



A scoping review on the impact of sustainable technology adoption on business growth in emerging economies

Abdul Feroz Maluleke ^{1*}, Praise Mutoko ²

¹ Department of Business and Information Management Services, Tshwane University of Technology, South Africa

² Department of Management and Entrepreneurship, Tshwane University of Technology, South Africa

Abstract

The rapid adoption of sustainable technology to promote business growth and sustainability is crucial in emerging economies, where it plays a key role in addressing economic and environmental challenges. This study investigates the impact of sustainable technology adoption on business growth and sustainability in emerging economies. A scoping review (SLR) was conducted using the PRISMA-ScR framework, analyzing data from the Scopus and Web of Science databases to map thematic areas related to sustainable technology and business growth. A total of 117 publications published between 2020 and 2024 were reviewed to assess the impact of sustainable technology adoption on business growth. The study identifies six key themes: sustainable industrial ecosystems, digital technology and sustainability, sustainable energy and transportation, green technology in entrepreneurship and urban logistics, frugal innovation (FI) and technological capabilities, and sustainability in agriculture. The findings also highlight a steady increase in research publications on sustainable technology adoption in emerging economies from 2020 to 2024. VOSviewer analysis revealed three main clusters: business and industry, development and economy, and relationships and frameworks, emphasizing the interconnected nature of these themes in driving sustainable business growth. The study recommends increased investment in sustainable technology research and implementation, encouraging governments and organizations to prioritize these technologies to foster business growth and achieve the Sustainable Development Goals (SDGs).

Keywords: Literature Mapping, SDGs, Sustainable Technology, Scoping Review, PRISMA ScR, Business Growth

Published by ISDS LLC, Japan | Copyright © 2025 by the Author(s) | This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



Cite this article as: Maluleke, A.F. and Mutoko, P. (2025), "A scoping review on the impact of sustainable technology adoption on business growth in emerging economies", *International Journal of Development and Sustainability*, Vol. 14 No. 8, pp. 547-568.

* Corresponding author. E-mail address: malulekaaf@tut.ac.za

1. Introduction

The concept of sustainability emerged prominently in the early 1980s, driven by the United Nations' (UN) commitment to ensuring that current activities support today's population without compromising the ability of future generations to meet their needs. In recent years, Sustainability is seen as a critical concept that seeks to address the finite nature of resources and the consequences of overconsumption, pollution, and poor land use (Church et al., 2022). In essence, Sustainability involves meeting current needs without compromising future generations' well-being and equity levels while preserving ecological processes and biodiversity (Hashim et al., 2023). The UN defines sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 2015). This principle underscores the importance of balancing economic growth, social inclusion, and environmental protection. In emerging economies, integrating sustainable practices is crucial for fostering long-term business growth. The UN's 2030 Agenda for Sustainable Development emphasizes that sustainable development is foundational for economic prosperity, social well-being, and environmental health (United Nations, 2015). Through the adoption of sustainable strategies, businesses in these regions can enhance their competitiveness, attract investment, and contribute to the achievement of the Sustainable Development Goals (SDGs). This study specifically focuses on two SDGs that are critical to emerging economies:

- **SDG 9:** This goal emphasizes the growth of industries, the development of infrastructure that supports local communities, and the promotion of innovation (Küfeoğlu, 2022).
- **SDG 12:** This goal advocates for responsible consumption, the reduction of harmful substances in the environment, and production methods that meet consumer demands without causing harm (Kour, 2024).

Contrary to the common perception that sustainability concerns only companies directly interacting with the environment and society, every business has an essential role in aligning its practices with sustainable growth principles (Kour, 2024). Given global economic challenges, social unrest, and environmental stress, an interdisciplinary approach is necessary for a sustainable future (Church et al., 2022; Lanzano et al., 2021). From an organizational perspective, sustainability involves balancing societal goals with commercial objectives, optimizing social, environmental, and economic dimensions simultaneously rather than treating them as trade-offs (Malhotra et al., 2013). This study aims to explore the impact of sustainable technology adoption on business growth and sustainability in emerging economies.

1.1. The concept of sustainable technology

Sustainable technology refers to innovations and practices designed to improve business processes and infrastructure while minimizing their negative impact on the environment and society (Ruggerio, 2021). Sustainable technology plays a crucial role in fostering economic development in emerging economies. The integration of sustainable technology, such as green energy solutions, digital efficiency tools, and circular economy innovations, has become a vital driver of business growth in emerging economies (Larbi-Siaw et al., 2022). By adopting sustainable technology practices, businesses can reduce operational costs, thrive amid resource scarcity, enhance resilience against resource scarcity, and strengthen their market positioning while contributing to global sustainability targets (Rasheed et al., 2025). Sustainable technologies aim to increase efficiency, promote innovation, and contribute to the overall well-being of the community. Additionally,

sustainable technology practices emphasize improving efficiency by optimizing processes to use less energy, minimize waste, and enhance operational effectiveness (Javaid et al., 2022).

Leveraging digital infrastructure, including blockchain, cloud storage, and resource planning systems, enables businesses to adopt more efficient and sustainable practices (Kayikci, 2018). Furthermore, these efforts contribute to community well-being by enhancing infrastructure and fostering sustainable development, ultimately improving the quality of life for all (Hustad and Olsen, 2021). Strategic investments in technology can enhance productivity, social inclusion, and environmental sustainability when aligned with local economic goals and supported by enabling policies (von Schönfeld & Ferreira, 2021). While traditionally associated with physical infrastructure, in the digital age, sustainable technology increasingly includes digital frameworks essential for enhancing business efficiency and reducing reliance on traditional practices that may be detrimental to sustainability (Argyroudis et al., 2022).

1.2. The adoption of sustainable technology in emerging economies

Emerging economies are characterized by rapid industrialization and economic growth which is often driven by contribution of Foreign Direct Investment (FDI) (Hosan et al., 2022). In 2023, it was projected that more than half of the global GDP would be driven by digitally transformed enterprises, many of which are from emerging economies (FutureScape, 2023). Businesses in emerging markets contribute significantly to GDP growth. For example, in India, Bengaluru alone contributes to 40% of the country's IT exports and is home to 43 to privately held start-up companies that have achieved a valuation of over \$1 billion (Forbes, 2024). Sustainable technology adoption in emerging markets accelerates business growth by enhancing knowledge management and innovation capacity (Tajpour et al., 2022). Through digital and social media platforms, businesses can facilitate knowledge exchange, optimize learning processes, and drive strategic decision-making. This, in turn, strengthens resilience in resource-constrained and emerging market environments, and also fosters market participation and competitiveness in the global digital economy (Tajpour et al., 2022).

The adoption of sustainable technology in the tourism and hospitality sector of emerging markets enhances business growth by optimizing resource efficiency, reducing environmental impact, and improving service delivery (Thommandru et al., 2023). By integrating smart tourism innovations such as AI-driven customer experiences, energy-efficient infrastructure, and digital payment solutions, businesses in emerging economies can achieve long-term competitiveness and sustainable economic expansion (Thommandru et al., 2023). Integrating sustainable digital technologies in emerging markets fosters business growth by driving innovation and enabling firms to compete in international markets (Al Koliby et al., 2024). Data from a survey study from business service providers in Tehran, Iran, found that entrepreneurially oriented businesses that adopt digital solutions such as AI, blockchain, and IoT enhances operational efficiency, expand market reach, and achieve sustainable competitive advantage (Dana et al., 2022). This highlights the pivotal role of technology-driven innovation in accelerating economic development within emerging economies. Tiep Le, Ngo and Aureliano-Silva (2023) advance that integrating sustainable technology in emerging markets could enhance business growth through fostering corporate social responsibility, which in turn strengthens brand trust and loyalty. As such, leveraging digital and green technologies allow businesses to improve transparency, environmental sustainability, and stakeholder engagement. Other scholars argue that this ultimately leads to increased customer retention, competitive differentiation, and long-term financial performance (Tiep Le et al., 2023). This reinforces the strategic importance of sustainability-driven business models in emerging

economies. In support to this notion, Yu et al. (2022) argue that adopting sustainable technology solutions in emerging markets could be a key driver of business growth and environmental sustainability, as it facilitates the transition to clean energy while enhancing operational efficiency. By investing in digital renewable energy solutions, businesses lower carbon footprints, and align with global sustainability standards. The adoption of sustainable technology could also aid government in revenue collection. Ho, Tran and Nguyen (2023) posits that sustainable technology adoption in emerging markets fosters business growth by improving tax revenue generation and optimizing trade efficiency. As such, the utilisation of digital innovations in taxation, such as blockchain-based tax collection and AI-driven financial analytics, enhances transparency and compliance, leading to increased government revenue (Ho et al., 2023). According to the International Monetary Fund (IMF), businesses in emerging economies have a significant contribution in the global markets (IMF, 2024). The list of countries classified under emerging economies by the IMF are found in Appendix A.

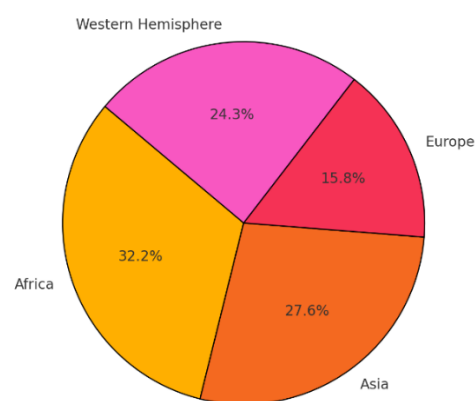


Figure 1. Proportion of emerging economies by region (IMF, 2024)

Despite the numerous benefits of sustainable technology adoption, scholars enlisted challenges facing businesses in developing economies. Financial resources emerge as a pivotal barrier of technology adoption, particularly for resource-constrained groups such as small-scale farmers and micro-enterprises (Bai, Quayson & Sarkis, 2021). A study on women-owned tourism micro-enterprises in Johannesburg, South Africa found that inadequate financial resources restricted both the adoption and effective use of digital technologies (Mametja et al., 2023). Similarly, high cost of digital tools, coupled with typically low revenue, significantly impedes the ability of businesses in emerging markets to acquire and use these technologies (Smidt and Jokonya, 2022). Furthermore, external mechanisms such as limited government programs, incubators, and accelerators play a vital role in addressing resource constraints among businesses (Smidt and Jokonya, 2022). Guerrero and Siegel (2024) highlight the importance of collaborative efforts and robust funding models in overcoming challenges that transcend national boundaries. These mechanisms create an environment conducive to sustainable technology adoption by ensuring equitable access and promoting innovation among businesses. In addition to financial constraints, limited digital literacy and technological skills are significant barriers, particularly for SMEs. Furthermore, inadequate or poor infrastructure, such as unreliable internet connectivity, limits the ability of businesses to fully utilize digital technologies, particularly in rural areas. As such, investments in

expanding digital infrastructure are critical to bridging this divide and ensuring broader access (Acilar and Sæbø, 2023). Another barrier includes the complexity of technology, which can discourage adoption if users perceive the type of technology as difficult to navigate. In order to address this challenge, Habbal and Abuzaraida (2024) opine that user-centric design approaches are essential to making technologies more intuitive and accessible. Data management practices and secure systems are perceived as some of the challenges that hinder adoption among businesses (Habbal and Abuzaraida, 2024). Lastly, the lack of reliable technical support and maintenance services can discourage adoption, particularly if users fear encountering difficulties without assistance. Developing comprehensive support ecosystems can mitigate these concerns, enabling a smoother transition and sustained use of technology (Leesakul et al., 2022).

2. Research methodology

The scope of this review was to systematically map and synthesize the existing body of literature examining the impact of sustainable technology adoption on business growth in emerging economies using Scopus and Web of Science databases. The primary goal was to identify and categorize key thematic areas and trends, thereby providing a comprehensive overview on this topic. To achieve this, a scoping review methodology was employed, as it is particularly suited to broad and exploratory research questions that aim to map evidence on a particular research topic. The PRISMA-ScR framework was adopted to guide the review process due to its emphasis on methodological transparency, systematic data charting, and rigorous reporting standards. The use of PRISMA-ScR ensured a structured and replicable approach, enhancing the credibility and robustness of the review findings (Rethlefsen et al., 2021; Page et al, 2021). Furthermore, the PRISMA-ScR framework provides a structured approach to conducting scoping reviews, ensuring transparency and completeness in the reporting of research findings (Sarkis-Onofre et al., 2021). Adhering to the PRISMA-ScR guidelines not only enhances the methodological rigor of this scoping review but also supports the comprehensive and transparent documentation of research processes and outcomes (Sarkis-Onofre et al. 2021). Castro et al. (2019) and López-Sánchez et al. (2023) emphasize the importance of applying quality criteria to SLR studies. Figure 2 depicts the quality criteria applied in this study.

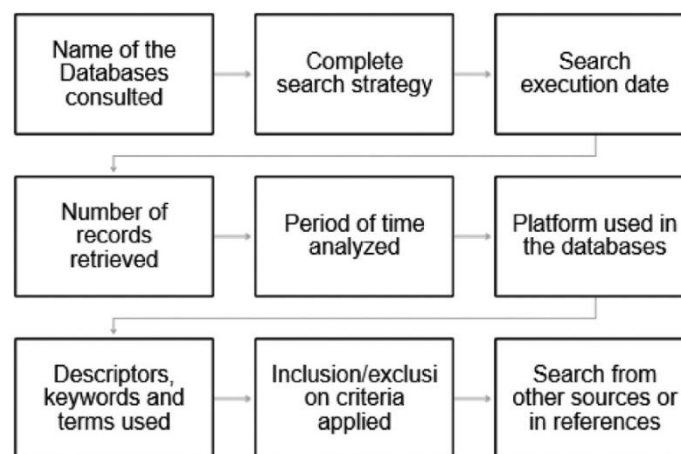


Figure 2. Quality criteria adopted for this SLR (taken from Castro et al. 2019).

2.1. Database selection

The study utilised two reputable scholarly databases: Scopus and Web of Sciences to extract the data on sustainable technology and sustainability in emerging economies in order to address the objectives of the study. These two databases were chosen for their comprehensive coverage of academic and peer-reviewed literature across the disciplines of technology adoption and sustainability.

2.2. Search strategy

The initial search was carried out in December 2024 in Scopus and Web of Science databases (see Table 1). Initially, a preliminary literature search was carried out to explore the topic and the publications related to sustainable technology or sustainability, particularly within the context of emerging economies. In order to identify relevant literature, a combination of keywords and Boolean operators were used. The searching of the database was devised as follows.

Table 1. Search protocol

	Web of Science	Scopus
Search Strategy	TI= ((Sustainable OR Sustainability) AND (technology) AND (emerging OR developing) AND (economies OR businesses))	TITLE-ABS-KEY (sustainable AND technology AND in AND emerging AND markets AND emerging AND businesses) AND PUBYEAR > 2019 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")) AND (LIMIT-TO (LANGUAGE, "English"))
Search Period	2020 – 2024	2020 – 2024
Publication Type	Articles	Articles
Countries/Region	Emerging economies (See Annexure 1)	

The initial search yielded 257 publications in Scopus and 115 documents in Web of Science databases. The search was limited to studies published within the last five years (2020 - 2024) to ensure the inclusion of contemporary research relevant in this field. Figure 3 depicts the PRISMA-ScR flowchart used to select records for review.

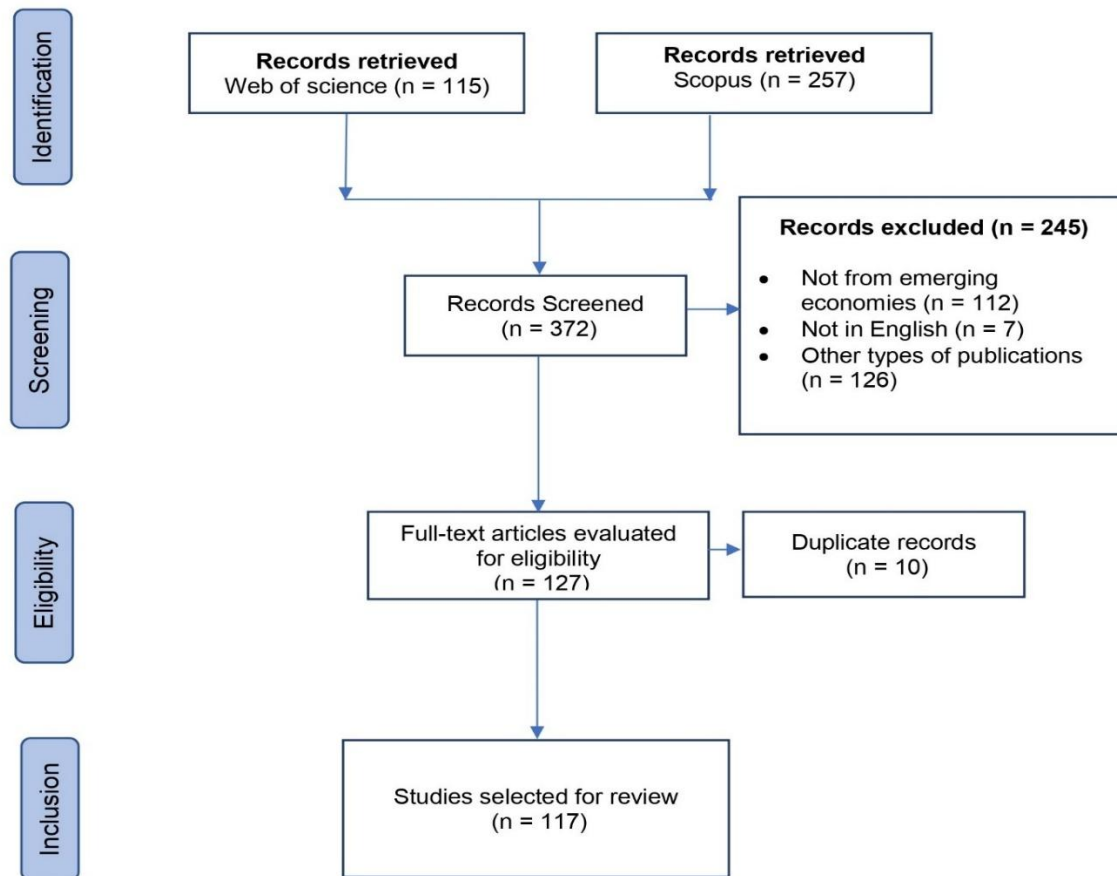


Figure 3. PRISMA Diagram illustrating the selection of process of studies (Source: Authors' compilation)

2.3. Eligibility criteria

To ensure the inclusion of studies relevant to the objectives of this study, the following eligibility criteria was ensured:

- **Publication Date:** Only articles published within the last five years (2020 – 2024) were considered.
- **Relevance:** Studies must focus on businesses growth and the use of technology for sustainability.
- **Language:** Only publications written in English were included.
- **Content Focus:** Articles must evaluate the benefits and challenges associated with sustainable technology use in emerging economies.

2.4. Screening process and risk of bias assessment

The screening process involves two stages, namely; a) the articles were initially screened based on their titles and abstracts to determine relevance to the research objectives and b) the screened articles were subjected to a thorough review of their full text to confirm alignment with the eligibility criteria. In line with the PRISMA-ScR framework, it is imperative for SLR studies to employ rigorous methodologies when evaluating studies

selected for review. Accordingly, the authors independently assessed the studies identified through the initial search results obtained from the two databases. To ensure objectivity, a risk of bias assessment was conducted. Each author performed data collection independently and subsequently utilised the Zotero reference management software to evaluate each study individually. This standardised approach ensured the quality and integrity of the research findings, aligning with the principles of the PRISMA-ScR framework.

2.5. Data extraction

SLR must be conducted in a manner that ensures the complete and transparent reporting of research results (Sarkis-Onofre et al., 2021). As such, researchers are required to not only detail the results but to also specify the manner and tools that were utilised to yield results from the search strategy. As indicated in Figure 1, the initial search yielded 371 studies. Using the eligibility criteria above as well as the filtering options available in each database, a total of 245 studies were excluded in line with the exclusion criteria. Thereafter, this means that there were 127 studies that remained for review. Subsequently, the duplicate records were identified and removed using Zotero reference manager. Finally, the full texts of 117 studies were read and evaluated to ensure that they contained information regarding the use or adoption of sustainable technology (see Annexure B for the complete list of studies). The extracted data was synthesised to identify common themes, patterns, and gaps in the literature.

3. Findings

In this section, we present the results in three sections; bibliometric analysis, VOSviewer analysis and thematic analysis of sustainable technology practices adopted in emerging economies.

3.1. Bibliometric analysis

Research on sustainable technology adoption in emerging economies has gained considerable momentum in recent years, reflecting its critical role in addressing the unique challenges in the 4IR era. Emerging economies are characterised by rapid industrialisation and population growth, which often exacerbate environmental degradation, resource scarcity, poverty and various socio-economic issues. The increasing scholarly focus on this field highlights its growing importance, as researchers seek innovative solutions to balance economic growth with SDGs.

Figure 4 illustrates the publication trend in the field of sustainable technology adoption in emerging economies in the past five years (2020 to 2024). The SLR data highlights a significant increase in scholarly output, reflecting growing research interest and attention to this critical area. In 2020, the number of publications stood at 15, which saw a slight decline to 10 in 2021. However, this was followed by a sharp increase in 2022, with the number of publications increasing to 25, marking a resurgence in academic focus.

The upward trajectory continued in subsequent years, with 30 publications recorded in 2023 and a peak of 40 publications in 2024. This consistent growth highlights the increasing relevance of sustainable technology adoption as a key driver for addressing developmental and environmental challenges in emerging economies. The trend also reflects advancements in technology, heightened global awareness of sustainability issues among the economies under study. Furthermore, these findings reinforce the importance of continued

exploration and innovation in sustainable practices to address the unique challenges faced by emerging economies in the digital era.

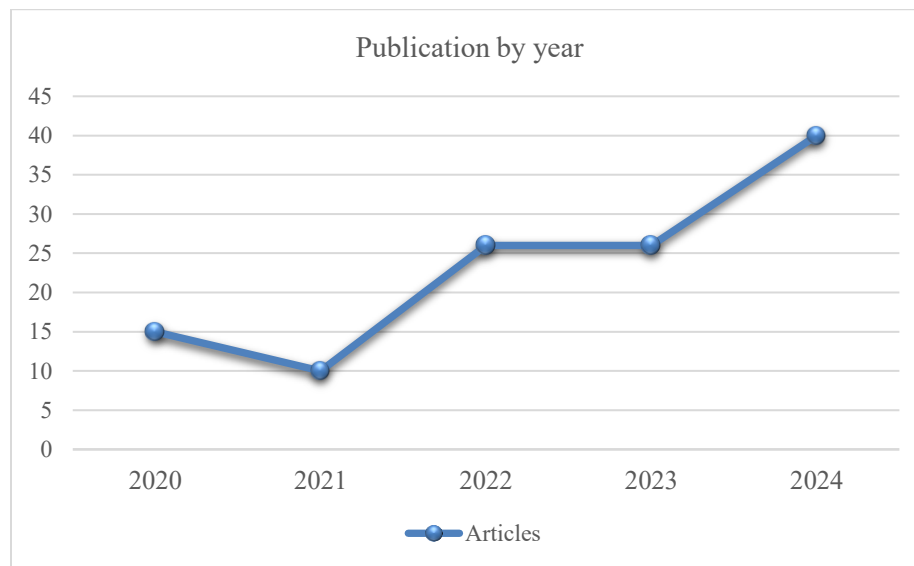


Figure 4. Distribution of publication by year from 2020-2024

3.2. VOSviewer software analysis

Next, we then exported the abstracts, keywords, citations, and bibliographic information to VOSviewer bibliometric software, to perform visualisation, keyword co-occurrence and text-mining abilities. VOSviewer provides graphical network visualisations and density maps of the publications in scoping reviews (van Eck and Waltman, 2010). The VOSviewer keyword co-occurrence map offers a comprehensive visualisation of the thematic focus of 117 studies on sustainable development in emerging economies (see Figure 5A and 5B). From the 843 keywords identified across the studies, 39 met the established threshold of a minimum of 20 co-occurrences, underscoring their central relevance to the sustainable technology research domain.

The map (Figure 5A) reveals three distinct clusters, each representing a unique thematic focus. The red cluster is centred on business and industry, with keywords such as "technology," "market," "SMEs," "sustainability," and "framework" emphasising the integration of technological innovation and sustainable practices within business practices. The frequent occurrence of these keywords highlights the significant role of SMEs and as economic drivers in developing sustainable strategies through. The green cluster focuses on development and the economy, with keywords such as "development," "economy," "impact," and "digital technology" illustrating the importance of digital innovation in advancing developmental goals. Furthermore, the green cluster emphasises the transformative potential of digital technologies in fostering economic growth and addressing developmental challenges in resource-constrained environments. The blue cluster highlights the role of relationships and frameworks in the sustainability discourse. Keywords such as "role,"

"relationship," "literature," and "geo" reflect the emphasis on understanding the interconnectedness of various stakeholders and geographic contexts. This cluster encapsulates discussions on the role of collaborative efforts, comparative studies across emerging economies, and the contextual application of sustainability frameworks to drive developmental goals across these regions. The frequent occurrence of these keywords indicates their alignment with SDGs, underscoring the importance of these practices in attaining sustainability.

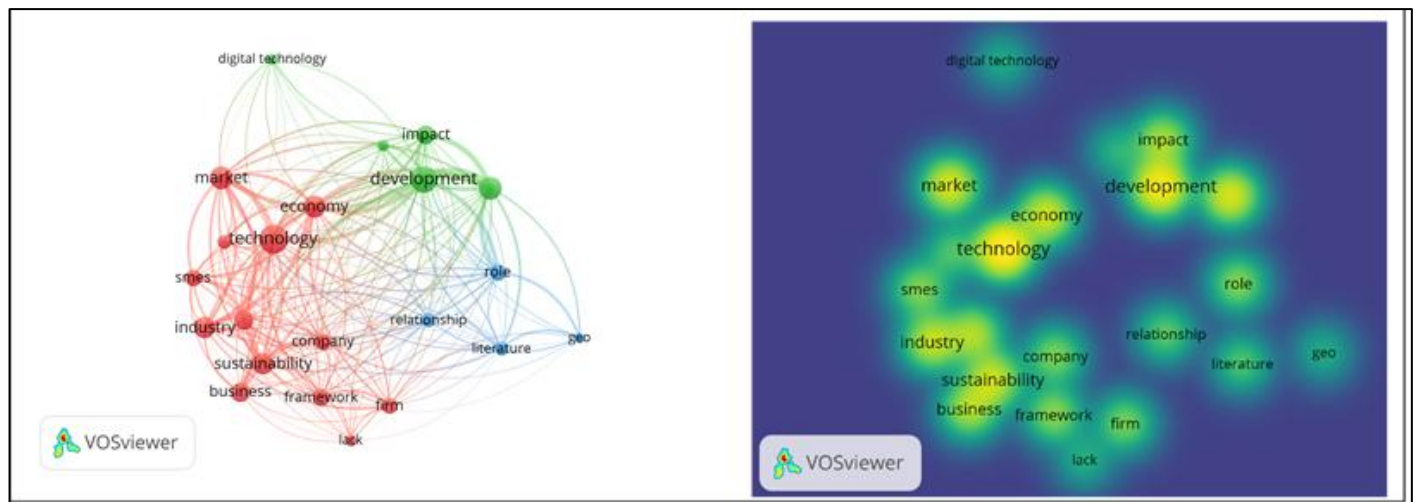


Figure 5. (A) Co-occurrence of terms network visualisation and (B) density visualisation

The VOSviewer density map (Figure 5B) provides a visual representation of the frequency and prominence of keywords within the dataset of 117 studies. The map uses a heat-based colour gradient, where brighter (yellow) regions indicate higher concentrations of co-occurrences and darker (blue) regions represent less frequent or peripheral keywords. Central keywords such as "technology," "development," "sustainability," and "economy" reflect the important role of technology towards sustainability and development in emerging economies. The density map further highlights thematic clusters, such as the intersection between technological innovations, market frameworks, and sustainable practices.

3.3. Thematic findings on sustainable technology adoption and business growth

In line with the PRISMA-ScR guidelines, thematic synthesis was employed to identify and structure key findings from the selected studies. After completing the selection and screening phases outlined in the PRISMA-ScR flow diagram, full-text articles were imported into ATLAS.ti version 25 for qualitative coding. Through an inductive approach, open coding was used to extract data segments relevant to sustainable technology and business growth. This enabled efficient identification of recurrent concepts, grouping of similar codes, and the use of memoing to support early theme development. Codes were then clustered into categories based on conceptual similarities, and recurring relationships across studies were identified to build preliminary themes.

Table 2. Summary of thematic findings on sustainable technology and business growth

Theme	Key Insights	Supporting Studies	Emerging Patterns and Relationships
Sustainable Industrial Ecosystems	Integration of eco-design, life cycle thinking, and circular economy principles; importance of stakeholder roles and collaboration	Suppipat and Hu (2022); Sharma et al. (2022); Latino et al. (2023)	Consistent emphasis on systemic thinking and multi-actor engagement; shared need for cultural transformation and infrastructure support
Digital Technology and Sustainability	Role of digital platforms in economic inclusion, innovation, and sustainable consumption	Utami et al. (2021); Latino et al. (2023); Chakravarty and Gomez (2024); Jibril & Padi (2024)	Digital transformation enables value creation and inclusive growth; diverse contexts share common benefits of tech adoption
Sustainable Energy and Transportation	Deployment of smart energy systems, automation, and PAYG models to enhance transport and energy sustainability	George-Williams et al. (2022); Sharma et al. (2022, 2020); Ockwell et al. (2019)	Cross-cutting focus on innovation-driven decarbonisation; PAYG models introduce socio-political dimensions
Green Technology in Entrepreneurship and Urban Logistics	Role of green entrepreneurial orientation and logistics tech in promoting sustainability	Sharma et al. (2022); George-Williams et al. (2022); San et al. (2022)	Shared need for policy and investment support; intellectual capital and automation bridge sustainability-performance gaps
Frugal Innovation and Technological Capabilities	Resource-efficient innovation targeted at low-income markets; links to sustainable design and inclusive growth	Chakravarty and Gomez (2024); Suppipat & Hu (2022); Shahid et al. (2023)	Frugality drives affordability and equity; consistent call for policy mechanisms and support for informal innovation
Sustainability in Agriculture	Digitalisation (A4.0), Metaverse, and innovation's impact on agri-sustainability; potential environmental trade-offs	Latino et al. (2023); Utami et al. (2021); Sarkar et al. (2024); Liu et al. (2021)	Need to balance productivity and environmental safety; tensions between innovation benefits and ecological risks

To complement this process, Microsoft Excel was used to map the frequency and distribution of codes and emerging categories across the dataset. A matrix was developed to cross-reference studies with corresponding codes and categories. Excel facilitated comparison across studies and aided in collapsing overlapping

categories into broader, analytically rigorous themes. As such, the combined use of ATLAS.ti and Excel ensured transparency and traceability in the thematic analysis, while supporting the PRISMA-ScR objective of providing a clear and systematic account of how key themes were developed from the scoping review data. Table 2 presents the summary of the thematic analysis on sustainable technology and business growth.

The thematic analysis of reviewed literature reveals six overarching themes reflecting the diverse ways of sustainable ways sustainable technology influences business growth across emerging economies:

3.3.1. Sustainable industrial ecosystems

Sustainability in industrial ecosystems is increasingly recognised as a multidimensional endeavour requiring integration across environmental, economic, and social dimensions to sustain business growth. Suppipat and Hu (2022) identify eco-design and circular economy principles as critical strategies, supported by pragmatic tools like life cycle thinking and design frameworks. Additionally, Suppipat and Hu (2022) highlight the importance of integrating life cycle thinking, design thinking, and business model tools to balance the three pillars of sustainability. Achieving sustainable industrial ecosystems requires stakeholder collaboration driven by key actors (driver, facilitator, supporter) and addressing challenges such as organisational culture, resource availability, and waste management. Similarly, Sharma et al. (2022) underscore the role of systemic innovations in urban logistics, emphasising collaboration among stakeholders to enhance socio-technical integration. These studies collectively advocate for organisational cultural shifts and the fostering of multi-disciplinary partnerships to address challenges like resource scarcity, waste management, and social inclusivity. Furthermore, these approaches resonate with the findings of Latino et al. (2023), who argue that sustainable ecosystems must leverage advanced technologies while ensuring equitable societal outcomes.

3.3.2. Digital technology and sustainability

Digital technologies are pivotal in reshaping sustainable practices across industries, particularly in emerging economies. Utami et al. (2021) illustrate how digital commerce fosters value co-creation at the Bottom of the Pyramid (BOP) markets by enabling fair trade practices and collaborative innovations. Similarly, Latino et al. (2023) demonstrate the transformative potential of Agriculture 4.0, where digitalisation supports sustainable agri-food production. These findings align with the findings of Chakravarty and Gomez (2024), who emphasise the role of digital platforms in addressing resource constraints while driving innovation to sustain business growth. Collectively, these studies highlight digital technologies as facilitators of economic inclusion and sustainable development. In the era of digital technologies, scholars emphasize the need for tailored marketing strategies that support sustainable digital technology adoption among businesses, particularly in emerging markets. Jibril and Padi (2024) utilised survey data from 279 respondents to examine the impact of digital influence on the purchasing patterns of Ghanaian women, highlighting differences between working and non-working lifestyles. Their findings reveal significant lifestyle-based distinctions in how digital media shapes sustainable purchasing decisions (Jibril and Padi, 2024).

3.3.3. Sustainable energy and transportation

Emerging energy technologies hold significant promise for sustainable transportation solutions in emerging economies. George-Williams et al. (2022) propose smart energy hubs incorporating photovoltaic systems,

hydrogen storage, and vehicle-to-grid technologies as transformative innovations for managing electric vehicle (EV) infrastructures. Their findings reveal that such systems not only improve financial viability but also enhance grid stability. The integration of advanced decision-making tools, such as Monte Carlo simulations, further ensures adaptability in uncertain environments among developing countries. This research complements Sharma et al. (2022), who underscore the role of automation and smart logistics in reducing carbon footprints. Sharma et al. (2020) further highlights a rising broader trend of green innovations shaping sustainable transportation in the digital era. In recent years, there has been an increase in pay-as-you-go (PAYG) in an effort to advance SDGs. Ockwell et al. (2019) explored the PAYG business models' potential to contribute to sustainable transformation. They analysed data from a literature review, stakeholder workshops, and interviews with 41 stakeholders, and identified significant research gaps in PAYG's theoretical and empirical understanding. Based on their study findings, Ockwell et al. (2019) proposed a set of critical questions at national, individual, and global levels to advance knowledge on PAYG's impact on environmental sustainability and social justice.

3.3.4. Green technology in entrepreneurship and urban logistics

The adoption of green technologies in urban logistics represents a critical avenue for addressing environmental and socio-economic challenges. Sharma et al. (2022) provide evidence of advancements in green logistics, including the use of automated systems and data-driven decision-making to optimise resource utilisation. These innovations align with the findings of George-Williams et al. (2022), who advocate for smart logistics frameworks to achieve higher energy efficiency and lower emissions. Both studies emphasise that, despite their potential, green technologies remain underutilised, necessitating targeted investments and policy interventions to unlock their full sustainability potential. In line with the global call to combat global warming, organisations in emerging economies are being coerced to encourage green initiatives through intellectual capital. San, Latif, and Di Vaio (2022) assessed the impact of intellectual capital as a green entrepreneurial orientation (GEO) among SMEs in Pakistan and Malaysia. Their findings highlight that in order to advance GEO initiatives, SMEs have to adopt green technology dynamism (GTD), which in turn moderates the relationship between GEO and financial and environmental performance (San et al., 2022). However, neither GTD nor environmental consciousness moderates GEO's impact on social performance.

3.3.5. Frugal innovation and technological capabilities

Frugal Innovation (FI) emerges as a strategic response to resource constraints, particularly in developing economies. Frugal innovation is a strategic approach that emphasises creating affordable and efficient solutions using minimal resources. Chakravarty and Gomez (2024) advocate for a developmental lens in understanding FI, emphasizing its dual role in enhancing individual capabilities and fostering firm-level technological advancements. Their insights align with Suppipat and Hu (2022), who identify the integration of sustainable design practices as a pathway to resource efficiency. Policy-driven support mechanisms are deemed essential for embedding frugality into broader industrial practices, thereby challenging mainstream technological hegemony and fostering inclusive growth. Shahid et al. (2023) explored the mechanisms through which frugal entrepreneurs in Pakistan embrace institutional voids to create and execute FIs targeting low-income customers. The findings highlight that societal needs drive entrepreneurs to develop FIs, leveraging appropriate technologies in resource-constrained environments. The novel implementation of FI ensures

affordable solutions for underserved markets, offering insights into frugal entrepreneurship and providing implications for future research in this emerging field.

3.3.6. Sustainability in agriculture

Agriculture 4.0 (A4.0) offers a paradigm shift in addressing the sustainability challenges of the agri-food sector. Latino et al. (2023) propose a taxonomy integrating digitalisation and sustainable innovations to address climate change and food security issues. A4.0 serves as a critical enabler of sustainability in the agri-food sector by offering data-driven, interdisciplinary innovations that address environmental, social, and economic challenges. In addition to proposing a taxonomy of A4.0 elements to guide future studies and practical applications, the authors also identified key research gaps in integrating sustainable innovations in the agricultural sector (Latino et al., 2023). Their findings resonate with Utami et al. (2021), who explore the role of digital technologies in enabling sustainable practices within supply chains. In the context of emerging economies, it is critical to identify success factors associated with the adoption of Metaverse technology in agriculture. A study conducted by Sarkar et al. (2024) identifies 15 critical success factors (CSFs) for the adoption of Metaverse technology in agriculture, categorised into three main groups: Technological, User Experience-related, and Intrinsic. Among these CSFs, market accessibility, monetisation support, and integration with existing systems are regarded as the most crucial factors, emphasising their role in enhancing efficiency and sustainability within the agricultural sector (Sarkar et al., 2024). It should be noted that technological led innovation could also have potential negative impact on the environment. Liu et al. (2021) assessed the environmental impact of farmer-led agricultural innovation, specifically in the context of chemical fertilizer usage in Qingpu District, China. The findings reveal that innovations focusing on new production technologies and sales often have negative environmental outcomes (Liu et al., 2021). Furthermore, the study highlights that value-added sources influence farmer incentives, with efficiency-driven innovations intensifying environmentally harmful practices, while quality and service-oriented innovations reduce environmental damage (Liu et al., 2021). These studies collectively emphasise the importance of technological evolution in driving systemic changes in agricultural production in ensuring environmental sustainability.

4. Discussion

The objective of this study was to explore the impact of sustainable technology adoption on business growth and sustainability in emerging economies. This scoping review lays the groundwork for future systematic reviews or meta-analyses on this topic. The increasing number of scholarly publications on sustainable technology adoption in emerging economies from 2020 to 2024 highlights the growing importance of this topic. This suggests a growing interest in this critical area, likely driven by global awareness of sustainability issues, advancements in technology, and the recognition of the unique challenges faced by emerging economies in balancing economic growth with environmental sustainability. The graphical network visualisations and density maps of this study, facilitated by VOSviewer, provides valuable insights into the multifaceted nature of sustainable technology adoption in emerging economies. The emergence of three distinct keyword clusters; Business and Industry, Development and the Economy, and Relationships and Frameworks signifies the interconnectedness of technological innovation, economic progress, and sustainable practices in emerging markets. This interconnectedness is further emphasized by the prominence of keywords such as "technology,"

"development," "sustainability," and "economy" in the density visualization, highlighting their central role in the discourse on sustainable development.

Using data from Scopus and Web of Science databases, six key themes emerged; Sustainable Industrial Ecosystems, digital technology and sustainability, sustainable energy and transportation, Green Technology in Entrepreneurship and Urban Logistics, Frugal Innovation and Technological Capabilities and Sustainability in agriculture. Each theme highlights the role of innovative technologies and systemic approaches in addressing sustainability challenges while promoting business growth. The findings point towards the fact that achieving sustainable industrial ecosystems requires stakeholder collaboration, with key drivers, facilitators, and supporters playing significant roles in overcoming challenges like organisational culture, resource availability, and waste management. Systemic innovations in urban logistics as essential to enhance socio-technical integration through multi-stakeholder partnerships have emerged critical in sustaining industrial systems (Sharma et al., 2022). These findings resonate with Latino et al. (2023), who advocate leveraging advanced technologies to achieve sustainability while ensuring equitable societal outcomes. The adoption of industrial ecosystems is further supported by existing literature.

In a study carried out by Wahyudion et al. (2024), 82.5% of managers under the age of 46 in East Java demonstrated greater openness to utilising digital spaces, illustrating how age demographics impact technology adoption within organisations. However, whilst sustainable industrial ecosystems thrive in adopting strategies and partnerships. Chancel (2020) expresses a concern that comes with these ecosystems as they may risk exacerbating social inequalities in the context of emerging economies. This is likely to highly affect start-ups negatively as they try to race towards the adoptions of technology that is ever changing but also not having enough means to access it.

Whilst the findings point towards digital technology and innovation playing a crucial role in ensuring sustainability in emerging economies, the generalisation of findings across industries and regions may mask critical contextual variations. For instance, the transformative potential of A4.0 (Latino et al., 2023) depends heavily on local factors such as infrastructure availability, government support, and the technological readiness of stakeholders. It is noteworthy to indicate that emerging economies face numerous distinct challenges and thus the transformative potential of technology is affected by these factors. Moreover, the rapid pace of digital innovation often outstrips the development of supportive regulatory frameworks in these economies. According to Hudstad and Olsen (2021), this can lead to unintended consequences, such as monopolisation of digital platforms or inadequate consumer protection.

Another way in which emerging economies foster sustainability is through the adoption of sustainable energy and transportation. Emerging economies, in particular, face challenges in securing the capital required to invest in renewable energy technologies, potentially limiting their scalability and accessibility (Latino et al., 2023). Additionally, automated systems and smart logistics frameworks, while effective in reducing carbon footprints, could lead to job displacements in traditional sectors, raising social and economic concerns (Sharma et al., 2020). As such, it imperative for policymakers and stakeholders to take into consideration the regulatory frameworks and infrastructure limitations in their respective economies. Similarly, the production and disposal of digital technologies and renewable energy infrastructure, including photovoltaic systems and batteries, often involve resource-intensive processes that can contribute to environmental degradation if not managed responsibly (Sovacool et al., 2019).

The integration of green technologies in urban logistics is essential for addressing environmental and socio-economic challenges in the context of emerging economies. Advancements such as automation, electric vehicles, and data-driven logistics systems are being widely acknowledged for their potential to optimize operations and reduce greenhouse gas emissions. For example, Ghadge et al. (2020) highlight the role of big data analytics in enabling logistics companies to improve efficiency and sustainability by enhancing real-time decision-making processes. However, despite the potential of green logistics, their implementation remains limited in emerging economies. A lack of investment and supportive policies hinders the scalability of these solutions. Ali et al. (2022) stress the importance of government interventions, such as financial incentives and public-private partnerships, in driving the adoption of green logistics technologies. Economic globalization has also played a role in accelerating the adoption of green logistics technologies by facilitating technology transfer and increasing access to international markets. However, it can exacerbate inequalities if local capabilities are not adequately developed (Hafezalkotob et al., 2019).

Frugal Innovation (FI) has emerged as a pivotal strategy for addressing resource constraints in developing economies, offering affordable and efficient solutions tailored to underserved markets. Unlike traditional innovation approaches, FI prioritizes minimal resource use while achieving maximum utility. This dual focus not only enhances economic inclusivity but also addresses pressing societal needs in regions where institutional voids often limit access to conventional technologies (Sharma and Bansal, 2023). Moreover, Suppipat and Hu (2022) underscore the importance of integrating sustainable design practices into FI, enabling resource efficiency without compromising functionality. This approach aligns with global sustainability goals, making FI a strategic tool for promoting circular economy principles.

The adoption of A4.0 technologies represents a transformative shift in addressing the sustainability challenges of the agri-food sector. By integrating digital tools and interdisciplinary approaches, A4.0 fosters innovative solutions to mitigate environmental, social, and economic challenges in developing economies. One of the key contributions of A4.0 lies in its ability to address global concerns such as food security and climate change. Latino et al. (2023) underscore the importance of a structured taxonomy that integrates digitalization with sustainable innovations to guide future research and practical applications. However, its implementation raises critical implications for policy, practice, and research. The emergence of new technologies such as the Metaverse introduces novel opportunities for enhancing agricultural productivity and sustainability.

This study, while offering valuable insights into sustainable technology adoption by startups in emerging economies, acknowledges limitations that pave the way for future research. The research primarily relied on a scoping review, which, though comprehensive, could be enriched by incorporating qualitative data through interviews or case studies to gain deeper contextual understanding (Kuhail et.al 2023). The absence of longitudinal studies limits the ability to track long-term impacts and assess the effectiveness of policies promoting sustainable technology adoption (Das, Kundu and Bhattacharya 2020). Future research should prioritize the development of standardized metrics to measure the impact of sustainable technology on business growth and sustainability. Further investigation is needed into the effectiveness of government policies, the integration of sustainable technology with other sustainability initiatives like circular economy models, and the specific impact of technologies such as blockchain and AI. Additionally, addressing the digital divide and exploring the social and ethical implications of widespread technology adoption, including job displacement and data privacy concerns, are crucial areas for future research.

5. Conclusions and recommendations

This study sought to provide a scoping review of the impact of sustainable technology adoption on business growth in emerging economies. The adoption of sustainable technology significantly influences the sustainability and growth of businesses in these regions. A total of 117 articles published between 2020 and 2024 were reviewed from the Web of Science and Scopus databases, following the PRISMA-ScR methodology. A targeted search strategy ensured that only studies focused on the use of sustainable technology in emerging economies were included. The analysis covered annual publication trends, country, keyword analysis, and emerging research directions related to sustainable technology for business growth. The increasing volume of publications in this field underscores the growing significance of sustainability, particularly in the context of the 4IR and its role in achieving the SDGs.

Using VOSviewer, the study identified prominent keywords that highlight the critical role of sustainable technology in business growth. The VOSviewer density map further reinforced these findings, showing that keywords such as technology, development, sustainability, and economy are central to the discourse, demonstrating the critical role of technology in fostering sustainable business growth. The thematic analysis revealed six key themes contributing to the field of sustainable technology and business growth in emerging economies: Sustainable Industrial Ecosystems, Digital Technology and Sustainability, Sustainable Energy and Transportation, Green Technology in Entrepreneurship and Urban Logistics, Frugal Innovation and Technological Capabilities, and Sustainability in Agriculture. These themes highlight the pivotal role of sustainability in shaping business strategies and economic development. This study offers a comprehensive global overview of sustainable technology adoption and its impact on business growth in emerging economies. The widespread adoption of sustainable technology is viewed as a means of narrowing the economic gap between developing and developed nations. Moreover, the focus on advancing SDGs through sustainable technological practices is recognized as a key initiative to enhance business growth and long-term sustainability in emerging economies. This research appeals to governments and organizations in developing countries to fund research in sustainable technology adoption to foster business growth. It emphasizes the need for policy support to accelerate the integration of sustainable technologies, which could significantly enhance the competitiveness of businesses in emerging economies. Furthermore, this study contributes to the growing body of literature on the role of technology in driving sustainability and business development.

References

- Acilar, A., and Sæbø, Ø. (2023), "Towards understanding the gender digital divide: A systematic literature review", *Global Knowledge, Memory and Communication*, Vol. 72 No. 3, pp. 233-249. <https://doi.org/10.1108/GKMC-09-2021-0147>
- Al Koliby, I.S., Mehat, N.A.B., Al-Swidi, A.K. and Al-Hakimi, M.A. (2024), "Unveiling the linkages between entrepreneurial culture, innovation capability, digital marketing capability and sustainable competitive performance of manufacturing SMEs: evidence from emerging countries", *The Bottom Line*, Vol. 37 No. 4, pp. 473-500. <https://doi.org/10.1108/BL-08-2023-0241>

- Ali, I. and Phan, H. M. (2022), "Industry 4.0 technologies and sustainable warehousing: A systematic literature review and future research agenda", *The International Journal of Logistics Management*, Vol. 33 No. 2, pp. 644-662. <https://doi.org/10.1108/IJLM-05-2021-0277>
- Argyroudis, S.A., Mitoulis, S.A., Chatzi, E., Baker, J.W., Brilakis, I., Gkoumas, K., Vousdoukas, M., Hynes, W., Carluccio, S., Keou, O. and Frangopol, D.M. (2022), "Digital technologies can enhance climate resilience of critical infrastructure", *Climate and Risk Management*, Vol. 35, pp. 1-9. <https://doi.org/10.1016/j.crm.2021.100387>
- Bai, C., Quayson, M. and Sarkis, J. (2021), "COVID-19 pandemic digitization lessons for sustainable development of micro-and small-enterprises", *Sustainable Production and Consumption*, Vol. 27 No. 2, pp. 1989-2001. <https://doi.org/10.1016/j.spc.2021.04.035>
- Castro, M.P., Castillo, R. and Zermeno, M. G.G. (2019), "Estrategias de visibilidad para la producción científica en revistas electrónicas de acceso abierto: Revisión sistemática de literature", *Education in the Knowledge Society (EKS)*, Vol. 20 No. 13, pp. 1-13. https://doi.org/10.14201/eks2019_20_a24
- Chakravarty, S. and Gómez, G. M. (2024), "A development lens to frugal innovation: bringing back production and technological capabilities into the discourse", *The European Journal of Development Research*, Vol. 36 No. 1, pp. 82-101. <https://doi.org/10.1057/s41287-023-00594-w>
- Chancel, L. (2020), *Unsustainable Inequalities: Social Justice and the Environment*, Harvard University Press, New York, NY. <https://doi.org/10.2307/j.ctv2jfvcd3>
- Church, J.M., Tirrell, A., Moomaw, W.R. and Ragueneau, O. (2022), "Sustainability: From ideas to action in international relations", In: Harris, P.G (Ed.), *Routledge Handbook of Global Environmental Politics*, Routledge, London, pp. 217-227. <https://doi.org/10.4324/9781003008873-20>
- Dana, L.P., Salamzadeh, A., Mortazavi, S. and Hadizadeh, M. (2022), "Investigating the impact of international markets and new digital technologies on business innovation in emerging markets", *Sustainability*, Vol. 14 No. 2, pp. 1-15. <https://doi.org/10.3390/su14020983>
- Das, S., Kundu, A. and Bhattacharya, A. (2020), "Technology adaptation and survival of SMEs: A longitudinal study of developing countries", *Technology Innovation Management Review*, Vol. 10 No. 6. <https://doi.org/10.22215/timreview/1369>
- Forbes (2024), "Top cities for starting up in India", available at: <https://www.forbes.com/sites/edmundingham/2015/12/06/indias-top-start-up-cities/> (Accessed 13 March 2025)
- FutureScape, I. D. C. (2018), "Worldwide IT industry 2019 predictions", available at: <https://phc.pt/enews/IDC-FutureScape.pdf> (accessed 11 August 2025).
- George-Williams, H., Wade, N., and Carpenter, R. N. (2022), "A probabilistic framework for the techno-economic assessment of smart energy hubs for electric vehicle charging", *Renewable and Sustainable Energy Reviews*, Vol. 162, pp. 1-26. <https://doi.org/10.1016/j.rser.2022.112386>
- Ghadge, A., Bourlakis, M., Kamble, S. and Seuring, S. (2023), "Blockchain implementation in pharmaceutical supply chains: A review and conceptual framework", *International Journal of Production Research*, Vol. 61 No. 19, pp. 6633-6651. <https://doi.org/10.1080/00207543.2022.2125595>

- Guerrero, M., and Siegel, D.S. (2024), "Prosocial technology transfer and academic entrepreneurship: Applying public goods theory", *Academy of Management Perspectives*, Vol 0, No. 00, pp. 1-17. <https://doi.org/10.5465/amp.2024.0079>
- Habbal, A., Ali, M. K. and Abuzaraida, M. A. (2024), "Artificial Intelligence trust, risk and security management (AI trism): Frameworks, applications, challenges and future research directions", *Expert Systems with Applications*, Vol. 240. <https://doi.org/10.1016/j.eswa.2023.122442>
- Hafezalkotob, A. and Zamani, S. (2019), "A multi-product green supply chain under government supervision with price and demand uncertainty", *Journal of Industrial Engineering International*, Vol. 15 No. 1, pp. 193-206. <https://doi.org/10.1007/s40092-018-0271-9>
- Hashim, M., Nazam, M., Baig, S.A., Ali, S.S., and Ahmad, M. (2023), "What Is Sustainability? A Layman Perspective". In: García Márquez, F.P. and Lev, B. (Ed.s), *Sustainability. International Series in Operations Research & Management Science*, Cham, pp. 9-26. https://doi.org/10.1007/978-3-031-16620-4_2
- Ho, T.T., Tran, X.H. and Nguyen, Q.K. (2023), "Tax revenue-economic growth relationship and the role of trade openness in developing countries", *Cogent Business & Management*, Vol. 10 No. 2, pp. 1-14. <https://doi.org/10.1080/23311975.2023.2213959>
- Hosan, S., Karmaker, S.C., Rahman, M.M., Chapman, A.J. and Saha, B.B. (2022), "Dynamic links among the demographic dividend, digitalization, energy intensity and sustainable economic growth: Empirical evidence from emerging economies", *Journal of Cleaner Production*, Vol. 330, pp. 1-40. <https://doi.org/10.1016/j.jclepro.2021.129858>
- Hustad, E., and Olsen, D.H. (2021), "Creating a sustainable digital infrastructure: The role of service-oriented architecture", *Procedia Computer Science*, Vol. 181, pp. 597–604. <https://doi.org/10.1016/j.procs.2021.01.210>
- International Monetary Fund. (2024), "Global Financial Stability Report", available at: <https://www.imf.org/en/Publications/GFSR/Issues/2024/10/22/global-financial-stability-report-october-2024> (Accessed 21 January 2025)
- Javaid, M., Haleem, A., Singh, R.P., Suman, R. and Gonzalez, E.S. (2022), "Understanding the adoption of Industry 4.0 technologies in improving environmental sustainability", *Sustainable Operations and Computers*, Vol. 3, pp. 203-217. <https://doi.org/10.1016/j.susoc.2022.01.008>
- Jibril, A.B. and Padi, A. (2024), "Digital influence: a multi-group analysis of purchasing pattern among women in the context of working and non-working lifestyles", *Cogent Business and Management*, Vol. 11 No. 1, pp. 1-18. <https://doi.org/10.1080/23311975.2024.2413389>
- Kayikci, Y. (2018), "Sustainability impact of digitization in logistics", *Procedia Manufacturing*, Vol. 21, pp. 782–789. <https://doi.org/10.1016/j.promfg.2018.02.184>
- Kour, M. (2024), "Understanding the drivers of green consumption: a study on consumer behavior, environmental ethics, and sustainable choices for achieving SDG 12", *SN Business & Economics*, Vol. 4 No. 97, pp. 1-27. <https://doi.org/10.1007/s43546-024-00691-w>
- Küfeoğlu, S. (2022), "SDG-9: Industry, innovation and infrastructure", *Emerging Technologies: Sustainable Development Goals Series*, Vol. 11, pp. 349–369. https://doi.org/10.1007/978-3-031-07127-0_11

- Kuhail, M.A., Berengueres, J., Taher, F. and Al Kuwaiti, M. (2024), *Advances, Applications and the Future of Haptic Technology*, Springer, Cham. <https://doi.org/10.1007/978-3-031-70588-5>
- Lanzano, C., Navarra, C. and Vallino, E. (2021), "Interdisciplinarity and the future of development studies after the 2019 Nobel Prize in economics", *Anthropologie & Développement*, (Hors-série), pp. 315-329. <https://doi.org/10.4000/anthropodev.1322>
- Larbi-Siaw, O., Xuhua, H., Owusu, E., Owusu-Agyeman, A., Fulgence, B.E., and Frimpong, S.A. (2022), "Eco-innovation, sustainable business performance and market turbulence moderation in emerging economies", *Technology in Society*, Vol. 68, pp. 10-19. <https://doi.org/10.1016/j.techsoc.2022.101899>
- Latino, M.E., Corallo, A., Menegoli, M. and Nuzzo, B. (2023), "Agriculture 4.0 as Enabler of Sustainable Agri-Food: A Proposed Taxonomy", *IEEE Transactions on Engineering Management*, Vol. 70 No. 10, pp. 3678–3696. <https://doi.org/10.1109/TEM.2021.3101548>
- Leesakul, N., Oostveen, A.M., Eimontaite, I., Wilson, M.L. and Hyde, R. (2022), "Workplace 4.0: Exploring the implications of technology adoption in digital manufacturing on a sustainable workforce", *Sustainability*, Vol. 14 No. 6, pp. 1-24. <https://doi.org/10.3390/su14063311>
- Liu, P., Qi, S., Li, D. and Ravenscroft, N. (2021), "Promoting agricultural innovation as a means of improving China's rural environment", *Journal of Environmental Management*, Vol. 280, pp. 1-9. <https://doi.org/10.1016/j.jenvman.2020.111675>
- López-Sánchez, J.A., Patiño-Vanegas, J.C., Valencia-Arias, A. and Valencia, J. (2023), "Use and adoption of ICTs oriented to university student learning: Systematic review using PRISMA methodology", *Cogent Education*, Vol. 10 No. 2, pp. 1-22. <https://doi.org/10.1080/2331186X.2023.2288490>
- Malhotra, A., Melville, N.P. and Watson, R.T. (2013), "Spurring impactful research on information systems for environmental sustainability", *MIS Quarterly*, Vol. 37 No. 4, pp. 1265-1274. <https://doi.org/10.25300/MISQ/2013/37:4.3>
- Mametja, T.R., Lebambo, M.M. and Tichaawa, T.M. (2023), "The Adoption of Digital Technologies by Women-owned Tourism Micro-enterprises", *African Journal of Hospitality, Tourism and Leisure*, Vol. 12 No. 2, pp. 717-734.
- Ockwell, D., Atela, J., Mbeva, K., Chengo, V., Byrne, R., Durrant, R., Kasprowicz, V., and Ely, A. (2019), "Can Pay-As-You-Go, Digitally Enabled Business Models Support Sustainability Transformations in Developing Countries? Outstanding Questions and a Theoretical Basis for Future Research", *Sustainability*, Vol. 11 No. 7, pp. 1-21. <https://doi.org/10.3390/su11072105>
- Page, M.J., J.E. McKenzie, P.M. Bossuyt, I. Boutron, T.C. Hoffmann, C.D. Mulrow, L. Shamseer, J.M. Tetzlaff, and D. Moher (2021), "Updating guidance for reporting systematic reviews: Development of the PRISMA 2020 statement", *Journal of Clinical Epidemiology*, Vol. 134 No. 1, pp. 103–112. <https://doi.org/10.1016/j.jclinepi.2021.02.003>
- Rasheed, M., Liu, J. and Ali, E. (2025), "Incorporating sustainability in organizational strategy: A framework for enhancing sustainable knowledge management and green innovation", *Kybernetes*, Vol. 54 No. 4, pp. 2363-2388. <https://doi.org/10.1108/K-08-2023-1606>

- Rethlefsen, M.L., Kirtley, S., Waffenschmidt, S., Ayala, A.P., Moher, D., Page, M.J. and Koffel, J.B. (2021), "PRISMA-S: an extension to the PRISMA statement for reporting literature searches in systematic reviews", *Systematic reviews*, Vol. 10, pp. 1-19. <https://doi.org/10.1186/s13643-020-01542-z>
- Ruggerio, C.A., (2021), "Sustainability and sustainable development: A review of principles and definitions", *Science of the Total Environment*, Vol. 786, pp. 74-81. <https://doi.org/10.1016/j.scitotenv.2021.147481>
- San, O., Latif, B. and Di Vaio, A. (2022), "GEO and sustainable performance: the moderating role of GTD and environmental consciousness", *Journal of intellectual capital*, Vol. 23 No. 7, pp. 38–67. <https://doi.org/10.1108/JIC-10-2021-0290>
- Sarkar, B.D., Shardeo, V., Mir, U.B. and Negi, H. (2024), "Harvesting success: Metaverse adoption in agriculture sector as a sustainable business strategy", *Journal of Enterprise Information Management*, Vol. 37 No. 6, pp. 1858–1884. <https://doi.org/10.1108/JEIM-10-2023-0536>
- Sarkis-Onofre, R., Catalá-López, F., Aromataris, E. and Lockwood, C. (2021), "How to properly use the PRISMA Statement", *Systematic Reviews*, Vol. 10, pp. 1-3. <https://doi.org/10.1186/s13643-021-01671-z>
- Shahid, M.S., Hossain, M., Karami, M. and Anwar, T. (2023), "Frugal entrepreneurship: A way to seize business opportunities for low-income customers", *Asia Pacific Journal of Management*, Vol. 41 No. 4, pp. 1989-2019. <https://doi.org/10.1007/s10490-023-09899-0>
- Sharma, G.D., Kraus, S., Srivastava, M., Chopra, R. and Kallmuenzer, A. (2022), "The changing role of innovation for crisis management in times of COVID- 19: An integrative literature review", *Journal of Innovation & Knowledge*, Vol. 7 No. 4, pp. 1-13. <https://doi.org/10.1016/j.jik.2022.100281>
- Sharma, M., Vadalkar, S., Antony, R., Chavan, G. and Tsagarakis, K. P. (2024), "Can Industry 4.0-enabled smart manufacturing help firms in emerging economies move toward carbon-neutrality?", *Computers & Industrial Engineering*, Vol. 192, 2024 Issue, pp. 1-19. <https://doi.org/10.1016/j.cie.2024.110238>
- Sharma, S. and Bansal, D. (2023), "Big data for smart grid: a way forward", in: Rajkumar, V. and Divya, S.S. (Ed.s), *Big Data Analytics Framework for Smart Grids*, pp. 64-78. <https://doi.org/10.1201/9781032665399-4>
- Sharma, V.P., Prakash, S. and Singh, R. (2022), "What prevents sustainable last-mile delivery in industry 4.0? An analysis and decision framework", *Sustainability*, Vol. 14 No. 24, pp. 1-20. <https://doi.org/10.3390/su142416423>
- Smidt, H.J. and Jokonya, O. (2022), "Factors affecting digital technology adoption by small-scale farmers in agriculture value chains (AVCs) in South Africa", *Information Technology for Development*, Vol. 28 No. 3, pp. 558-584. <https://doi.org/10.1080/02681102.2021.1975256>
- Sovacool, B.K., Martiskainen, M., Hook, A. and Baker, L. (2019), "Decarbonization and its discontents: a critical energy justice perspective on four low-carbon transitions", *Climatic Change*, Vol. 155 No. 4, pp. 581-619. <https://doi.org/10.1007/s10584-019-02521-7>
- Suppipat, S. and Hu, A.H. (2022), "Achieving sustainable industrial ecosystems by design: A study of the ICT and electronics industry in Taiwan", *Journal of Cleaner Production*, Vol. 369, pp. 1-14. <https://doi.org/10.1016/j.jclepro.2022.133393>

- Tajpour, M., Hosseini, E., Mohammadi, M. and Bahman-Zangi, B. (2022), "The effect of knowledge management on the sustainability of technology-driven businesses in emerging markets: The mediating role of social media", *Sustainability*, Vol. 14 No. 14, pp. 1-15.
- Thommandru, A., Espinoza-Maguiña, M., Ramirez-Asis, E., Ray, S., Naved, M. and Guzman-Avalos, M. (2023), "Role of tourism and hospitality business in economic development", *Materials Today: Proceedings*, Vol. 80, pp. 2901-2904. <https://doi.org/10.1016/j.matpr.2021.07.059>
- Tiep Le, T., Ngo, H.Q. and Aureliano-Silva, L. (2023), "Contribution of corporate social responsibility on SMEs' performance in an emerging market-the mediating roles of brand trust and brand loyalty", *International Journal of Emerging Markets*, Vol. 18 No. 8, pp. 1868-1891. <https://doi.org/10.1108/IJOEM-12-2020-1516>
- United Nations. (2015), "Transforming our world: the 2030 Agenda for Sustainable Development", available at: <https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf> (accessed 18 December 2024).
- Utami, H.N., Alamanos, E. and Kuznesof, S. (2021), "A social justice logic: how digital commerce enables value co-creation at the bottom of the pyramid", *Journal of Marketing Management*, Vol. 37 No. 9-10, pp. 816-855. <https://doi.org/10.1080/0267257X.2021.1908399>
- von Schönfeld, K.C. and Ferreira, A. (2021), "Urban planning and European innovation policy: Achieving sustainability, social inclusion, and economic growth?", *Sustainability*, Vol. 13 No. 3, pp. 11-37. <https://doi.org/10.3390/su13031137>
- Wahyudiono, Aini, N., Murni, S.A., and Rosyid, A. (2024), "Maintaining Sustainable Growth of Micro and Small Enterprises: Antecedents of Management Orientation and Digital", *Business Sustainability*, Vol. 16 No. 15, pp. 1-19. <https://doi.org/10.3390/su16156638>
- Yu, Z., Khan, S.A.R., Ponce, P., de Sousa Jabbour, A.B.L., and Jabbour, C.J.C. (2022), "Factors affecting carbon emissions in emerging economies in the context of a green recovery: Implications for sustainable development goals", *Technological Forecasting and Social Change*, Vol. 176, pp. 1-39. <https://doi.org/10.1016/j.techfore.2021.121417>