Tec Empresarial
P-ISSN: 1659-2395; E-ISSN: 1659-3359

Dynamic Capability Microfoundations and Sustainability Performance: Examining the Mediating Role of Supply Chain Collaborative Innovation

Alhidayatullah[A], Herlitah[B], Suparno[C]

Abstract

This study aims to analyze the impact of Dynamic Capability Microfoundations comprising Sensing Capability, Seizing Capability, and Transforming Capability on Sustainability Performance, with Supply Chain Collaborative Innovation (SCCI) serving as a mediating variable in bamboo handicraft SMEs in West Java. The study employs a quantitative methodology utilising an explanatory research design. Data was collected from 250 owners or managers of handmade SMEs, selected through purposive sampling methods. Data analysis was conducted via SEM-PLS through SmartPLS 4.0. The findings indicated that Seizing Capability and Transforming Capability positively and significantly influenced Sustainability Performance, however Sensing Capability did not exert a meaningful effect. Moreover, Sensing Capability and Seizing Capability exert a favourable and considerable influence on Supply Chain Collaborative Innovation, whereas Transforming Capability has no impact. This study demonstrates that Supply Chain Collaborative Innovation positively and significantly influences Sustainability Performance. In mediation analysis, Supply Chain Collaborative Innovation was demonstrated to completely mediate the association between Sensing Capability and Sustainability Performance, while partially mediating the relationship between Seizing Capability and Sustainability Performance. Mediation does not influence the link between Transforming Capability and Sustainability Performance. This study theoretically enhances Dynamic Capability Theory and Open Innovation Theory by demonstrating that each dimension of dynamic capability microfoundations employs distinct mechanisms to enhance Sustainability Performance, while also confirming the strategic significance of Supply Chain Collaborative Innovation as a means of converting dynamic capabilities into sustainable competitive advantage. The study's findings offer recommendations for SMEs to enhance their capacity to capitalise on opportunities, reform their organisations, and establish new collaborations within the supply chain to bolster business sustainability.

Keywords: *Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, Sustainability Performance.*

[A]*Universitas Negeri Jakarta, Indonesia, Email: al.hidayatullah@mhs.unj.ac.id*
[B]*Universitas Negeri Jakarta, Indonesia, Email: herlitah@unj.ac.id*
[C]*Universitas Negeri Jakarta, Indonesia, Email: suparno@unj.ac.id*

INTRODUCTION

Sustainability has emerged as a strategic concern receiving heightened focus in management and business literature, attributable to escalating environmental, social, and economic pressures confronting organisations amid globalisation and digital transformation (Pricopoaia et al., 2025; Rahman et al., 2025). In this context, sustainability performance is perceived not solely as economic achievement but also encompasses the organization's capacity to generate social value while concurrently preserving environmental sustainability (Bossink, 2025; Ji et al., 2025). The triple bottom line method asserts that organisational success should be evaluated by balancing economic (profit), social (people), and environmental (planetary) dimensions to guarantee long-term corporate sustainability (Alsawafi et al., 2021).

SMEs play a crucial role in fostering sustainable economic development by facilitating job creation, alleviating poverty, enhancing community income, and bolstering the local economy (Dukhaykh & Alangri, 2026). In Indonesia, small and medium-sized enterprises (SMEs) account for over 60% of the national Gross Domestic Product and employ more than 97% of the workforce, establishing them as the cornerstone of the national economy (Abduh et al., 2024; Suparno et al., 2022). The handmade industry, a promising SME subsector, leverages creativity, local culture, and community skills to generate economic value (Herlitah, 2025). The handicraft sector not only generates high-value items but also contributes to the preservation of local culture and the empowerment of rural populations (Valdivieso-Uvidia et al., 2025).

Handcraft SMEs, despite their significant potential, encounter numerous problems stemming from the escalating complexity of the global business environment (Ali et al., 2023). Shifting consumer preferences, advancements in digital technology, variations in raw material costs, global supply chain disturbances, and heightened competition from mass-produced goods necessitate that SMEs swiftly adapt to external environmental changes (Anwer & Ahmed Siddiqui, 2019; Herzallah et al., 2025; Masocha, 2018). Furthermore, contemporary global customers increasingly need items that are both of superior quality and manufactured sustainably and environmentally responsibly (Huang et al., 2025). This state enables SMEs to possess strategic competencies that facilitate effective responses to market fluctuations and sustain long-term competitiveness (Iranto et al., 2025; Saunila et al., 2024).

From the viewpoint of strategic management theory, organisations' capacity to adjust to environmental changes is elucidated by the concept of dynamic capability, as introduced by Teece and further explored in various contemporary studies (Dukhaykh & Alangri, 2026; D. J. Teece, 2018a). Dynamic capability denotes an organization's capacity to assimilate, develop, and reorganise internal and external resources in response to swift and unpredictable environmental shifts (Bogers et al., 2019; Mohaghegh et al., 2021). Recent studies indicate that organisations possessing robust dynamic skills are generally more

innovative, adaptable, and proficient in establishing a lasting competitive advantage compared to those that depend exclusively on traditional resources (Anwer & Ahmed Siddiqui, 2019; Dukhaykh & Alangri, 2026). Recent work indicates that the effectiveness of dynamic capability is determined not only by organisational-level capabilities but also by the microfoundations that underpin their development (Suddaby et al., 2020). Unlike the conventional perspective, which conceptualises dynamic capability as a higher-order organisational capability, the microfoundational perspective explains how adaptive capability emerges from the interaction of managerial cognition, organisational routines, learning processes, coordination mechanisms, and strategic decision-making that collectively enable organisations to sense opportunities, seize them through timely resource allocation, and transform existing resources into new competitive advantages (D. J. Teece et al., 2023). This perspective provides stronger explanatory power because organisational adaptation is not an automatic organisational outcome but rather the cumulative result of managerial actions and internal organisational processes. Such an approach is particularly relevant for SMEs, where limited financial, technological, and human resources make organisational performance highly dependent on the capabilities of owners, managers, and employees to continuously recognise environmental changes, mobilise available resources, and reconfigure organisational routines (Dukhaykh & Alangri, 2026). Accordingly, examining dynamic capability through its microfoundations provides a more comprehensive understanding of how SMEs develop adaptive behaviour and sustain competitiveness under conditions of environmental uncertainty than studies that examine dynamic capability solely as an aggregated organisational capability. The success of a business in attaining sustainable performance is determined not only by its internal capabilities but also by its capacity to establish collaborative partnerships with diverse stakeholders in the supply chain (Jum'a et al., 2025). The open innovation paradigm posits that innovation is no longer solely generated internally within a business; rather, it emerges from collaboration across enterprises, suppliers, customers, research institutions, universities, communities, and government entities (Audretsch et al., 2023). This partnership enables organisations to access expertise, technology, market information, and external resources, hence enhancing innovative capacity and operational efficiency (Jum'a et al., 2025).

Although previous studies have frequently examined organisational learning, green innovation, knowledge integration, and absorptive capability as mechanisms linking dynamic capability with organisational performance, these approaches primarily emphasise internal organisational processes. In contrast, Supply Chain Collaborative Innovation provides a broader theoretical explanation by capturing how organisations jointly create, exchange, and exploit knowledge across organisational boundaries through collaborative relationships with suppliers, customers, distributors, communities,

research institutions, and government agencies. From the perspective of Open Innovation Theory, sustainable organisational performance is increasingly achieved through the integration of internal capabilities with external knowledge and complementary resources rather than relying solely on internally generated innovation (Audretsch et al., 2023). Therefore, positioning Supply Chain Collaborative Innovation as a mediating mechanism extends existing literature by explaining how dynamic capability microfoundations are translated into sustainability performance through collaborative value creation within supply chain networks.

In this context, supply chain collaborative innovation serves as a strategic mechanism enabling organisations to generate shared value through the integration of information and the coordination of actions across supply chain participants (Audretsch et al., 2023). Research indicates that inventive collaboration throughout the supply chain enhances product quality, expedites innovation processes, diminishes operational expenses, and bolsters organisational responsiveness to market fluctuations (Jum'a et al., 2025). Furthermore, collaborative innovation throughout the supply chain enhances the attainment of sustainability objectives by optimising resource utilisation and mitigating the environmental repercussions of industrial processes (Liu et al., 2023). The connection between dynamic capability and sustainability performance typically transpires indirectly, facilitated by several mediating mechanisms that translate organisational capabilities into measurable performance outcomes (Dukhaykh & Alangri, 2026). Collaborative innovation has garnered significant attention as it enables organisations to integrate internal and external resources to develop more effective ideas (Jum'a et al., 2025). Organisations that possess strong sensing capabilities for cooperation possibilities, adeptness in using external networks, and proficiency in integrating partner resources will be more effective in generating innovations that promote business sustainability (Wei et al., 2025).

Recent studies indicate that collaborative innovation within supply chains positively impacts sustainability performance by enhancing operational efficiency, fortifying stakeholder relationships, and generating innovations that possess both economic and environmental value (Fontoura & Coelho, 2022; Jum'a et al., 2025). Nonetheless, prior research continues to exhibit contradictions concerning the correlation among dynamic capability, collaborative innovation, and sustainable performance (Anwer & Ahmed Siddiqui, 2019; Journeault et al., 2021; Xie & Wang, 2025). Certain studies identified positive and significant effects, although others indicated that these effects were contingent upon industry features, environmental volatility, and the organization's ability to handle external collaborations (Lei et al., 2025). The variability of these data indicates a research gap that requires additional investigation, particularly for SMEs in developing nations.

The context of bamboo handicraft SMEs in West Java provides a theoretically relevant setting for examining the proposed conceptual

framework because these enterprises operate within production systems that are highly dependent on local knowledge, traditional craftsmanship, community participation, and long-term relationships with raw material suppliers and market intermediaries. Unlike large manufacturing firms with abundant internal resources, bamboo handicraft SMEs typically face financial, technological, and managerial resource constraints that increase their dependence on collaborative networks to access market information, design innovation, sustainable raw materials, and technological support. At the same time, increasing market competition, fluctuating export performance, limited innovation adoption, and disruptions within supply chains create substantial environmental uncertainty that requires firms to continuously strengthen their adaptive capabilities (Alhidayatullah et al., 2025). The rapid development of digital technologies and growing consumer demand for environmentally responsible products further reinforce the importance of integrating dynamic capability microfoundations with collaborative innovation strategies to improve sustainability performance (Bernal-Torres et al., 2025; J. Li et al., 2024). These characteristics make bamboo handicraft SMEs an appropriate empirical context for investigating how internal adaptive capabilities are transformed into sustainable organisational outcomes through collaborative relationships across supply chains. Although the present study focuses on bamboo handicraft SMEs in West Java, the proposed theoretical framework may also provide valuable insights for other creative industries characterised by resource constraints, community-based production systems, and intensive inter-organisational collaboration, while acknowledging that differences in industrial structure and institutional environments may influence the transferability of the findings.

While the relationship between dynamic capability and sustainability performance has been widely investigated across various organisational settings, several important theoretical gaps remain. First, previous studies have predominantly conceptualised dynamic capability as a higher-order organisational capability, providing limited understanding of how adaptive capability emerges from its underlying microfoundations, including managerial cognition, organisational routines, learning processes, and resource orchestration (Dukhaykh & Alangri, 2026). Second, existing studies have primarily employed organisational learning, green innovation, knowledge management, and absorptive capability as mediating mechanisms explaining the relationship between dynamic capability and sustainability performance (Achmad & Wiratmadja, 2025; H. Li, 2022). Comparatively, the role of Supply Chain Collaborative Innovation as a collaborative mechanism through which dynamic capability microfoundations generate sustainable organisational outcomes remains insufficiently explored, particularly from the perspective of Open Innovation Theory. Third, empirical evidence has been dominated by studies conducted in large manufacturing firms, high-technology industries, and developed economies, leaving limited understanding regarding resource-

constrained creative SMEs operating within developing countries (Jum'a et al., 2025; Qiu et al., 2020). Addressing these gaps, this study contributes theoretically by extending Dynamic Capability Theory through the examination of dynamic capability at the microfoundational level rather than solely as an organisational-level capability. Furthermore, this study extends Open Innovation Theory by demonstrating how Supply Chain Collaborative Innovation functions as the mechanism through which internal adaptive capabilities are translated into sustainability performance through collaborative value creation across supply chain networks. Finally, by focusing on bamboo handicraft SMEs in West Java, this study expands the contextual applicability of both theories within resource-constrained creative industries characterised by strong dependence on local knowledge, collaborative partnerships, and environmental uncertainty. Based on these theoretical gaps and contributions, this study aims to analyse the influence of dynamic capability microfoundations on sustainability performance in bamboo handicraft SMEs by examining the mediating role of Supply Chain Collaborative Innovation. Therefore, this study aims to examine the influence of dynamic capability microfoundations, represented by sensing, seizing, and transforming capabilities, on sustainability performance in bamboo handicraft SMEs in West Java, with Supply Chain Collaborative Innovation serving as a mediating mechanism.

LITERATURE REVIEW

Dynamic Capability Theory and Open Innovation Theory

This research employs Dynamic Capability Theory to elucidate the organization's capacity to sustain competitive advantage and attain sustainability within a fluctuating business environment. This theory advances the Resource-Based View (RBV), asserting that competitive advantage is influenced not only by the possession of strategic resources but also by the organization's capacity to manage, develop, and reconfigure these resources in response to environmental changes (D. J. Teece et al., 1997). D. J. Teece (2018) defines dynamic capability as an organization's ability to generate, enhance, and modify resources and competences to effectively address evolving markets, technologies, and consumer demands. Dynamic capability encompasses three interrelated dimensions: sensing capability, seizing capability, and transforming capability. Sensing capability refers to the ability to identify changes, opportunities, and threats in the external environment; seizing capability concerns the ability to evaluate identified opportunities and mobilise resources through appropriate strategic decisions and investments; while transforming capability refers to the ability to reconfigure organisational resources, routines, and processes in response to changing environmental conditions (D. J. Teece et al., 2016). These dimensions are conceptually interconnected, as sensing provides the information required for seizing, while seizing translates recognised

opportunities into strategic actions that may subsequently require organisational transformation and resource reconfiguration. Thus, dynamic capability should be understood not merely as a collection of independent capabilities but as an interrelated process through which organisations adapt to environmental changes.

Within the realm of handicraft SMEs, these competencies facilitate collaborative supply chain innovation and the sustainable enhancement of sustainability performance (Anwer & Ahmed Siddiqui, 2019). This research also draws on Open Innovation Theory to explain how organisations access, integrate, and utilise knowledge and resources beyond their organisational boundaries. Chesbrough (2003) argues that innovation does not depend exclusively on internally generated knowledge but can also emerge through the purposeful use of external knowledge, technologies, expertise, and other complementary resources. Open innovation therefore emphasises the importance of collaboration with external actors, including suppliers, customers, universities, government institutions, and other organisations, to expand the knowledge and resources available for innovation (Bogers et al., 2019; West & Bogers, 2017). For SMEs, this perspective is particularly relevant because resource constraints may limit their ability to independently develop all the knowledge and capabilities required to respond to changing market and technological conditions. Chesbrough (2003) asserts that organisations now depend not only on internal resources for innovation but also on external resources via strategic partnerships and collaboration. Open innovation enables organisations to acquire new technologies, market insights, technical skills, and knowledge that might enhance innovation efficacy (Bogers et al., 2019; West & Bogers, 2017). Collaboration among suppliers, customers, universities, governments, and the business sector is a crucial element in fostering rapid and efficient innovations within supply chains (Jum'a et al., 2025).

Dynamic Capability Microfoundations

Sensing capability

Sensing capability refers to an organisation's capacity to identify, interpret, and evaluate opportunities and threats arising from changes in the external environment (D. J. Teece, 2018). As a microfoundation of dynamic capability, sensing is reflected in managerial and organisational activities such as monitoring market developments, gathering and interpreting customer information, tracking technological advancements, assessing competitors, and identifying industry trends that may affect organisational performance and sustainability (D. J. Teece et al., 2016). Organisations with stronger sensing capability are therefore better positioned to recognise changes in their environment and anticipate shifts in customer preferences than organisations with weaker sensing capability (Zabel et al., 2023). In the context of handicraft SMEs,

sensing capability enables business owners and managers to identify changing preferences for environmentally responsible products, contemporary designs, digital marketing channels, and emerging market opportunities, thereby providing an informational basis for subsequent strategic decisions (Dukhaykh & Alangri, 2026). Previous studies indicate that sensing capability can contribute to organisational creativity, new product development, organisational flexibility, and sustainability performance (Achmad & Wiratmadja, 2025; Chaudhuri et al., 2024). As the initial process of dynamic capability, however, sensing primarily generates awareness and knowledge of environmental changes; the conversion of these insights into concrete strategic responses depends on the organisation's subsequent seizing capability.

Seizing Capability

Seizing capability refers to an organisation's capacity to act upon opportunities and threats identified through sensing by converting environmental insights into strategic decisions and resource commitments that generate value and competitive advantage (D. J. Teece, 2018). As the second microfoundation of dynamic capability, seizing involves activities such as investment decision-making, product innovation, adoption of new technologies, business model development, and the allocation of resources to selected strategic opportunities (D. J. Teece et al., 2016). Seizing capability enables organisations to transform recognised market opportunities into new products, services, revenue streams, and strategic positions (Schilke et al., 2018). In competitive environments, organisations with stronger seizing capability are better able to translate market information into timely innovations and responses to changing customer demands (Qiu et al., 2020). Within handicraft SMEs, seizing capability can be reflected in decisions to develop new products, adopt digital technologies, expand marketing channels, allocate resources to promising market opportunities, and establish strategic partnerships to strengthen competitiveness (Dukhaykh & Alangri, 2026). Thus, while sensing provides the knowledge necessary to recognise environmental changes, seizing represents the managerial process through which such knowledge is converted into strategic action.

Transforming Capability

Transforming capability refers to an organisation's capacity to reconfigure and renew its resources, organisational structures, business processes, and competences in response to changes in the business environment (D. J. Teece, 2018). As the third microfoundation of dynamic capability, transforming enables organisations to implement and institutionalise strategic changes by modifying existing routines, reallocating resources, and redesigning organisational processes when

established arrangements no longer provide an adequate response to environmental conditions (D. J. Teece et al., 2016). This capability can strengthen organisational flexibility, support continuous learning, foster innovation, and improve the implementation of strategic decisions (Schilke et al., 2018). Organisations with stronger transforming capability are better positioned to modify business models, production technologies, organisational structures, and operating processes in response to evolving market requirements (Ghosh et al., 2022). Within handicraft SMEs, transforming capability may be demonstrated through the digitalisation of operations, improvements in production efficiency, adoption of sustainable production practices, modification of business processes, and restructuring of collaborative networks to support long-term business sustainability (Dukhaykh & Alangri, 2026; Sousa-Zomer et al., 2020). Transforming therefore represents the reconfiguration stage of dynamic capability, through which strategic responses developed from sensed opportunities and seized through managerial decisions are embedded and adjusted within the organisation.

Sustainability Performance

Sustainability performance refers to an organisation's ability to achieve economic, social, and environmental objectives simultaneously while maintaining its long-term viability (Elkington, 1997). This concept is grounded in the Triple Bottom Line perspective, which argues that organisational performance should be assessed not only through financial outcomes but also through the organisation's contribution to social well-being and environmental sustainability (Elkington, 1997; Madhavan et al., 2022). Accordingly, sustainability performance represents a multidimensional organisational outcome that reflects the extent to which firms are able to balance and integrate economic, social, and environmental considerations in their business activities (Pascucci et al., 2022; Elsebaie et al., 2023).

The economic dimension encompasses outcomes related to productivity, profitability, operational efficiency, and market competitiveness, reflecting the firm's ability to maintain economic viability while pursuing sustainability objectives (Bataineh et al., 2024). The social dimension concerns employee welfare, community empowerment, and relationships with relevant stakeholders, reflecting the organisation's contribution to social well-being and stakeholder interests (Le, 2022; Tegethoff et al., 2025). The environmental dimension includes efficient resource utilisation, waste management, emission reduction, and the adoption of environmentally responsible practices (Halbusi et al., 2024; Valdivieso-Uvidia et al., 2025).

In this study, these dimensions are treated as complementary components of a single sustainability performance construct because sustainable organisational performance requires the simultaneous consideration of economic viability, social responsibility, and environmental outcomes. Treating sustainability performance as an

integrated construct is consistent with the Triple Bottom Line perspective, in which the three dimensions collectively represent the broader sustainability outcomes of an organisation rather than isolated performance domains (Elkington, 1997). This approach is particularly relevant to SMEs because their sustainability is unlikely to be adequately represented by financial performance alone; their long-term viability is also influenced by their relationships with employees and communities and their ability to manage environmental resources efficiently. Therefore, the integrated construct captures the overall sustainability outcomes that emerge from the interaction of these three dimensions.

Supply Chain Collaborative Innovation

Supply Chain Collaborative Innovation (SCCI) refers to the joint development and implementation of new or improved products, processes, services, or solutions through collaboration among actors within and around the supply chain, including suppliers, manufacturers, distributors, customers, research institutions, universities, and government entities. SCCI emphasises the joint mobilisation of knowledge, resources, technologies, and expertise across organisational boundaries rather than relying exclusively on innovation generated within a single organisation. This concept is consistent with Open Innovation Theory, which argues that organisations can enhance their innovation processes by purposefully accessing, integrating, and exploiting knowledge and resources from external sources (Chesbrough, 2003; Bogers et al., 2019).

Collaboration within the supply chain becomes particularly important when organisations face limitations in financial resources, technological capabilities, knowledge, and market information. Through collaborative relationships, firms can access complementary resources, exchange knowledge, coordinate activities, and jointly develop solutions that would be difficult to generate independently (Bogers et al., 2019). Corrales-Estrada et al. (2025) conceptualise collaborative innovation as a process of generating shared value through resource integration, knowledge exchange, and joint development of innovative solutions among participating actors. Accordingly, SCCI can strengthen organisational flexibility, accelerate innovation, and improve the ability of firms to respond to changing market and environmental requirements (Jum'a et al., 2025).

The role of SCCI is particularly relevant to SMEs because resource constraints can limit their ability to develop and implement innovations independently. Through collaboration with supply chain partners, SMEs can complement their internal capabilities with external knowledge, technologies, market information, and other resources. Therefore, SCCI provides an inter-organisational mechanism through which internal organisational capabilities can be connected with external resources and knowledge. From an Open Innovation perspective, this mechanism is

important because the availability of internal capabilities alone does not guarantee that firms can convert recognised opportunities into innovations that generate broader organisational value. SCCI enables firms to extend their innovation activities beyond organisational boundaries and jointly create solutions that can contribute to economic, social, and environmental outcomes. This theoretical role provides a basis for examining SCCI as a mechanism through which dynamic capability microfoundations may contribute to sustainability performance.

Hypothesis Development

Sensing capability to sustainability performance

Sensing capability enables organisations to systematically identify, interpret, and evaluate changes in markets, technologies, customer preferences, competitor behaviour, and other external conditions that may create opportunities or threats for organisational performance (D. J. Teece, 2018). From the perspective of Dynamic Capability Theory, sensing constitutes the initial process through which organisations develop an informed understanding of environmental changes and identify issues that require strategic responses (D. J. Teece et al., 2016). The information generated through sensing can provide a basis for recognising emerging market opportunities, anticipating changes in stakeholder expectations, and identifying environmental and social pressures that may affect the organisation's long-term viability. Previous studies indicate that sensing capability is associated with organisational creativity, flexibility, adaptability, and sustainability performance (Zabel et al., 2023; Al-Husain et al., 2025; Anwer & Ahmed Siddiqui, 2019; Dukhaykh & Alangri, 2026). In handicraft SMEs, the ability to identify changing consumer preferences for environmentally responsible products, emerging design trends, digital market opportunities, and sustainability requirements can provide information for developing responses that simultaneously support economic viability, social value creation, and environmental responsibility. Therefore, stronger sensing capability is expected to enhance an organisation's ability to recognise and respond to sustainability-related opportunities and pressures, leading to improved sustainability performance.

H_1: Sensing Capability has a positive effect on Sustainability Performance.

Seizing capability to sustainability performance

Seizing capability refers to an organisation's ability to convert opportunities identified through sensing into strategic decisions, resource commitments, and concrete actions that generate organisational value (D. J. Teece, 2018). Whereas sensing provides knowledge about changes in the external environment, seizing determines how organisations select appropriate responses and commit resources to pursue identified opportunities. This process may involve

investment decisions, new product development, technology adoption, business model adaptation, and the allocation of resources to activities considered strategically important (D. J. Teece et al., 2016). Organisations with stronger seizing capability are better positioned to translate environmental information into innovations and strategic initiatives that address market demands and sustainability challenges (Anwer & Ahmed Siddiqui, 2019; Schilke et al., 2018). Empirical evidence also indicates that seizing capability can contribute to sustainability performance through improvements in operational efficiency, product innovation, and organisational resilience (Dukhaykh & Alangri, 2026). For handicraft SMEs, the ability to commit resources to digital technologies, environmentally responsible products, new distribution channels, and emerging market opportunities can generate economic value while simultaneously supporting social and environmental objectives. Accordingly, stronger seizing capability is expected to increase the likelihood that identified sustainability-related opportunities will be converted into actions that improve sustainability performance.

H_2: Seizing Capability has a positive effect on Sustainability Performance.

Transforming capability to sustainability performance

Transforming capability refers to an organisation's ability to reconfigure and renew its resources, organisational structures, business processes, and operating models in response to changes in the external environment (D. J. Teece, 2018). This capability enables organisations to institutionalise strategic responses by modifying existing routines, reallocating resources, and restructuring activities when established practices become less effective under changing conditions (D. J. Teece et al., 2016). Transforming capability is therefore particularly relevant to sustainability because sustainability-oriented strategies often require changes that extend beyond individual decisions, including the modification of production processes, organisational routines, resource utilisation, and business models. Sousa-Zomer et al. (2020) emphasise the importance of transformation in strengthening organisational flexibility and the implementation of strategic change, while empirical studies indicate that transforming capability contributes to organisational agility, innovation, and sustainability performance (Ferradás-González et al., 2024; Ghosh et al., 2022; Dukhaykh & Alangri, 2026). In handicraft SMEs, transforming capability may enable firms to adopt digital production and marketing practices, improve resource efficiency, implement more sustainable production methods, and adapt business models to changing market requirements. These changes can improve economic viability while reducing environmental impacts and supporting longer-term organisational sustainability. Therefore, stronger transforming capability is expected to positively influence sustainability performance.

H_3: Transforming Capability has a positive effect on Sustainability Performance.

Sensing capability to supply chain collaborative innovation

Sensing capability can facilitate Supply Chain Collaborative Innovation by enabling organisations to identify changes in market requirements, technological developments, customer preferences, supply conditions, and potential opportunities for inter-organisational collaboration (D. J. Teece, 2018). The ability to recognise such changes provides firms with information about where external knowledge and complementary resources may be required and which supply chain actors may contribute to the development of innovative solutions. This argument is consistent with Open Innovation Theory, which emphasises that firms can strengthen their innovation activities by identifying and accessing relevant external knowledge, technologies, and expertise (Chesbrough, 2003). Previous studies have demonstrated that market knowledge, customer understanding, and awareness of external developments can support collaborative innovation by helping organisations identify appropriate partners and opportunities for knowledge exchange and joint innovation (Bogers et al., 2019; Jum'a et al., 2025; Khurana et al., 2022; West & Bogers, 2017). For handicraft SMEs, sensing capability can help business owners and managers recognise opportunities to collaborate with raw material suppliers, designers, creative communities, educational institutions, distributors, and digital platforms in response to emerging market and technological requirements. Consequently, organisations with stronger sensing capability are expected to be better able to identify and initiate collaborative opportunities that support Supply Chain Collaborative Innovation.

H_4: Sensing Capability has a positive effect on Supply Chain Collaborative Innovation.

Seizing capability to supply chain collaborative innovation

Seizing capability enables organisations to convert collaboration opportunities identified through sensing into concrete innovation initiatives by making strategic decisions, committing resources, and coordinating activities with external partners (D. J. Teece et al., 2016). In the context of collaborative innovation, seizing involves more than recognising potential partners; it requires organisations to determine which collaborative opportunities should be pursued, allocate resources to joint activities, establish appropriate forms of cooperation, and integrate external expertise into innovation initiatives. This argument is consistent with Open Innovation Theory, as the effective use of external knowledge depends on the firm's ability to select, mobilise, and combine external resources with its internal capabilities (Chesbrough, 2003;

Audretsch et al., 2023). Previous studies indicate that the ability to act upon collaborative opportunities and commit resources to inter-organisational activities can strengthen collaborative innovation (Fontoura & Coelho, 2022; Jum'a et al., 2025; Khurana et al., 2022). In handicraft SMEs, seizing capability may be reflected in decisions to establish joint product development with designers, coordinate innovation activities with suppliers and distributors, adopt technologies provided through external partnerships, and allocate resources to collaborative market development. These actions enable firms to move from identifying potential collaboration opportunities to actively creating and implementing innovations with supply chain partners. Therefore, stronger seizing capability is expected to positively influence Supply Chain Collaborative Innovation.

H_5: Seizing Capability has a positive effect on Supply Chain Collaborative Innovation.

Transforming capability to supply chain collaborative innovation

Transforming capability enables organisations to reconfigure their structures, routines, work processes, resources, and coordination mechanisms in response to changing environmental conditions (D. J. Teece, 2018b). In the context of collaborative innovation, such reconfiguration can create organisational conditions that facilitate the integration of knowledge, technologies, and resources obtained from external partners. Effective collaboration may require firms to modify established routines, adjust coordination mechanisms, adopt new technologies, and develop organisational practices that support knowledge sharing across organisational boundaries. Therefore, transforming capability can strengthen the organisational readiness required to engage in and sustain collaborative innovation. Previous studies indicate that organisational transformation can support collaborative innovation by improving coordination, facilitating knowledge integration, and enabling technological adaptation (Fontoura & Coelho, 2022; Jum'a et al., 2025; Khurana et al., 2022). In handicraft SMEs, the ability to modify production methods, adopt digital technologies, adjust internal processes, and develop more collaborative organisational practices can facilitate stronger relationships with supply chain partners and support the joint development of innovative solutions. Accordingly, stronger transforming capability is expected to increase an organisation's ability to engage in Supply Chain Collaborative Innovation.

H_6: Transforming Capability has a positive effect on Supply Chain Collaborative Innovation.

Supply chain collaborative innovation to sustainability performance

Supply Chain Collaborative Innovation (SCCI) enables organisations to jointly develop and implement innovations through the exchange and integration of knowledge, technologies, resources, and expertise among supply chain stakeholders, including suppliers, customers, distributors, research institutions, government entities, and other business partners (Journeault et al., 2021; Jum'a et al., 2025). From the perspective of Open Innovation Theory, such collaboration allows firms to complement their internal resources with external knowledge and capabilities that can improve the effectiveness and relevance of innovation activities (Bogers et al., 2019; Chesbrough, 2003). Through intensive collaboration, organisations can jointly develop new products and processes, improve product quality, increase operational efficiency, and reduce unnecessary costs and resource consumption (West & Bogers, 2017). These outcomes can contribute to sustainability by strengthening economic performance while also supporting more efficient resource utilisation, waste reduction, and environmentally responsible practices (Khurana et al., 2022a). Collaborative relationships may also strengthen stakeholder engagement and knowledge sharing, thereby supporting the social dimension of sustainability. Empirical studies consequently indicate that collaborative innovation can improve sustainability performance through its contribution to economic, social, and environmental outcomes (Audretsch et al., 2023; Saunila et al., 2024). Therefore, organisations with stronger Supply Chain Collaborative Innovation are expected to achieve higher levels of Sustainability Performance.

H_7: Supply chain collaborative innovation has a positive effect on Sustainability Performance.

The role of collaborative innovation supply chain mediation on the relationship between sensing capability and sustainability performance

Dynamic Capability Theory suggests that sensing capability enables organisations to identify opportunities, threats, and changes in their external environment, but the information generated through sensing does not automatically produce improved organisational outcomes (D. J. Teece, 2018). Sensing primarily provides knowledge about emerging customer requirements, technological developments, market changes, and potential opportunities, while the conversion of such knowledge into valuable innovation may require access to complementary resources and knowledge beyond the organisation's boundaries. Supply Chain Collaborative Innovation can provide such a mechanism by connecting the information identified through sensing with external actors that possess complementary knowledge, technologies, resources, and market expertise. Consistent with Open

Innovation Theory, collaboration enables organisations to combine internally generated knowledge with external resources and capabilities to develop innovations that would be difficult to achieve independently (Chesbrough, 2003; Bogers et al., 2019). For handicraft SMEs, sensing capability may identify changing preferences for sustainable products or emerging market opportunities, while collaboration with suppliers, customers, designers, communities, and other partners can provide the resources and knowledge required to translate those insights into innovative products and processes. Such collaborative innovations can subsequently contribute to economic, social, and environmental performance (Jum'a et al., 2025). Therefore, SCCI is expected to function as an intermediary mechanism through which sensing capability is translated into improved sustainability performance.

H_8: Supply Chain Collaborative Innovation positively mediates the relationship between Sensing Capability and Sustainability Performance.

The role of collaborative innovation supply chain mediation on the relationship between seizing capability and sustainability performance

Seizing capability enables organisations to convert recognised opportunities into strategic decisions, resource commitments, and concrete innovation initiatives (D. J. Teece et al., 2016). Although this capability provides the basis for acting upon opportunities, the successful implementation of strategic initiatives may depend on resources and knowledge that are not fully available within the organisation. Open Innovation Theory suggests that firms can overcome such limitations by accessing and integrating external knowledge, technologies, and complementary capabilities through collaboration (Chesbrough, 2003). Supply Chain Collaborative Innovation provides a mechanism through which seizing capability can be extended beyond internal resource mobilisation by enabling firms to coordinate strategic actions with suppliers, customers, distributors, technology providers, and other partners. Through these relationships, firms can obtain complementary resources and expertise, jointly develop products and processes, and improve the implementation of innovations that address economic, social, and environmental requirements (West & Bogers, 2017; Jum'a et al., 2025). In handicraft SMEs, for example, a strategic decision to develop sustainable products or enter new digital markets may generate greater sustainability outcomes when the firm can mobilise suppliers, designers, distributors, and other partners to provide the knowledge and resources required for implementation. Thus, SCCI is expected to strengthen the process through which seizing capability is translated into sustainability performance.

H_9: Supply Chain Collaborative Innovation positively mediates the relationship between Seizing Capability and Sustainability Performance.

The role of collaborative innovation supply chain mediation on the relationship between transforming capability and sustainability performance

Transforming capability enables organisations to reconfigure resources, organisational structures, business processes, and operating models so that established arrangements remain aligned with changing environmental conditions (D. J. Teece, 2018). However, organisational transformation may require knowledge, technologies, and resources that cannot be generated internally, particularly in SMEs with limited financial, technological, and managerial resources. External collaboration can therefore complement internal transformation by providing access to partners that possess relevant expertise, technologies, market knowledge, and other complementary resources (Liu et al., 2023). Supply Chain Collaborative Innovation provides a mechanism for integrating these external resources into organisational transformation by facilitating joint problem-solving, knowledge exchange, technology adoption, and coordination among supply chain partners (Bogers et al., 2019). Such collaboration can help firms implement changes more effectively, improve operational efficiency, adopt sustainable production practices, and develop new approaches to value creation (Fontoura & Coelho, 2022). In handicraft SMEs, for example, transforming production processes or adopting digital technologies may generate stronger sustainability outcomes when suppliers, distributors, designers, technology providers, and other strategic partners contribute complementary knowledge and resources. Therefore, Supply Chain Collaborative Innovation is expected to mediate the relationship between transforming capability and sustainability performance by facilitating the translation of organisational transformation into collaborative and sustainable outcomes.

H_{10}: Supply Chain Collaborative Innovation positively mediates the relationship between Transforming Capability and Sustainability Performance.

METHOD

Research Design

This study employs a quantitative approach with an explanatory research design to examine the hypothesised relationships among Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, and Sustainability Performance in handicraft SMEs in West Java (Sakas et al., 2021). The quantitative approach is appropriate because the study seeks to empirically test theoretically derived hypotheses concerning the direct and mediating relationships among the constructs. A survey method was employed, with a structured questionnaire used as the primary instrument for collecting data from the selected respondents.

Subjects and objects of research

The subjects of this study are owners, administrators, or managers of handicraft SMEs located in West Java Province. These respondents were selected because they are directly involved in strategic decision-making, innovation activities, supply chain management, and the implementation of business sustainability initiatives, making them appropriate informants for assessing the organisational capabilities and outcomes examined in this study. The research examines five constructs: (1) Sensing Capability, (2) Seizing Capability, (3) Transforming Capability, (4) Supply Chain Collaborative Innovation, and (5) Sustainability Performance. Sensing Capability, Seizing Capability, and Transforming Capability are specified as the antecedent variables, Supply Chain Collaborative Innovation as the mediating variable, and Sustainability Performance as the outcome variable.

Measurement instruments

The constructs in this study were measured using measurement items adapted from previous studies with established validity and reliability. The measurement items were adjusted to the context of handicraft SMEs while maintaining the conceptual meaning of the original constructs. All constructs were measured using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree.

Table 1. Measurement of the construct

Variable	Indicator	Source
Sensing Capability	Monitor changes in the business environment Identify customer needs Analyze competitor strategies Evaluate business opportunities Building strategic insights Leveraging external networks Identify innovation assets Driving employee strategic ideas	D. J. Teece (2018)
Seizing Capability	Designing new business models Allocate strategic resources Making strategic investments Developing a value proposition Determining make-or-buy decisions Managing intellectual property Integrating organizational capabilities Testing business models	Schilke et al. (2018), D. Teece et al. (2016)
Transforming Capability	Strategic organizational restructuring Reconfigure resources Operational process updates Reinforcement of adaptive culture Human resource competency development Strategic incentive adjustments Business unit integration Organizational change management	D. J. Teece et al. (2023)
Supply Chain Collaborative Innovation	Product development supplier collaboration Customer collaboration in innovation	Xie et al. (2023)

	Process improvement supplier collaboration Utilization of customer feedback Coordination of supply chain innovationsk	
Sustainability Performance	Reduced resource expenditure costs Efficient use of resources Employment Return on investment (ROI) Revenue stability Sales growth Cash flow Market share Employment practices . Well-being of workers and local communities . Reduce the negative impact of the business . Building a brand image in the local community . On-time delivery of goods . Customer satisfaction product line . Reduced inventory levels . Damage rate . Order processing time . Increase in capacity utilization . Supplier and customer relationship . Customer retention	Madhavan et al. (2022)

Population and Sample

The population of this study comprises handicraft SMEs, particularly those operating in the bamboo handicraft sector and registered with the Cooperatives and SMEs Office in West Java Province. Given that the population is distributed across multiple districts and cities, purposive sampling was employed to select respondents who met the predetermined criteria relevant to the objectives of the study (Hunziker & Blankenagel, 2024). The respondents were required to be owners or managers of handicraft SMEs that had been operating for at least three years, were actively involved in production and marketing activities, maintained collaborative relationships with suppliers, customers, distributors, or other business partners, and possessed sufficient knowledge of their firm's operational conditions and business strategies (Gadatsch, 2023). These criteria were established to ensure that respondents had adequate organisational experience and direct knowledge of the capabilities, collaborative activities, and sustainability practices examined in the study. The final sample consisted of 250 respondents.

Data Collection Techniques

Primary data were collected through a structured questionnaire distributed to eligible respondents using Google Forms. The questionnaire was administered to owners and managers who met the predetermined sampling criteria and were considered knowledgeable

about their firm's operations, strategic decisions, supply chain relationships, and sustainability practices. Secondary data were used to provide contextual and supporting information and were obtained from government documents, statistical publications, SME association reports, scientific journals, and relevant research reports.

Data Analysis Techniques

Data were analysed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 to evaluate the measurement model, test the structural relationships among the constructs, and examine the mediating role of Supply Chain Collaborative Innovation in the proposed research model (J. F. Hair, 2021). Descriptive statistics were first used to describe the characteristics of the respondents and the distribution of the observed data (J. Hair & Alamer, 2022). The measurement model was evaluated by examining convergent validity, discriminant validity, and internal consistency reliability. Convergent validity was assessed through indicator loadings and Average Variance Extracted (AVE), with values above 0.70 for indicator loadings and 0.50 for AVE used as the general criteria. Discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio, while internal consistency reliability was evaluated using Cronbach's Alpha and Composite Reliability, with values above 0.70 considered acceptable (Shmueli et al., 2019). After the measurement model met the required criteria, the structural model was evaluated using the coefficient of determination (R^2) and effect size (f^2) to assess the explanatory power and substantive contribution of the structural relationships. Hypotheses were tested using bootstrapping at a 5% significance level, with a t-statistic greater than 1.96 and a p-value below 0.05 indicating statistical significance (Shmueli et al., 2019). The mediating role of Supply Chain Collaborative Innovation was assessed through the significance of the indirect effects, allowing the study to determine whether and to what extent SCCI transmits the effects of the three dynamic capability microfoundations to Sustainability Performance.

RESULTS

Respondent Characteristics

This study involved 250 respondents from handicraft SMEs, primarily within the bamboo handicraft sector, registered with the Cooperatives and SMEs Office in West Java Province. The respondents were described according to gender, age, educational attainment, and duration of business involvement.

Table 2. Respondent Characteristics

Respondent Characteristics	Category	Number of Respondent	Percentage %
Gender	Man	81	32,4%
	Woman	169	67,6%
Age	20–30 years	36	14,4%
	31–40 years	85	34%

	41–50 years	88	35,2%
	>50 years	41	16,4%
Education Level	< Senior High School	24	9,6%
	Senior High School	102	40,8%
	Diploma III	36	14,4%
	Graduate	76	30,4%
	Magister	12	4,8%
Long Term of Effort	3–5 years	58	23,2%
	6–10 years	87	34,8%
	11–15 years	58	23,2%
	>15 years	47	18,8%
	Total	**250**	**100%**

Source: Researcher-processed data (2026)

As presented in Table 1, female respondents accounted for 169 respondents (67.6%), while male respondents accounted for 81 respondents (32.4%). In terms of age, the largest groups were respondents aged 41–50 years (35.2%) and 31–40 years (34.0%), indicating that most respondents were within the economically active age groups. Regarding educational attainment, 40.8% of respondents had completed high school and 30.4% held a bachelor's degree, while the remaining respondents had diploma, master's-level, or lower educational backgrounds. In terms of business involvement, the largest proportion of respondents had managed their businesses for 6–10 years (34.8%), followed by those with 3–5 years and 11–15 years of involvement, each accounting for 23.2%. Overall, the respondent profile indicates that most participants had substantial involvement in their businesses and were therefore positioned to provide information concerning organisational capabilities, supply chain collaboration, and sustainability practices examined in this study.

Measurement Model Test (Outer Model)

The measurement model was evaluated to assess the validity and reliability of the indicators used to measure the five constructs in the study: Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, and Sustainability Performance. All constructs were specified as reflective constructs. The assessment was conducted using SmartPLS 4.0 and included convergent validity, discriminant validity, and internal consistency reliability. Convergent validity was evaluated based on indicator outer loadings and Average Variance Extracted (AVE), while discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. Internal consistency reliability was evaluated using Cronbach's Alpha and Composite Reliability. The results of these assessments are presented in the following tables.

Convergent Validity Test

Convergent validity was assessed using indicator outer loadings and Average Variance Extracted (AVE). An outer loading value above 0.70 indicates that an indicator has a strong association with its respective latent construct, while an AVE value above 0.50 indicates that the

construct explains more than half of the variance of its indicators. These criteria were applied to Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, and Sustainability Performance. Figure 1 presents the measurement model and the outer loading values obtained for each indicator.

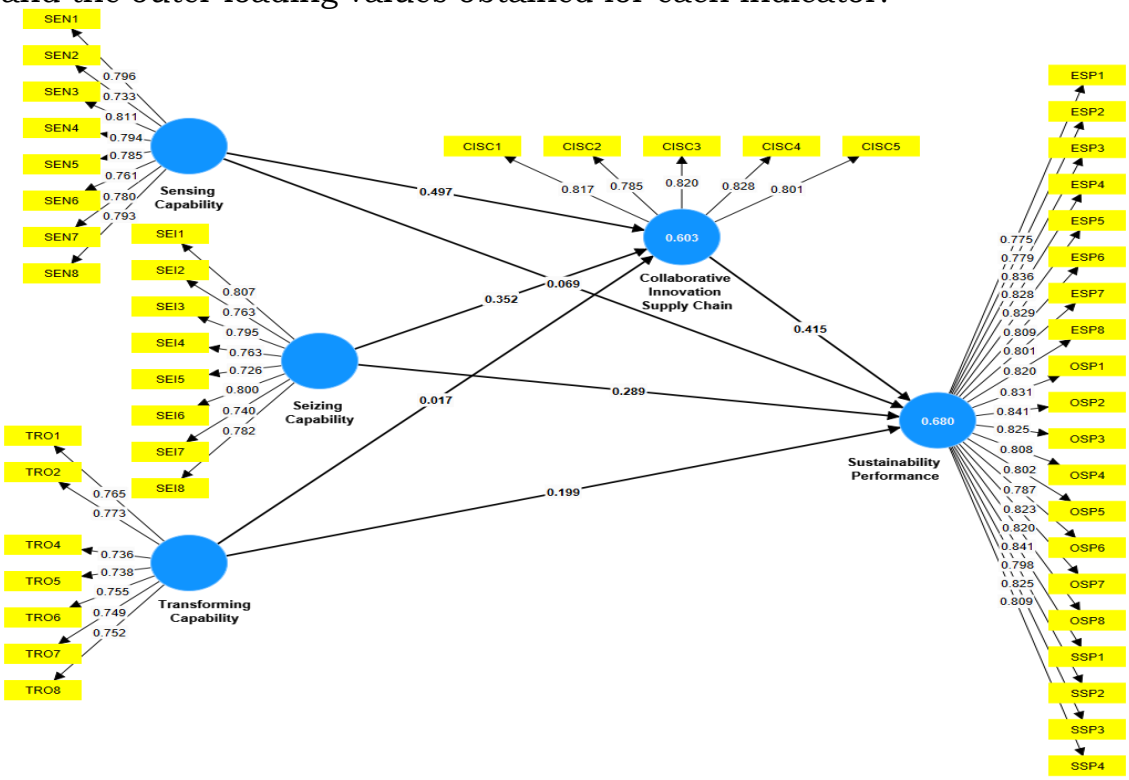

Figure 1. Outer Model

Source: Processed Smart PLS4 (2026)

Figure 2 presents the convergent validity assessment generated using SmartPLS, while the detailed outer loading results for each indicator are presented in Table 3.

Table 3. Loading Factor

	Sensing Capability	Seizing Capability	Transforming Capability	Collaborative Innovation Supply Chain	Sustainability Performance
SEN1	0.796				
SEN2	0.733				
SEN3	0.811				
SEN4	0.794				
SEN5	0.785				
SEN6	0.761				
SEN7	0.780				
SEN8	0.793				
SEI1		0.807			
SEI2		0.763			
SEI3		0.795			
SEI4		0.763			

SEI5		0.726			
SEI6		0.800			
SEI7		0.740			
SEI8		0.782			
TRO1			0.765		
TRO2			0.773		
TRO4			0.736		
TRO5			0.738		
TRO6			0.755		
TRO7			0.749		
TRO8			0.752		
CISC1				0.817	
CISC2				0.785	
CISC3				0.820	
CISC4				0.828	
CISC5				0.801	
ESP1					0.775
ESP2					0.779
ESP3					0.836
ESP4					0.828
ESP5					0.829
ESP6					0.809
ESP7					0.801
ESP8					0.820
SSP1					0.841
SSP2					0.798
SSP3					0.825
SSP4					0.809
OSP1					0.831
OSP2					0.841
OSP3					0.825
OSP4					0.808
OSP5					0.802
OSP6					0.787
OSP7					0.823
OSP8					0.820

Source: Researcher-processed data (2026)

The results presented in Table 3 show that all indicators across the five constructs achieved outer loading values above 0.70, indicating satisfactory convergent validity at the indicator level. Sensing Capability, measured by eight indicators (SEN1–SEN8), recorded loading values ranging from 0.733 to 0.811, with SEN3 showing the highest loading and SEN2 the lowest. Seizing Capability recorded loading values between 0.726 and 0.807, with SEI1 showing the highest loading and SEI5 the lowest. Transforming Capability produced loading values ranging from

0.736 to 0.773, with TRO2 showing the highest loading. Supply Chain Collaborative Innovation recorded values between 0.785 and 0.828, while Sustainability Performance recorded values between 0.775 and 0.841. Since all indicators exceeded the minimum loading criterion, none required removal on the basis of convergent validity.

Convergent validity was further assessed at the construct level using Average Variance Extracted (AVE). The results are presented in Table 4.

Table 4. AVE Value

Variable	Average Variance Extracted (AVE)
Seizing Capability	0.597
Sensing Capability	0.612
Transforming Capability	0.566
Collaborative Innovation Supply Chain	0.657
Sustainability Performance	0.663

Source: Researcher-processed data (2026)

The results in Table 4 indicate that all five constructs achieved AVE values above the minimum threshold of 0.50. Seizing Capability recorded an AVE of 0.597, followed by Sensing Capability at 0.612 and Transforming Capability at 0.566. Supply Chain Collaborative Innovation recorded an AVE of 0.657, while Sustainability Performance achieved the highest AVE at 0.663. Thus, each construct explains more than 50% of the variance in its respective indicators, confirming satisfactory convergent validity at the construct level. Taken together with the outer loading results, the measurement model demonstrates adequate convergent validity and can proceed to the subsequent assessment of discriminant validity and reliability.

Discriminant Validity Test

Discriminant validity was assessed to determine whether the five constructs—Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, and Sustainability Performance—were empirically distinct from one another. The assessment was conducted using indicator cross-loadings and the Heterotrait-Monotrait Ratio (HTMT). For the cross-loading assessment, each indicator was expected to exhibit a higher loading on its associated construct than on the other constructs. The HTMT criterion was subsequently used as an additional assessment, with values below 0.90 indicating satisfactory discriminant validity. The cross-loading results are presented in Table 5.

Tabel 5. Cross Loading Factor

Indicator	Sensing Capability	Seizing Capability	Transforming Capability	Collaborative Innovation Supply Chain	Sustainability Performance
SEN1	0.796	0.469	0.335	0.508	0.446
SEN2	0.733	0.472	0.350	0.584	0.516
SEN3	0.811	0.499	0.348	0.569	0.461

SEN4	0.794	0.446	0.264	0.582	0.494
SEN5	0.785	0.575	0.396	0.516	0.533
SEN6	0.761	0.516	0.308	0.587	0.514
SEN7	0.780	0.435	0.360	0.587	0.494
SEN8	0.793	0.465	0.387	0.578	0.510
SEI1	0.492	0.807	0.444	0.548	0.585
SEI2	0.449	0.763	0.482	0.516	0.576
SEI3	0.517	0.795	0.528	0.529	0.588
SEI4	0.501	0.763	0.393	0.515	0.593
SEI5	0.457	0.726	0.438	0.451	0.501
SEI6	0.476	0.800	0.492	0.515	0.595
SEI7	0.468	0.740	0.388	0.554	0.532
SEI8	0.467	0.782	0.444	0.507	0.508
TRO1	0.311	0.394	0.765	0.299	0.386
TRO2	0.296	0.456	0.773	0.305	0.480
TRO4	0.335	0.435	0.736	0.350	0.462
TRO5	0.379	0.441	0.738	0.349	0.456
TRO6	0.357	0.421	0.755	0.369	0.410
TRO7	0.254	0.432	0.749	0.303	0.392
TRO8	0.369	0.490	0.752	0.343	0.464
CISC1	0.602	0.589	0.386	0.817	0.657
CISC2	0.568	0.511	0.294	0.785	0.574
CISC3	0.575	0.496	0.361	0.820	0.571
CISC4	0.611	0.565	0.345	0.828	0.609
CISC5	0.572	0.548	0.400	0.801	0.610
ESP1	0.407	0.530	0.438	0.534	0.775
ESP2	0.503	0.565	0.477	0.528	0.779
ESP3	0.559	0.621	0.499	0.640	0.836
ESP4	0.544	0.592	0.446	0.642	0.828
ESP5	0.562	0.602	0.495	0.634	0.829
ESP6	0.513	0.617	0.535	0.601	0.809
ESP7	0.523	0.597	0.460	0.579	0.801
ESP8	0.543	0.581	0.486	0.614	0.820
SSP1	0.521	0.577	0.470	0.661	0.841
SSP2	0.530	0.577	0.434	0.613	0.798
SSP3	0.513	0.612	0.501	0.621	0.825
SSP4	0.521	0.611	0.515	0.609	0.809
OSP1	0.537	0.628	0.507	0.611	0.831
OSP2	0.547	0.601	0.440	0.651	0.841
OSP3	0.513	0.637	0.498	0.630	0.825
OSP4	0.495	0.568	0.421	0.585	0.808
OSP5	0.554	0.575	0.476	0.613	0.802
OSP6	0.463	0.533	0.398	0.568	0.787
OSP7	0.489	0.598	0.524	0.603	0.823
OSP8	0.503	0.603	0.447	0.611	0.820

Source: Researcher-processed data (2026)

The discriminant validity test, utilising the cross loading approach, indicates that all indicators exhibit the highest loading values inside their respective constructs in comparison to other constructs. The results demonstrate that each indicator effectively differentiates latent constructs, ensuring no measurement overlap between them. The Sensing Capability construct exhibits a cross-loading value ranging from 0.733 to 0.811, with all indicators more robustly representing the original construct. The Seizing Capability construct exhibits a loading

value of 0.726–0.807, continuously surpassing its connection with other constructs. The Transforming Capability construct achieved a loading value ranging from 0.736 to 0.773, with all indicators demonstrating a predominant presence of the construct. Konstruk Supply Chain Collaborative Innovation yielded a loading value of 0.785–0.828, whereas Sustainability Performance achieved a score of 0.775–0.841. The results affirm that the construct possesses strong discriminant validity, making it appropriate for future structural research.

The test results utilising the Heterotrait-Monotrait Ratio (HTMT) are displayed in Table 6 below:

Table 6. Heterotrait-monotrait ratio (HTMT) test results

Remarks	Heterotrait-monotrait ratio (HTMT)
Seizing Capability <-> Collaborative Innovation Supply Chain	0.754
Sensing Capability <-> Collaborative Innovation Supply Chain	0.811
Sensing Capability <-> Seizing Capability	0.684
Sustainability Performance <-> Collaborative Innovation Supply Chain	0.809
Sustainability Performance <-> Seizing Capability	0.773
Sustainability Performance <-> Sensing Capability	0.673
Transforming Capability <-> Collaborative Innovation Supply Chain	0.504
Transforming Capability <-> Seizing Capability	0.656
Transforming Capability <-> Sensing Capability	0.490
Transforming Capability <-> Sustainability Performance	0.627

Source: Researcher-processed data (2026)

The HTMT results in Table 6 show that all construct pairs recorded values below the 0.90 threshold, confirming satisfactory discriminant validity. The highest HTMT value was observed between Sensing Capability and Supply Chain Collaborative Innovation (0.811), followed by the relationship between Sustainability Performance and Supply Chain Collaborative Innovation (0.809). Although these values indicate relatively strong associations between the respective constructs, they remain below the established threshold and therefore do not indicate problematic discriminant validity. The lowest HTMT value was observed between Transforming Capability and Sensing Capability (0.490). Taken together, the cross-loading and HTMT results provide consistent evidence that the five constructs are empirically distinguishable and that the measurement model meets the requirements for subsequent structural model assessment.

Construct Reliability

Construct reliability was assessed to determine the internal consistency of the indicators measuring Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, and Sustainability Performance. Reliability was evaluated using Cronbach's Alpha and Composite Reliability (CR), with values above 0.70 considered indicative of satisfactory internal consistency. AVE was also considered in conjunction with the reliability measures to

confirm the adequacy of the measurement model. The results of the reliability assessment are presented in Table 7.

Table 7. Reliability Test

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Sensing Capability	0.909	0.909	0.612
Seizing Capability	0.903	0.904	0.597
Transforming Capability	0.872	0.873	0.566
Collaborative Innovation Supply Chain	0.869	0.870	0.657
Sustainability Performance	0.973	0.974	0.663

Source: Researcher-processed data (2026)

The results show that all five constructs achieved Cronbach's Alpha and Composite Reliability values above 0.70, indicating satisfactory internal consistency. Sensing Capability recorded Cronbach's Alpha and Composite Reliability values of 0.909 and 0.909, respectively, with an AVE of 0.612. Seizing Capability recorded values of 0.903 and 0.904, with an AVE of 0.597, while Transforming Capability recorded values of 0.872 and 0.873, with an AVE of 0.566. Supply Chain Collaborative Innovation recorded Cronbach's Alpha and Composite Reliability values of 0.869 and 0.870, respectively, with an AVE of 0.657. Sustainability Performance recorded the highest reliability values, with Cronbach's Alpha of 0.973 and Composite Reliability of 0.974, accompanied by an AVE of 0.663. Overall, the results indicate that the indicators demonstrate satisfactory internal consistency and convergent validity, supporting the adequacy of the measurement model for subsequent structural model assessment.

Inner VIF Values

The inner Variance Inflation Factor (VIF) was assessed to identify potential collinearity among the predictor constructs in the structural model. VIF values indicate whether excessive linear relationships among predictor constructs may affect the stability of the estimated path coefficients. In this study, VIF values below 5.00 were considered indicative of the absence of critical collinearity concerns, while the more conservative threshold of 3.30 was also considered in evaluating the predictor relationships. The inner VIF results for the structural model are presented in Table 8.

Table 8. Multicollinearity Test (VIF)

	Collaborative Innovation Supply Chain	Seizing Capability	Sensing Capability	Sustainability Performance	Transforming Capability
Collaborative Innovation Supply Chain				2.521	
Seizing Capability	2.021			2.333	
Sensing Capability	1.649			2.272	

Sustainability Performance					
Transforming Capability	1.542			1.542	

Source: Researcher-processed data (2026)

The results presented in Table 8 show that the inner VIF values range from 1.542 to 2.521, with all values below both the 5.00 and 3.30 thresholds. The highest VIF value is 2.521 for the relationship involving Supply Chain Collaborative Innovation and Sustainability Performance, while the lowest value is 1.542 for the Transforming Capability predictor of Sustainability Performance. Seizing Capability recorded VIF values of 2.021 for Supply Chain Collaborative Innovation and 2.333 for Sustainability Performance, whereas Sensing Capability recorded values of 1.649 and 2.272, respectively. These results indicate that the predictor constructs do not exhibit problematic collinearity in the structural model, supporting the stability of the subsequent path coefficient and hypothesis estimates.

Model Fit

Model fit was assessed using the Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI) as supplementary indicators of the model's overall fit. An SRMR value below 0.10 and an NFI value above 0.90 were used as reference criteria for assessing model fit. The results obtained from SmartPLS are presented below.

Table 9. Test Model Fit

	Saturated model	Estimated model
SRMR	0.042	0.042
d_ULS	2.097	2.097
d_G	0.867	0.867
Chi-square	1245.141	1245.141
NFI	0.968	0.968

Source: Researcher-processed data (2026)

The model fit results indicate satisfactory overall fit based on the reported SRMR and NFI values. The SRMR value was 0.042 for both the saturated and estimated models, which is below the 0.10 reference threshold and indicates a relatively small discrepancy between the observed and model-implied correlations. The NFI value was 0.968, exceeding the 0.90 reference criterion and indicating a satisfactory level of comparative model fit. The model also produced a d_ULS value of 2.097, a d_G value of 0.867, and a Chi-square value of 1,245.141. Taken together, these results provide supplementary evidence that the proposed model demonstrates an acceptable overall fit and can proceed to structural model assessment and hypothesis testing.

Structural Model Test (Inner Model)

Path Coefficients

The structural model was assessed to examine the hypothesised relationships among Sensing Capability, Seizing Capability, Transforming Capability, Supply Chain Collaborative Innovation, and

Sustainability Performance. The assessment included the coefficient of determination (R^2), effect size (f^2), and hypothesis testing using the bootstrapping procedure. R^2 was used to assess the proportion of variance in the endogenous constructs explained by their respective predictors, while f^2 was used to evaluate the contribution of individual exogenous constructs to the explained variance of endogenous constructs. Hypothesis testing was performed by examining the path coefficients, t-statistics, and p-values generated through bootstrapping. These assessments provide empirical evidence regarding the explanatory capacity and significance of the proposed structural relationships.

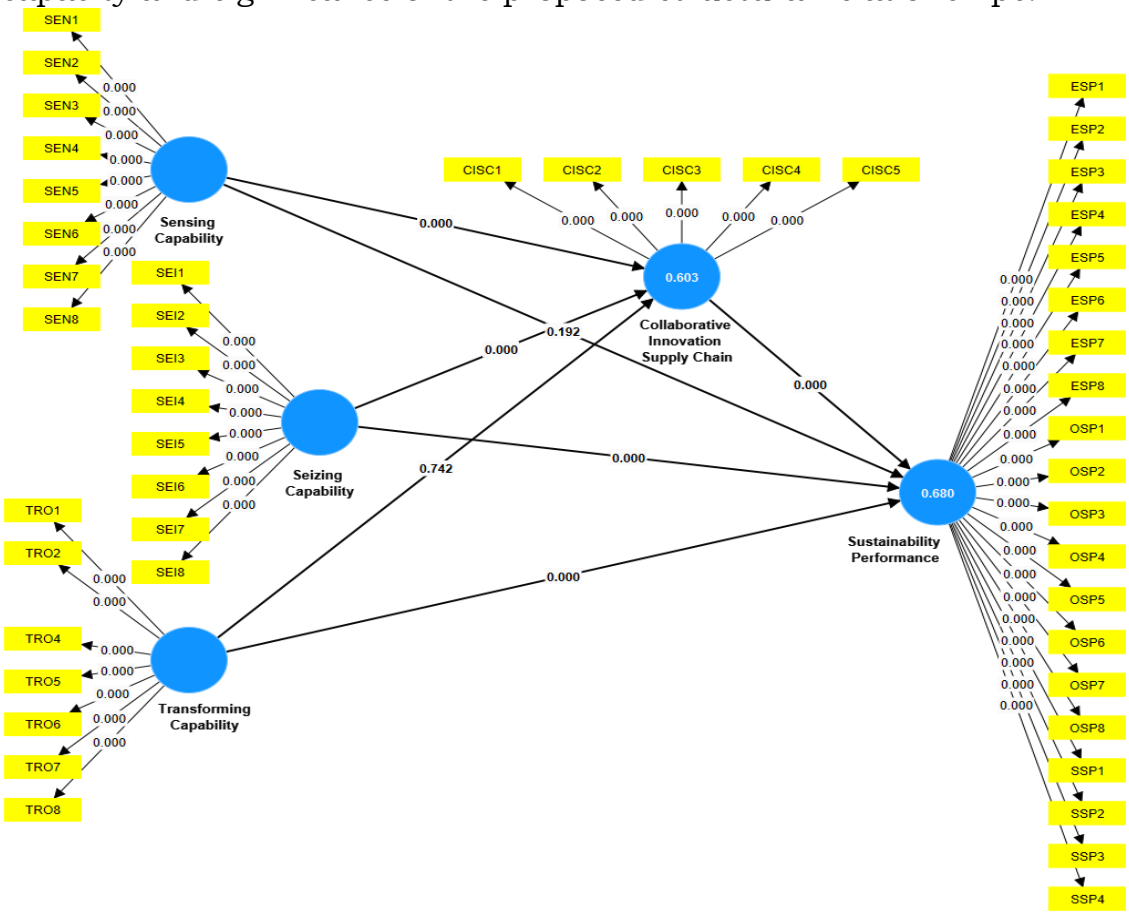

Figure 3. Bootsrapping (Path Coefficient)

Source: Processed Smart PLS 4 (2026)

The structural model results indicate different patterns across the hypothesised relationships. Sensing Capability and Seizing Capability significantly influence Supply Chain Collaborative Innovation, whereas Transforming Capability does not show a significant direct effect on this mediator. For Sustainability Performance, Seizing Capability, Transforming Capability, and Supply Chain Collaborative Innovation demonstrate positive and significant effects, while the direct effect of Sensing Capability is not statistically significant. Supply Chain Collaborative Innovation obtained an R^2 value of 0.603, indicating that 60.3% of its variance is explained by Sensing Capability, Seizing Capability, and Transforming Capability, while the remaining 39.7% is attributable to other factors outside the model. Sustainability

Performance obtained an R^2 value of 0.830, indicating that 83.0% of its variance is explained by the predictors included in the structural model. These results indicate substantial explanatory capacity while also demonstrating that the effects of individual predictors differ across the endogenous constructs.

The bootstrapping procedure in PLS-SEM was used to estimate the path coefficients and their corresponding t-statistics and p-values. A hypothesised relationship was considered statistically significant when the two-tailed p-value was below 0.05, corresponding to a t-statistic greater than 1.96. The results of the direct-effect hypothesis testing are presented in Table 9.

Table 10. Path Coefficients (Test Hypothesis)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Sensing Capability -> Sustainability Performance	0.069	0.069	0.053	1.306	0.192
Seizing Capability -> Sustainability Performance	0.289	0.288	0.053	5.501	0.000
Transforming Capability -> Sustainability Performance	0.199	0.202	0.045	4.457	0.000
Sensing Capability -> Collaborative Innovation Supply Chain	0.497	0.497	0.047	10.489	0.000
Seizing Capability -> Collaborative Innovation Supply Chain	0.352	0.353	0.055	6.428	0.000
Transforming Capability -> Collaborative Innovation Supply Chain	0.017	0.019	0.053	0.329	0.742
Collaborative Innovation Supply Chain -> Sustainability Performance	0.415	0.414	0.049	8.445	0.000

Source: Researcher-processed data (2026)

According to Table 9, Path Coefficients (Hypothesis Test), the results indicate that not all variable linkages in the research model exert a significant influence, as detailed below:

1. Sensing Capability → Sustainability Performance produced a path coefficient of 0.069, a t-statistic of 1.306, and a p-value of 0.192. The positive path coefficient indicates a positive direction of association; however, the relationship is not statistically significant because the p-value exceeds 0.05 and the t-statistic is below 1.96. Therefore, H1 is not supported.
2. Seizing Capability → Sustainability Performance produced a path coefficient of 0.289, a t-statistic of 5.501, and a p-value of <0.001. The positive coefficient and statistically significant result indicate that Seizing Capability has a positive effect on Sustainability Performance. Therefore, H2 is supported.
3. Transforming Capability → Sustainability Performance produced a path coefficient of 0.199, a t-statistic of 4.457, and a p-value of <0.001. The results indicate a positive and statistically significant

effect of Transforming Capability on Sustainability Performance. Therefore, H3 is supported.

4. Sensing Capability → Supply Chain Collaborative Innovation produced a path coefficient of 0.497, a t-statistic of 10.489, and a p-value of <0.001. The results indicate a positive and statistically significant effect of Sensing Capability on Supply Chain Collaborative Innovation. Therefore, H4 is supported.
5. Seizing Capability → Supply Chain Collaborative Innovation produced a path coefficient of 0.352, a t-statistic of 6.428, and a p-value of <0.001. The results indicate that Seizing Capability has a positive and statistically significant effect on Supply Chain Collaborative Innovation. Therefore, H5 is supported.
6. Transforming Capability → Supply Chain Collaborative Innovation produced a path coefficient of 0.017, a t-statistic of 0.329, and a p-value of 0.742. The relationship is positive in direction but statistically insignificant, indicating that Transforming Capability does not have sufficient empirical evidence of a direct effect on Supply Chain Collaborative Innovation in the sampled SMEs. Therefore, H6 is not supported.
7. Supply Chain Collaborative Innovation → Sustainability Performance produced a path coefficient of 0.415, a t-statistic of 8.445, and a p-value of <0.001. The results indicate a positive and statistically significant effect of Supply Chain Collaborative Innovation on Sustainability Performance. Therefore, H7 is supported.

Overall, the direct-effect results reveal that the three dimensions of dynamic capability do not produce uniform effects across the structural relationships. Sensing Capability significantly contributes to Supply Chain Collaborative Innovation but does not demonstrate a significant direct effect on Sustainability Performance. Seizing Capability has significant positive effects on both Supply Chain Collaborative Innovation and Sustainability Performance, whereas Transforming Capability significantly affects Sustainability Performance but not Supply Chain Collaborative Innovation. In addition, Supply Chain Collaborative Innovation has a significant positive effect on Sustainability Performance. This pattern indicates that the three microfoundations may operate through different pathways in contributing to sustainability outcomes, providing an important basis for interpreting the subsequent mediation results.

Specific indirect effect testing was conducted to examine the mediating role of Supply Chain Collaborative Innovation in the relationships between Sensing Capability, Seizing Capability, Transforming Capability, and Sustainability Performance. The analysis evaluates whether the effects of the three dynamic capability microfoundations on Sustainability Performance are transmitted through Supply Chain Collaborative Innovation. The significance of each indirect effect was assessed using the bootstrapping procedure based on

its path coefficient, t-statistic, and p-value. The results of the specific indirect effect analysis are presented in Table 11.

Table 11. Specific Indirect Effects

	Original Sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Sensing Capability -> Collaborative Innovation Supply Chain -> Sustainability Performance	0.207	0.206	0.033	6.174	0.000
Seizing Capability -> Collaborative Innovation Supply Chain -> Sustainability Performance	0.146	0.146	0.028	5.190	0.000
Transforming Capability -> Collaborative Innovation Supply Chain -> Sustainability Performance	0.007	0.008	0.022	0.327	0.744

Source: Researcher-processed data (2026)

Table 11 presents the specific indirect effects of Sensing Capability, Seizing Capability, and Transforming Capability on Sustainability Performance through Supply Chain Collaborative Innovation. The results show that the three mediation pathways do not produce identical effects, with significant indirect effects observed for Sensing Capability and Seizing Capability, whereas the indirect effect of Transforming Capability is not statistically significant.

1. The indirect effect of Sensing Capability on Sustainability Performance through Supply Chain Collaborative Innovation produced a coefficient of 0.207, a t-statistic of 6.174, and a p-value of <0.001. The positive and statistically significant indirect effect indicates that Supply Chain Collaborative Innovation mediates the relationship between Sensing Capability and Sustainability Performance. Therefore, H8 is supported.
2. The indirect effect of Seizing Capability on Sustainability Performance through Supply Chain Collaborative Innovation produced a coefficient of 0.146, a t-statistic of 5.190, and a p-value of <0.001. The positive and statistically significant indirect effect indicates that Supply Chain Collaborative Innovation mediates the relationship between Seizing Capability and Sustainability Performance. Therefore, H9 is supported.
3. The indirect effect of Transforming Capability on Sustainability Performance through Supply Chain Collaborative Innovation produced a coefficient of 0.007, a t-statistic of 0.327, and a p-value

of 0.744. The indirect effect is positive in direction but statistically insignificant, indicating that there is insufficient empirical evidence that Supply Chain Collaborative Innovation mediates the relationship between Transforming Capability and Sustainability Performance. Therefore, H10 is not supported.

R Square (R^2)

The coefficient of determination (R^2) was assessed to determine the proportion of variance in each endogenous construct that can be explained by its predictor constructs within the structural model. R^2 was evaluated for Supply Chain Collaborative Innovation and Sustainability Performance because both constructs function as endogenous variables in the proposed model. The results of the R^2 assessment are presented in Table 12.

Table 12. R Square Test Results

	R-square	R-square adjusted
Collaborative Innovation Supply Chain	0.603	0.598
Sustainability Performance	0.680	0.675

Source: Researcher-processed data (2026)

The results show that Supply Chain Collaborative Innovation has an R^2 value of 0.603 and an adjusted R^2 value of 0.598. This indicates that 60.3% of the variance in Supply Chain Collaborative Innovation is explained by Sensing Capability, Seizing Capability, and Transforming Capability, while the remaining 39.7% is associated with factors outside the structural model. Sustainability Performance has an R^2 value of 0.680 and an adjusted R^2 value of 0.675, indicating that 68.0% of its variance is explained jointly by Sensing Capability, Seizing Capability, Transforming Capability, and Supply Chain Collaborative Innovation, while the remaining 32.0% is attributable to factors not included in the model. The relatively high R^2 values indicate that the proposed structural model provides substantial explanatory capacity for both endogenous constructs.

Uji F Squares (F^2)

The f^2 effect size was assessed to determine the substantive contribution of each exogenous construct to the R^2 value of its corresponding endogenous construct. The assessment complements the path coefficient and significance testing by indicating the extent to which an endogenous construct's explained variance changes when a particular predictor is included or excluded from the model. Following the commonly used thresholds, f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effect sizes, respectively. Values below 0.02 indicate a negligible effect. The results of the f^2 assessment are presented in Table 13.

Table 13. f Square Test Results

	f-square
Sensing Capability -> Sustainability Performance	0.006
Seizing Capability -> Sustainability Performance	0.112
Transforming Capability -> Sustainability Performance	0.080
Sensing Capability -> Collaborative Innovation Supply Chain	0.378
Seizing Capability -> Collaborative Innovation Supply Chain	0.154
Transforming Capability -> Collaborative Innovation Supply Chain	0.000
Collaborative Innovation Supply Chain -> Sustainability Performance	0.214

Source: Researcher-processed data (2026)

The f^2 results demonstrate different substantive contributions across the structural relationships. Sensing Capability has a negligible effect on Sustainability Performance ($f^2 = 0.006$), while Seizing Capability ($f^2 = 0.112$) and Transforming Capability ($f^2 = 0.080$) have small effects on Sustainability Performance. In contrast, Sensing Capability demonstrates a large effect on Supply Chain Collaborative Innovation ($f^2 = 0.378$), whereas Seizing Capability has a medium effect ($f^2 = 0.154$). Transforming Capability has a negligible effect on Supply Chain Collaborative Innovation ($f^2 = 0.000$). Supply Chain Collaborative Innovation demonstrates a medium effect on Sustainability Performance ($f^2 = 0.214$). These results indicate that Sensing Capability makes the strongest substantive contribution to explaining variance in Supply Chain Collaborative Innovation, whereas Supply Chain Collaborative Innovation itself makes a meaningful contribution to explaining Sustainability Performance.

DISCUSSION

The effect of sensing capability on sustainability performance

The hypothesis test results indicate that Sensing Capability does not have a significant direct effect on Sustainability Performance. This finding suggests that the ability of handicraft SMEs to identify market opportunities, understand changing customer preferences, monitor technological developments, and recognise environmental changes does not automatically translate into improved economic, social, and environmental outcomes. From the perspective of Dynamic Capability Theory, sensing represents the process through which organisations identify opportunities and threats, but the identification of opportunities alone does not guarantee the creation of performance outcomes (Teece, 2018). Sensing activities generate information and strategic awareness, but their contribution to sustainability depends on whether the organisation is able to subsequently evaluate the identified opportunities, commit resources, and implement appropriate responses.

The insignificant direct relationship therefore provides an important theoretical insight into the microfoundational nature of dynamic capabilities. In the context of bamboo handicraft SMEs, information obtained through market observation or customer interaction may remain at the level of awareness if managers lack sufficient financial resources, technological capabilities, managerial expertise, or implementation mechanisms to convert that information

into operational changes. This condition is particularly relevant for resource-constrained SMEs, where the ability to recognise a growing demand for environmentally friendly products, for example, does not necessarily mean that the firm can immediately redesign production processes, acquire appropriate technology, develop new products, or establish sustainable supply arrangements. Consequently, sensing should not be interpreted as an independent capability that directly produces sustainability outcomes, but as an initial microfoundational process that must be followed by effective seizing and transformation activities.

The finding also differs from previous studies reporting a positive relationship between Sensing Capability and Sustainability Performance (Anwer & Ahmed Siddiqui, 2019; Dukhaykh & Alangri, 2026; Zabel et al., 2023). The difference may be explained by variations in organisational context and the availability of resources required to act upon sensed opportunities. Larger organisations examined in some previous studies may possess more developed managerial systems, technological infrastructure, financial resources, and decision-making structures that allow environmental information to be translated more rapidly into strategic and operational initiatives. In contrast, bamboo handicraft SMEs operate with more limited resources and frequently rely on owner-managers and informal organisational routines. Under these conditions, sensing may improve awareness without producing an immediate improvement in sustainability performance.

The finding is also consistent with the sequential logic of Dynamic Capability Theory, in which sensing, seizing, and transforming represent interconnected processes rather than isolated organisational attributes (Teece, 2018). The results suggest that identifying an opportunity is insufficient when the organisation cannot effectively mobilise resources or implement changes in response to that opportunity. Importantly, the subsequent mediation analysis shows that Sensing Capability has a significant indirect effect on Sustainability Performance through Supply Chain Collaborative Innovation. This pattern indicates that the value of sensing may emerge when information about market needs, technological developments, and environmental changes is converted into collaborative action with supply chain partners. Thus, the insignificant direct effect should not be interpreted as evidence that sensing is unimportant; rather, it suggests that its contribution to sustainability is contingent upon the mechanisms through which sensed information is translated into innovation and organisational action.

The effect of seizing capability on sustainability performance

The results demonstrate that Seizing Capability has a positive and significant effect on Sustainability Performance. This finding indicates that the ability of handicraft SMEs to convert identified opportunities into concrete strategic actions contributes directly to improvements in sustainability outcomes. Whereas sensing primarily involves recognising and interpreting changes in the external environment, seizing involves

selecting opportunities, committing resources, making investment decisions, and implementing strategic responses that enable organisations to capture value from those opportunities (D. J. Teece, 2018). The significant effect observed in this study therefore supports the sequential logic of Dynamic Capability Theory, in which opportunities identified through sensing become more consequential for organisational performance when they are followed by deliberate resource mobilisation and strategic action.

Within bamboo handicraft SMEs in West Java, Seizing Capability can be reflected in decisions to diversify products, modify designs according to changing customer preferences, adopt digital technologies, expand online marketing channels, improve production processes, and utilise government programmes related to training, certification, digitalisation, and financing. These actions allow SMEs to transform market information into tangible changes in products, operations, and market access. Such changes can directly contribute to economic sustainability through increased sales opportunities and operational efficiency, while also supporting social sustainability through employment and community-based production and environmental sustainability through more efficient production practices and the adoption of environmentally responsible products.

The significant direct effect also provides an important distinction from the finding for Sensing Capability. The results suggest that sustainability performance is more closely associated with the organisation's capacity to act upon identified opportunities than with its ability merely to recognise those opportunities. In other words, information about changing consumer preferences or market conditions becomes strategically valuable when SMEs possess the capacity to allocate resources and implement appropriate responses. This finding reinforces the microfoundational perspective of Dynamic Capability Theory by demonstrating that different stages of the dynamic capability process may contribute differently to organisational outcomes rather than producing equivalent effects.

The finding is consistent with previous studies reporting a positive relationship between Seizing Capability and organisational sustainability and performance (Anwer & Ahmed Siddiqui, 2019; Dukhaykh & Alangri, 2026; Schilke et al., 2018). It also complements the logic of Open Innovation Theory because the implementation of identified opportunities may be strengthened through access to external knowledge, technologies, and resources obtained from business partners and other stakeholders (Chesbrough, 2003). However, the significant direct effect found in this study indicates that Seizing Capability does not depend entirely on collaborative mechanisms to generate sustainability outcomes. SMEs can obtain direct sustainability benefits when managers are capable of making appropriate strategic decisions and committing available resources to relevant opportunities, while collaboration can provide an additional pathway through which these capabilities generate value.

The Effect of Transforming Capability on Sustainability Performance

The results indicate that Transforming Capability has a positive and significant effect on Sustainability Performance, thereby supporting H3. This finding suggests that the ability of handicraft SMEs to reconfigure resources, modify business processes, develop organisational competencies, and adapt operating routines to changing environmental conditions contributes directly to sustainability outcomes. In the context of bamboo handicraft SMEs, transformation may involve improving production processes, adopting more appropriate technologies, developing employee competencies, modifying organisational routines, and implementing more sustainable production practices. These changes can improve operational efficiency and economic performance while also supporting social and environmental objectives.

From the perspective of Dynamic Capability Theory, Transforming Capability represents the organisational process through which previously mobilised resources and capabilities are reconfigured to maintain alignment with a changing environment (D. J. Teece, 2018). The significant relationship observed in this study therefore reinforces the sequential character of dynamic capabilities. Sensing allows firms to identify relevant changes, while seizing enables them to commit resources and respond to identified opportunities; transforming subsequently ensures that these responses become embedded in organisational structures, processes, and routines. The positive effect of Transforming Capability on Sustainability Performance indicates that sustainability outcomes depend not only on recognising opportunities or making strategic decisions, but also on the organisation's ability to institutionalise and continuously adapt those changes.

This finding is consistent with Sousa-Zomer et al. (2020), who demonstrate that organisational transformation strengthens agility in responding to changing business conditions. Ferradás-González et al. (2024) similarly show that the ability to reconfigure resources enhances organisational adaptability to technological and market changes, while Ghosh et al. (2022) associate transformational capability with improvements in operational efficiency, innovation, and organisational flexibility in responding to sustainability requirements. The findings are also consistent with Dukhaykh and Alangri (2026), who report that organisations with stronger transformation capabilities tend to achieve better sustainability outcomes.

The significant effect of Transforming Capability also provides an important contrast with the findings for Sensing Capability. Whereas Sensing Capability does not demonstrate a significant direct effect on Sustainability Performance, Transforming Capability does. This difference suggests that identifying environmental changes is not sufficient to generate sustainability outcomes unless organisations are capable of embedding strategic responses into their operational processes and resource configurations. Thus, the findings provide

empirical support for viewing dynamic capability microfoundations as interconnected processes rather than equivalent or independent organisational attributes. Although Open Innovation Theory emphasises the importance of external knowledge and collaboration in organisational adaptation (Chesbrough, 2003), the direct relationship observed here indicates that the internal capacity to reconfigure resources and routines itself remains important for achieving sustainability outcomes.

The Influence of Sensing Capability on Supply Chain Collaborative Innovation

The results indicate that Sensing Capability has a positive and significant effect on Supply Chain Collaborative Innovation, thereby supporting H4. With a path coefficient of 0.497, t-statistic of 10.489, and p-value below 0.001, Sensing Capability represents a substantial predictor of Supply Chain Collaborative Innovation in the examined handicraft SMEs. The result is further supported by the f^2 value of 0.378, which indicates a large effect size. These findings demonstrate that the ability to monitor market developments, understand customer requirements, identify technological changes, and recognise emerging opportunities plays an important role in enabling SMEs to identify and develop productive relationships with supply chain partners.

From the perspective of Dynamic Capability Theory, sensing constitutes an important microfoundational process through which organisations identify changes in their external environment and determine where new opportunities for action may exist (Teece, 2018). However, the findings reveal an important distinction between sensing as a source of sustainability outcomes and sensing as a foundation for collaborative innovation. Although Sensing Capability does not have a significant direct effect on Sustainability Performance, it has a strong and significant effect on Supply Chain Collaborative Innovation. This suggests that information acquired through sensing becomes more consequential when it is used to identify potential partners, understand their resources and expertise, and determine opportunities for joint innovation.

This finding is also consistent with Open Innovation Theory, which emphasises that innovation can be strengthened through the acquisition and integration of knowledge, technologies, and resources from external actors (Chesbrough, 2003). Sensing activities provide SMEs with the information necessary to determine which external actors possess relevant resources and how those resources can be integrated into innovation activities. In the context of bamboo handicraft SMEs in West Java, this may involve identifying suppliers capable of providing alternative raw materials, customers who can provide information about changing preferences, designers who contribute new product ideas, digital platforms that facilitate market access, or other partners that provide technical and business knowledge. Thus, sensing does not merely involve environmental observation; it also enables SMEs to

recognise where and with whom collaborative innovation opportunities can be developed.

The findings are consistent with previous studies by Bogers et al. (2019), Jum'a et al. (2025), Khurana et al. (2022), and West and Bogers (2017), which indicate that the ability to identify external opportunities and relevant knowledge sources facilitates inter-organisational collaboration and innovation. The strong effect observed in the present study further suggests that sensing is particularly important for resource-constrained handicraft SMEs because external collaboration can provide access to resources and expertise that may not be available internally. Therefore, the empirical evidence positions Sensing Capability as an important microfoundation for activating the external relationships required for Supply Chain Collaborative Innovation.

The Influence of Seizing Capability on Collaborative Innovation Supply Chain

The results indicate that Seizing Capability has a positive and significant effect on Supply Chain Collaborative Innovation, thereby supporting H5. This finding suggests that the ability of bamboo handicraft SMEs to convert identified opportunities into concrete strategic actions contributes to their capacity to develop collaborative innovation with supply chain partners. Seizing Capability involves decisions concerning resource allocation, investment, product development, technology adoption, and the establishment of strategic relationships that enable organisations to capture value from identified opportunities (D. Teece et al., 2016). Unlike Sensing Capability, which primarily enables organisations to recognise potential opportunities and collaboration possibilities, Seizing Capability involves committing resources and taking action to realise those opportunities. The significant relationship therefore indicates that recognising potential partners alone is insufficient; SMEs must also possess the decision-making and resource mobilisation capacity required to initiate and sustain collaborative innovation.

The finding is consistent with Open Innovation Theory, which emphasises that organisations can enhance innovation by accessing and combining knowledge, technology, and resources beyond their organisational boundaries (Chesbrough, 2003). In this context, Seizing Capability enables SMEs to move from identifying external knowledge or collaboration opportunities toward actively engaging with suppliers, customers, designers, distributors, digital platforms, and other relevant stakeholders. For bamboo handicraft SMEs, such actions may involve allocating resources to joint product development, adopting technologies provided through external partnerships, coordinating with suppliers to develop alternative materials, or establishing distribution partnerships that support new product commercialisation. Thus, Seizing Capability provides the strategic commitment necessary to transform potential external resources into collaborative innovation outcomes.

The findings are consistent with previous studies by Audretsch et al. (2023), Fontoura and Coelho (2022), Jum'a et al. (2025), Khurana et al. (2022), and Schilke et al. (2018), which indicate that the ability to exploit identified opportunities can strengthen inter-organisational relationships, facilitate knowledge exchange, and support product and process innovation. The result also complements the finding for Sensing Capability: both capabilities significantly influence Supply Chain Collaborative Innovation, but through different stages of the dynamic capability process. Sensing helps SMEs recognise potential collaboration opportunities, whereas Seizing enables them to commit resources and establish concrete collaborative actions. This distinction provides empirical support for conceptualising dynamic capability microfoundations as interconnected processes rather than interchangeable organisational attributes.

The Influence of Transforming Capability on Collaborative Innovation Supply Chain

The results indicate that Transforming Capability does not have a significant effect on Supply Chain Collaborative Innovation, thereby rejecting H6. The finding suggests that the ability of bamboo handicraft SMEs to reconfigure resources, modify organisational processes, develop employee competencies, and adapt internal operating routines does not necessarily translate into greater collaborative innovation with supply chain partners. This result is particularly important because Transforming Capability has a significant positive effect on Sustainability Performance in the present study. The contrasting results indicate that transformation may contribute directly to internal organisational adaptation and sustainability outcomes without necessarily generating stronger inter-organisational innovation.

From the perspective of Dynamic Capability Theory, Transforming Capability concerns the reconfiguration and renewal of organisational resources, structures, processes, and routines in response to environmental changes (D. J. Teece, 2018). However, organisational transformation and collaborative innovation represent different forms of organisational activity. Transformation may be primarily directed toward improving internal efficiency, modifying production routines, adopting digital technologies, or restructuring organisational processes, whereas collaborative innovation requires the additional capacity to coordinate with external actors, exchange knowledge, establish trust, and jointly develop solutions. Therefore, possessing the capability to transform internal operations does not automatically imply the capability to transform external relationships into collaborative innovation.

The insignificant relationship may be particularly relevant to the characteristics of bamboo handicraft SMEs. These businesses often operate with limited financial and technological resources and rely heavily on owner-managers for strategic and operational decisions. Transformation initiatives may consequently be concentrated on immediate internal priorities, such as improving production efficiency,

adopting digital marketing, modifying product designs, or developing employee skills. Such initiatives can improve the firm's internal adaptability but may not necessarily involve suppliers, customers, distributors, communities, or other external stakeholders in the innovation process. Moreover, effective collaborative innovation requires relational conditions such as trust, information sharing, coordination mechanisms, and willingness among partners to commit resources to joint activities. The absence or weakness of these conditions may limit the extent to which internal transformation capabilities can generate collaborative innovation.

This finding differs from previous studies by Fontoura and Coelho (2022), Jum'a et al. (2025), and Khurana et al. (2022), which report positive relationships between organisational transformation and collaborative innovation. The difference may reflect variations in organisational maturity, technological adoption, institutional support, and resource availability across research settings. Organisations operating in more developed collaborative ecosystems may have established digital infrastructure, formal partnership arrangements, and stronger institutional support that allow internal transformation to extend naturally into inter-organisational innovation. In contrast, bamboo handicraft SMEs may possess sufficient transformation capability to adapt their own operations but lack the organisational and relational infrastructure required to translate those changes into joint innovation with supply chain partners.

The result therefore provides an important qualification to the assumption that all dimensions of dynamic capability contribute equally to collaborative innovation. While Sensing Capability and Seizing Capability significantly facilitate Supply Chain Collaborative Innovation, Transforming Capability does not demonstrate a significant direct contribution in this setting. This suggests that the transformation of internal resources and routines alone is insufficient to establish collaborative innovation unless it is accompanied by mechanisms that connect internal organisational change with external partners. The finding contributes to the microfoundational perspective by demonstrating that different dynamic capability processes may generate distinct outcomes depending on whether the targeted change is internal organisational adaptation or external collaborative innovation.

The Influence of Collaborative Innovation Supply Chain on Sustainability Performance

The results indicate that Supply Chain Collaborative Innovation has a positive and significant effect on Sustainability Performance, thereby supporting H7. The finding demonstrates that collaborative innovation among supply chain actors contributes directly to the ability of bamboo handicraft SMEs in West Java to achieve economic, social, and environmental outcomes. Through collaborative innovation, SMEs can combine internal resources with external knowledge, technologies, market information, and expertise that may not be available within the

firm. These external resources can subsequently be translated into improvements in product development, production processes, resource utilisation, market access, and stakeholder relationships.

This finding is consistent with Open Innovation Theory, which emphasises that organisational innovation can be strengthened through the purposeful inflow and integration of knowledge and resources from external actors (Chesbrough, 2003; Bogers et al., 2019). Supply Chain Collaborative Innovation provides a concrete organisational mechanism through which this external knowledge can be accessed and transformed into joint innovation outcomes. In the context of bamboo handicraft SMEs, collaboration with raw-material suppliers may facilitate improvements in material quality and resource utilisation, while interaction with customers can provide information for product and design development. Partnerships with universities, government institutions, creative communities, and other business actors can additionally provide technological knowledge, training, certification support, and access to broader markets. The resulting innovations can improve economic outcomes while simultaneously supporting social relationships and more responsible resource utilisation.

The findings are consistent with previous studies by Audretsch et al. (2023), Jum'a et al. (2025), Khurana et al. (2022), Saunila et al. (2024), and West and Bogers (2017), which demonstrate that inter-organisational collaboration can strengthen innovation and contribute to organisational performance and sustainability. The present finding further establishes the importance of Supply Chain Collaborative Innovation within the proposed dynamic capability framework. Rather than functioning merely as an outcome of organisational capabilities, collaborative innovation represents an external-oriented mechanism through which SMEs can combine internal capabilities with resources possessed by supply chain partners. This finding therefore supports the argument that sustainability in resource-constrained SMEs depends not only on what firms can do internally, but also on how effectively they mobilise and integrate resources across organisational boundaries.

The Role of Collaborative Innovation Supply Chain Mediation on the Relationship between Sensing Capability and Sustainability Performance

The specific indirect effect results indicate that Supply Chain Collaborative Innovation positively and significantly mediates the relationship between Sensing Capability and Sustainability Performance. The indirect effect is 0.207, with a t-statistic of 6.174 and a p-value below 0.001, while the direct effect of Sensing Capability on Sustainability Performance is not significant ($\beta = 0.069$; $p = 0.192$). This pattern indicates an indirect-only mediation relationship, whereby the contribution of Sensing Capability to Sustainability Performance is realised through Supply Chain Collaborative Innovation rather than through a significant direct pathway. The finding provides an important explanation for why Sensing Capability, despite being an essential

process for identifying market and environmental changes, does not independently produce sustainability outcomes in the examined SMEs.

From the perspective of Dynamic Capability Theory, sensing constitutes the process through which organisations identify opportunities, threats, market changes, technological developments, and changing customer requirements (D. J. Teece, 2018). However, identifying these changes does not by itself create organisational value. The information obtained through sensing must be converted into decisions, resource mobilisation, and organisational action. The mediation result demonstrates that Supply Chain Collaborative Innovation can function as this conversion mechanism. When SMEs use information acquired through sensing to identify relevant partners, exchange knowledge, and develop joint solutions, the information becomes embedded in concrete innovation activities that can contribute to sustainability performance.

This finding also extends the application of Open Innovation Theory within the dynamic capability framework. Open Innovation Theory explains how organisations can access and utilise knowledge and resources beyond their organisational boundaries to strengthen innovation (Chesbrough, 2003; Bogers et al., 2019). The present findings suggest that sensing provides SMEs with awareness of external opportunities, while Supply Chain Collaborative Innovation provides the relational mechanism through which that awareness can be transformed into innovation. In this sense, collaborative innovation does not merely represent an additional organisational activity; it represents the mechanism that connects the firm's internal ability to recognise environmental changes with the external resources required to respond to those changes.

The finding is particularly relevant to bamboo handicraft SMEs because these businesses frequently operate with limited internal resources and depend on relationships with suppliers, customers, creative communities, universities, government institutions, and other external actors. Market information concerning consumer preferences for sustainable materials or contemporary designs, for example, may have limited value if the SME cannot access partners capable of providing appropriate materials, design expertise, technology, or market access. Through collaborative innovation, such information can be combined with external knowledge and resources to generate new products, improve production processes, and expand market opportunities. Thus, the significant indirect effect indicates that the sustainability value of sensing is contingent upon the firm's ability to connect what it learns from the external environment with collaborative action.

The result contributes to the microfoundational interpretation of Dynamic Capability Theory by demonstrating that different capability processes may have different routes to sustainability performance. Sensing does not demonstrate a significant direct effect on Sustainability Performance, but it strongly influences Supply Chain Collaborative Innovation, which subsequently affects Sustainability Performance. This

pattern indicates that the value of sensing is not necessarily realised through direct organisational outcomes but can emerge through an external collaborative mechanism. The finding therefore strengthens the theoretical argument that dynamic capabilities should be examined not only as aggregate organisational capacities but also in terms of the specific processes through which individual capability dimensions are converted into performance outcomes. It also supports previous findings concerning the importance of external collaboration and knowledge integration in translating organisational capabilities into innovation and performance (Bogers et al., 2019; Jum'a et al., 2025).

The Role of Collaborative Innovation Supply Chain Mediation on the Relationship between Seizing Capability and Sustainability Performance

The specific indirect effect results indicate that Supply Chain Collaborative Innovation positively and significantly mediates the relationship between Seizing Capability and Sustainability Performance. Because Seizing Capability also has a significant direct effect on Sustainability Performance, the mediation pattern can be interpreted as partial mediation. This finding indicates that the ability of handcraft SMEs to recognise and exploit business opportunities contributes to Sustainability Performance through two complementary pathways: directly through strategic actions and resource allocation, and indirectly through collaborative innovation with supply chain partners. From the perspective of Dynamic Capability Theory, Seizing Capability enables firms to convert identified opportunities into strategic investments, product development, technological adoption, and business model adjustments, while Open Innovation Theory explains why the implementation of these opportunities can be strengthened through access to external knowledge, technologies, and complementary resources (D. J. Teece, 2018a; Chesbrough, 2003). Thus, Supply Chain Collaborative Innovation does not replace the role of Seizing Capability but provides an additional mechanism through which the value generated from opportunity exploitation can be converted into broader sustainability outcomes.

Within the context of bamboo handicraft SMEs in West Java, Seizing Capability is reflected in actions such as product diversification, digital marketing, participation in government-supported programmes, adoption of new technologies, and the development of broader distribution channels. These actions can generate sustainability benefits independently, but their effects can become more extensive when firms mobilise complementary resources through collaboration with suppliers, customers, universities, creative communities, and government or business-support institutions. Such collaboration can provide access to product-design knowledge, technological expertise, training, market information, and distribution networks that may be difficult for resource-constrained SMEs to develop internally. This finding is consistent with Audretsch et al. (2023), Jum'a et al. (2025), Khurana et al. (2022), and

West and Bogers (2017), while extending these studies by demonstrating that collaborative innovation functions as a mechanism through which opportunity exploitation is translated into sustainability outcomes. The partial mediation further suggests that collaboration is an important enhancer of Seizing Capability rather than its sole source of sustainability benefits.

The Role of Collaborative Innovation Supply Chain Mediation on the Relationship between Transforming Capability and Sustainability Performance

The specific indirect effect results indicate that Supply Chain Collaborative Innovation does not significantly mediate the relationship between Transforming Capability and Sustainability Performance. Therefore, H10 is rejected. This result is consistent with the preceding path analysis, in which Transforming Capability has a positive and significant direct effect on Sustainability Performance but does not significantly influence Supply Chain Collaborative Innovation. The findings therefore suggest that the sustainability benefits generated by Transforming Capability in the observed SMEs are realised primarily through internal organisational reconfiguration rather than through supply chain collaborative innovation. From the perspective of Dynamic Capability Theory, transforming capability enables firms to reconfigure resources, processes, organisational routines, and competencies in response to environmental changes (D. J. Teece, 2018). In the context of bamboo handicraft SMEs, such transformation may involve improving production processes, adopting digital tools, developing employee competencies, and reorganising internal operations, which can directly improve efficiency, adaptability, and sustainability performance without necessarily requiring intensive inter-organisational collaboration.

The absence of a significant mediation effect also provides an important explanation for the difference between the present findings and previous studies reporting a positive relationship between Transforming Capability and collaborative innovation (Fontoura & Coelho, 2022; Jum'a et al., 2025). Open Innovation Theory emphasises that organisational transformation can generate greater innovation outcomes when firms are able to exchange knowledge, integrate external expertise, and establish sustained relationships with external partners (Chesbrough, 2003). However, these conditions may not be equally available to resource-constrained SMEs. Limited financial resources, uneven technological adoption, restricted access to specialised knowledge, relatively narrow business networks, and limited coordination capacity may cause transformation activities to remain concentrated on internal operational improvements rather than extending to collaborative innovation. The role of institutional support may also be important because government programmes, universities, business associations, and other intermediary organisations can provide the networks and knowledge required to connect internal transformation with external collaboration. Consequently, the insignificant indirect

effect should not be interpreted as evidence that Transforming Capability is irrelevant to sustainability. Rather, it suggests that the transformation capabilities of the sampled SMEs currently generate sustainability benefits primarily through internal changes, while the external collaborative conditions required to convert transformation into Supply Chain Collaborative Innovation may not yet be sufficiently developed.

CONCLUSION

This study examined the role of Dynamic Capability Microfoundations, comprising Sensing Capability, Seizing Capability, and Transforming Capability, in enhancing Sustainability Performance, with Supply Chain Collaborative Innovation (SCCI) as a mediating mechanism among bamboo handicraft SMEs in West Java. The findings demonstrate that the three microfoundations do not contribute to sustainability performance through an identical pathway. Sensing Capability has no significant direct effect on Sustainability Performance but significantly contributes to SCCI, which in turn significantly enhances Sustainability Performance. This indicates that environmental scanning and opportunity recognition alone are insufficient to generate sustainability outcomes and require collaborative mechanisms through which market information, technological knowledge, and external resources can be converted into innovation and organisational value. In contrast, Seizing Capability has both a significant direct effect on Sustainability Performance and a significant indirect effect through SCCI, indicating partial mediation. Transforming Capability has a significant direct effect on Sustainability Performance but does not significantly influence SCCI, resulting in no significant mediation effect. These findings demonstrate that the sustainability value of dynamic capabilities depends on how specific capabilities are converted into strategic action and, where necessary, connected with external collaborative resources.

The findings contribute to Dynamic Capability Theory by demonstrating the differentiated roles of sensing, seizing, and transforming capabilities at the microfoundational level within resource-constrained SMEs. Rather than treating dynamic capability as a uniform organisational capability, the results show that each microfoundation generates sustainability outcomes through a distinct mechanism. The findings also extend Open Innovation Theory by positioning Supply Chain Collaborative Innovation as an important mechanism through which selected internal capabilities can be connected with external knowledge, resources, and partners to generate sustainability outcomes. In particular, the full mediation of Sensing Capability and the partial mediation of Seizing Capability demonstrate that external collaboration is especially important when SMEs need to convert market information or identified opportunities into tangible innovation and sustainability outcomes. Meanwhile, the absence of mediation for Transforming Capability indicates that internal organisational reconfiguration can generate sustainability benefits without necessarily producing

collaborative innovation, particularly where SMEs face constraints in technological adoption, organisational resources, networks, and inter-organisational coordination.

From a managerial perspective, the findings suggest that SME managers should not treat all dynamic capabilities as requiring the same intervention. Sensing activities should be connected to concrete collaborative mechanisms, such as systematic engagement with suppliers, customers, universities, creative communities, and business-support institutions, so that market and technological information can be transformed into innovations. Seizing capability should be supported through resource allocation, product development, digital marketing, and strategic partnerships because it contributes to Sustainability Performance both directly and through SCCI. For Transforming Capability, managers should prioritise internal improvements in production processes, technology adoption, employee competencies, and organisational routines while simultaneously developing the networks and coordination mechanisms necessary to translate internal transformation into external collaborative innovation.

The study is subject to limitations that should be considered when interpreting its findings. The respondents were limited to bamboo handicraft SMEs in West Java, and therefore the findings should not be assumed to represent SMEs in other industrial sectors, regions, or institutional environments. Differences in technological maturity, market conditions, access to institutional support, and supply chain structures may produce different relationships among dynamic capabilities, collaborative innovation, and sustainability performance. Future research should therefore examine the proposed model across different sectors and geographical contexts and consider longitudinal or comparative research designs. Future studies may also incorporate Digital Transformation Capability, Green Innovation, and Environmental Turbulence to provide a broader explanation of how SME capabilities and external conditions interact in producing sustainable organisational outcomes.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to Universitas Negeri Jakarta for its academic support throughout the conduct of this research. The authors also extend their heartfelt appreciation to the West Java Office of Cooperatives and Small and Medium Enterprises, the National Unity and Political Affairs Agency of West Java Province, and the owners and managers of handcraft SMEs in West Java for their voluntary participation and for providing valuable data and insights that were essential to this study. The authors are also grateful to their colleagues and the reviewers for their constructive comments and valuable suggestions, which significantly contributed to improving the quality of this manuscript. Furthermore, the authors acknowledge all individuals and institutions whose direct or indirect support made the

successful completion of this research possible. Any remaining errors or omissions in this article are solely the responsibility of the authors.

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