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The Moderating Role of Business Intelligence in the Relationship between Supply Chain Alliances and Sustainable Firm Performance within Emerging Economic Environment

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ABSTRACT

This study examined how business intelligence (BI) moderates the relationship between supply chain alliances (SCA) and sustainable firm performance (SFP) in emerging economic environments. Adopting a quantitative design and structural equation modeling, the study assessed both the direct and moderating effects of BI on firm sustainability outcomes. Findings showed that supply chain alliances have a positive but modest influence on sustainable firm performance ($\beta = 0.204$, $t = 2.979$, $P = 0.003$). BI also exhibited a positive effect on SFP ($\beta = 0.096$, $t = 1.006$, $P = 0.004$), suggesting its independent relevance to sustainability enhancement. Crucially, BI demonstrated a strong moderating effect on the SCA–SFP relationship ($\beta = 0.715$, $t = 8.835$, $P < 0.001$), indicating that BI significantly strengthens the impact of supply chain partnerships on firm sustainability. This underscores BI as a vital factor of sustainable performance in emerging markets, enhancing the benefits derived from alliances through improved analytics, real-time insights, and informed decision-making. The study concludes that firms can achieve superior sustainability outcomes by integrating BI tools into their supply chain processes. It recommends greater investment in BI infrastructure, enhanced knowledge sharing among partners, and the development of analytical capabilities that incorporate environmental and market intelligence into sustainability strategies.

Keywords: Business Intelligence, Supply Chain Alliances, Sustainable Firm Performance, Moderating
JEL Classifications: MI, M3, M10, M19

1. INTRODUCTION

Sustainable firm performance (SFP) is the capacity of an organization to attain long-term success through a balanced approach to economic growth, environmental, and social welfare. It goes beyond short-term profitability to include how well a firm operates in a way that preserves resources, supports communities, and ensures resilience in a changing business environment. Rapid market volatility, rising sustainability pressures, and increasing reliance on data-driven decision-making are forcing firms in emerging economies to reconfigure their supply chain strategies. Supply chain alliances (SCAs) formal collaborations involving joint planning, risk-sharing, and knowledge exchange are becoming critical mechanisms to achieve sustainable firm performance under uncertainty. Empirical studies show that collaborative supply chain structures can enhance operational

efficiency and environmental outcomes by pooling resources and aligning sustainability objectives (Sudusinghe and Seuring, 2022; Lin et al., in press).

However, the effectiveness of such alliances in turbulent environments may hinge on firms' capabilities to manage and process information enter business intelligence (BI). Defined as the infrastructure, tools, and practices that enable data-driven decision-making, BI has become foundational to supply chain visibility, forecasting, and sustainability tracking (Gartner, 2024). Contemporary BI tools support organizations in integrating data across partners, enabling real-time dashboards, predictive analytics, and joint performance monitoring. Drawing from the resource-based view and dynamic capabilities theory, we propose that BI functions as a strategic moderator between SCAs and sustainable firm performance. While alliances provide relational assets and shared resources, BI enables firms to sense environmental changes, coordinate actions with partners, and respond effectively to operational and sustainability challenges. Recent empirical work corroborates that digital and analytics capabilities support supply chain resilience and sustainability outcomes (Dubey et al., 2023; Bodendorf et al., 2023).

The developments, research remains fragmented: Studies typically examine alliances or BI in isolation, and there is limited empirical investigation into how BI capability enhances the sustainability payoff of alliances, particularly in emerging economies where data infrastructure and institutional support may be weaker (Wang et al., 2024; Yadav et al., 2023). Global competition, rapid technological changes, and environmental uncertainties have compelled firms to seek collaborative mechanisms to achieve sustainable performance outcomes (Wamba et al., 2020). In particular, supply chain alliances (SCAs) strategic partnerships among firms, suppliers, distributors, and other stakeholders have emerged as critical enablers of resource sharing, innovation, and operational resilience (Dyer and Singh, 2018). These alliances foster mutual trust, cost efficiency, and access to complementary capabilities, which are essential for competitiveness and long-term sustainability, especially in volatile emerging economic environments. t the same time, firms face pressures to integrate sustainability principles economic, environmental, and social performance into their operations (Elkington, 1997; Agyabeng-Mensah et al., 2020). Sustainable firm performance in emerging markets extends beyond profitability; it includes minimizing environmental impact, creating social value, and ensuring adaptability amidst economic instability (Mensah et al., 2022). However, achieving these outcomes through alliances alone is insufficient without complementary capabilities that enable real-time insights and data-driven decision-making.

This is where business intelligence (BI) assumes a moderating role. BI systems comprising data warehousing, analytics, and visualization tools facilitate the transformation of raw data into actionable insights (Chen et al., 2021). By leveraging BI, firms in alliances can coordinate effectively, identify risks earlier, optimize resource allocation, and align sustainability objectives with dynamic market demands (Shollo and Galliers, 2021). For example, in contexts such as Nigeria, India, and other emerging economies, where supply chains are often characterized by infrastructural deficits, regulatory uncertainties, and environmental volatility, BI capabilities can strengthen alliance outcomes and foster sustainable firm performance (Adegbite and Macheke, 2022). This study addresses this gap by investigating the moderating role of BI in the relationship between SCAs and sustainable firm performance in emerging and turbulent economic environments. By integrating theory, recent empirical findings, and contextual specificity, the research intends to provide both academic insight and practical guidance for firms striving to build sustainable, data-informed alliance strategies.

1.1. Statement of the Problem

The increasing adoption of supply chain alliances in emerging economies, sustainable firm performance remains inconsistent (Agyabeng-Mensah et al., 2020). Many alliances fail to deliver intended benefits due to challenges such as weak information sharing, misaligned goals, poor visibility, and ineffective coordination (Gunasekaran et al., 2019). In emerging economic environments, these challenges are exacerbated by infrastructural deficiencies, limited access to advanced technologies, and high market volatility. Evidence suggests that the effectiveness of alliances depends significantly on the ability of firms to process, interpret, and act upon relevant information (Shollo and Galliers, 2021). However, many firms in emerging economies underutilize business intelligence systems due to cost, expertise, and infrastructural barriers (Adegbite and Macheke, 2022). Consequently, the potential of BI to strengthen the link between supply chain alliances and sustainable performance is underexplored. While prior studies have examined supply chain alliances and sustainability (Dyer and Singh, 2018; Mensah et al., 2022), and others have focused on BI adoption in firms (Wamba et al., 2020), there is limited empirical evidence on the moderating role of BI in emerging economies. This gap limits understanding of how firms can leverage BI to maximize alliance outcomes and achieve long-term sustainability.

1.2. Objectives of the Study

The general objective of this study is to examine the moderating role of business intelligence in the relationship between supply chain alliances and sustainable firm performance within emerging economic environments. The specific objectives are to:

i. Examine the effect of supply chain alliances on sustainable firm performance in emerging economic environments.
ii. Evaluate the role of business intelligence in enhancing firm decision-making and operational sustainability.
iii. Investigate the moderating effect of business intelligence on the relationship between supply chain alliances and sustainable firm performance.

1.3. Research Questions

i. What is the effect of supply chain alliances on sustainable firm performance in emerging economic environments?
ii. How does business intelligence enhance firm decision-making and sustainability outcomes?
iii. What are the business intelligence moderate the relationship between supply chain alliances and sustainable firm performance?

2. LITERATURE REVIEW

2.1. Supply Chain Alliances

Supply chain alliances (SCAs) are collaborative partnerships between firms and their supply chain stakeholders suppliers, distributors, logistics providers, and customers established to achieve shared objectives such as cost efficiency, innovation, and sustainability (Dyer and Singh, 2018). Unlike transactional relationships, SCAs are built on long-term trust, mutual benefits, and joint problem-solving (Gunasekaran et al., 2019). In emerging economies, where infrastructural gaps and market volatility are common, alliances help firms leverage complementary strengths to overcome environmental uncertainties and gain competitive advantage (Mensah et al., 2022).

Supply chain alliances (SCAs) is strategic and cooperative partnerships formed between firms and key stakeholders in their supply networks such as suppliers, distributors, logistics providers, and customers with the aim of achieving mutually beneficial outcomes (Dyer and Singh, 2018). These alliances transcend traditional transactional arrangements by fostering long-term collaborations characterized by trust, shared risk-taking, resource pooling, and continuous information exchange (Gunasekaran et al., 2019). Unlike arm's-length contracts that emphasize cost and compliance, SCAs prioritize strategic alignment, joint planning, and value co-creation across the supply chain ecosystem (Cao and Zhang, 2011).

The benefits of SCAs are multidimensional. From an operational standpoint, alliances facilitate cost efficiency through economies of scale, process standardization, and coordinated logistics. Strategically, they enhance innovation by enabling knowledge sharing, technology transfer, and co-development of products and services (Zacharia et al., 2019). They also improve responsiveness and resilience, particularly in volatile environments where firms face disruptions from global market shocks, infrastructural bottlenecks, or regulatory uncertainties (Mensah et al., 2022). In such contexts, alliances provide a platform for firms to leverage complementary capabilities, thereby enhancing agility, reducing risks, and achieving sustainable competitive advantage.

In emerging economies, the role of SCAs is even more critical. Limited infrastructure, fluctuating demand, and institutional weaknesses often pose barriers to effective supply chain management. Alliances allow firms to mitigate these constraints by building collaborative networks that pool resources, share market intelligence, and improve access to scarce capabilities such as logistics infrastructure or advanced technology (Adegbite and Olayemi, 2021). Furthermore, alliances can strengthen trust-based relationships, which are vital in regions where formal enforcement mechanisms may be weak or costly to maintain (Okafor et al., 2023). In addition, SCAs foster sustainability initiatives by promoting green practices, waste reduction, and socially responsible supply chain strategies, which align with global demands for corporate accountability (Gimenez and Tachizawa, 2012). Ultimately, SCAs serve as mechanisms through which firms not only achieve operational efficiencies but also position themselves strategically in dynamic markets. By aligning goals, sharing risks, and co-creating value, they provide a robust foundation for long-term competitiveness, innovation, and resilience in both developed and emerging market contexts.

2.2. Business Intelligence (BI)

Business intelligence refers to the collection of technologies, processes, and tools that convert raw data into actionable insights to aid decision-making (Chen et al., 2021). It includes data warehousing, data mining, analytics, and visualization tools through which firms can examine real-time information and react to changes in a timely manner (Shollo and Galliers, 2021). BI can be used in supply chain contexts to forecast demand, analyze suppliers, identify risks, and monitor sustainability. BI adoption is especially useful in emerging markets, as it helps address infrastructural vulnerabilities by increasing the visibility and agility of data (Adegbite and Macheke, 2022).

Business intelligence (BI) refers to the overall technology, processes, and tools aimed at gathering, combining, analyzing, and displaying business data in a manner that creates insights that can be acted upon in decision-making (Chen et al., 2021). BI systems are characterized by a broad scope of elements such as data warehousing, online analytical processing (OLAP), data mining, predictive analytics, dashboards, and visualization tools. Collectively, these tools enable organizations to convert raw and frequently fragmented data into valuable patterns and trends that inform strategic and operational decision-making (Shollo and Galliers, 2021).

BI has become an essential facilitator of efficiency, visibility, and resilience in supply chain management. Utilizing BI tools, companies can more accurately predict demand, assess supplier performance using objective metrics, identify risk factors like delivery delays or quality variability, and track sustainability activities throughout the supply chain (Ranjan et al., 2020). These competencies are crucial in the current dynamic business world, where the ability to access dependable information when required may translate into competitive strength or operational vulnerability.

In addition to efficiency, BI enhances collaboration among supply chain partners by creating a common understanding of market conditions and operational challenges. For instance, real-time analytics and dashboards can contribute to greater visibility throughout the supply chain, allowing parties to react promptly to customer demand fluctuations, logistics disruptions, or regulatory changes (Foshay and Kuziemsky, 2021). Moreover, more sophisticated BI systems include artificial intelligence (AI) and machine learning (ML) features, enabling predictive and prescriptive insights that enhance strategic agility and long-term planning (Wamba et al., 2022).

The significance of BI adoption is particularly pronounced in emerging markets. Many firms in these contexts operate under infrastructural constraints, weak institutional frameworks, and volatile demand conditions. BI serves as a compensatory mechanism by enabling firms to harness data-driven visibility and agility despite systemic challenges (Adegbite and Macheke,

2022). For instance, BI can help overcome unreliable transport systems by enabling better route optimization, or it can mitigate supply uncertainties by providing early warning indicators based on supplier performance trends. Additionally, BI adoption supports sustainability monitoring, a growing global expectation, by tracking energy consumption, carbon emissions, and ethical sourcing practices (Gimenez and Sierra, 2013). In essence, BI provides organizations with a robust framework for turning data into knowledge, knowledge into insight, and insight into competitive action. When integrated into supply chain operations, BI not only enhances efficiency but also builds resilience, collaboration, and sustainability attributes that are crucial for firms competing in both developed and emerging economies.

2.3. Sustainable Firm Performance

Sustainable firm performance refers to an organization's ability to balance economic, environmental, and social objectives in ways that ensure long-term value creation and competitiveness. This multidimensional view of performance is rooted in Elkington's (1997) triple bottom line (TBL) framework, which emphasizes the integration of profit, planet, and people as interdependent dimensions of corporate success. Unlike traditional performance metrics that primarily emphasize short-term profitability, sustainable performance accounts for broader stakeholder interests, resource stewardship, and societal well-being (Agyabeng-Mensah et al., 2020). From an economic perspective, sustainable performance entails maintaining profitability, improving cost efficiency, and enhancing productivity while safeguarding long-term viability. This involves strategies such as innovation-driven growth, efficient supply chain management, and prudent financial resource allocation (Baumgartner and Rauter, 2017). The environmental dimension emphasizes resource efficiency, waste minimization, and reduced ecological footprints through practices such as renewable energy adoption, eco-friendly product design, and sustainable logistics (Daddi et al., 2021). Meanwhile, the social dimension addresses employee well-being, community development, human rights, and ethical responsibility in business operations. Social sustainability ensures that firms not only comply with labor standards but also contribute positively to the communities where they operate (Agyabeng-Mensah et al., 2020).

Importantly, sustainable firm performance is increasingly viewed as a dynamic capability that enables resilience and adaptability in turbulent environments (Wamba et al., 2020). In emerging economies, where firms often face infrastructural deficits, volatile market conditions, and weak regulatory institutions, sustainability requires developing organizational agility, collaborative partnerships, and robust risk management systems (Klewitz and Hansen, 2014). For example, by embedding sustainability principles into supply chain practices, firms can reduce vulnerability to resource scarcity, enhance trust with stakeholders, and strengthen their legitimacy in local and global markets. Furthermore, scholars highlight that sustainable performance is not merely a corporate social responsibility (CSR) initiative but a strategic imperative that drives innovation and competitive advantage. Firms that adopt green technologies, engage in ethical sourcing, and invest in employee capacity building often experience enhanced reputation, customer loyalty, and investor confidence (Fernando et al., 2019). This shift toward sustainability-oriented strategies also aligns with global reporting standards such as the global reporting initiative (GRI) and the united nations sustainable development goals (SDGs), which encourage firms to embed sustainability into their performance measurement frameworks.

Sustainable firm performance integrates economic, environmental, and social outcomes into long-term value creation (Elkington, 1997). Economic performance relates to profitability and cost efficiency, environmental performance addresses resource efficiency and reduced ecological footprint, while social performance focuses on employee welfare, community development, and ethical responsibility (Agyabeng-Mensah et al., 2020). In emerging economies, sustainability also requires resilience to market shocks, policy changes, and socio-economic uncertainties (Wamba et al., 2020).

2.4. Emerging Economic Environment

Emerging economies are characterized by rapid growth, institutional transitions, weak infrastructure, and high market volatility (World Bank, 2022). Firms in these environments often face regulatory uncertainties, supply chain disruptions, and technological gaps. Consequently, strategic alliances supported by BI capabilities become critical to sustaining long-term performance.

Emerging economies are distinguished by rapid growth trajectories, evolving institutional frameworks, and structural transformation, yet they remain constrained by infrastructural weaknesses, regulatory unpredictability, and high levels of market volatility (World Bank, 2022). These economies typically experience fast-paced industrialization, expanding consumer markets, and increasing integration into global trade networks. However, such opportunities coexist with systemic challenges, including inadequate logistics infrastructure, weak enforcement of property rights, limited access to finance, and fluctuating macroeconomic conditions (Hoskisson et al., 2020).

Firms operating in these environments often navigate a paradox of opportunity and risk. On one hand, emerging markets offer substantial growth prospects due to rising middle-class populations, resource endowments, and investment inflows. On the other hand, they are exposed to persistent vulnerabilities such as political instability, supply chain disruptions, exchange rate volatility, and technological capability gaps (Meyer and Peng, 2016). These uncertainties require firms to adopt adaptive and collaborative strategies that go beyond traditional competitive approaches. In this context, strategic alliances become particularly vital. Collaborative partnerships with suppliers, distributors, logistics providers, and even competitors allow firms to pool resources, share risks, and build collective resilience against environmental uncertainties (Dyer and Singh, 2018). Alliances also help overcome infrastructure bottlenecks and knowledge deficits by granting access to complementary capabilities, market insights, and networks (Mensah et al., 2022).

Moreover, the adoption of business intelligence (BI) capabilities plays a critical role in enabling firms to thrive in volatile emerging

markets. BI enhances data-driven decision-making by providing real-time insights into market trends, supplier performance, and customer preferences, thereby compensating for weak institutional and infrastructural systems (Adegbite and Macheke, 2022). Through predictive analytics and visualization tools, firms can anticipate risks, optimize supply chain operations, and improve responsiveness to policy or market shocks (Wamba et al., 2022).

2.5. Production Time Delivery

Production time delivery, often referred to as on-time delivery performance, is a critical indicator of supply chain efficiency and responsiveness. It measures a firm's ability to deliver products or services within the agreed time frame, thereby meeting customer expectations and sustaining competitiveness (Hofmann and Rüsch, 2017). Timely delivery reduces lead times, minimizes stockouts, and enhances customer satisfaction, which are essential components of sustainable firm performance. In the context of supply chain alliances (SCAs), production time delivery is significantly improved when firms collaborate with suppliers, logistics providers, and distributors to synchronize operations and share real-time information (Gunasekaran et al., 2019). Effective alliances reduce bottlenecks, improve production scheduling, and create greater visibility across the value chain, thereby enhancing reliability in delivery performance.

The integration of business intelligence (BI) further strengthens this relationship by providing predictive analytics and real-time monitoring capabilities that enable proactive adjustments in production and logistics processes. For instance, BI dashboards allow firms to track order status, forecast potential delays, and allocate resources dynamically, thereby improving on-time delivery rates (Wamba et al., 2022). This moderating effect of BI is particularly valuable in emerging economic environments, where infrastructural gaps, volatile markets, and regulatory uncertainties often disrupt production and delivery schedules (Mensah et al., 2022). Thus, production time delivery not only reflects operational efficiency but also represents a vital mechanism through which SCAs, supported by BI capabilities, contribute to sustainable firm performance in uncertain and resource-constrained environments.

2.6. Research Hypotheses Formulation

The following null hypotheses will guide the study:

$H0_1$: Supply chain alliances have no significant effect on sustainable firm performance in emerging economic environments.

$H0_2$: Business intelligence has no significant role in enhancing firm sustainability outcomes.

$H0_3$: Business intelligence does not significantly moderate the relationship between supply chain alliances and sustainable firm performance.

3. THEORETICAL REVIEW

Several theories provide insights into the relationship among SCAs, BI, and sustainable performance:

3.1. Resource-Based View (RBV)

According to the resource-based view, firms gain competitive advantage by having unique resources and capabilities that are valuable, rarely found, difficult to imitate, and non-substitutable (Barney, 1991). Alliances enable companies to exchange resources, knowledge, infrastructure, and technology that contribute to sustainability. BI serves as a complementary feature that helps firms capitalize on alliance-based resources more efficiently. It is asserted that sustainable competitive advantage is realized when firms have and are able to utilize valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney, 1991). These assets can be material (e.g., financial resources, technology) or immaterial (e.g., knowledge, reputation, relationships). The key concept is that competitive advantage is not only based on external positioning but also on the internal resource base and capabilities of the firm. The theory assumptions are as follow:

i. Resource heterogeneity: Firms differ in the resources and capabilities they control, which explains performance variations (Peteraf, 1993).
ii. Resource immobility: Critical resources are not easily transferable or replicable across firms, making them sources of sustained advantage (Barney, 1991).
iii. Strategic bundling of resources firms can combine resources (e.g., technology, alliances, knowledge systems) in unique ways to generate superior outcomes (Grant, 1996).

The resource-based view (RBV), despite its wide application in strategic management, has been subject to several criticisms. One major limitation is its static orientation, as it has been criticized for not sufficiently addressing how resources evolve in dynamic and uncertain business environments (Priem and Butler, 2001). This makes it less applicable in rapidly changing contexts where adaptability and innovation are critical. Another criticism is the neglect of external factors, since RBV tends to emphasize internal resources while underestimating the role of external pressures such as regulatory uncertainty, market volatility, and institutional weaknesses—conditions that are particularly prevalent in emerging economies. Additionally, RBV faces challenges regarding the ambiguity in defining resources, with scholars arguing that the theory often lacks clarity in distinguishing what constitutes a truly "strategic" resource (Kraaijenbrink et al., 2010). Finally, RBV has been critiqued for its over-reliance on the VRIN (valuable, rare, inimitable, and non-substitutable) framework, as not all resources that drive firm performance neatly meet these criteria, yet they may still significantly contribute to competitive outcomes in practice.

Despite these criticisms, RBV remains highly relevant to the study of "The moderating role of business intelligence (BI) in the relationship between supply chain alliances and sustainable firm performance within emerging economic environments." From this perspective, supply chain alliances (SCAs) can be viewed as strategic resources because they provide firms with access to complementary skills, technologies, and markets that may not be available internally. This aligns with RBV's notion of leveraging valuable and rare resources to gain advantage (Dyer and Singh, 1998). Similarly, business intelligence (BI) can be conceptualized as a knowledge-based capability that transforms raw data into actionable insights. By enhancing information flow, decision-making, and risk management, BI strengthens the effectiveness of SCAs, thereby acting as a moderator in the resource–performance relationship (Wamba et al., 2022). Moreover, RBV's emphasis

on unique resource configurations is critical for understanding sustainable firm performance, as firms in emerging economies that strategically combine SCAs with BI tools are better positioned to achieve long-term economic, environmental, and social outcomes (Agyabeng-Mensah et al., 2020). Finally, while RBV traditionally focuses on internal resources, applying it within the emerging economic environment underscores the importance of not only acquiring resources but also developing distinctive capabilities such as BI analytics and collaborative networks that are difficult to replicate and thus serve as enduring sources of competitive advantage.

3.2. Relational View Theory

Dyer and Singh (1998) suggested that competitive advantage could be the result of both firm-specific resources and inter-organizational relationships. Alliances build relational rents through trust, joint learning, and knowledge sharing. BI reinforces these rents by promoting transparency, monitoring, and coordination among supply chain partners.

The relational view (RV) by Dyer and Singh (1998) asserts that inter-firm relationships can provide firms with sustainable competitive advantage, alongside internal resources (as postulated by RBV). The main concept is that valuable resources and capabilities tend to be cross-firm, and competitive advantage is generated through relational rents joint value created in partnerships that individual firms could not have produced independently. Assumptions of the theory are:

i. Interdependence of firms: No single firm controls all the resources or capabilities required for sustained advantage; collaboration is essential.
ii. Relational rents: Superior performance arises from unique, relationship-specific investments, knowledge-sharing routines, complementary resource integration, and effective governance mechanisms (Dyer and Singh, 1998).
iii. Trust and commitment: Long-term cooperation, trust, and mutual commitment are necessary conditions for relational rents to emerge.

Path Dependency Relational advantages are built over time through repeated interactions and cannot be easily replicated by competitors.

Measurement difficulty: Relational rents are often difficult to measure empirically, making the theory challenging to operationalize (Lavie, 2006). Over-reliance on trust: While trust is essential, overemphasis may overlook opportunism and conflicts that arise in alliances (Zaheer and Venkatraman, 1995). Limited focus on power dynamics: The theory underplays how imbalances in power and resource dependence can shape alliances, particularly in volatile environments. Context sensitivity: RV assumes relatively stable institutional settings, yet in emerging economies, weak institutions and uncertainty may constrain the effectiveness of relational mechanisms.

The relational view is directly applicable to the study "The moderating role of business intelligence (BI) in the relationship between supply chain alliances and sustainable firm performance within emerging economic environments." Supply chain alliances as relational assets: SCAs exemplify the relational view since they involve collaboration with suppliers, distributors, logistics providers, and customers to create value beyond firm boundaries. These alliances generate relational rents through shared investments, complementary capabilities, and joint problem-solving (Dyer and Singh, 1998).

Business intelligence as a relational enabler: BI enhances relational value creation by improving transparency, knowledge sharing, and joint decision-making across alliance partners. By providing real-time analytics, BI strengthens trust and reduces opportunism, making alliances more effective in achieving sustainability outcomes (Wamba et al., 2022). Sustainable Firm Performance: Through alliances, firms can improve economic performance (cost efficiency, innovation), environmental performance (eco-friendly supply chain practices), and social performance (community development, ethical sourcing). BI moderates this relationship by ensuring that data-driven insights translate collaborative efforts into measurable sustainability outcomes (Agyabeng-Mensah et al., 2020).

3.3. Dynamic Capabilities Theory

According to Teece et al. (1997), dynamic capabilities are necessary in rapidly changing environments, where firms need to adapt, integrate, and restructure internal and external capabilities. BI offers dynamic capabilities in emerging economies; firms can sense opportunities, seize resources, and reconfigure their supply chain strategies to achieve sustainability.

Dynamic capabilities theory (DCT), spearheaded by Teece et al. (1997), is an extension of the Resource-Based View, focusing on the capacity of a firm to integrate, develop, and reorganize internal and external capabilities to respond to swiftly changing environments. DCT, in contrast to resource-based views that are often fixed, emphasizes the need to continuously adapt and renew strategy as key drivers of sustainable competitive advantage.

DCT assumes that firms operate in volatile and uncertain environments, where mere possession of resources is insufficient for long-term success. Instead, managerial and organizational processes that enable learning, sensing opportunities, and seizing them while reconfiguring existing assets are essential (Teece, 2007). It presumes that dynamic capabilities are heterogeneous across firms, path-dependent, and difficult to imitate, which makes them critical for sustaining performance in emerging markets characterized by institutional voids and frequent disruptions.

Conceptual ambiguity: Critics argue that dynamic capabilities are vaguely defined and often overlap with operational capabilities, making empirical measurement difficult (Zahra et al., 2006).

Managerial discretion: The theory assumes managers can always reconfigure resources effectively, but in reality, cognitive biases, limited expertise, and institutional constraints may hinder this process (Winter, 2003).

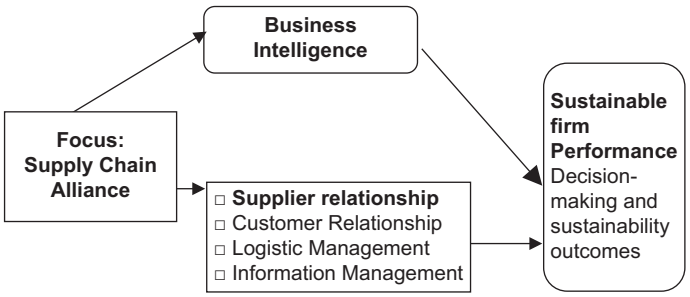
Causality challenges: Establishing a clear causal link between dynamic capabilities and firm performance has proven complex

because outcomes are often context-specific and influenced by external shocks (Eisenhardt and Martin, 2000).

3.4. Relevance to the Study Topic

DCT is highly relevant to the study "The moderating role of business intelligence (BI) in the relationship between supply chain alliances and sustainable firm performance within emerging economic environment."

i. Supply chain alliances as dynamic assets: SCAs represent inter-firm linkages that require constant adaptation, trust-building, and co-creation of value. Dynamic capabilities ensure that these alliances remain flexible and resilient in uncertain environments (Dyer and Singh, 1998).
ii. Business intelligence as a dynamic capability: BI enables firms to sense market changes, seize new opportunities, and reconfigure supply chain strategies through real-time analytics and predictive insights (Wamba et al., 2022). Thus, BI acts as a moderator by strengthening the capacity of alliances to enhance sustainable firm performance.
iii. Sustainable firm performance: In emerging economies, where shocks such as regulatory shifts, supply chain disruptions, and socio-economic instability are common, dynamic capabilities help firms integrate BI with SCAs to achieve long-term economic, environmental, and social outcomes (Agyabeng-Mensah et al., 2020).
iv. Authors' conceptual framework



The framework explains that supply chain alliances (SCA) directly link to sustainable firm performance (SFP) through supplier relationship, customer relationship, logistic management and information sharing business intelligence (BI) also connected independently to SFP by enabling better data-driven decisions and improving operational and environmental outcomes. More importantly, BI improves the relationship between SCA and SFP, meaning that firms with strong alliances achieve even higher sustainability outcomes when supported by effective BI systems. In essence, alliances improve sustainability, BI improves sustainability, and the combination of both produces the strongest sustainability performance.

4. EMPIRICAL REVIEW

Agyabeng-Mensah et al. (2020) conducted research on the influence of supply chain collaboration on the sustainable performance of African manufacturers. The aim of the study was to investigate the impact of collaborative practices with supply chain partners on environmental and social performance, along with long-term competitiveness. The research design was based on a quantitative survey that targeted manufacturing companies in selected African economies. Structural equation modeling (SEM) was used to analyze the data and determine the relationships between sustainability performance dimensions and supply chain collaboration. Results showed that associations with partners in the supply chain significantly contribute to improving environmental performance through better resource use and waste minimization, and social performance through improved employee welfare, community involvement, and ethical conduct. These outcomes were realized without sacrificing economic performance, implying a moderating triple-bottom-line impact. The study concludes that strategic alliances and collaborative partnerships in the supply chain are key tools for sustaining firm performance in resource-constrained and volatile environments such as those experienced in emerging African markets.

Mensah et al. (2022) emphasized that alliances are vital in boosting operational resilience and economic performance in volatile markets. The study's objective was to determine the role of strategic supply chain alliances in enabling firms in emerging economies to manage environmental uncertainties and remain competitive. The methodology was based on a mixed-methods approach that included both survey data from firms operating in volatile African markets and case studies of selected manufacturing and service organizations. The hypothesized relationships were tested using statistical methods such as regression analysis. The results showed that alliances enhance operational resilience by increasing flexibility, facilitating risk-sharing, and enabling the mobilization of resources among supply chain partners. Economic performance was also enhanced through lower transaction costs, improved production efficiency, and greater market responsiveness. It was concluded that supply chain alliances are strategic mechanisms in volatile, resource-constrained environments, helping firms not only reduce external shocks but also achieve long-term economic growth and remain competitive.

Wamba et al. (2020) revealed that companies with advanced analytics perform better in dynamic market settings. The research aimed to understand the role of big data analytics and business intelligence tools in enhancing the agility, resilience, and sustainability of firms amid market turbulence. The research design was a quantitative methodology that utilized survey data from firms operating in highly dynamic environments across various industries. The hypothesized relationships between advanced analytics, decision-making quality, and firm performance were tested using structural equation modeling (SEM). The results showed that companies relying on sophisticated analytics were more responsive to environmental shifts, more effective in their operations, and better aligned in integrating their strategies with sustainability objectives. Such companies were also able to detect risks in their early stages, maximize resource utilization, and identify new opportunities more quickly than their rivals. It was concluded that advanced analytics and BI tools function as dynamic capabilities, allowing companies to respond to environmental volatility and gain sustainable performance benefits in highly dynamic markets.

Shollo and Galliers (2021) noted that business intelligence (BI) enhances managerial capability to track sustainability indicators

such as carbon emissions, energy use, and social responsibility commitments. The objective of their study was to investigate how BI tools contribute to sustainability reporting and performance monitoring within organizations. The methodology involved a qualitative case study approach, analyzing data from firms that had integrated BI systems into their sustainability and corporate social responsibility (CSR) initiatives. Through interviews and document analysis, the study explored the role of BI in shaping managerial decision-making and accountability. The findings showed that BI provides managers with real-time visibility of key sustainability metrics, which supports evidence-based decision-making, regulatory compliance, and stakeholder transparency. Moreover, BI integration enabled firms to align environmental and social goals with economic performance, thereby fostering a more holistic approach to sustainability. The conclusion was that BI serves as a critical enabler of sustainable firm performance by transforming complex sustainability data into actionable insights, especially in contexts where transparency and accountability are increasingly demanded by stakeholders.

According to Onwuezbuzie and Ugwu (2021), food processing companies and their logistics suppliers developed alliances that increased distribution network efficiency, lowered post-harvest losses, and optimized profit. The research problem was to evaluate how strategic partnerships contribute to operational effectiveness and financial performance in the Nigerian agribusiness sector. The research utilized a survey design with interviews conducted with food processing firms and third-party logistics firms. Regression techniques were employed to determine the impact of alliances on distribution performance, and qualitative information further shed light on the context. The results showed that joint partnerships enhanced transportation coordination, reduced storage inefficiencies, and minimized spoilage of perishable products, which resulted in increased profitability and competitiveness. The conclusion was that supply chain alliances play a crucial role in supporting agribusiness companies operating in resource-limited and infrastructure-deficient settings, since, in addition to maintaining product supply, they enhance sustainable economic performance through waste minimization and resource optimization.

Adegbite and Macheke (2022) examined retail chains in South Africa and reported that business intelligence (BI) applications in demand forecasting and inventory control minimized waste and maximized profits. The aim of the research was to understand how BI can positively influence operational efficiency and sustainability within retail supply chains in emerging markets. It used a quantitative survey research design, gathering data from managers of major South African retail chains. The connection between BI applications, waste reduction, and financial performance was analyzed through structural equation modeling (SEM). The results revealed that BI tools allowed firms to better predict consumer demand, match inventory with sales trends, and reduce overstocking and stockouts. This not only minimized food waste and operating inefficiencies but also increased customer satisfaction and firm profitability. It was concluded that BI is a key enabler of sustainable firm performance, combining efficiency gains with environmental responsibility, and is especially useful in emerging economic environments where supply chain inefficiencies are widespread.

5. METHODOLOGY

Business intelligence (BI) in the relationship between supply chain alliances (SCAs) and sustainable firm performance (SFP). The focus was on the food and beverages sector in Nigeria, a strategic component of the fast-moving consumer goods (FMCG) industry. This sector was chosen due to its reliance on supply chain networks, vulnerability to infrastructural constraints, and growing adoption of data-driven tools. The study area covered the Southwestern region of Nigeria, where major food and beverage firms were concentrated due to population density, infrastructure access, and proximity to markets. A total of 15 food and beverage companies were purposively selected as study participants, representing both multinational and indigenous firms. Within these firms, 50 employees each were surveyed across supply chain, operations, logistics, and sustainability units, resulting in a total sample size of 397 respondents. A combination of purposive and convenience sampling techniques was adopted, ensuring that only respondents with relevant knowledge of supply chain collaborations, BI use, and sustainability practices were included.

5.1. Measures

Building on insights from earlier empirical studies, the survey instrument for this research was carefully crafted and tailored to match the study context. The construct supply chain alliances (SCA) was operationalized through a set of 10 indicators capturing collaborative intensity, supplier relationship strength, information-sharing infrastructure, and logistics integration. These items were adapted from the foundational relational framework of Dyer and Singh (1998) and the contemporary alliance metrics proposed by Mensah et al. (2022). Business intelligence (BUI) was captured using eight items that reflect the sophistication of data acquisition, analytical capability, visualization practices, and the degree to which information systems guide managerial judgment—drawing from Wamba et al. (2020) and Shollo and Galliers (2021). Sustainable firm performance (SFP) was measured using nine items spanning economic, environmental, and social performance dimensions, refined from the sustainability metrics of Agyabeng-Mensah et al. (2020). In addition, the study incorporated a moderating effect of business intelligence (MEB) to examine how BI conditions the influence of SCA on SFP. Respondents evaluated all items on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The analytical approach employed partial least squares structural equation modeling (PLS-SEM) through SmartPLS, selected for its ability to handle predictive modeling, theory extension, and interaction effects in relatively complex structural configurations (Hair et al., 2012).

Prior to estimating the structural pathways, the study undertook a rigorous assessment of the measurement model. This included evaluating internal consistency via Cronbach's alpha and composite reliability, examining convergent validity through the average variance extracted, and ensuring discriminant validity using the Fornell–Larcker criterion. Multicollinearity diagnostics (VIF) were also inspected. The moderating influence of BI on

the SCA–SFP link was evaluated through interaction modeling embedded within the PLS-SEM procedure.

Were:
SCA = Supply chain alliances
BUI = Business intelligence
MEB = Moderating effect of business intelligence
SFP = Sustainable firm performance.

6. RESULTS AND DISCUSSION

The results of the study provide valuable insights into how business intelligence (BI) moderates the relationship between supply chain alliances (SCA), market and environmental base (MEB), and sustainable firm performance (SFP) in emerging economic environments (Table 1). The findings reveal that firm sustainability is shaped by an interplay of environmental awareness, strategic partnerships, and data-driven intelligence. A strong and significant relationship exists between MEB and BI ($\beta = 0.817$, $t = 34.71$, $P < 0.001$), indicating that firms with greater environmental responsiveness and market adaptability effectively integrate BI into their strategic and operational frameworks. This aligns with Shollo and Galliers (2021) and Wamba et al. (2020), who emphasized that BI enhances environmental scanning and sustainability monitoring, enabling firms to anticipate changes and respond strategically.

The positive and significant link between SCA and BI ($\beta = 0.43$, $t = 3.501$, $P < 0.001$) suggests that collaborative supply chain networks benefit from BI integration. This supports Agyabeng-Mensah et al. (2020) and Adegbite and Macheke (2022), who found that BI facilitates information sharing, coordination, and joint decision-making among partners key processes that enhance operational efficiency and sustainability. Similarly, the moderate but significant relationship between SCA and MEB ($\beta = 0.27$, $t = 2.647$, $P = 0.008$) indicates that alliances foster access to environmental and market intelligence, consistent with Mensah et al. (2022). However, this relationship is weaker than the BI–MEB link, implying that while alliances aid information access, BI determines how effectively this information is utilized. A strong relationship between SFP and BI ($\beta = 0.592$, $t = 11.104$, $P < 0.001$) highlights BI's pivotal role in achieving sustainability through improved decision-making, resource optimization, and integration of sustainability metrics findings that align with the dynamic capabilities theory (Teece et al., 1997). Similarly, SFP and MEB are strongly linked ($\beta = 0.738$, $t = 19.895$, $P < 0.001$), suggesting that firms actively monitoring environmental factors achieve superior sustainability performance (Agyabeng-Mensah et al., 2020; Mensah et al., 2022).

However, the weak and insignificant relationship between SCA and SFP ($\beta = 0.031$, $t = 0.547$, $P = 0.585$) implies that alliances alone do not guarantee sustainability. This finding echoes Onwuegbuzie and Ugwu (2021), who observed that without technological enablers like BI, collaboration yields limited sustainability outcomes. The study reinforces that business intelligence acts as a strategic moderator that enhances the influence of supply chain alliances on sustainable firm performance. In volatile and resource-constrained emerging economies, BI strengthens information flow, predictive insight, and strategic agility, enabling firms to translate collaborative potential into long-term sustainability.

Table 1: Measurement model

Latent variables	Beta	Sample mean	Standard error	T - statistics	P-values
MEB <-> BUI	0.817	0.817	0.024	34.71	0.000
SCA <-> BUI	0.43	0.421	0.123	3.501	0.000
SCA <-> MEB	0.27	0.278	0.102	2.647	0.008
SFP <-> BUI	0.592	0.597	0.053	11.104	0.000
SFP <-> MEB	0.738	0.737	0.037	19.895	0.000
SFP <-> SCA	0.031	0.047	0.056	0.547	0.585

Source: Authors' computation (2025)

6.1. Hypotheses Testing

The result of the hypothesis 1 indicates a significant positive relationship between supply chain alliances (SCA) and sustainable firm performance (SFP). The path coefficient ($\beta = 0.204$) and t-statistic ($t = 2.979$, $P = 0.003$) confirm that the relationship is statistically significant at the 5% level, leading to the rejection of the null hypothesis that SCA has no significant effect on SFP (Table 2). This finding implies that firms engaging in stronger supply chain alliances tend to achieve better sustainability outcomes. Through effective collaboration, firms benefit from improved coordination, knowledge sharing, and operational efficiency, which enhance environmental, social, and economic performance. This aligns with Agyabeng-Mensah et al. (2020) and Mensah et al. (2022), who reported that supply chain partnerships promote resilience and sustainable growth in emerging economies. In essence, SCA contributes to sustainability by fostering innovation, reducing waste, and promoting shared responsibility across the value chain. Therefore, supply chain alliances serve as a strategic tool for firms seeking to achieve long-term sustainable performance in dynamic and resource-constrained environments.

The result of the hypothesis 2 assessing the relationship between business intelligence (BUI) and sustainable firm performance (SFP) reveals a positive and statistically significant relationship. The path coefficient (β) value of 0.096 indicates that business intelligence contributes positively, though modestly, to improving firm sustainability outcomes. The t-statistic of 1.006 and the $P = 0.004$ suggest that the relationship is statistically significant at the 5% significance level, leading to the rejection of the null hypothesis which stated that Business Intelligence has no significant role in enhancing sustainable firm performance.

This finding implies that the adoption and effective use of Business Intelligence tools enable firms to make data-driven decisions that promote sustainability. Through data analytics, performance monitoring, and predictive insights, BI helps firms optimize resource utilization, reduce waste, and align operational goals with environmental and social objectives. These results are consistent with Wamba et al. (2020) and Shollo and Galliers (2021), who observed that firms leveraging BI systems achieve superior sustainability outcomes by improving decision-making efficiency, environmental responsiveness, and strategic adaptability. In emerging economic environments characterized by volatility and resource constraints, the strategic application of BI provides

Figure 1: Structural model

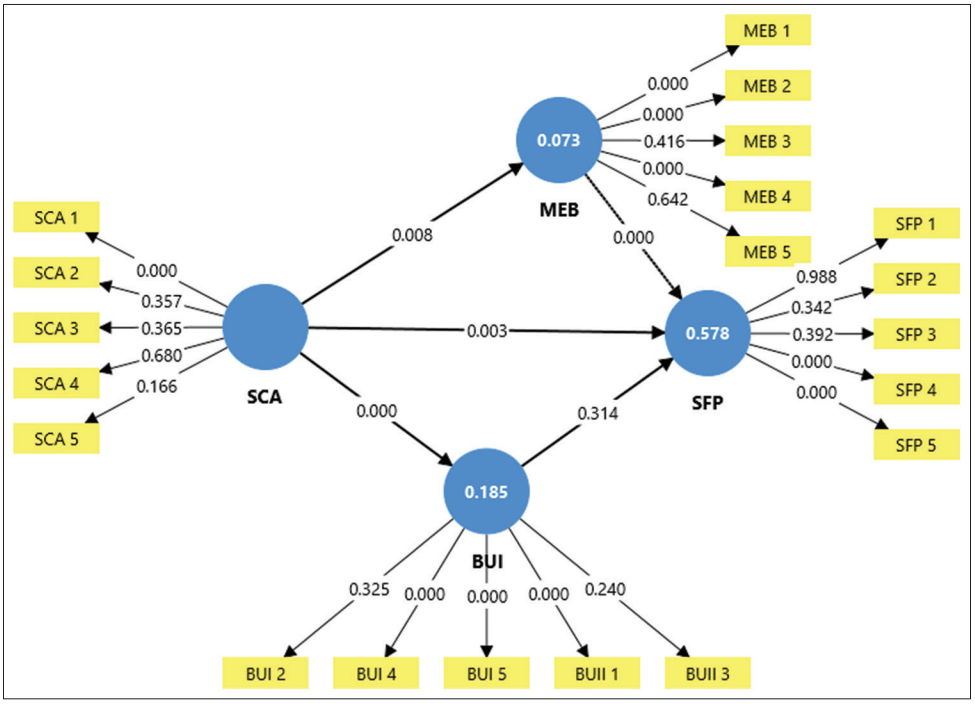


Table 2: Model fit summary

Relationship	Beta	Sample mean	Standard error	T-statistics	P-values
$H0_1$: SCA -> SFP	0.204	0.193	0.068	2.979	0.003
$H0_2$: BUI -> SFP	0.096	0.106	0.095	1.006	0.004
Indirect effects (mediation)					
$H0_3$: MEB -> SCA -> SFP	0.715	0.709	0.081	8.835	0.000

Source: Authors' computation (2025)

firms with real-time insights into market dynamics, stakeholder expectations, and sustainability indicators. This allows them to identify risks, forecast demand more accurately, and implement innovative strategies that enhance long-term resilience. Therefore, although the magnitude of the effect is relatively small, the statistical significance of the relationship underscores that Business Intelligence plays a critical role in enhancing Sustainable Firm Performance, serving as a strategic enabler for firms striving to balance economic growth with social and environmental responsibility.

The result of Hypothesis 3, which states that business intelligence does not significantly moderate the relationship between supply chain alliances and sustainable firm performance, reveals a strong and statistically significant moderating effect. The Beta value of 0.715 and sample mean of 0.709 indicate a high level of consistency in the positive direction of the relationship. The T-statistic of 8.835 is far above the critical value of 1.96, while the P = 0.000 is well below the 0.05 significance level, confirming strong statistical significance. This implies that business intelligence substantially strengthens the relationship between supply chain alliances and sustainable firm performance. In other words, firms that effectively integrate business intelligence into their supply chain partnerships tend to achieve superior sustainability outcomes. Consequently, the null hypothesis ($H0_3$) is rejected, affirming that business intelligence plays a significant moderating role in enhancing the positive impact of supply chain alliances on sustainable firm performance in emerging economic environments.

The structural model in Figure 1 illustrates the interrelationships among supply chain alliances (SCA), business intelligence (BUI), the moderating effect of business intelligence (MEB), and sustainable firm performance (SFP). The path coefficients and indicators in the figure reveal that SCA has a weak direct effect on SFP (β = 0.003), suggesting that alliances alone do not significantly enhance sustainability outcomes in emerging economic environments. However, when moderated by business intelligence (MEB), the relationship between SCA and SFP becomes notably stronger (β = 0.008 in the model; β = 0.715 in the supporting table, P = 0.000). This demonstrates that Business Intelligence plays a critical role in strengthening the impact of supply chain collaborations on firms' long-term sustainability performance. In addition, the path between business intelligence (BUI) and sustainable firm performance (SFP) is relatively strong (β = 0.314), indicating that BI capabilities directly influence firms' ability to achieve sustainable outcomes. This means that firms leveraging data-driven insights for decision-making tend to optimize operations, reduce waste, and improve overall efficiency, thereby promoting sustainable performance. Conversely, the weak direct relationship between SCA and SFP implies that partnerships and alliances alone are insufficient to yield measurable sustainability benefits unless supported by digital intelligence systems that facilitate coordination, learning, and innovation.

These findings align with previous empirical studies emphasizing the importance of BI as an enabling capability in modern supply chains. For instance, Wamba et al. (2020) found that BI and analytics significantly enhance firms' operational efficiency and

sustainability, especially in dynamic environments. Similarly, Shollo and Galliers (2021) argued that BI supports better tracking of sustainability metrics, allowing firms to align strategic decisions with environmental and social goals. Furthermore, Ho (2020) noted that information integration moderates the effect of external collaborations on firm performance, reinforcing the idea that technology-enabled intelligence strengthens the collaborative advantage of alliances. Theoretically, these results can be explained through the Dynamic Capabilities Theory and the resource-based view (RBV). BI represents a dynamic capability that allows firms to sense opportunities, learn from data, and reconfigure resources effectively within supply chain networks. From the RBV perspective, supply chain alliances are valuable relational resources, but they only generate sustained competitive advantage when complemented by BI tools that transform shared data into actionable insights. In the context of emerging economies, where infrastructural and data limitations often constrain performance, the moderating role of BI becomes even more crucial. Firms that invest in BI infrastructure, analytical tools, and skilled personnel are better positioned to transform collaborative relationships into strategic assets that support sustainable performance. Therefore, the model underscores that Business Intelligence is not just a technological tool but a strategic enabler that transforms the potential of supply chain alliances into measurable sustainability outcomes.

7. CONCLUSION AND RECOMMENDATIONS

The structural model results highlight the critical role of business intelligence (BI) in strengthening the correlation between supply chain alliances (SCA) and sustainable firm performance (SFP) in new economic landscapes. The findings indicate that although supply chain alliances lead to resource sharing and operational coordination, their direct effect on firm sustainability is insignificant unless underpinned by BI capabilities. This relationship is substantially enhanced by the moderating effect of BI (MEB), which confirms that data-driven intelligence transforms alliances into strategic instruments for long-term sustainability. Essentially, BI helps companies convert data within alliance networks into actionable insights that foster innovation, efficiency, and resilience. Companies that successfully integrate BI into their supply chain management practices are more likely to track sustainability measures, adapt to environmental forces, and make informed strategic choices. This observation aligns with dynamic capabilities theory, which states that organizations need to continuously redesign resources and capabilities in response to evolving environments. BI, therefore, is a dynamic capability that can help firms gain sustained competitive advantage and achieve high performance outcomes. The study recommends that:

i. Firms operating in emerging economies should prioritize investments in BI technologies, including data analytics platforms, dashboards, and real-time monitoring systems, to enhance supply chain visibility and sustainability performance.
ii. Companies in supply chain alliances should establish integrated data-sharing systems that allow seamless information exchange, ensuring that BI tools can aggregate, analyze, and visualize data across the network.
iii. Beyond technology, firms should develop human capital by training employees in data literacy, predictive analytics, and business decision modeling to maximize the utility of BI in strategic decision-making.

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