platforms in the process of the speed of low-carbon transitions. These findings can be used by policymakers to develop specific interventions, including subsidies to invest in digital infrastructure and the formation of public–private collaborations to create joint ecosystems in the field of green entrepreneurship. This research, by connecting SME innovation and these national strategies, offers practical recommendations to policymakers to speed up the process of achieving carbon neutrality and sustainable industrialization in China.

This paper presents considerable social implications that serve the greater objectives of society. The results highlight the importance of green entrepreneurship in the creation of sustainable communities through the promotion of circular business models that minimize environmental degradation and increase resource efficiency among SMEs. Through the emphasis on KSCs and sustainability attitudes, SMEs will be able to shape an attitude of society towards sustainability, encouraging employees, customers, and local communities to embrace environmentally friendly practices. The cultural change has the potential to increase the social effect of green entrepreneurship, which in turn leads to a larger awareness of the problem of the environment and switching to sustainable consumption habits. Furthermore, the focus of the study on EES demonstrates the significance of collaboration networks between universities, governmental agencies, and community organizations. Such partnerships have the potential to strengthen social capital, which provides inclusive platforms that empower various stakeholders, including those who are underrepresented to engage in green entrepreneurial activities. This inclusivity may result in equal economic opportunities and make communities resilient to environmental pressures. Also, the concept of digital infrastructure as a moderator implies that developments in digital access can help democratize knowledge and innovation allowing smaller or resource-limited SMEs to play a role in achieving the sustainability goals in society. Through green innovation and CE practices, SMEs will be at the forefront of solving social challenges like resource scarcity and pollution, which will eventually enhance the quality of life and contribute to the overall societal shift to a low-carbon and sustainable future for China.

5.2 | Limitations and Future Research Directions

Although this research has strong empirical data and an in-depth model of examining GES among Chinese SMEs, it suffers a number of limitations, which should be mentioned to put the research into perspective and to inform subsequent studies. These limitations do not negate the contributions of the study but act as an opportunity to continue research in the future to build upon the findings of the study. First, the focus of the study on Chinese manufacturing and technology SMEs can restrict its generalizability because it is possible that it was affected by the culture. This situation may be different in China, where the high level of governmental support for sustainability and the collectivist cultural orientation may influence entrepreneurial behavior and ecosystem dynamics. Such cultural and institutional issues might affect the relevance of the findings to other areas or economies, implying the necessity to conduct comparative research to investigate the impact of cultural dimensions on green entrepreneurship. Second, using self-reported information among SME managers and owners presents the possibility of biases, including social desirability or recall errors, that can influence the accuracy of the answers on the topic of INC, knowledge sharing, or sustainability results. Although rigorous validation methods were used in the study, self-reported measures are not necessarily effective at measuring objective performance or dynamic behavior. To strengthen the validity of results, future studies may include objective sources of data, for example, financial statements or independent sustainability audits. Lastly, the study design is cross-sectional, which restricts the power of making a causal inference or dynamic temporal development of GES. The connections between INC, knowledge sharing, ecosystem support, and CBD can shift with the maturity of SMEs or with the external factors, including digital infrastructure or policy frameworks. Longitudinal studies would give more insight into how these relationships vary over time and allow testing the causal mechanisms put forward in the model. This kind of research would also perfect the synthesized theoretical framework, which has been advanced in this paper, and increase its applicability in various situations.

6 | Conclusion

The present research offers good empirical support for the joint influence of INC, KSC, EES, and CBD with GES of Chinese manufacturing and technology SMEs. By adding to the mediating effect of KTE and ESM the moderating effect of DIQ, the study will assist in the process of comprehending how ecosystem-level and organizational factors may be translated into feasible entrepreneurial activity. The findings substantiate the fact that firm-level capabilities and positive external conditions are indispensable, and their impact is amplified by digitalization. This multi-theoretic measure is a direct contributor to the national priorities of China that focus on ecological civilization and sustainable economic growth. The results emphasize the importance of CBD in the alignment of SME strategies with national objectives on the efficiency of resources and the minimization of emissions. Additionally, the application of INC and DIQ in the study offers practical advice on the implementation of industrial upgrading policies and SME innovation programs in China, which contribute to technological development and green entrepreneurship in major industrial areas. The study highlights the relevance of government-initiated programs in the development of sustainable business models by showing the significance of EES.

In the light of these results, it is possible to draw the attention of managers to the improvement of digital infrastructure and the possibility to innovate and create the culture of knowledge sharing in the SME industry. They are also supposed to capitalize on cultural advantages, even as they tap into institutional networks such as the Ecological Civilization project to get policy incentives and backup. Specialized incentives and support to create circular business solutions, including tax exemptions on environmentally innovative SMEs and grants on the use of digital platforms, will complement the shift to green entrepreneurship in accordance with the objectives of carbon neutrality and industrial modernization in China. These will be enhanced through cooperation with ecosystems. The potential responses include investment in digital platforms and capacity-building programs to SMEs and knowledge network investments. The findings showed that to an investor, human and technological resource investment is essential to create a sustainability culture and enable knowledge transfer. These insights can assist policymakers in developing specific interventions, including the development of digital infrastructure in industrial centers and the enhancement of the partnership between the state and business in favor of the green SMEs, to increase the countrywide shift toward a low-carbon CE. Future studies ought to examine the proposed model in other cultural and economic environments outside of China to boost the generalizability of these findings. The relationship between INC, knowledge sharing, ecosystem support, and CBD in other emerging economies or developed markets could be studied comparatively to determine how differences in cultural values, regulatory environments, or the maturity of digital infrastructure affect the relationships.

Acknowledgements

We are grateful to anonymous reviewers and the editor for their insightful comments and suggestions. The research was supported by the 2024 Humanities and Social Sciences Research Project of the Ministry of Education (Grant Number 24YJA790018); the 2023 Natural Science Foundation of Fujian Province (Grant Number 2023J011134); the 2023 Social Science Fund of Fuzhou City (Grant Number: 2023FZB88); the 2024 Fujian Provincial Social Science Program (Grant Number JAS23177); the 2024 Fujian Province Fujian Association for Science and Technology Innovation Think Tank Research Program (Grant Number FJKX-2024XKB040); the 2024 Social Science Fund of Fujian Province (Grant Number: FJ2024BF009); and the 2025 Natural Science Foundation of Fujian Province (Grant number 2025J08258).

Funding

The research was supported by the 2024 Humanities and Social Sciences Research Project of the Ministry of Education (Grant Number 24YJA790018); the 2023 Natural Science Foundation of Fujian Province (Grant Number 2023J011134); the 2023 Social Science Fund of Fuzhou City (Grant Number: 2023FZB88); the 2024 Fujian Provincial Social Science Program (Grant Number JAS23177); the 2024 Fujian Province Fujian Association for Science and Technology Innovation Think Tank Research Program (Grant Number FJKX-2024XKB040); the 2024 Social Science Fund of Fujian Province (Grant Number: FJ2024BF009); and the 2025 Natural Science Foundation of Fujian Province (Grant number 2025J08258).

References

Abu-Bakar, H., F. Charnley, P. Hopkinson, and E. K. Morasae. 2024. "Towards a Typological Framework for Circular Economy Roadmaps: A Comprehensive Analysis of Global Adoption Strategies." *Journal of Cleaner Production* 434: 140066. https://doi.org/10.1016/j.jclepro.2023.140066.

Akram, M. W., S. Yang, M. Hafeez, M. A. Kaium, I. Zahan, and R. Salahodjaev. 2023. "Eco-Innovation and Environmental Entrepreneurship: Steps Towards Business Growth." *Environmental Science and Pollution Research International* 30, no. 23: 63427–63434. https://doi.org/10.1007/s11356-023-26680-4.

Albort-Morant, G., A. Leal-Millán, and G. Cepeda-Carrión. 2016. "The Antecedents of Green Innovation Performance: A Model of Learning and Capabilities." *Journal of Business Research* 69, no. 11: 4912–4917. https://doi.org/10.1016/j.jbusres.2016.04.052.

Andreini, D., C. Bettinelli, N. J. Foss, and M. Mismetti. 2022. "Business Model Innovation: A Review of the Process-Based Literature." *Journal of Management and Governance* 26, no. 4: 1089–1121. https://doi.org/10.1007/s10997-021-09590-w.

Arroyave, J. J., F. J. Sáez-Martínez, P. Ruiz-Palomino, and Á. González-Moreno. 2025. "From Environmental Orientation to Circular Economy Practices: Is It Easier When Firms Frequently Cooperate With Stakeholders?" *Corporate Social Responsibility and Environmental Management* 32: 4802–4818. https://doi.org/10.1002/csr.3209.

Avelar, S., T. Borges-Tiago, A. Almeida, and F. Tiago. 2024. "Confluence of Sustainable Entrepreneurship, Innovation, and Digitalization in SMEs." *Journal of Business Research* 170: 114346. https://doi.org/10.1016/j.jbusres.2023.114346.

Barbini, F. M., M. Corsino, and P. Giuri. 2021. "How Do Universities Shape Founding Teams? Social Proximity and Informal Mechanisms of Knowledge Transfer in Student Entrepreneurship." *Journal of Technology Transfer* 46, no. 4: 1046–1082. https://doi.org/10.1007/s10961-020-09799-1.

Barrachina Fernández, M., M. D. C. García-Centeno, and C. Calderón Patier. 2021. "Women Sustainable Entrepreneurship: Review and Research Agenda." *Sustainability* 13, no. 21: 12047. https://doi.org/10.3390/su132112047.

Blok, V. 2018. "Information Asymmetries and the Paradox of Sustainable Business Models: Towards an Integrated Theory of Sustainable Entrepreneurship." In *Sustainable Business Models: Principles, Promise, and Practice*. Springer. https://doi.org/10.1007/978-3-319-73503-0_10.

Bocken, N. M. P., I. de Pauw, C. Bakker, and B. van der Grinten. 2016. "Product Design and Business Model Strategies for a Circular Economy." *Journal of Industrial and Production Engineering* 33, no. 5: 308–320. https://doi.org/10.1080/21681015.2016.1172124.

Borah, P. S., C. S. K. Dogbe, W. W. K. Pomegbe, B. A. Bamfo, and L. K. Hornuvo. 2021. "Green Market Orientation, Green Innovation Capability, Green Knowledge Acquisition and Green Brand Positioning as Determinants of New Product Success." *European Journal of Innovation Management* 26, no. 2: 364–385. https://doi.org/10.1108/ejim-09-2020-0345.

Brislin, R. W. 1970. "Back-Translation for Cross-Cultural Research." *Journal of Cross-Cultural Psychology* 1, no. 3: 185–216. https://doi.org/10.1177/135910457000100301.

Brynjolfsson, E. 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. Vol. 236. WW Norton Company.

Cantner, U., J. A. Cunningham, E. E. Lehmann, and M. Menter. 2021. "Entrepreneurial Ecosystems: A Dynamic Lifecycle Model." *Small Business Economics* 57, no. 1: 407–423. https://doi.org/10.1007/s11187-020-00316-0.

Castro Oliveira, J., J. M. Lopes, L. Farinha, S. Silva, and M. Luízio. 2021. "Orchestrating Entrepreneurial Ecosystems in Circular Economy: The New Paradigm of Sustainable Competitiveness." *Management of Environmental Quality: An International Journal* 33, no. 1: 103–123. https://doi.org/10.1108/meq-11-2020-0271.

Chaudhary, S., P. Kaur, H. Alofaysan, J. Halberstadt, and A. Dhir. 2023. "Connecting the Dots? Entrepreneurial Ecosystems and Sustainable Entrepreneurship as Pathways to Sustainability." *Business Strategy and the Environment* 32, no. 8: 5935–5951. https://doi.org/10.1002/bse.3466.

Chaudhuri, A., N. Subramanian, and M. Dora. 2022. "Circular Economy and Digital Capabilities of SMEs for Providing Value to Customers: Combined Resource-Based View and Ambidexterity Perspective." *Journal of Business Research* 142: 32–44.

Chen, X., Y. Chen, X. Zhang, and Q. He. 2025. "Green Transformational Leadership and Green Innovation in Megaprojects: Is Green Knowledge Sharing a Missing Link?" *Engineering Construction and Architectural Management* 32, no. 1: 194–213. https://doi.org/10.1108/ECAM-02-2023-0117.

Cohen, W. M., and D. A. Levinthal. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarterly* 35, no. 1: 128–152.

Cosa, M. 2024. "Business Digital Transformation: Strategy Adaptation, Communication and Future Agenda." *Journal of Strategy and Management* 17, no. 2: 244–259. https://doi.org/10.1108/JSMA-09-2023-0233.

Dean, T. J., and J. S. McMullen. 2007. "Toward a Theory of Sustainable Entrepreneurship: Reducing Environmental Degradation Through Entrepreneurial Action." *Journal of Business Venturing* 22, no. 1: 50–76. https://doi.org/10.1016/j.jbusvent.2005.09.003.

Del Rio, P., J. Garcia-Quevedo, and E. Martinez-Ros. 2025. "Corporate Environmental R&D: Does Organisational Innovation Matter?" *Industry and Innovation* 32, no. 6: 710–745. https://doi.org/10.1080/13662716.2024.2420792.

Del Vecchio, P., G. Passiante, G. Barberio, and C. Innella. 2020. "Digital Innovation Ecosystems for Circular Economy: The Case of ICESP, the Italian Circular Economy Stakeholder Platform." *International Journal of Innovation and Technology Management* 18, no. 01: 2050053. https://doi.org/10.1142/s0219877020500534.

Fernando, Y., C. J. C. Jabbour, and W. X. Wah. 2019. "Pursuing Green Growth in Technology Firms Through the Connections Between Environmental Innovation and Sustainable Business Performance: Does Service Capability Matter?" *Resources, Conservation and Recycling* 141: 8–20.

Fichter, K., and K. Hurrelmann. 2021. "Sustainability-Oriented Business Incubation: Framing and Supporting Sustainable Entrepreneurship." In *Handbook of Research on Business and Technology Incubation and Acceleration*, 478–495. Edward Elgar Publishing.

Florez-Jimenez, M. P., A. Lleo, E. McNeely, and P. Ruiz-Palomino. 2025. "The Power of Purpose: How Organizational Purpose Strength Enhances Social Well-Being Within Work Teams." *Business Strategy & Development* 8, no. 4: e70216. https://doi.org/10.1002/bsd2.70216.

Fornell, C., and D. F. Larcker. 1981. "Evaluating Structural Equation Models With Unobservable Variables and Measurement Error." *Journal of Marketing Research* 18, no. 1: 39–50. https://doi.org/10.1177/002224378101800104.

Geissdoerfer, M., T. Santa-Maria, J. Kirchherr, and C. Pelzeter. 2022. "Drivers and Barriers for Circular Business Model Innovation." *Business Strategy and the Environment* 32, no. 6: 3814–3832. https://doi.org/10.1002/bse.3339.

Grant, R. M. 1996. "Toward a Knowledge-Based Theory of the Firm." *Strategic Management Journal* 17, no. S2: 109–122. https://doi.org/10.1002/smj.4250171110.

Hair, J. F., J. J. Risher, M. Sarstedt, and C. M. Ringle. 2019. "When to Use and How to Report the Results of PLS-SEM." *European Business Review* 31, no. 1: 2–24. https://doi.org/10.1108/EBR-11-2018-0203.

Hällerstrand, L., W. Reim, and M. Malmström. 2023. "Dynamic Capabilities in Environmental Entrepreneurship: A Framework for Commercializing Green Innovations." *Journal of Cleaner Production* 402: 136692.

Henseler, J., C. M. Ringle, and M. Sarstedt. 2015. "A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling." *Journal of the Academy of Marketing Science* 43, no. 1: 115–135. https://doi.org/10.1007/s11747-014-0403-8.

Hockerts, K., and R. Wüstenhagen. 2010. "Greening Goliaths Versus Emerging Davids—Theorizing About the Role of Incumbents and New Entrants in Sustainable Entrepreneurship." *Journal of Business Venturing* 25, no. 5: 481–492. https://doi.org/10.1016/j.jbusvent.2009.07.005.

Huo, X., S. Wang, B. Zheng, and X. Wu. 2025. "R&D Subsidies and Radical Innovation: Innovative Mindset and Competition Matter." *System* 13, no. 4: 282. https://doi.org/10.3390/systems13040282.

Idrees, H., J. Xu, and N. A. Andrianarivo Andriandafiarisoa Ralison. 2025. "Green Entrepreneurial Orientation and Knowledge Creation Process as Enablers of Green Innovation Performance: The Moderating Role of Resource Orchestration Capability." *European Journal of Innovation Management* 28, no. 3: 754–782. https://doi.org/10.1108/EJIM-02-2023-0143.

Jansson, J., J. Nilsson, F. Modig, and G. Hed Vall. 2017. "Commitment to Sustainability in Small and Medium-Sized Enterprises: The Influence of Strategic Orientations and Management Values." *Business Strategy and the Environment* 26, no. 1: 69–83. https://doi.org/10.1002/bse.1901.

Jilani, M. M. A. K., L. Fan, M. T. Islam, and M. A. Uddin. 2020. "The Influence of Knowledge Sharing on Sustainable Performance: A Moderated Mediation Study." *Sustainability* 12, no. 3: 908. https://doi.org/10.3390/su12030908.

Kanda, W., M. Geissdoerfer, and O. Hjelm. 2021. "From Circular Business Models to Circular Business Ecosystems." *Business Strategy and the Environment* 30, no. 6: 2814–2829. https://doi.org/10.1002/bse.2895.

Kanda, W., M. Klofsten, D. Bienkowska, D. B. Audretsch, and M. Geissdoerfer. 2025. "Orchestration in Mature Entrepreneurial Ecosystems Towards a Circular Economy: A Dynamic Capabilities Approach." *Business Strategy and the Environment* 34, no. 4: 4747–4765. https://doi.org/10.1002/bse.4229.

Khizar, H. M. U., M. J. Iqbal, and M. I. Rasheed. 2021. "Business Orientation and Sustainable Development: A Systematic Review of Sustainability Orientation Literature and Future Research Avenues." *Sustainable Development* 29, no. 5: 1001–1017. https://doi.org/10.1002/sd.2190.

Kiefer, C. P., P. Del Río González, and J. Carrillo-Hermosilla. 2019. "Drivers and Barriers of Eco-Innovation Types for Sustainable Transitions: A Quantitative Perspective." *Business Strategy and the Environment* 28, no. 1: 155–172. https://doi.org/10.1002/bse.2246.

Kirchherr, J., D. Reike, and M. Hekkert. 2017. "Conceptualizing the Circular Economy: An Analysis of 114 Definitions." *Resources, Conservation and Recycling* 127: 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005.

Klofsten, M., W. Kanda, D. Bienkowska, N. Bocken, S. Mian, and W. Lamine. 2024. "Start-Ups Within Entrepreneurial Ecosystems: Transition Towards a Circular Economy." *International Small Business Journal* 42, no. 4: 383–395. https://doi.org/10.1177/02662426241227520.

Kodama, M. 2025. "New Knowledge Creation Through Technology Convergence Case Studies of Toyota and Panasonic." In *Developing Knowledge Convergence Through Collective Phronesis*, 241–290. Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-96-4403-2_6.

Kohtamäki, M., V. Parida, P. Oghazi, H. Gebauer, and T. Baines. 2019. "Digital Servitization Business Models in Ecosystems: A Theory of the Firm." *Journal of Business Research* 104: 380–392. https://doi.org/10.1016/j.jbusres.2019.06.027.

Kowshik, S. T. H., E. Y. Chew, and S. W. H. Lee. 2025. "Knowledge Transfer as a Dynamic Capability: A Meta-Analysis of Its Impact on Organizational Outcomes in International Contexts." *Knowledge Management Research and Practice* 1-16: 1–16. https://doi.org/10.1080/14778238.2025.2519291.

Kulp, J. F., and M. Mrożewski. 2025. "The Role of Institutions and Digital Infrastructure for Sustainable Entrepreneurship: A Macro-Level Perspective on Twin Transformation." *International Journal of Innovation Management* 29, no. 05n06: 2540005. https://doi.org/10.1142/S1363919625400055.

Lacy, P., and J. Rutqvist. 2015. "The Roots of the Circular Economy." In *Waste to Wealth: The Circular Economy Advantage*, edited by P. Lacy and J. Rutqvist, 19–23. Palgrave Macmillan UK. https://doi.org/10.1057/9781137530707_2.

Le, T. T., A. Behl, and V. Pereira. 2022. "Establishing Linkages Between Circular Economy Practices and Sustainable Performance: The Moderating Role of Circular Economy Entrepreneurship." *Management Decision* 62, no. 8: 2340–2363. https://doi.org/10.1108/md-02-2022-0150.

Le, T. T., N. B. T. Tuyết, and T. Le Anh. 2024. "Drive Sustainable Business Performance With Humane Entrepreneurship, Knowledge Management: The Mediation of Sustainable Business Advantage and Sustainable Business Model Innovation." *European Journal of Innovation Management* 28, no. 5: 2125–2149. https://doi.org/10.1108/ejim-12-2023-1079.

Li, X., L. Zhang, and J. Cao. 2023. "Research on the Mechanism of Sustainable Business Model Innovation Driven by the Digital Platform Ecosystem." *Journal of Engineering and Technology Management* 68: 101738.

Lüdeke-Freund, F. 2019. "Sustainable Entrepreneurship, Innovation, and Business Models: Integrative Framework and Propositions for Future Research." *Business Strategy and the Environment* 29, no. 2: 665–681. https://doi.org/10.1002/bse.2396.

Lüdeke-Freund, F., S. Gold, and N. M. P. Bocken. 2019. "A Review and Typology of Circular Economy Business Model Patterns." *Journal of Industrial Ecology* 23, no. 1: 36–61. https://doi.org/10.1111/jiec.12763.

Makhloufi, L. 2023. "Do Knowledge Sharing and Big Data Analytics Capabilities Matter for Green Absorptive Capacity and Green Entrepreneurship Orientation? Implications for Green Innovation." *Industrial Management & Data Systems* 124, no. 3: 978–1004. https://doi.org/10.1108/imds-07-2023-0508.

Manohar, H. L. 2024. "Social Innovation Capability of a Social Entrepreneur: Scale Development and Validation." *Journal of Social Entrepreneurship* 15, no. 3: 1161–1182. https://doi.org/10.1080/19420676.2022.2127853.

Mehrotra, S., and S. R. Jaladi. 2022. "How Start-Ups in Emerging Economies Embrace Circular Business Models and Contribute Towards a Circular Economy." *Journal of Entrepreneurship in Emerging Economies* 14, no. 5: 727–753. https://doi.org/10.1108/JEEE-10-2021-0410.

Mondal, S., S. Singh, and H. Gupta. 2023a. "Assessing Enablers of Green Entrepreneurship in Circular Economy: An Integrated Approach." *Journal of Cleaner Production* 388: 135999.

Mondal, S., S. Singh, and H. Gupta. 2023b. "Green Entrepreneurship and Digitalization Enabling the Circular Economy Through Sustainable Waste Management—An Exploratory Study of Emerging Economy." *Journal of Cleaner Production* 422: 138433.

Nambisan, S., M. Wright, and M. Feldman. 2019. "The Digital Transformation of Innovation and Entrepreneurship: Progress, Challenges and Key Themes." *Research Policy* 48, no. 8: 103773. https://doi.org/10.1016/j.respol.2019.03.018.

Nonaka, I., H. Takeuchi, and K. Umemoto. 1996. "A Theory of Organizational Knowledge Creation." *International Journal of Technology Management* 11, no. 7–8: 833–845. https://doi.org/10.1504/IJTM.1996.025472.

Odeyemi, O., F. O. Usman, N. Z. Mhlongo, O. A. Elufioye, and C. U. Ike. 2024. "Sustainable Entrepreneurship: A Review of Green Business Practices and Environmental Impact." *World Journal of Advanced Research and Reviews* 21, no. 2: 346–358. https://doi.org/10.30574/wjarr.2024.21.2.0461.

O'Neill, K., and D. Gibbs. 2016. "Rethinking Green Entrepreneurship—Fluid Narratives of the Green Economy." *Environment and Planning A: Economy and Space* 48, no. 9: 1727–1749. https://doi.org/10.1177/0308518x16650453.

Ozlen, K., and M. Handzic. 2021. "A Contingency Perspective for Knowledge Management Solutions in Different Decision-Making Contexts." In *Research Anthology on Decision Support Systems and Decision Management in Healthcare, Business, and Engineering*, 1242–1257. IGI Global.

Palmié, M., J. Boehm, C. K. Lekkas, V. Parida, J. Wincent, and O. Gassmann. 2021. "Circular Business Model Implementation: Design Choices, Orchestration Strategies, and Transition Pathways for Resource-Sharing Solutions." *Journal of Cleaner Production* 280: 124399. https://doi.org/10.1016/j.jclepro.2020.124399.

Panait, M., E. Hysa, L. Raimi, A. Kruja, and A. Rodriguez. 2022. "Guest Editorial: Circular Economy and Entrepreneurship in Emerging Economies: Opportunities and Challenges." *Journal of Entrepreneurship in Emerging Economies* 14, no. 5: 673–677. https://doi.org/10.1108/jeee-10-2022-487.

Pieroni, M. P., T. C. McAloone, and D. C. Pigosso. 2019. "Business Model Innovation for Circular Economy and Sustainability: A Review of Approaches." *Journal of Cleaner Production* 215: 198–216. https://doi.org/10.1016/j.jclepro.2019.01.036.

Ploum, L., V. Blok, T. Lans, and O. Omta. 2018. "Toward a Validated Competence Framework for Sustainable Entrepreneurship." *Organization & Environment* 31, no. 2: 113–132. https://doi.org/10.1177/1086026617697039.

Rajpal, M., and B. Singh. 2024. "How to Drive Sustainable Entrepreneurial Intentions: Unraveling the Nexus of Entrepreneurship Education Ecosystem, Attitude and Orientation." *Corporate Social Responsibility and Environmental Management* 31, no. 3: 1705–1721. https://doi.org/10.1002/csr.2644.

Rocha, C. S., P. Antunes, and P. Partidário. 2023. "Design for Circular Economy in a Strong Sustainability Paradigm." *Sustainability* 15, no. 24: 16866. https://doi.org/10.3390/su152416866.

Rossi, M., J. Chouaibi, D. Graziano, and G. Festa. 2022. "Corporate Venture Capitalists as Entrepreneurial Knowledge Accelerators in Global Innovation Ecosystems." *Journal of Business Research* 142: 512–523. https://doi.org/10.1016/j.jbusres.2022.01.003.

Sadiq, M., M. A. Nawaz, A. Sharif, and S. Hanif. 2024. "Bridging Green Supply Chain Practices and Environmental Performance in Chinese Semiconductor Sector: With the Role of Energy Efficiency and Green HRM." *International Journal of Production Economics* 277: 109381. https://doi.org/10.1016/j.ijpe.2024.109381.

Santa-Maria, T., W. J. V. Vermeulen, and R. J. Baumgartner. 2021. "How Do Incumbent Firms Innovate Their Business Models for the Circular Economy? Identifying Micro-Foundations of Dynamic Capabilities." *Business Strategy and the Environment* 31, no. 4: 1308–1333. https://doi.org/10.1002/bse.2956.

Sarstedt, M., J. F. Hair, M. Pick, B. D. Liengaard, L. Radomir, and C. M. Ringle. 2022. "Progress in Partial Least Squares Structural Equation Modeling Use in Marketing Research in the Last Decade." *Psychology & Marketing* 39, no. 5: 1035–1064. https://doi.org/10.1002/mar.21640.

Schaltegger, S., and M. Wagner. 2011. "Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions." *Business Strategy and the Environment* 20, no. 4: 222–237. https://doi.org/10.1002/bse.682.

Schnell, L., and E. S. Berger. 2025. "Sharing and Exchange Dynamics in Entrepreneurial Spaces: A Systematic Literature Review and Conceptualization." *Technological Forecasting and Social Change* 218, no. C: 124185. https://doi.org/10.1016/j.techfore.2025.124185.

Scott, S., M. Hughes, and D. Ribeiro-Soriano. 2022. "Towards a Network-Based View of Effective Entrepreneurial Ecosystems." *Review of Managerial Science* 16, no. 1: 157–187. https://doi.org/10.1007/s11846-021-00440-5.

Shao, J., C. Aneye, A. Kharitonova, and W. Fang. 2023. "Essential Innovation Capability of Producer-Service Enterprises Towards Circular Business Model: Motivators and Barriers." *Business Strategy and the Environment* 32, no. 7: 4548–4567. https://doi.org/10.1002/bse.3380.

Shu, Y., S. J. Ho, and T. C. Huang. 2020. "The Development of a Sustainability-Oriented Creativity, Innovation, and Entrepreneurship Education Framework: A Perspective Study." *Frontiers in Psychology* 11: 1878. https://doi.org/10.3389/fpsyg.2020.01878.

Spigel, B. 2017. "The Relational Organization of Entrepreneurial Ecosystems." *Entrepreneurship Theory and Practice* 41, no. 1: 49–72. https://doi.org/10.1111/etap.12167.

Sun, Y., J. C. Hong, and J. H. Ye. 2022. "The Effects of Employees' Perceived Intrinsic Motivation on Knowledge Sharing and Creative Self-Efficacy." *Frontiers in Psychology* 12: 762994. https://doi.org/10.3389/fpsyg.2021.762994.

Tao, F., Q. Qi, L. Wang, and A. Y. C. Nee. 2019. "Digital Twins and Cyber–Physical Systems Toward Smart Manufacturing and Industry 4.0: Correlation and Comparison." *Engineering* 5, no. 4: 653–661. https://doi.org/10.1016/j.eng.2019.01.014.

Teece, D. J., G. Pisano, and A. Shuen. 1997. "Dynamic Capabilities and Strategic Management." *Strategic Management Journal* 18, no. 7: 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z.

Theodoraki, C., L. Dana, and A. Caputo. 2022. "Building Sustainable Entrepreneurial Ecosystems: A Holistic Approach." *Journal of Business Research* 140: 346–360.

Truong, B. T. T., P. V. Nguyen, and D. Vrontis. 2024. "Enhancing Firm Performance Through Innovation: The Roles of Intellectual Capital, Government Support, Knowledge Sharing and Knowledge Management Success." *Journal of Intellectual Capital* 25, no. 1: 188–209. https://doi.org/10.1108/JIC-08-2023-0181.

Woldeyes, T. D., M. Muffatto, and F. Ferrati. 2025. "Emerging Business Model Archetypes in the Circular Economy: A Systematic Literature Review." *Sustainable Development* 33, no. 3: 4428–4456. https://doi.org/10.1002/sd.3348.

Ye, P., L. Liu, and J. Tan. 2022. "Creative Leadership, Innovation Climate and Innovation Behaviour: The Moderating Role of Knowledge Sharing in Management." *European Journal of Innovation Management* 25, no. 4: 1092–1114. https://doi.org/10.1108/EJIM-05-2020-0199.

Yodchai, N., P. T. M. Ly, and L. T. T. Tran. 2022. "How the Creative Mindset Affects Entrepreneurial Success in the Tourism Sector: The Mediating Role of Innovation Capability." *International Journal of Contemporary Hospitality Management* 34, no. 1: 279–298. https://doi.org/10.1108/IJCHM-06-2021-0695.

Zahra, S. A., and G. George. 2002. "Absorptive Capacity: A Review, Reconceptualization, and Extension." *Academy of Management Review* 27, no. 2: 185–203. https://doi.org/10.5465/amr.2002.6587995.

Zhai, Y., K. Yang, L. Chen, H. Lin, M. Yu, and R. Jin. 2023. "Digital Entrepreneurship: Global Maps and Trends of Research." *Journal of Business & Industrial Marketing* 38, no. 3: 637–655. https://doi.org/10.1108/JBIM-05-2021-0244.

Zhang, L., S. Banihashemi, L. Zhu, H. Molavi, E. Odacioglu, and M. Shan. 2024. "A Scientometric Analysis of Knowledge Transfer Partnerships in Digital Transformation." *Journal of Open Innovation: Technology, Market, and Complexity* 10, no. 3: 100325. https://doi.org/10.1016/j.joitmc.2024.100325.