East African Scholars Journal of Economics, Business and Management
Abbreviated Key Title: East African Scholars J Econ Bus Manag
ISSN 2617-4464 (Print) | ISSN 2617-7269 (Online)
Published By East African Scholars Publisher, Kenya

Volume-5 | Issue-11 | Dec-2022 | DOI: 10.36349/easjebm.2022.v05i11.004

OPEN ACCESS

Original Research Article

A Conceptual Model for Aligning AI-Driven Product Innovation with Sustainable Business Strategy in Emerging Economies

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Article History
Received: 13.11.2022
Accepted: 22.12.2022
Published: 30.12.2022

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: AI investment is rising rapidly worldwide, yet its sustainability impact in emerging economies remains remarkably limited, a paradox that existing theories cannot fully explain. Despite widespread adoption of machine learning, predictive analytics, and automation tools, most firms in developing contexts struggle to convert AI capabilities into sustainability-oriented product innovation or circular business outcomes. To address this disconnect, this study proposes the AI–Product–Sustainability (AI–PS) Alignment Model, a conceptual framework that explains how AI capabilities drive product innovation that, in turn, strengthens sustainable business strategy within emerging-economy environments. Drawing on systematic literature review of 68 high-quality studies published between 2017 and 2022, this study synthesizes insights from AI adoption, innovation capability and sustainable business models. The findings show that AI capabilities enhance product development through improved design efficiency, eco-optimization, circularity-oriented features, and user-centric innovation processes. The study makes several novel contributions, including the development of the AI–PS Alignment Model and the theoretical integration of the Resource-Based View (RBV), Dynamic Capabilities Theory, Sustainable Business Model Innovation (SBMI) and Institutional Theory. It further reveals that institutional weaknesses such as infrastructure deficits, skill shortages, and regulatory ambiguity, significantly moderate the alignment between AI-enabled innovation and sustainability strategy in emerging economies. Therefore, this study provides a unified framework that clarifies how firms in emerging economies can strategically leverage AI to advance sustainable innovation and long-term competitiveness.

Keywords: AI-Driven Product Innovation, Sustainable Business Strategy, Emerging Economies, AI–Product–Sustainability (AI–PS) Alignment Mode.

1. INTRODUCTION

Artificial intelligence (AI) is rapidly transforming how firms design and develop new products, enabling advanced analytics, predictive modelling, and automated design processes that enhance speed, precision, and innovation performance (Chaudhuri *et al*., 2021; Haefner *et al*., 2021). As AI becomes embedded in product development, it has shifted from a supportive technical tool to a strategic capability essential for competitiveness in the digital economy (Garbuio & Lin, 2019).

At the same time, rising environmental pressures and shifting stakeholder expectations have pushed firms to integrate sustainability into core strategy rather than treat it as a peripheral activity. Concerns about climate change, regulatory pressures, and resource scarcity increasingly require businesses to adopt circular principles and reduce environmental impacts (Baldassarre *et al*., 2017; Machireddy *et al*., 2021). As a result, sustainable business strategy has become a key pathway for long-term competitiveness, especially in innovation-intensive sectors (Zhang *et al*., 2022).

Despite progress in both domains, the relationship between AI-driven product innovation and sustainable business strategy remains insufficiently understood, particularly in emerging economies, where structural constraints complicate the adoption and strategic use of AI (Syed *et al*., 2022; Appiahene *et al*.,

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2021). Weak digital infrastructure, skill shortages, adoption costs, institutional voids, and regulatory ambiguities limit firms' ability to translate AI capabilities into sustainability outcomes (Aremu *et al*., 2021). Yet these same contexts face urgent sustainability challenges and present opportunities for AI-enabled solutions across sectors such as energy, agriculture, and manufacturing (Khan *et al.,* 2019; Risel & von Leipzig, 2022).

Existing studies offer fragmented insights across three separate streams, AI adoption, sustainable innovation, and emerging-economy digital transformation, but provides little integration. AI studies emphasize efficiency and design enhancements; sustainability literature highlights circularity and environmental value creation; and emerging-economy research documents capability and institutional gaps (Jovanović *et al*., 2022; Pieroni *et al*., 2021; Sarkis, 2020; Antikainen & Valkokari, 2017). What remains missing is a holistic framework explaining how AI capabilities can be converted into sustainability-oriented product innovation within institutionally constrained environments.

Although a few integrative studies demonstrate AI's potential to support eco-innovative design, sustainable manufacturing, and circular business models (Risel & von Leipzig, 2022; García-Muiña *et al*., 2019), they remain industry-specific and do not offer a holistic conceptual perspective. However, no prior research has developed an integrated framework that explains how AI capabilities are transformed into sustainability-oriented product innovation and how this process is shaped by the unique institutional constraints of emerging economies, leaving the AI–innovation–sustainability linkage theoretically fragmented and empirically underexplained.

To address this gap, this study proposes the AI–Product–Sustainability (AI–PS) Alignment Model, a conceptual framework that illustrates how AI capabilities enable product innovation that advances sustainable business strategy in emerging economies. Grounded in the Resource-Based View, Dynamic Capabilities Theory, Sustainable Business Model Innovation, and Institutional Theory, the model integrates evidence from 2017–2022 to clarify the mechanisms and contextual moderators shaping this alignment. The study thereby contributes to theory and practice by offering a structured explanation of how firms can leverage AI not only for product advancement but also for sustainability-oriented strategic transformation in emerging markets.

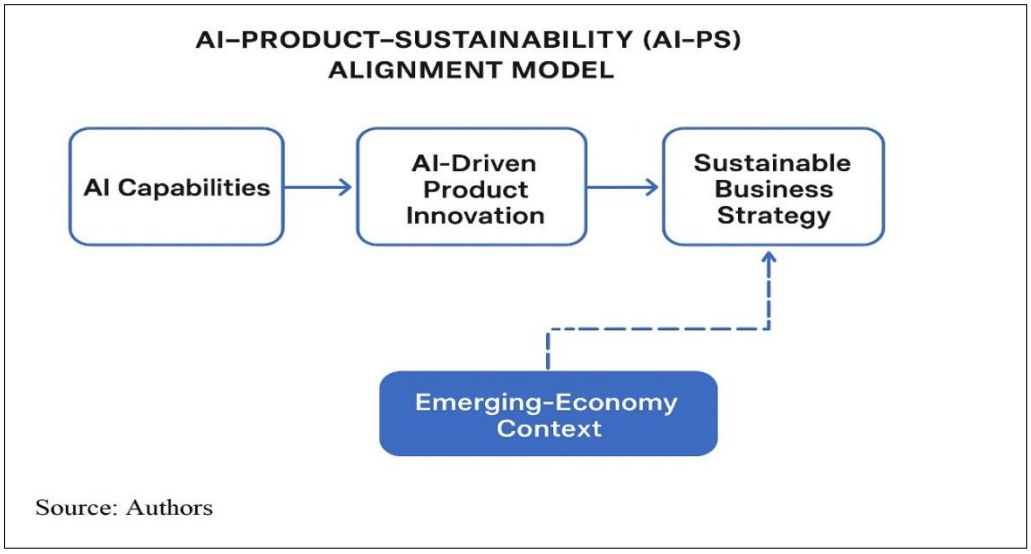

Figure 1: AI–Product–Sustainability (AI–PS) Alignment Model

The second component of the model is AI-Driven Product Innovation, which refers to the development of new or improved products enabled by AI technologies. This includes innovations in product functionality, performance, durability, resource efficiency, circular design, and product–service integration (Zhang *et al*., 2022). AI-driven product innovation forms the direct pathway through which AI capabilities influence firm-level outcomes. AI facilitates rapid prototyping, life-cycle analysis, eco-design optimisation, and the integration of environmental intelligence into product development (Özen, 2022). These mechanisms enhance firms' ability to create offerings that not only satisfy market needs but also contribute to environmental and social value creation (Rai, 2020). The third component is Sustainable Business Strategy, which encompasses the firm's long-term strategic orientation toward environmental stewardship, social responsibility, and economic resilience (Chesbrough, 2020). Sustainable business strategy involves embedding sustainability goals into product portfolios, supply chains, business models, and competitive positioning. Through this strategic lens, product innovation is not merely a technological activity

but a pathway through which firms align with broader sustainability goals, such as reducing environmental footprints, enabling circularity, and supporting inclusive development (Pieroni *et al*., 2021; Sarkis, 2020). The AI–PS model posits that AI-driven product innovation serves as the key mediating mechanism linking AI capabilities with sustainability strategy. Firms with strong AI capabilities are better positioned to generate product innovations that inherently support sustainability objectives, thereby facilitating strategic alignment.

A critical dimension of the AI–PS model is the moderating role of institutional weakness in emerging economies, which include institutional voids, regulatory uncertainties, infrastructure constraints, digital-readiness gaps, limited access to capital, and shortages of technical expertise. While AI capabilities have the potential to accelerate sustainable innovation, these challenges influence how effectively firms can deploy AI for strategic sustainability outcomes. Institutional Theory argues that such constraints shape organizational responses, behaviours, and innovation priorities. In many emerging economies, weak institutional environments slow down AI adoption, limit the scalability of AI-enabled product innovations, and reduce firms' ability to integrate sustainability into competitive strategies (Appiahene *et al*., 2021).

The AI–PS model therefore presents a context-dependent pathway: AI capabilities enhance sustainable business strategy through AI-driven product innovation, but the strength of this pathway is contingent on the enabling or constraining conditions within emerging economies. This contextualized understanding is essential because it reflects the reality that firms in developing countries cannot simply replicate AI–sustainability integration models observed in advanced economies. Instead, alignment depends on adaptive capacity, institutional support mechanisms, and strategic resource configuration unique to their environments.

3. Theoretical Framework

The AI–Product–Sustainability (AI–PS) Alignment Model is grounded in four complementary theoretical lenses: the Resource-Based View (RBV), Dynamic Capabilities Theory, Sustainable Business Model Innovation (SBMI), and Institutional Theory. These theories provide a comprehensive foundation for understanding how artificial intelligence (AI) capabilities drive product innovation and influence sustainable business strategy, particularly within the structural conditions of emerging economies.

Resource-Based View (RBV)

The Resource-Based View posits that firms achieve competitive advantage through the possession and effective deployment of valuable, rare, inimitable, and non-substitutable (VRIN) resources. Within this study, AI capabilities, including data infrastructures, machine learning competencies, analytics tools, and algorithmic assets, are conceptualized as strategic resources that enable superior product development and innovation outcomes. AI provides firms with the ability to process large datasets, forecast market needs, optimize design processes, and generate innovative product features that competitors may find difficult to replicate. As firms increasingly rely on advanced digital tools to differentiate their offerings, AI capabilities become a critical resource through which they develop products that meet both market and sustainability expectations. RBV therefore underpins the first link in the model, which proposes that firms with strong AI-based resources are better positioned to innovate sustainably and achieve strategic alignment.

Dynamic Capabilities Theory

While RBV emphasizes resource possession, Dynamic Capabilities Theory explains how firms mobilize, reconfigure and integrate these resources to respond to environmental change. AI-related capabilities only translate into meaningful innovation outcomes when organizations have the dynamic capacity to sense new opportunities, seize innovation pathways, and transform internal processes. In the context of this study, AI-driven product innovation represents a manifestation of the firm's dynamic capabilities. By enabling rapid prototyping, predictive modelling, life-cycle assessment, and continuous product improvement, AI equips firms to redesign products in ways that reduce environmental impact and enhance resource efficiency. Thus, dynamic capabilities provide the theoretical justification for treating AI-driven product innovation as an adaptive mechanism through which firms strategically align technological possibilities with sustainability-oriented goals. This lens strengthens the argument that AI is not merely a technological tool but a foundational enabler of strategic agility and sustainability-oriented transformation.

Sustainable Business Model Innovation (SBMI)

Sustainable Business Model Innovation theory argues that firms achieve sustainability-based competitive advantage by transforming the way value is created, delivered, and captured. Such innovation emphasizes reducing ecological footprints, enhancing social value, promoting circular resource flows, and integrating sustainability into core strategy. Within the AI–PS model, AI-driven product innovation serves as the bridge linking technological capabilities to sustainable business strategy. AI enables firms to redesign products for durability, recyclability, efficiency, and circularity, elements essential to sustainable business models. SBMI offers the theoretical foundation for understanding sustainable business strategy as not merely a set of environmental practices but as a strategic orientation embedded in the product development process. This perspective helps explain why product innovation is conceptualized as the mediating mechanism between AI resources and sustainability outcomes in the model.

Institutional Theory

Institutional Theory provides the contextual backbone of the AI–PS model by explaining how regulatory structures, socio-economic conditions, norms, and institutional voids shape organizational behavior. In emerging economies, firms often operate in environments characterized by weak regulatory systems, insufficient digital infrastructure, limited access to technical expertise, and inconsistent sustainability policies. These conditions moderate the effectiveness of AI adoption and the extent to which AI-driven product innovation can support sustainability-oriented strategies. Institutional constraints may hinder AI deployment, inflate operational risks, or limit the feasibility of large-scale sustainable product initiatives. Conversely, supportive institutions, such as strong innovation ecosystems, stable regulatory frameworks, and sustainability-oriented policy environments, may amplify the alignment between technological innovation and sustainability strategy. Institutional Theory therefore justifies the inclusion of emerging-economy context as a moderating variable in the AI–PS model.

Together, these theories provide a coherent explanatory foundation for the AI–PS Alignment Model. RBV explains why AI capabilities matter; Dynamic Capabilities Theory clarifies how such capabilities are transformed into product innovation; SBMI illustrates how innovative products support sustainable business strategy; and Institutional Theory accounts for the contextual variability observed in emerging economies. The integration of these theories positions the AI–PS model as a robust framework for understanding how firms can strategically align AI-enabled product innovation with sustainability imperatives under diverse environmental conditions.

4. METHODS AND MATERIALS

This study adopts a systematic literature review (SLR) methodology to synthesize existing evidence on how artificial intelligence (AI)–driven product innovation supports sustainable business strategy in emerging economies. An SLR is the most appropriate design because the topic is conceptually dispersed across multiple domains including AI capability development, product innovation management, sustainability transitions, and emerging-economy institutional contexts, where empirical findings remain fragmented. Unlike empirical studies, which require statistical validation, the purpose of an SLR is to integrate prior scholarship through transparent, replicable, and methodologically rigorous procedures. Thus, reliability and validity in this study derive from systematic search processes, explicit inclusion criteria, structured coding, and quality appraisal rather than from t-tests or significance testing associated with primary data analysis.

The search targeted major scholarly databases such as Scopus, Web of Science, IEEE Xplore, Emerald Insight, and ScienceDirect, covering publications from 2017 to October 2022. The review period (2017–2022) corresponds to the era in which machine learning, advanced analytics, and Industry 4.0 systems became widely integrated into product development and sustainability discourse.

Search strings combined AI-related keywords (e.g., “machine learning,” “advanced analytics”), product innovation terms (“product development,” “innovation capability”), and sustainability concepts (“circular economy,” “sustainable business strategy”). Boolean operators, truncation, and backward and forward snowballing were applied to ensure comprehensive coverage and to minimize selection bias. Inclusion criteria required that studies (a) examined AI technologies or capabilities, (b) addressed product innovation or sustainability-related strategic outcomes, and (c) were conducted in either general or emerging-economy contexts. Only peer-reviewed empirical, conceptual, or review papers were considered. Exclusion criteria removed non-scholarly publications, purely technical AI engineering papers without managerial relevance, and studies unrelated to product innovation or sustainability.

The initial search yielded 2,300 records, reduced to 1,480 after deduplication, with 132 studies retained after full-text evaluation. A final methodological and conceptual quality evaluation, drawing on criteria from the Critical Appraisal Skills Programme (CASP), produced 68 high-quality studies for synthesis. To enhance reliability and analytic rigor, a structured data extraction protocol was developed and applied consistently across all included studies. Extracted variables included publication metadata, methodological approach, theoretical foundations, AI capabilities examined, product innovation implications, sustainability outcomes, and emerging-economy contextual factors. Accordingly, thematic synthesis was conducted to identify recurrent constructs, relationships, and contextual conditions linking AI capabilities, product innovation processes, and sustainability-oriented business strategy. The final synthesis fed directly into the development of the AI–Product–Sustainability (AI–PS) Alignment Model.

5. LITERATURE REVIEW

Artificial intelligence (AI) has become a central driver of product innovation, enabling faster development cycles, predictive decision-making, and data-informed design processes (Haefner *et al*., 2021; Garbuio & Lin, 2019). Recent studies highlight that explainable and transparent AI systems further strengthen innovation outcomes by enhancing interpretability and user trust (Rai, 2020; Chatterjee *et al*., 2021). More broadly, Industry 4.0 technologies—including machine learning and advanced analytics—support new product–service architectures and business

model reconfigurations, expanding firms' capacity to create and deliver value (Ibarra *et al.*, 2019).

Parallel work at the intersection of AI and sustainability demonstrates that AI technologies can support eco-innovation, sustainable manufacturing, circular design, and broader sustainable business model innovation (Pieroni *et al.*, 2021; Chesbrough, 2020). Open innovation networks further facilitate knowledge exchange and cross-sector collaboration, reinforcing firms' sustainability-oriented efforts (Rauter *et al*., 2019; Antikainen & Valkokari, 2017). Integrated studies show that AI can optimize materials use, improve life-cycle assessment accuracy, and support regenerative industrial processes, contributing to circular and sustainable transformation (Risel & von Leipzig, 2022; García-Muiña *et al*., 2019; Jovanović *et al*., 2022; Elkington, 2018).

However, the application of AI for sustainability in emerging economies is shaped by distinct constraints. Scholars note persistent infrastructure gaps, digital skills shortages, institutional voids, and regulatory uncertainty, all of which limit firms' ability to adopt AI for innovation and sustainability outcomes (Aremu *et al*., 2021; Appiahene *et al*., 2021; Khan *et al*., 2019). Yet, these contexts also present significant unmet needs, such as in energy, healthcare, agriculture, and resource management, making AI-enabled sustainable innovation particularly valuable.

Other studies offer insights into capabilities and organizational conditions necessary for leveraging AI effectively. Sustainable business model innovation research emphasizes the value of user-driven design and iterative engagement for developing multi-stakeholder value propositions (Baldassarre *et al*., 2017). Evidence shows that firms with strong internal R&D investments and retained earnings achieve higher innovation performance and profitability (Rijanto, 2018), underscoring the role of internal capabilities. Studies also show that AI-enabled business model transformation requires strong data governance, high-quality datasets, and effective model selection (Machireddy *et al*., 2021), while a robust data-driven culture enhances product innovation and process performance (Chaudhuri *et al.*, 2021). Leadership and governance factors, including digital leadership and regulatory compliance, further moderate AI's impact on innovation (Onoja *et al*., 2021; Syed *et al*., 2022).

In addition, studies examining organizational knowledge processes and technological capabilities provides sector-specific insights. Firms benefit from both explorative and exploitative knowledge sharing, although contextual factors such as business group affiliation influence these effects (Özen, 2022). Technological R&D and capability development are also essential for sustainable innovation in complex product–service systems (Zhang *et al*., 2022). High-tech SMEs in emerging economies selectively adopt open innovation practices across different stages of product development to enhance innovation outcomes (Jin *et al*., 2022).

Collectively, this body of work advances understanding of AI capabilities, sustainability-oriented innovation, and the organizational and institutional factors that shape them. However, the literature remains fragmented, with limited integration of AI-driven product innovation, sustainable business strategy, and the unique institutional constraints of emerging economies. This gap highlights the need for a unified conceptual framework, addressed here through the AI–Product–Sustainability (AI–PS) Alignment Model, which explains how AI capabilities can be aligned with sustainability priorities in institutionally constrained environments.

6. DISCUSSION

The findings of this review suggest that the relationship between AI capabilities, product innovation, and sustainable business strategy is more complex and context-dependent than existing research implies. While prior studies frequently document the potential of AI to enhance design intelligence, improve resource efficiency, and support eco-innovation, the synthesis reveals that these benefits rarely occur in isolation. Instead, AI exerts its strategic influence through the reconfiguration of product innovation processes—confirming the central mechanism proposed in the AI–PS Alignment Model. This aligns with Dynamic Capabilities Theory, which argues that technology generates value only when it enables firms to sense, seize, and reconfigure opportunities. Our review extends this theoretical logic by demonstrating that sustainability-oriented outcomes emerge when AI-enabled product innovation incorporates circularity and environmental considerations at the design stage.

The review also provides deeper insight into the limitations of the Resource-Based View in explaining AI's sustainability impact in emerging economies. Although AI capabilities can be conceptualized as valuable and potentially inimitable resources, their benefits are constrained by institutional voids and infrastructural weaknesses. This means that the same AI resources that yield sustainability gains in advanced economies may not produce equivalent outcomes in developing contexts. Prior studies acknowledge capability and infrastructure gaps, but few explicitly theorize *how* these gaps weaken the capability–innovation–sustainability pathway. The AI–PS model therefore contributes by specifying the moderating role of institutional environments, bridging a gap between AI adoption research and institutional theory.

In comparing these insights with previous work, the findings indicate that while earlier studies have highlighted AI's potential contributions to circular

economy, eco-design, and sustainable manufacturing, they tend to adopt an optimistic, technology-centric perspective. Our synthesis offers a more nuanced interpretation: AI-driven sustainability impact is contingent on organizational readiness, governance quality, and context-specific constraints. This resonates with Sustainable Business Model Innovation theory but extends it by positioning AI capabilities as both technological and strategic enablers whose influence is mediated—and sometimes constrained—by product innovation dynamics.

Importantly, the review also identifies boundary conditions that shape the applicability of AI-driven sustainability pathways. For example, in sectors with high data availability (e.g., manufacturing and energy), AI-enabled optimization is easier to implement than in low-data environments such as SMEs in rural or informal markets. Likewise, firms with strong data governance and digital leadership are better positioned to operationalize AI-enabled sustainability tools. These contextual drivers and barriers have been noted in scattered studies, but the present synthesis consolidates them into a coherent model, offering a more comprehensive account of how AI translates into sustainability outcomes.

7. Novel Contributions of This Study

This study makes several unique contributions to the literature on artificial intelligence, product innovation, and sustainable business strategy within emerging economies. First, it develops the AI–PS Alignment Model, a new integrative framework that explains how and why AI capabilities influence sustainable business strategy through the mediating mechanism of product innovation. Existing research has examined these domains separately; this study is most likely the first to articulate a coherent pathway linking AI resources, innovation processes, and sustainability within a single conceptual architecture. Second, the study advances theoretical understanding by repositioning AI as a strategic enabler of sustainability-oriented product innovation, rather than treating it merely as a digital tool or operational enhancer. This offers a conceptual extension to the Resource-Based View, Dynamic Capabilities Theory, and Sustainable Business Model Innovation literature by revealing how AI-driven innovation activities can generate sustainability-oriented competitive advantage. Finally, the study demonstrates that institutional conditions in emerging economies moderate the effectiveness of AI's contribution to sustainable innovation. This fills a gap in both digital transformation and sustainability scholarship, which often assumes well-developed institutional environments and overlooks the constraints faced by developing-country firms.

8. Real-World Application of the AI–PS Alignment Model

The AI–PS Alignment Model can guide organizations in strategically integrating AI capabilities into product development and sustainability initiatives, ensuring that technological adoption translates into tangible environmental, social, and economic value. For firms, the model emphasizes the importance of developing core AI capabilities, including advanced analytics, machine learning, predictive modeling, and automation tools, as foundational resources. Companies can design products that are not only technologically sophisticated but also environmentally efficient, resource-optimized, and aligned with circular economy principles. For example, manufacturers can use AI-driven predictive modeling to optimize materials usage, reduce waste, and enhance product lifecycle sustainability, while consumer goods firms can leverage AI to personalize eco-friendly products based on user behavior and demand forecasts. In addition, managers can apply the AI–PS framework to align organizational resources, processes and strategic priorities. Cross-functional teams combining data scientists, product engineers, sustainability specialists, and business strategists can implement AI-driven innovation pipelines that systematically integrate sustainability considerations. Organizational culture and leadership play a critical role, with data governance, transparency, and ethical AI practices fostering trust, reducing operational risks, and ensuring responsible innovation.

9. Implications for Theory and Practice

Implications for Theory

This study advances theoretical understanding by integrating AI capabilities, product innovation, and sustainable business strategy within a single conceptual framework, thereby addressing a long-standing gap in the literature. Prior research has treated these domains largely in isolation—AI scholarship emphasizing technological potential, sustainability research focusing on environmental and social value creation, and emerging-economy literature highlighting institutional constraints. The AI–PS Alignment Model synthesizes these fragmented perspectives by demonstrating that AI capabilities exert their sustainability impact primarily through product innovation processes. This mediated logic provides a more coherent explanation of how advanced digital technologies contribute to sustainability outcomes, offering a refinement of the Resource-Based View and Dynamic Capabilities Theory in technology-intensive, sustainability-oriented contexts.

The model further extends Sustainable Business Model Innovation (SBMI) theory by positioning AI not simply as a digital tool but as a strategic enabler of circularity, eco-design, and regenerative product development. Additionally, the incorporation of Institutional Theory provides an important contextual dimension missing from earlier frameworks. The model shows that emerging-economy institutional conditions

moderate the strength of AI's impact on innovation and sustainability, emphasizing that technological adoption cannot be understood independently of broader governance, infrastructure, and capability environments. This contextualization contributes to comparative innovation theory and deepens understanding of how institutional voids reshape digital-sustainability pathways in developing countries.

Implications for Practice

The AI–PS model also carries significant practical relevance for managers, firms, and policymakers, particularly in emerging economies where resource constraints and institutional weaknesses make the alignment of AI and sustainability more challenging. For firms, the model underscores the importance of building foundational AI capabilities, such as data management systems, machine learning competences, and predictive analytics infrastructure, as prerequisites for generating sustainable product innovations. Managers must recognize that AI on its own does not produce sustainability benefits; these benefits arise only when AI is embedded into product development processes. Firms therefore need to adopt cross-functional approaches that integrate data science, design engineering, sustainability management, and strategic planning.

The findings also highlight the critical role of organizational culture, data governance, and leadership in shaping the success of AI-enabled sustainable innovation. Firms with strong data-driven cultures, transparent governance structures, and proactive digital leadership are better positioned to capture value from AI and translate it into sustainability outcomes. Practical actions include investing in workforce upskilling, establishing interdisciplinary innovation teams, and implementing ethical AI frameworks to guide responsible technological deployment.

For policymakers and regulators, the review underscores the necessity of creating enabling conditions that strengthen the AI–innovation–sustainability nexus. Investments in digital infrastructure, incentives for clean technologies, AI governance frameworks, and support for innovation clusters can significantly enhance firms' ability to leverage AI for sustainable development. Policymakers should also prioritize regulatory clarity, data protection standards, and sustainability-oriented tax incentives to reduce uncertainty and encourage long-term corporate investment in AI-driven green innovation.

10. CONCLUSION

This study introduced the AI–PS Alignment Model to clarify how artificial intelligence capabilities can support sustainability-oriented product innovation in emerging economies. The systematic review shows that while AI offers tools that may enhance design efficiency, predictive analysis, and resource optimization, these benefits do not translate automatically into improved sustainability outcomes. Instead, their effectiveness depends on the firm's internal innovation capabilities and the broader institutional context in which AI is deployed. The analysis demonstrates that emerging economies face structural constraints such as limited digital infrastructure, skills shortages, and regulatory ambiguity, that can weaken the pathways through which AI contributes to sustainable product development. As such, AI's strategic contribution is conditional rather than universal, and that its impact varies according to organizational readiness and environmental support.

By integrating insights from AI adoption research, innovation management, sustainability strategy, and institutional theory, the model consolidates previously fragmented perspectives into a single conceptual framework. This provides a structured basis for examining how firms might align technological capability with sustainability priorities under constrained conditions. Nevertheless, empirical testing is needed to validate the model's propositions and to evaluate the extent to which AI-enabled innovations produce measurable sustainability improvements. Future studies should incorporate objective performance indicators and comparative analyses across sectors and regions to strengthen understanding of these relationships.

11. Limitations and Future Research

While this study provides a comprehensive conceptual framework linking AI capabilities, product innovation, and sustainable business strategy, several limitations should be acknowledged. First, the research is based on a systematic literature review (SLR) rather than primary empirical data. Although the SLR allowed for a rigorous synthesis of 68 high-quality studies, the findings are inherently interpretive and contingent on the scope and quality of the included literature. As a result, the model's propositions remain theoretical and require empirical validation to confirm the strength, direction, and generalizability of the hypothesized relationships. Second, the study focuses specifically on emerging economies, which introduces both strengths and constraints. While this provides valuable insights into institutional voids, infrastructure gaps, and regulatory uncertainties that shape AI-driven sustainable innovation, the findings may not fully generalize to advanced-economy settings where institutional support, digital infrastructure, and market conditions differ significantly. Comparative research across countries or regions could help determine how context-specific factors influence the AI–innovation–sustainability nexus. Third, the AI–PS Alignment Model primarily emphasizes AI-driven product innovation as the mediating mechanism linking AI capabilities to sustainability. Although this pathway is supported by existing literature, other mediators such as process innovation, organizational learning, or business model experimentation, may also play critical roles. Future studies could explore these additional mechanisms to

provide a more nuanced understanding of the multiple pathways through which AI contributes to sustainability-oriented strategic outcomes.

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Cite This Article: Anthony Ogechukwu Okolo, Israel Boafo Bansah, Stephen Alaba John (2022). A Conceptual Model for Aligning AI-Driven Product Innovation with Sustainable Business Strategy in Emerging Economies. *East African Scholars J Econ Bus Manag*, *5*(11), 418-425.