Global Retail Sustainability: A Comparative Analysis of Environmental Management Practices and Technology Adoption Across Developed and Developing Economies

Omofolasaye Omobolanle Adegoke, PhD[1]; Oluwaseun Akinyeye[2]; Esther Oreoluwa Adedipe[3]; Timilehin Olasoji Olubiyi, PhD[4]

Abstract

This comparative research employs a convergent parallel mixed-methods approach to examine the adoption of sustainability technologies and environmental management strategies across four regions: Sweden, Indonesia, Malaysia, and Nigeria. A total of 130 retail companies were involved in the research. One of the major results was the discovery of the significant disparity in technology adoption between

1. Department of Business Administration, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria; adegokeoo@abuad.edu.ng; https://orcid.org/0000-0001-7999-9766.
2. Department of Business Administration; Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria; akinyeyeol@fedpolyado.edu.ng; https://orcid.org/0009-0005-1852-7163
3. Department of Business Administration, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria; estheradedipe26@gmail.com; https://orcid.org/0009-0003-8634-8357
4. Faculty of Management and Social Sciences; West Midlands Open University, Lagos State, Nigeria; timi.olubiyi@westmidlands.university; https://orcid.org/0000-0003-0690-7722

different countries with Sweden on top having the adoption rate of 87% for IoT, 72% for AI, and 91% for renewable energy, followed by Indonesia with 58%, 52% and 48% respectively, and subsequently Malaysia (41%, 28%, 32%) and lastly Nigeria (23%, 12%, 15%). Such technology adoption was indicative of the companies' environmental performance: among the different countries, Swedish retailers were the most successful in waste reduction (22.7% average) and carbon footprint (up to 23.1%) reductions, while Nigerian companies were the least successful (18.4% and 12.3%, respectively). Circular economy technologies were the next, with adoption rates going from 78% in Sweden to 19% in Nigeria. The study ends by asserting that although technology is a major factor in achieving sustainability, there are still considerable resource, infrastructure, and regulatory support gaps in developing countries that will require context-specific, incremental strategies plus enhanced policy facilitation for the global retail trade to achieve its sustainability goals.

Keywords: Retail Sustainability, Technology Adoption, Circular Economy, Environmental Management, Developed and Developing Economies

Introduction

The retail sector is increasingly reshaped by heightened regulatory scrutiny, growing concern for eco-friendly practices, and a sharper environmental focus (Asmat *et al.*, 2023). With the advancement of globalisation, retail businesses face mounting optimisation pressure to integrate comprehensive green management systems that balance economic objectives with environmental stewardship (Kannan & Gambetta, 2025). Sustainability within retail sectors is no longer considered ethical branding; it is increasingly viewed and used strategically as a core driver for competition and longevity (Wiese, sielke, & Toporowski, 2020).

Environmentally, the retail industry impacts numerous areas, such as the supply chain, energy, waste generation, packaging, and consumer behaviour (Sarkar, Sarker, & Sadeka, 2024). As reported, the retail industry

Adegoke, et al.

is responsible for roughly 15% of carbon emissions, and developing countries are witnessing more rapid growth in the environmental impact associated with retail (Lincoln, 2025). This impact is significant, and there is a diverse international focus on the disparity in the pace of adopting sustainable technology and environmental management in different economies in different contexts (Rahman, Ahmed, & Islam, 2024).

The role of technology has emerged as a differentiating factor between genuine efforts towards sustainability and 'greenwashing' compliance through technology (Martínes-Falcó *et al*., 2024). Recent advancements, including IoT and AI, blockchain technology, and sophisticated energy management systems, enable retailers to enhance transparency and resource consumption, reduce waste, and improve efficiency across their value chains (Bui, Nguyen, & Le, 2023). However, emerging countries vary significantly in the level of implementation due to a lack of infrastructure, funding, regulations, and even cultural considerations (Asmat *et al*., 2023).

The sustainability maturity, level of technological development, and adoption strategies of retail companies across the globe reveal surprising gaps when examined comparatively. Countries in emerging economies, like Sweden and Canada, display vigorous adoption of circular economies. In contrast, countries in developing economies such as Nigeria and Malaysia are hindered by a lack of financial resources, poorly developed technological infrastructures, and competing priorities (Schiaroli, Testa, & Iraldo, 2025).

This study targets a critical gap in understanding how retail businesses from different economic contexts deploy and incorporate techniques for environmental management. It analyses patterns of technological adoption, evaluates the impact of sustainability initiatives, and determines the significant barriers and enabling factors regarding environmental performance outcomes. This study contributes to emerging economies by informing policymakers, retail practitioners, and sustainability advocates about enhanced global environmental management practices (Chen, Wang, & shang, 2024).

The theoretical framework of this study combines technology acceptance models, the resource-based view theory, and circular economy concepts to explain the interconnected and dynamic relationship among technological capabilities, organisational resources, and environmentally related

performance outcomes (Bui *et al*., 2023). Methodologically, this study employs a mixed-methods strategy, intertwining quantitative data from the retail sector in Nigeria with qualitative studies from Sweden, Canada, and Malaysia to expand the scope of understanding regarding global sustainability (Kannan & Gambetta, 2025).

Literature Review

The past decade has seen a shift in retail sustainability from a peripheral aspect of corporate social responsibility to integrating it as a key feature of business strategy. In this regard, the evolution of the framework business models integrates social and environmental elements alongside the traditional monetary metric to enable consideration of sustainable retail practices in conjunction with profit generation. This approach ensures viable retail practices alongside acceptance across all stakeholders (Asmat *et al*., 2023). Current study around the sustainability of retail businesses focuses on technology as a primary driver that enables circular economy practices aimed at minimising waste while optimising resource utilisation. The circular economy differs fundamentally from the traditional linear consumptive approach by focusing on regenerative systems designed to extend the productive use of materials. Retailers embracing circular economy principles experience increased operational efficiency, reduced negative impact on the environment, and improved stakeholder relationships (Singh, Behera, & Bala, 2024).

Adopting technology to manage environmental concerns in retail has become more sophisticated. Retailers now use everything from basic monitoring tools to more advanced predictive analytics platforms. With IoT (Internet of Things) sensors, energy use, water use, and waste production can be tracked in real-time, providing the necessary data for enhanced, environmentally responsible operational decision-making. These technologies enable employers to practice proactive environmental management that goes beyond compliance (Chen, Wang, & Shang, 2024). The application of artificial intelligence (AI) and machine learning in forecasting demand, managing inventories, and logistics has transformed supply chain Management. AI optimisation of supply chains is reported to lead to an 18-23% reduction in waste while increasing customer satisfaction and

Adegoke, et al.

operational efficiency. In addition, retail formats employing energy management systems that incorporate smart grid technology and renewable energy sources demonstrate efficiency gains of 14-19% (Kannan & Gambetta, 2025).

Sustainability practices in retail differ from region to region due to differences in economic development, culture, regulatory environments, and the region's infrastructure. More economically advanced countries tend to have better sustainability practices because of existing regulations, heightened consumer sophistication, greater funding, and superior infrastructure. For example, Swedish retailers have embraced circular economy practices more than their counterparts in other nations, driven by government policies, technological advancements, and proactive consumers (Sarkar, Sarker, & Sadeka, 2024). On the other hand, developing economies have greater financial hardships, weaker regulatory frameworks, and limited technological infrastructure, which unfortunately delays the adoption of sustainable retail practices. Some studies argue that these economies have a few advantages, such as flexibility in adopting new practices, robust grassroots initiatives, and increasing public concern regarding ecological sustainability (Lincoln, 2025; Asmi, Roni, & Sa'at, 2024).

Sustainability within the scope of the supply chain is one of the most essential elements of retail strategic environmental management. The adoption of blockchain facilitates the sustainable sourcing and IoT-based ecological monitoring of products during transport and storage, thus providing real-time monitoring of environmental conditions—Martines-Falco *et al*. (2024) detail how these devices enhance traceability and accountability in sourcing. Recent studies have shown how collaborative strategies are crucial in achieving sustainable supply chain goals, as no single retailer can comprehensively address the environmental impact without engaging their suppliers, distributors, and other stakeholders. This participation is made possible by the technology platforms that provide shared data visibility, coordinated modelling, and uniform key indicators, thus making collaboration actionable (Rahman, Ahmed, & Islam, 2024).

Organisational capabilities, available finances, operational mandates, market rivalry, and stakeholder demands influence the adoption of sustainable technologies in retail. The complexity of these technologies, stringent

1247

technical expertise requirements, concerns about return on investment, and high initial costs pose barriers to adoption. These challenges are more pronounced in developing countries with limited financial and technical support (Lincoln, 2025; Bui, Nguyen, & Le, 2023). On the other hand, facilitators include strong supportive regulatory frameworks, rising consumer demand for eco-friendly products, operational efficiencies, procurement cost savings, and reductions in resource allocation that offer a competitive edge. In contrast to other regions, developing regions face greater constraints on financial and technical support, resulting in greater reliance on these factors than on regulatory and stakeholder pressures that emerging economies face (Kannan & Gambetta, 2025; Yadegaridehkordi et al., 2023).

Retail sustainability has moved from a peripheral issue to front-and-centre consideration, motivated by the Triple Bottom Line and made possible through technological advancements. A circular economy is considered a paradigm shift as it seeks to transform consumption and production for better environmental and social consequences. Sustainability is enabled by technological innovations, such as IoT, AI, and blockchain, which improve monitoring, supply chain optimisation, and collaboration. Still, there are gaps between different regions due to economic, cultural, and infrastructural differences. Addressing tech adoption gaps requires an appropriate approach that considers organisational capacities, financial conditions, and the political framework of the area. The retail industry is fast evolving, and businesses need to integrate sustainability with technology, innovation, and responsive collaborative supply chain management to meet the consumers', policymakers, and global sustainability agenda.

Methodology

To triangulate quantitative breadth with qualitative depth across economies, a convergent parallel mixed-methods design was implemented. The 71 primary data sets were collected from Nigerian retailers that provided a deep and rigorously analysable data set for a key emerging market. The three secondary qualitative data sets from Sweden, Indonesia and Malaysia offered the analyst practical and contextual benchmarks for comparison. A five-level sustainability maturity model facilitated a standardised and comprehensive cross-evaluation. SPSS 29 was the tool used for conducting

Adegoke, et al.

the descriptive and regression analyses of the survey data, while NVivo was used for the systematic thematic analysis of the interviews and documents. The validity of the study was strengthened through the use of triangulation, a pilot study, member checking, and inter-rater reliability, which ultimately led to producing credible and integrated findings about global retail sustainability practices.

Results

Descriptive Analysis of Sample Characteristics

The study included a total of 130 retail companies from four different economies. It was the case that 71 companies from Nigeria were included in the sample while the other 59 companies were represented through the secondary data coming from Sweden, Indonesia, and Malaysia. The distribution of the sample serves to highlight that developing economies were mainly the focus of the research, while at the same time allowing a global comparison.

Different retail formats were represented in the Nigerian sample: supermarkets/hypermarkets (34%), specialty retailers (28%), department stores (22%), and e-commerce platforms (16%). The examination of organisational profiles showed that there were considerable differences in the size and development of the firms across regions. Nigerian companies were the youngest and the smallest in terms of average age and revenue, with an average operational period of 8.3 years and average annual revenue of ¦2.8 billion (approximately USD 6.8 million). In contrast, Swedish retailers were the most mature in terms of average operational period of 23.7 years and revenue of €45.2 million. Indonesian and Malaysian retailers were classified as those in the middle, with average operational periods of 15.4 years and 11.2 years, and average revenues of Rp 393.1 million and RM 18.6 million, respectively.

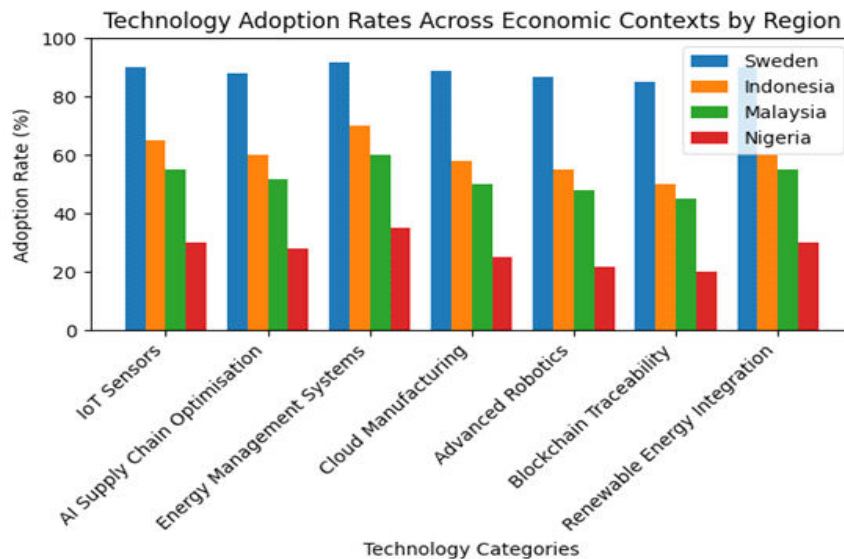### *Technology Adoption Patterns Across Economic Contexts*

An evident and specific hierarchy in technology adoption appeared, strongly connected to the level of economic growth. Retailers in Sweden showed the highest adoption rates, which were comprised of IoT sensors (87%), AI for supply chain optimisation (72%), and blockchain for traceability (69%).

They also occupied the top spot in renewable energy integration (91%). Retailers in Indonesia were positioned in the middle with their moderate to high adoption, highlighted by 58% for IoT sensors and 64% for energy management systems. Retailers in Malaysia were seen to be adopting new technologies, although slowly, and they were particularly active in the areas of energy management (47%) and waste analytics (36%). Retailers in Nigeria were at the bottom of the adoption scale in all categories, although there was some, albeit not very extensive, adoption of the energy management systems (31%) and carbon footprint monitoring (22%) present. Table 1 provides an overview of the current situation.

Table 1: Technology Adoption Rates by Region (%)

Technology Category	Nigeria	Malaysia	Indonesia	Sweden
IoT Sensors	23%	41%	58%	87%
AI Supply Chain Optimisation	12%	28%	52%	72%
Energy Management Systems	31%	47%	64%	83%
Blockchain Traceability	8%	19%	35%	69%
Renewable Energy Integration	15%	32%	48%	91%
Waste Management Analytics	19%	36%	55%	78%
Carbon Footprint Monitoring	22%	38%	61%	85%

Adegoke, et al.

Figure 1: Technology Adoption Rates Across Economic Contexts

Environmental Performance Outcomes

The analysis revealed a strong correlation between environmental performance metrics and the extent of technology adoption in all regions. The application of certain technologies led to measurable and differentiated enhancements, with performance levels rising parallel to economic development.

The use of supply chain optimisation algorithms was linked with an average reduction of waste to the extent of 18% to 23%. The retail sector in Sweden was the one that reduced waste the most, with a mean of 22.7%. It was followed by the retail sector in Indonesia (19.8%), then Malaysia (19.1%), and lastly Nigeria (18.4%). Furthermore, coupling the smart grid and renewable energy technologies with energy management systems led to a 14% to 19% gain in efficiency. The retail sector in Sweden led as its average energy saving was 18.6%, followed by Indonesia (16.2%), Malaysia (15.7%), and Nigeria (14.2%).
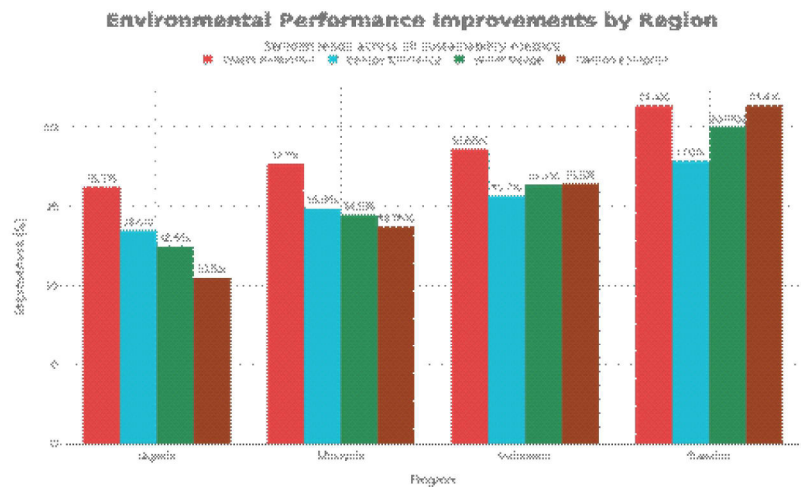
1251

All environmental metrics measured contributed to the persistent ranking, which was explicitly presented in Table 2. Swedish firms led with the highest scores, followed by Indonesia, Malaysia, and Nigeria. For instance, the cutting down of water use was 11.3-13.7% in Nigeria but was 18.9-21.2% in Sweden. The greatest difference among the various regions was seen in the carbon footprint reduction area, where Swedish retailers managed to reduce by 19.7%-23.1%, while Nigerian ones did by 8.7%-12.3%. A composite score for supply chain transparency further highlighted this gradient, with Swedish retailers scoring 81-92 out of 100 while Nigerian ones scored 42-56.

Table 2: Environmental Performance Improvements by Technology Implementation

Performance Metric	Nigeria	Malaysia	Indonesia	Sweden
Waste Reduction (%)	14.2 - 18.4	16.3 - 19.1	17.5 - 19.8	20.1 - 22.7
Energy Efficiency (%) Improvement	12.8 - 14.2	14.1 - 15.7	15.2 - 16.2	17.2 - 18.6
Water Usage Reduction (%)	11.3 - 13.7	13.2 - 15.8	15.5 - 17.3	18.9 - 21.2
Carbon Footprint Reduction (%)	8.7 - 12.3	12.1 - 15.4	15.1 - 17.9	19.7 - 23.1
Supply Chain Transparency (Score/100)	42 - 56	58 - 67	65 - 74	81 - 92

The data unequivocally shows that the presence of technology at higher levels, as in Sweden and Indonesia, gives rise to excellent environmental performance, while areas with lower technology usage, as in Nigeria, get only minor improvements.

Adegoke, et al.

Figure 2: Environmental Performance Improvements by Region

Environmental Performance Improvements by Region

Findings

Circular Economy Implementation Patterns

The assessment indicates a varied acceptance of circular economy (CE) practices, with the strongest connection to economic development. In the vanguard, Swedish retailers are setting the trend by totally involving 78% CE practices that include the management of product life-cycle and recovery of resources. Indonesian retailers are showing the next level of progression with a 52% adoption, then come Malaysia (34%) and Nigeria (19%). The hierarchy of adoption is corresponding to the factors facilitating CE practices: the Swedish case is backed by connective policy, robust reverse logistics, and high consumer mindset. Indonesian and Malaysian retailers are gradually coming up, usually in areas of waste and recycling methods. The Nigerian market is the most affected by constraints like poor infrastructure, unclear laws, and a lack of resources that prevent the development of formal CE systems. Still, there are small community-based recycling projects and informal sector participation that are considered adaptive local solutions.

1253

Assessment of Sustainability Maturity

Regional differences are clearly highlighted by the sustainability maturity evaluation. By way of a cross-cutting evaluation (governance, technology, performance measurement, etc.), Swedish retailers got the highest mean score (4.2 out of 5.0), especially in the adoption of technology (4.4) and the process of improvement (4.3). The next in line were Indonesian retailers with a score of 3.6, the points in which they were strong being governance and performance measurement. Malaysian retailers, with an average of 2.8, showed the early stages of maturity, being the strongest in the areas of governance and strategy. Nigerian retailers were the least mature with a score of 2.1, which signifies that they are at a very basic stage; their engagement with stakeholders, though relatively better (2.4), was sharply contrasted by the low scores in technology adoption (1.8) and performance measurement (1.9).

Patterns of Regional Innovation

Local capabilities and challenges moulded the creation of distinct innovation patterns. The Swedish innovativeness is the most technological and characterised by an integrated digital platform for monitoring energy, waste, and emissions. The Indonesian innovation is of the moderate-to-high adoption of key technologies like IoT and energy management systems, which are the main reason for its mid-tier performance. The innovation of Malaysian retailers comes in the form of localised adaptations, for instance, energy management for tropical climates and culturally sensitive stakeholder engagement. On the contrary, the Nigerian innovation is mainly grassroots and need-based, concentrating on community-driven projects, integration of the informal sector, and modifying technologies to cope with the lack of proper infrastructure.

To put it another way, the findings suggest a direct scale where advanced CE implementation, higher sustainability maturity, and sophisticated technology-led innovation are all found in developed economies (Sweden). In contrast, the emerging and developing economies (Indonesia, Malaysia, and Nigeria) exhibit gradual progress, limited by resources but encouraging context-specific, often community-based, innovations.

Adegoke, et al.

Discussion

The empirical results of the study support the theoretical frameworks regarding technology adoption, implementation effectiveness, and the identification of barriers to adoption. Endorsing Asmat et al. (2023) and the Technology Acceptance Model, a straightforward relationship can be seen between economic development and the retail sustainability technologies' adoption. In fact, the relationship is so clear that there is a specific ranking: Swedish retailers are at the top of the list, and they are the ones that mainly use the IoT, AI, and blockchain technologies due to the policy support and well-established infrastructure. Indonesian retailers are of moderate-to-high adoption level, while Malaysian and Nigerian retailers are at the emerging and foundational levels, each often starting with basic systems like energy management. In this way, the first objective of the study has been accomplished by classifying technology adoption according to the economic context.

The outstanding environmental performance of the Swedish retailers corroborates the Resource-Based View theory. The company's capacity to utilise organisational resources, sophisticated technology, and strong policy frameworks leads to sustainability as a source of competitive advantage which is in line with literature on developed nations (Sarkar et al., 2024). On the contrary, the gradual, community-based methods used in Nigeria are consistent with the Frugal Innovation theory (Lincoln, 2025), revealing how resource-scarce contexts are able to overcome barriers by integrating with the grassroots and informal sector. This also answers the third objective by showcasing the contextual opportunities.

The cross-regional evaluation of circular economy (CE) practices validates wide gaps (Schiaroli et al., 2025). The Swedish retailers (78% CE adoption) are at the top of the list due to government support and consumer engagement. Indonesia indicates moderate development (52%), while Malaysia (34%) and Nigeria (19%) are suffering from the lack of infrastructure and regulations, yet both are demonstrating localised adaptations. This range supports the stakeholder theory, illustrating that

1255

multi-actor interaction leads to sustainability value differently in different contexts.

Innovation trends are also ranked in a similar way. Swedish innovation is very technological and it emphasises the digital platforms that are integrated. The adoption of core enabling technologies reflects the innovation in Indonesia. Malaysian retailers come up with local solutions that are suitable for the tropical climates of their country, whereas Nigerian innovations are largely frugal and grassroots. This again underscores the importance of adaptive innovation frameworks in the case of developing countries (Bui et al., 2023).

The analysis of barriers points out the challenges that are specific to each region. Financial and infrastructural hurdles are the main issues in Nigeria and Malaysia, while other countries in the region, such as Indonesia, are facing regulatory complexity and lack of funding at the same time. The paramount need for government support as a facilitator and the rising power of consumer demand in pushing the initiatives are highlighted (Martínes-Falcó et al., 2024).

The study has successfully achieved its three goals: (i) examining technology adoption patterns influenced by economy and regulation; (ii) determining the positive correlation between the use of technology and the environmental performance of different regions; and (iii) identifying context-specific barriers and enablers for actionable insights.

Through the integration of the Technology Acceptance Model, Resource-Based View, and Circular Economy notions, the research focuses on the gap identified by Chen et al. (2024) and clarifies the interaction among technological proficiency, resources, and the environment. The mixed-methods approach, which uses quantitative data from Nigeria and qualitative insights from Sweden, Indonesia, and Malaysia, offers a comprehensive and comparative view, thus responding to the researchers' request for context-spanning studies (Rahman et al., 2024).

To sum up, the study established that retail sustainability was determined by economic growth, organisational competency, and the specific regional circumstance. Sustainability has transitioned from being a merely ethical concern to a strategic necessity. Barriers to adoption can be overcome through the deployment of different strategies: in the developed contexts i,t

will be by strong policy and cutting-edge innovation, and in the developing ones by providing finance, infrastructure, and grassroots adaptation through blended support. For retailers worldwide, it is turning out that sustainability integration is an essential source of long-term competitive advantage.

Conclusion
Studies in retail sustainability within four different economies have revealed key relationships among embracing new technological solutions, managing ecological challenges, and overall performance results. These regional approaches, although very different from each other, still have some common principles.

When it comes to sustainability, Swedish retailers are always one step ahead as they have the backing of an excellent infrastructure, strong government regulations, and a well-developed market for consumers. They lead the way in applying the circular economy concepts and unifying all the technologies into a whole. The Indonesian retailers, being practical in sustainability, take a middle position with a moderate-to-high technology adoption and a strong focus on the effectiveness of the core systems, thus being a reference point for other less developed countries.

In Malaysia, numerous sustainable practices are emerging due to heightened environmental awareness and improved infrastructure development. The innovation lies in the resort to the culturally sound and localised adaptations, which are very much suitable for the developing contexts. Among the retailers in Nigeria, the obstacles are the most severe, with the severe lack of funds being the main one, along with poor infrastructure. Nevertheless, their devising of low-cost, community-based schemes and informal sector engagement shows that there are indeed, among very tough constraints of resources, some vital alternative paths to sustainability.

Infrastructure, funding, and regulations play a decisive role in shaping the global pace and manner of technology adoption. The use of energy management systems has the widest foundation of adoption all over the world. On the other hand, high-impact technologies such as supply chain optimisation algorithms earn their place by giving real measurable results

1257

that are in line with the study's claims of 18-23% waste reduction and 14-19% energy efficiency improvements.

The specific barriers differ by market type: developing nations such as Nigeria and Malaysia are mostly limited by a lack of financial and infrastructural backing, whereas emerging economies like Indonesia experience these issues plus additional regulatory complications. In every case, government support is the most important enabling factor, together with the increasing demand from consumers and the collaboration of the industries.

Sustainability maturity correlates very closely with economic development, but still can be available everywhere if stakeholders are prioritised and resources are optimised. The results not only validate the global benefits of technology-based management but also point out the need for adaptation depending on critical contexts. The principles of a circular economy can be applied at all development levels and can be achieved through the right infrastructure, stakeholder engagement, and technology suitable for the situation.

In the end, the investment in sustainability technology must be constant and unflinching. The economically weak areas can still reap the benefits of such a strategy through a step-by-step, cost-effective approach, while the resource-rich regions should go for the opposite, that is, full-scale, simultaneous integrated strategies in order to keep the retail sector both competitive and environment-friendly.

Recommendations

Bolster Government Support and Financial Resources
Barriers experienced in emerging economies require supportive policies to eliminate obstacles hindering the growth of small and medium-sized retailers. Providing subsidised loans with tax deductions can drastically improve the financial position and encourage a gradual increase in technology adoption. Alongside these supports, streamlining regulations, forms of tailored technical assistance, and programme design to foster expertise gaps are fundamental in dealing with adequate gaps in sustainability.

Encourage Cohesive and Custom Strategies within the Industry

In retail, sustainability strategies must be based on the resources available and the specific needs of the markets. Large retailers have an opportunity to implement integrated technology solutions and take the lead in helping smaller businesses through collaborative projects. Small and medium businesses need to focus on technological evolution, beginning with a simple but effective energy management system and forming coalitions to gain better access to higher-level technologies.

Encourage the Development of Low-Cost, Adaptable Technologies

These technologies permit incremental capability enhancement, optimal performance extraction, and seamless attachment to associated systems. Focusing on affordability and easy adaptation to low-resource environments will stimulate acceptance and use in developing economies. Technology sellers must focus more on developing modular and scalable options for use within different economic settings.

Widen Stakeholders Active Participation with Consumers' Skills

Retailers must educate consumers about the benefits of these practices using the right culture to help them make better purchasing decisions. Working more closely with suppliers and partners by providing them with technical materials and rewards will encourage them to adopt more sustainable strategies, making the retail value network more effective.

Develop Detailed Efforts for Performance Evaluation and Continuous Improvement Systems

As with any other business sector, retail stores or shopping centres must develop and adopt uniform but adaptable digitised assessment systems that work together with modern environmental sustainability models. Current evaluation processes should focus on environmental management system learning and enhancement practices, allowing complete optimisation of environmental management systems. These approaches are necessary for evaluating standards and best practices and ascertaining the benefits of whole-system sustainability.

1259

References

Asmat, F., Lim, W. M., Moyeen, A., Voola, R., & Gupta, G. (2023). Convergence of business, innovation, and sustainability at the tipping point of the sustainable development goals. *Journal of Business study*, *167*, 114170. https://doi.org/10.1016/j.jbusres.2023.114170

Asmi, F. R., Roni, M., & Sa'at, M. (2024). Circular supply chain management in developing countries: Challenges, opportunities and pathways to sustainability. *Information Management and Business Review*, *16*(1), 105-115. https://doi.org/10.47992/imbr.2024.16.1.7

Bui, Q. T., Nguyen, D. T., & Le, H. M. (2023). Circular business strategy challenges and opportunities for Industry 4.0: A social media data-driven analysis. *Business Strategy and the Environment*, *32*(4), 1456-1472. https://doi.org/10.1002/bse.3217

Chen, L., Wang, Y., & shang, H. (2024). Retail technology use in sustainability practices: A mixed-methods analysis of implementation approaches and future directions. *Journal of Retailing and Consumer Services*, *78*, 103712. https://doi.org/10.1016/j.jretconser.2024.103712

Kannan, S., & Gambetta, N. (2025). Technology-driven sustainability in small and medium-sised enterprises: A systematic literature review. *Journal of Small Business Strategy*, *35*(1), 129-157. https://doi.org/10.53703/001c.126636

Kumar, A., Singh, R., & Patel, M. (2023). Sustainability and consumer behaviour in electronic commerce: Environmental awareness and green product adoption. *Sustainability*, *15*(22), 15902. https://doi.org/10.3390/su152215902

Lincoln, A. A. (2025). Challenges to environmental sustainability and circular economy practices of Nigerian small and medium enterprises. *Journal of Sustainable Business*, *1*(1), 1-24. https://doi.org/10.1186/s40991-025-00110-9

Martínes-Falcó, J., Sánches-García, E., Marco-Lajara, B., & Andreu, R. (2024). Green supply chain management and sustainable performance: exploring the role of circular economy capability and green ambidexterity innovation. *British Food Journal*, *126*(11), 3985-4011. https://doi.org/10.1108/BFJ-01-2024-0062

Rahman, M. M., Ahmed, S., & Islam, T. (2024). Fostering technology adoption towards sustainable-oriented innovation: Does circular economy matter? *E3S Web of Conferences*, *456*, 01004. https://doi.org/10.1051/e3sconf/202445601004

Sarkar, M. S. K., Sarker, M. N. I., & Sadeka, S. (2024). Comparative analysis of environmental sustainability indicators: Insights from Japan, Bangladesh, and Thailand. *Heliyon*, *10*(13), e33362. https://doi.org/10.1016/j.heliyon.2024.e33362

Schiaroli, E., Testa, F., & Iraldo, F. (2025). Mapping sustainable options in the fashion industry: A systematic literature review and a future study agenda. *Sustainable Development*, *33*(2), 234-251. https://doi.org/10.1002/sd.3129

Shou, X., Liu, J., & Thompson, R. (2023). Implementing circular economy activities in manufacturing for environmental sustainability. *International Journal of Production Economics*, *257*, 108756. https://doi.org/10.1016/j.ijpe.2023.108756

Singh, A. P., Behera, R. K., & Bala, P. K. (2024). Evolution of sustainable retailing and how it influences consumer behaviour: a bibliometric review. *The International Review of Retail, Distribution and Consumer study*, *34*(3), 289-315. https://doi.org/10.1080/09593969.2024.2381066

Wiese, A., sielke, S., & Toporowski, W. (2020). Sustainability in retailing – study streams and emerging trends. *International Journal of Retail & Distribution Management*, *48*(4), 332-356. https://doi.org/10.1108/IJRDM-02-2015-0024

Yadegaridehkordi, E., Foroughi, B., Iranmanesh, M., Nilashi, M., & Ghobakhloo, M. (2023). Determinants of environmental, financial, and social sustainable performance of manufacturing SMEs in Malaysia. *Sustainable Production and Consumption*, *35*, 129-140. https://doi.org/10.1016/j.spc.2022.10.026