



From Waste to Worth: A Case Study Analysis of Circular Economy Practices in Leading Global Companies

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Abstract.

The circular economy transition stands as a fundamental strategic priority for global companies because it helps them enhance sustainability and waste reduction while maximizing resource effectiveness. This research investigates circular economy approaches adopted by IKEA, Tesla, Unilever, Adidas, Nike, BMW, Nestlé, Apple, HP and H&M to analyse their initiatives, challenges and impacts in sustainable business model implementation. The companies have introduced innovative approaches that combine product life cycle extension, closed-loop manufacturing and waste reduction to achieve environmental and economic returns. This research evaluates corporate circular economy integration across operations, supply chains and customer engagement approaches through a comprehensive analysis. The secondary data in the form of a comparative analysis provided information regarding the transition of different sectors from linear to circular model. The study points out the influence of innovation, consumer engagement and regulation environments on the outcome of CE.

Findings show effective strategies for circularity alongside potential growth opportunities as well as specific business constraints which hinder total circularity implementation. Research presents recommendations for business improvement of circular economy models to sustain long-term sustainability and competitive performance.

Keywords: Circular Economy, Sustainability, Resource Efficiency, Zero Waste Strategies

1. Introduction

The business world has adopted circular economy (CE) as its fundamental evolution because it focuses on sustainable resource management and waste reduction. The circular economy focuses on continuous resource utilization through recycling methods remanufacturing operations and closed-loop system development [1]. Global corporations lead the implementation of CE strategies at the forefront to combine environmental impact reduction with sustainable economic outcomes [2].

The CE concept has emerged through its ability to address environmental challenges caused by industrialization and urbanization and excessive consumption of natural resources [1]. According to the European Commission, CE is a recovery method that promotes product longevity and reduces resource allocation [3]. The theoretical advantages of CE have received broad acceptance from researchers but its practical deployment faces barriers related to regulations, economic feasibility, and consumer acceptance [1].

Numerous multinational companies showcase leadership by implementing CE principles which turn waste materials into valuable resources while incorporating sustainability across their business operations [2]. Companies have developed CE business approaches for emerging markets by implementing local supply chains and informal recycling systems to establish sustainable production [2]. The examined cases demonstrate how targeted business approaches should be developed to resolve challenges that prevent CE adoption within particular industries.

Successful case examples demonstrate that leading global businesses use CE principles to advance their innovation and sustainability initiatives. Multinational fashion and electronics companies have introduced product-as-a-service models and material recovery systems along with remanufacturing methods to decrease their environmental impact [1]. Business entities operating in the food and beverage industry use biodegradable packaging and closed-loop production methods to reduce waste production and maximize their resource efficiency [2]. The analysed case studies deliver crucial information regarding how circular business models are applied in real-world settings as well as their prospects for growth.

The research paper evaluates global business leadership strategies for implementing circular economy principles through waste-to-value resource transformation. A case study research design allowed the paper to analyse effective circular business strategies while exploring their implementation challenges and strategic effects on different industries. The evaluation of practical applications in this study generated strategic recommendations for companies and stakeholders involved in sustainability efforts in worldwide supply chains. The research findings guide organizations toward establishing circular economy models by helping them change from wasteful linear systems to sustainable economic systems.

2. Background and Literature Review

Circular Economy (CE) is a systems-oriented approach to economic growth that seeks to eliminate waste, products and materials in circulation, and regenerate nature. In contrast to the linear 'take-make-dispose', CE targets restorative and regenerative design. Mainstreaming of the CE idea has been facilitated by the Ellen MacArthur Foundation (2021) [4], which emphasizes its capacity to disconnect growth from the consumption of finite resources.

CE supports SDG 12 (Responsible Consumption and Production) to facilitate sustainable industrialization and green innovation. By enhancing the effective use of resources, preventing waste, and promoting sustainable production techniques, CE directly contributes to achieving goals under SDG 12 such as preventing food loss and waste (Target 12.3), obtaining sustainable consumption and production patterns for natural resources (Target 12.2), and promoting sustainable lifestyles and adequate information on sustainability in reporting (Target 12.6).

In addition, CE models promote innovation in green technologies, sustainable product design, and lifecycle thinking, which are essential for the transformation to low-carbon and inclusive economic systems. Incorporating CE into national and corporate agendas also increases transparency, traceability, and accountability throughout global value chains, and as such is a critical enabler for realizing the broader United Nations 2030 Agenda [5].

Although CE provides a promising approach, its application is constrained by multi-sectoral policies, the absence of universal standards, and diverse interests from stakeholders [5]. In the same vein, the applicability of CE models in developing markets, especially through decentralized recycling and local innovation [6]. CE has a beneficial effect on innovation, competitiveness, and climate resilience [7]. Nevertheless, a critique that CE has to be inclusive, systemic, and wary of greenwashing has also been recognised [1].

Global business leaders such as Philips and Renault have led the way in product-as-a-service offerings and remanufacturing operations, with CE success on a scalable level. While digital technologies like Artificial Intelligence (AI), Internet of Things (IoT), and blockchain have emerged as enablers for CE transformation through enhancing traceability, material tracking, and minimization of waste [8].

For the services sector, Software as a Service (SaaS) solution such as Salesforce and Microsoft Azure are good examples of digital circularity in the form of cloud-based software that minimizes hardware reliance and maximizes operational longevity. Therefore, CE is more applicable not just in manufacturing but also in digital platforms.

The business world supports a rising adoption of circular economy concepts because they make resources more efficient and lower environmental impacts and extend sustainability. A 'take-make-dispose' linear economic approach led to vast resource depletion together with increasing amounts of waste. The circular economy system operates as a sustainable solution because it focuses on maximizing resource usage while minimizing waste output and creating looped production systems [4].

Major global businesses use circular economy principles to develop innovative sustainable business operations. The global corporations IKEA, Tesla, Unilever, Adidas, Nike, BMW, Nestlé, Apple, HP, and H&M have launched initiatives that focus on product life cycle extension alongside recycled materials implementations and closed-loop supply chain development. The furniture manufacturer IKEA seeks 100% circular by 2030 through its production of sustainable materials and complete packaging plastic removal [5]. Tesla established a circular battery recycling system that allows the company to retrieve lithium, cobalt, and nickel materials from used batteries thus minimizing the need for fresh raw materials extraction [6].

Unilever has committed to utilizing 100% recyclable, reusable or compostable plastic packaging for all its fast-moving consumer goods (FMCG) sector by 2025. The companies Adidas and Nike push forward with circular product designs through their efforts which include FUTURECRAFT.LOOP and Nike's Move to Zero initiative both centered on designing recyclable waste reduction products [7] [8]. Apple stands as an industry leader in sustainable manufacturing since it implements recycled materials into its automotive and consumer electronics supply chains [9].

This research evaluated the circular economy approaches implemented by major organizations to find opportunities that drive sustainable business system improvements.

3. Emerging Trends in Circular Economy Practices

The ecosystem of the circular economy (CE) is quickly expanding to new areas that are no longer related to its conventional focus areas and is showing significant ascendance in the spheres of digital inclusion, altering consumer expectations, and the rising impact of startups and small and medium enterprises (SMEs).

One of them is the achievement of CE principles in digital platforms and services. Advances such as Artificial Intelligence (AI), the Internet of Things (IoT), and blockchain are currently able to facilitate resources tracking, supply management, as well as traceability of materials. Cloud applications like Salesforce and Microsoft Azure software-as-a-service (SaaS) are the embodiment of digital circularity because they consume very little hardware and avoid electronic waste [8]. The blockchain promotes traceability to raw material procurement and a circle-based procurement system [9].

The shift in the consumer behaviour towards sustainable and circular products is also possible, especially by the younger generations. A rising demand can be noted toward the used items, repaired and refurbished electronics, and waste-free packaging [2]. Not only sustainable products are now demanded by a number of consumers, but also products associated with tools that encourage socially responsible consumption and recycling (mobile applications, trackers of particular products, etc.) [1]. Still, the obstacles such as unclear labeling, the lack of availability, and low prices continue to impede mass adoption [6].

At the same time, new business enterprises and SMEs are the central element of CE innovation. At times, these companies develop circular systems from ground up using eco-design and local material loops. In various industries such as fashion, food, construction SMEs promote circularity by implementing decentralized systems and digital technology [2]. Supportive policies and green financing plans are also helping the SMEs to adhere with SDG 12 and extend innovations [5].

Overall, these trends show that, as a whole, CE becomes more technology-driven, consumer-responsive, and innovation-led model, changing production and consumption in almost every industry.

4. Case Study Analysis

4.1 IKEA: Circular Economy in Retail & Furniture

The company IKEA is committed to building a fully circular and climate-positive business model which should be operational by 2030. Ikea uses circular economy principles in each stage of product design procurement and operational processes to support reuse, recycling and refurbishment. The Circular Product Design Guide enables PAX wardrobes and GUNNÖN gazebos to be easily reassemble and disassemble. The DÄNHULT sofa with no foam and bio-based adhesive materials serve to decrease dependence on fossil fuels. IKEA dedicated itself to eliminate all plastic packaging by 2028. IKEA incorporates recycled components at 50% of fibreboard uses and 70% of plastic materials during their European manufacturing process. IKEA's combined climate footprint reduced by 12% from FY22 and 22% from FY16 to 24.1 million tonnes CO₂e in FY23. IKEA's SILVERSIDA

range of products now contains 65–70% ceramic factory waste. It started to utilise more than 50% recycled wood in fibreboard and produced bio-based glue, accounting for 5% of overall emissions. IKEA rolled out an international wood supply map, improving material traceability. It implements the Buyback & Resell program along with IKEA Preowned Marketplace to allow product reuse and TRIXIG repair kits enable customers to maintain their products. Nine production units under IKEA operate without landfill waste as the company works toward 100% circularity in store operations and packaging through renewable energy adoption by 2025.

4.2 Tesla: Circular Economy in the Automotive Industry

Tesla practices circular economy with designs for the product's life, waste minimization, and material reuse. It's designed to use its vehicle batteries for over 200,000 miles with 85% capacity, cutting down on material demand. Gigafactory Texas is where Tesla has a closed loop battery recycling system where lithium, cobalt and nickel are recovered for reuse. Giga casting improves material efficiency, and Gigafactory Shanghai recycles 94 percent of total waste. All of Tesla's Supercharger network runs on renewable energy, and aluminium scrap from vehicle production is used to make new castings. Suppliers are tracked and greenhouse carbon footprints are reduced by the company, and investment by the company in AI driven waste sorting extends to improve recycling. However, most of progress remains to be seen in amplifying recycling of batteries and regulatory compliance. Tesla's proprietary closed-loop battery recycling process yields back 92% of critical materials, such as lithium, cobalt, and nickel. Gigafactory Shanghai now has 94% recycling of total waste, and Gigafactory Berlin-Brandenburg is designed with climate-resilient infrastructure. More than 35% of scrap aluminium can be recycled in casting new parts.

4.3 Unilever: Circular Economy in FMCG

Unilever implements circular economy approaches across all its packaging operations, supply chain management and manufacturing practices. Unilever continues to raise the post-consumer recycled plastic (PCR) content in its products from 18% in 2021 to 22% in 2023 which leads to a decrease in virgin plastic utilization with the help of its "Less Plastic, Better Plastic, No Plastic" strategy". As part of its efforts the company actively supports Extended Producer Responsibility (EPR) schemes while co-leading the Circle Alliance for circular packaging development. Unilever aims for 100% recyclable, compostable or reusable plastic packing by 2025 utilising piloting reuse and refill models with the Ellen MacArthur Foundation. Unilever decreased Scope 1 and 2 emissions by 74% since 2015 and has a target of reducing Scope 3 emissions by 42% by 2030. With the Circle Alliance and revised Climate Transition Action Plan, Unilever integrates greenhouse gas targets into the financial plans of its 5 business groups. The business is converting to other aerosol propellants and climate-friendly ice cream cases with renewable energy. The company integrates recycled materials into its supply chain networks and supports the practice of regenerative agriculture. The main challenges to overcome consist of expanding sustainable material utilization while following global recycling standards.

4.4 Adidas: Circular Fashion & Footwear

The company implements circular economy strategies through its commitment to transform into 100% recycled polyester production by 2024 while building products for endless recycling potential. The

FUTURECRAFT.LOOP running shoe uses single material to create a product that can be completely recycled. Adidas collaborate with Allbirds to develop the FUTURECRAFT.FOOTPRINT running shoe which represents low-carbon footwear products. The implementation of circular economy principles in its value chain along with employee participation allows Adidas to advance sustainable systemic measures. Industrial circularity presents a difficult task despite recent innovation in the field.

4.5 Nike: Sportswear Circularity Innovations

Nike operates through "Move to Zero" initiative to achieve two significant sustainability goals which involve eliminating waste and carbon emissions from operations. Nike Grind program transforms rubber along with foam, fiber and textile waste from post-consumer products and manufacturing into new footwear items and sporting surfaces and apparel. Nike diverted 100% of waste from landfills in Tier 1 manufacturing and achieved a 69% GHG reduction in its owned facilities since 2020. Nike implements its Circular Design Guide to make products last longer and promote recycling and the Recycling + Donation and Refurbished programs help extend product lifespan. The Flyknit technology reduces production waste by 60% by minimizing material waste. A significant barrier remains to scale up recycling facilities while encouraging people to accept circular product use.

4.6 BMW: Circularity in the Automotive Sector

The BMW organization puts circularity at the forefront through resource efficiency improvements while minimizing its dependence on primary raw materials. The company seeks to decrease carbon dioxide emissions by 40% per vehicle throughout its life cycle by 2030. The company partners for battery recycling through which they recover cobalt, nickel, and lithium and plan future expansion of these programs in North America. The BMW i Vision Circular concept car demonstrates complete recyclability through materials that rely on bio-based substances and secondary elements. BMW maintains ongoing manufacturing enhancements for material recovery while decreasing waste production as the leading company in automotive circular transition benchmarking.

4.7 Nestlé: Sustainable Packaging & Food Waste Reduction

Nestlé implements circular economy fundamentals by taking measures to make packaging sustainable and reduce waste while seeking material reuse possibilities. The company established 83.5% recyclable packaging in its operations while striving to reach 95% by 2025. The company has reduced its virgin plastic consumption by 14.9% since 2018 while working intensively to establish a Global Plastics Treaty which will enhance circularity regulations. Nestlé collaborates with the Ellen MacArthur Foundation to develop and expand reuse and refill packaging solutions across their operations. The company recycles agricultural byproducts to create biofuel while simultaneously cutting down on food waste quantities. The company supports regenerative agriculture through its 15.2% sustainable farming supply while aiming to reach 50% by 2030. The main obstacles stem from the need to match worldwide regulatory standards while building up recycling facilities worldwide.

4.8 Apple: Circular Economy in Consumer Electronics

The circular economy design of Apple relies on material recycling together with extended products lifespan and supply chain recycling systems. The Apple 2030 strategy enabled the company to reduce environmental emissions by 55% since 2015. The number of recycled materials Apple utilizes reached 22% in 2023 while 100% of rare earth elements used in magnets came from recycled sources and tungsten materials reached a 99% recycled rate.

Apple's Trade-In and Recycling programs mostly supported the restoration of 12.8 million devices in 2023. Moreover, the company uses robotic systems namely Daisy and Taz to extract important substances like gold and cobalt from devices. Through its 2025 goal Apple plans to implement total fiber packaging solutions while moving product shipping primarily to ocean freight for environmental purposes. There are ongoing obstacles to raise recycling participation from consumers while expanding material recovery technology deployment.

4.9 HP: IT Industry Circularity Practices

HP adopts circular economy principles through lifecycle extensions of its products with enhanced material reuse and lowered electronic waste amounts. During the last three years the TRC facilities of HP processed 9.5 million IT assets while refurbishing 86% of servers and 94% of PCs. The IT Asset Disposition (ITAD) program maintains responsible recycling together with HPs closed-loop manufacturing that uses recycled plastics from post-consumer materials to make new products. Since implementing circular supply chain approaches HP managed to reduce CO₂ emissions by 2.4 million kg while collecting a total of 39,988 kg of waste. The implementation of artificial intelligence technology increases the operational effectiveness of recycling processes. Multiple obstacles prevent further development of the recycling infrastructure along with consumer participation in product recovery systems.

4.10 H&M Group: Circularity in Fast Fashion

The circular economy strategies of H&M Group consist of durable product development along with new business systems and textile waste recycling. The Circulator tool within the company helps teams develop sustainable products that last longer and maintain reusability and recyclability. Recycled down and feathers will become 100% of H&M's supply by 2025 while the company has already achieved 90% recycling. H&M Group invests funds into rental services together with resale platforms and repair programs to extend product existence. The H&M garment collection program began in 2013 to facilitate textile recycling through its donation-based insulation material production. The recycling infrastructure challenges have not stopped H&M from continuing its innovation in circular fashion models and superior material usage.

5. Research Methodology

A case study approach was used to study circular economy practices in leading companies globally. Secondary data in the research were collected from official sustainability reports, company websites and utilized company press releases and industry publications. The methodology produced detailed assessments about how each corporation operates within the circular economy framework to disclose their individual business strategies and forthcoming plans along with identified challenges.

The proposed study aims at conducting a qualitative multiple case study to examine how major corporations in the world with diverse industries are integrating their circular economy (CE) strategies. The use of a case study approach is especially appropriate to study the practices that are complex, such as circularity initiatives, and require in-depth contextual knowledge [16].

5.1 Research Design

The study conducted an exploratory multiple-case study approach which ensured circular economy practices and comparison among different industry. This research adopted companies from retail, automotive, FMCG, fashion, IT, and electronics segments to detect commonalities and differences in circular strategies.

Exploratory multiple-case study design was chosen to allow comparative experience in dealing with different industrial sectors. This methodology delivers the possibility to define both the trends within the sector and common trends in CE practices. Cases belong to a variety of industries, such as retail (IKEA), automotive (Tesla, BMW), FMCG (Unilever, Nestle), electronics (Apple, HP), fashion (Adidas, Nike, H&M) and information technology services. This heterogeneity enables there to be representativeness and also guarantee that the results do not limit the experience to one industry, hence promoting generalizability of conceptual insights [17].

5.2 Case Selection Criteria

The companies underwent selection through these essential criteria:

1. Global leadership position within their industries stands as one of the selection criteria.
2. Circular Economy Commitment – Firms with well-documented circular economy strategies and measurable sustainability goals.
3. The companies which provide transparency through sustainability reports also reveal their circular economy initiative progress.
4. The evaluation includes organizations from different business sectors to understand circular economy implementation across diverse business models.

IKEA, Tesla, Unilever, Adidas, Nike, BMW, Nestlé, Apple, HP and H&M were the final selection of companies that provided diverse insights into circular economy adoption.

5.3 Data Collection

Multiple secondary sources provided the data for this study to ensure both reliability and comprehensive analysis in circular economy practices. Sustainability Reports of various companies during the years 2023 to 2025 functioned as the main data sources for understanding their circularity strategies. The evaluation of latest sustainable business practices alongside policy updates and partnership initiatives relied on official corporate websites and press releases. Review of Environmental Social Governance (ESG) reports allowed to evaluate the company(s) achievements regarding circular economy aspects like resource utilization efficiency, waste minimization and sustainable supply chain management.

6. Comparative Analysis of Circular Economy Practices

Table 1. Circular Economy Strategies

Company	Industry	Key Circular Initiatives	Challenges	Future Goals
IKEA	Furniture & Retail	Circular product design, Buyback & Resell, Renewable energy	Scaling recycled material use	100% circularity by 2030
Tesla	Automotive	Battery recycling, Renewable energy, Sustainable supply chain	Regulatory barriers, Scaling take-back programs	Expand closed-loop battery systems
Unilever	FMCG	Sustainable packaging, EPR, Reuse & refill models	Plastic recycling infrastructure	100% reusable/recyclable packaging by 2025
Adidas	Fashion & Footwear	FUTURECRAFT.LOOP, Recycled polyester, Sustainable collaborations	Scaling recycling infrastructure	Fully circular product lines
Nike	Sportswear	Move to Zero, Nike Grind, Circular design guide	Consumer adoption	Zero waste & carbon neutrality
BMW	Automotive	Battery circularity, Sustainable materials, Low-carbon manufacturing	Expanding closed-loop materials	Reduce CO ₂ per vehicle by 40% by 2030
Nestlé	Food & Beverage	Plastic reduction, Food waste repurposing, Regenerative agriculture	Regulatory alignment, Supply chain transformation	50% regenerative ingredient sourcing by 2030
Apple	Consumer Electronics	Trade-in programs, Robotic recycling, Renewable supply chain	Consumer participation, Tech waste management	Carbon neutrality by 2030
HP	IT & Electronics	ITAD, Closed-loop plastics, AI-driven waste sorting	Scaling digital tracking, Consumer recycling	Increased e-waste recovery
H&M	Fashion	Resale & rental, Garment recycling, Circular materials	Textile recycling infrastructure	100% circular design

7. Discussion and Key Findings

The research outcomes from case studies demonstrate major circular economy methods used by business leaders. Leading global firms put product life cycle extension as their main focus according to observations of companies such as IKEA and Apple. Organizations put their efforts into designing products that have long lifespans, repairability and recycling capabilities to prevent waste while maximizing product duration. The business strategy of closed-loop recycling with material reuse stands as a critical approach and Tesla BMW and HP lead the way. The manufacturing systems operated by these firms utilize closed-loop procedures to extract valuable materials such as lithium along with cobalt and plastics which they can reintroduce into their production processes. Zero-waste initiatives and waste minimization programs have become prominent in the market as Unilever and Nestlé implement this approach in their operations.

The circular economy initiatives heavily depend upon sustainable supply chain management as one of its essential elements. The brands Adidas and Nike focus on sustainable resources, moral supply systems and circular resource movement through their adoption of recycled fabrics and minimized usage of fresh raw materials. The engagement levels of consumers and circular business strategies have increased in importance as H&M and Adidas implement

both buy-back initiatives and resale services and rentals for circular economy participation. The favourable industry advances have not stopped companies from dealing with regulatory and market-related issues. The accomplishment of regulatory compliance and consumer acceptance of recycled goods and the high financial investment needed for circularity execution create substantial barriers. Progress has been achieved but the essential challenge lies in achieving worldwide circular initiative expansion and resolving infrastructure impediments.

8. Policy and Business Implications

The study yielded essential implications that guided both governmental authorities and business organizations. Governments bear an essential responsibility to promote circular economy principles as part of their policy activities. Extended producer responsibility (EPR) requires powerful regulators to enforce it while sustainable manufacturing requires suitable motivation programs. The establishment of a recycling facility demands investment and essential public-private collaboration to build advanced facilities and circular supply systems. Businesses should join forces with governmental entities to run public education efforts that explain sustainable purchase practices and circular product advantages to consumers. The creation of a worldwide benchmarking standard depends on establishing standardized metrics for circular economy which will enable effective metrics comparison across different industrial sectors.

Companies need to embed circularity principles into their fundamental business strategies. Businesses need to integrate sustainability with resource efficiency as core elements of their extended business models to achieve enduring effects. The advancement of circular economy initiatives heavily relies on technology and innovation. Companies can promote circular economics through financial investments that support AI waste sorting systems and state-of-the-art recycling methods and bio-based product development. The development of shared circular solutions requires firms to establish partnerships between different industries through which they can create joint recycling initiatives and innovative materials. To achieve market-wide circular product adoption consumers need an approach that focuses on them while scalable resale combined with refurbishment as well as rental systems serve as essential drivers for their engagement.

9. Conclusion, Limitations & Recommendations

Circular economy (CE) is a radical approach to sustainability development, as it can redesign the functioning of resources schemes based on their use, re-use, and regeneration along the value chain. It is consistent with the philosophy of decoupling the economy and the degradation of nature and long-term resource resilience [9]. The scalability opportunity of CE is vast knowing that the principles can be enabled in any sector, geographical location and business size with just large corporations, SMEs and local supply chains contributing to better sustainability outcomes globally.

Multiple secondary sources provided the data for this study to ensure both depth and dependability in circular economy practice evaluation. Reports of various companies during the years 2023 to 2025 functioned as the main data sources for understanding their circularity strategies. The evaluation of latest sustainable business practices alongside policy updates and partnership initiatives relied on official corporate websites and press releases. The evaluation of Environmental Social Governance (ESG) reports allowed to understand the company(s)

performances in circular economy aspects such as resource efficiency, waste reduction and sustainable supply chain management.

This research has some limitations. First, it is built mainly on secondary data gathered from publicly released reports, news releases, and company websites that can generate a one-sided or optimistic view of circular economy success. Second, while the use of a multiple-case study design is valuable for gaining knowledge of industry-specific behaviours, it restricts generalizability of results beyond the larger business community. In addition, the study fails to include consumer or worker viewpoints, which may provide additional insight into circular economy acceptance, behaviour, and internal cultural congruence with circular economy objectives. Finally, the cross-sectional nature of the data eliminates the possibility of understanding long-term effects or changes over time. Future research should focus on mixed-method approach, such as interviews and questionnaires, and utilize longitudinal frameworks to more effectively convey the development and success of circular economy measures.

The research generated multiple essential recommendations. Governments, consumers, and companies must collaborate in effective partnerships to drive circular economy plans across the world. Extended Producer Responsibility (EPR) must be enforced, there must be financial incentives to support green innovation, and there must be investment in national recycling and reprocessing facilities. Standard and circular economy metrics need to be harmonized worldwide. Companies need to integrate CE into their strategic models through the uptake of Product-as-a-Service (PaaS), refurbishment and resale models, and incorporation of CE-related KPIs into performance assessments. Business operations need to implement extended circular business models and focus on material innovation to ensure sustainable operations. Companies should also adopt digital technologies like Artificial Intelligence (AI), Internet of Things (IoT), and blockchain to enhance transparency, maximize resources, and improve supply chain efficiency. Consumer participation should be stepped up by way of awareness campaigns, transparent labeling systems, and reward-based recycling drives to encourage active association with reuse, resale, and repair programs. Finally, multi-stakeholder collaboration should be stepped up to drive shared CE innovations, encourage R&D in circular materials, and create industrial clusters that enable regional circular ecosystems. To favour circular approaches, business organizations ought to continue to be engaged in active policy advocacy that challenges governments to enact enabling regulations and create customized incentives.

These suggestions offer a road map to make adoption of circular economy more ubiquitous, effective, and enduring in the presence of increasing international sustainability issues.

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