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Circular Supply Chain Management in Developing Countries: Challenges, Opportunities and Pathways to Sustainability

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Abstract: This paper offers a comprehensive exploration of circular supply chain management (CSCM) in the context of developing countries, unveiling a multifaceted landscape of challenges, opportunities, strategies and future prospects. Challenges facing these nations in embracing CSCM include a lack of waste infrastructure, limited awareness and education, financial constraints, a shortage of technical expertise, barriers to accessing global markets, and a dearth of data and information. These challenges underscore the need for tailored, context-specific solutions to establish a robust foundation for CSCM. The study looks ahead and predicts that soon there will be more circular business models, less waste management and more resource optimization, more local circular ecosystems, and more streamlined circular supply chains. Technological advancements, such as blockchain, the Internet of Things (IoT) and data analytics, are poised to revolutionize CSCM. Increased global awareness of environmental issues and sustainability will be a driving force for change, with academia, businesses, and governments playing pivotal roles in shaping this future. This paper emphasizes the pivotal role of CSCM in advancing sustainable development, both in developing countries and globally. It underscores the critical importance of a steadfast commitment to sustainability, circularity, and responsible resource management for the future of these nations and the entire planet.

Keywords: *Circular Supply Chain Management (CSCM), Developing Countries, Waste Infrastructure, Sustainability, Circular Business Models*.

1. Introduction

The circular economy concept represents a departure from the traditional linear "take-make-dispose" model of production and consumption. It seeks to redefine economic growth by prioritizing resource efficiency, minimizing waste, and promoting materials' continual use and regeneration (Ogunmakinde, Egbelakin, & Sher, 2022). This approach aligns closely with sustainability goals, aiming to decouple economic growth from resource depletion and environmental degradation. In a circular economy, products and materials are designed to be used, repaired, remanufactured, and eventually recycled, creating a closed-loop system that reduces the need for virgin resources and minimizes the generation of waste (Kara et al., 2022; Mishra et al., 2023) This approach not only reduces the environmental impact of production and consumption but also presents economic opportunities through innovation, job creation, and reduced reliance on raw materials (Maiurova et al., 2022; Kurniawan et al., 2022). Circular Supply Chain Management (CSCM) stands as a pivotal strategy in the pursuit of achieving the Sustainable Development Goals (SDGs) and addressing the pressing environmental challenges that confront societies worldwide (Luthra et al., 2022). The concept of CSCM, deeply rooted in circular economy principles, resonates profoundly with the objectives outlined by the United Nations' SDGs.

These goals encompass a comprehensive framework for sustainable development that includes environmental protection, economic growth, and social well-being. CSCM aligns directly with several of these goals, notably SDG 12 (responsible consumption and production), SDG 8 (decent work and economic growth), and SDG 9 (industry, innovation, and infrastructure). By prioritizing resource efficiency, waste reduction, and sustainable practices throughout the supply chain, CSCM contributes to attaining these pivotal global objectives. A primary focal point is SDG 12, which underscores the importance of responsible consumption and production patterns. CSCM champions the creation of products designed for longevity, repairability, and recyclability, thereby curtailing the rampant cycle of waste accumulation associated with linear production models. This shift towards circularity not only decreases the environmental burden imposed by excessive waste but also ensures a more sustainable utilization of finite resources. CSCM emphasizes the transformation of product design, manufacturing, and consumption practices, thereby reducing the strain on ecosystems and promoting more sustainable use of materials (Nayal et al., 2022).

Moreover, the connection between CSCM and SDG 8, concerning decent work and economic growth, is noteworthy. Developing economies often grapple with limited job opportunities and sustainable economic avenues (Toker & Görener, 2023). CSCM introduces avenues for employment generation, particularly in the repair, refurbishment, and recycling sectors. These economic opportunities not only bolster local economies but also foster a more inclusive form of economic growth that aligns with the principles of sustainable development (Bai & Li, 2023). Furthermore, CSCM resonates with the essence of SDG 9, focusing on industry, innovation, and infrastructure. By encouraging the redesign of products for circularity, CSCM stimulates innovation across sectors, leading to the creation of novel business models, technologies, and practices that reduce waste and conserve resources (Ghosh, Bhola, & Sivarajah, 2022). This transition to circular practices fosters the growth of sustainable industries and advances technological innovation, which is paramount for both economic progress and environmental protection. In essence, the significance of CSCM in addressing environmental challenges is profound (Tseng et al., 2023). It directly mitigates waste generation, conserves resources, contributes to climate change mitigation, and promotes biodiversity conservation (Aithal & Aithal, 2023). The transformative potential of CSCM is poised to shape more sustainable consumption and production patterns, aligning with the broader objectives of the circular economy (Bocken, Niessen, & Short, 2022).

The core purpose of this paper is to undertake a comprehensive exploration of the landscape of CSCM within the specific context of developing countries. By delving into the status, challenges, and potential pathways for implementing CSCM, this paper aims to provide a holistic understanding of the intricate interplay between circular economy principles and the unique dynamics characterizing developing economies. By unravelling the complexities inherent in reshaping supply chains into circular paradigms, the paper endeavors to unravel how developing countries can harness the principles of CSCM to simultaneously drive sustainable economic growth and address environmental imperatives. Furthermore, by identifying the specific hurdles encountered in these contexts, the study aspires to contribute to the development of tailored strategies that can navigate the challenges posed by limited resources, cultural factors, and infrastructural constraints. In essence, this paper endeavors to go beyond theoretical discourse by offering a practical roadmap that can guide policymakers, businesses, and stakeholders in developing countries toward effective CSCM adoption. By unravelling the intricate web of challenges and opportunities, this research seeks to facilitate a comprehensive dialogue on the role of CSCM in steering developing countries towards sustainable development trajectories, underscoring its significance in achieving the dual objectives of economic advancement and environmental preservation.

2. Challenges in Circular Supply Chain Management in Developing Countries

CSCM practices in developing countries present a unique set of challenges that stem from a combination of resource constraints, infrastructural limitations, socio-economic factors, and cultural considerations. These challenges, while intricate and multifaceted, underscore the need for tailored strategies to effectively transition to circular economies.

Limited Waste Infrastructure: The absence of robust waste management infrastructure undermines the fundamental principles of circularity by impeding the smooth flow of materials through the supply chain (Ding, Wang, & Zou, 2023). Inadequate waste collection systems result in the improper disposal of potentially recyclable materials, contributing to environmental degradation and resource depletion. Without the capacity to effectively separate, recover, and process recyclable materials, developing countries are unable to capitalize on the inherent value of these resources (Tseng et al., 2023). This challenge is particularly pronounced in the context of the circular economy, where the efficient retrieval and reintroduction of materials into the production cycle are paramount. A well-functioning circular system hinges on the ability to reclaim materials from end-of-life products, a process greatly hindered by the absence of proper waste infrastructure (Venkatachalam et al., 2022). Addressing this challenge demands a multifaceted approach involving policy interventions, investment in waste management technologies, and community engagement. Governments must prioritize the development of waste management policies that encourage recycling and incentivize responsible disposal practices. Simultaneously, targeted investments in waste collection, sorting, and recycling technologies are crucial to establishing the necessary infrastructure for effective CSCM (Sopha, Purnamasari, & Ma'mun, 2022).

Lack of Awareness and Education: Promoting circular consumption patterns through effective awareness and education campaigns stands as a pivotal challenge in the context of developing countries (Sarker, Ghosh, & Islam, 2022). Thus, encouraging a shift in consumer behavior and attitudes toward circularity presents multifaceted obstacles that underscore the importance of tailored educational initiatives (Lopes, Gomes, & Trancoso, 2023). Developing countries often contend with deeply entrenched consumption patterns that prioritize disposability and novelty. Convincing consumers to adopt more sustainable practices, such as reusing and recycling products, necessitates a comprehensive understanding of local contexts and preferences (Suphasomboon & Vassanadumrongdee, 2023). This challenge is particularly pertinent due to the diverse socio-cultural dynamics prevalent in these regions. Raising awareness about the benefits of circular consumption emerges as a critical strategy to catalyze behavioral change. In the absence of such awareness, the inherent advantages of circular practices, including reduced resource consumption and environmental impact, remain elusive to consumers (Ncube, et al., 2023).

Targeted educational campaigns are instrumental in conveying these benefits to local communities and resonating with their values and aspirations. The effectiveness of awareness campaigns lies in their ability to connect with consumers on a personal level. Tailored messaging, culturally sensitive communication, and relatable examples can bridge the gap between theoretical concepts and actionable behaviors (Duong & Hopfer, 2023). For instance, a campaign that emphasizes how circular consumption can contribute to local employment and community development might be more compelling in certain contexts. Successfully navigating this challenge requires collaboration between governments, civil society organizations, and businesses. Government-led initiatives can drive policy changes that support circular practices, while businesses can play a pivotal role by incorporating circular principles into their branding and marketing strategies (Danvers, Robertson, & Zutshi, 2023). Collaborative efforts can also leverage local influencers and community leaders to enhance the credibility and resonance of awareness campaigns.

Financial Constraints: Developing countries, grappling with economic challenges, often find it difficult to allocate the required funding for the implementation and scaling of CSCM practices (Dulia, Ali, Garshasbi, & Kabir, 2021). The need to revamp supply chain processes, adopt innovative technologies, and train personnel to operate within circular systems demands a level of investment that may exceed available budgets (Trevisan et al., 2023). This financial obstacle obstructs the potential benefits that CSCM can bring, such as reduced resource consumption and enhanced economic resilience. Addressing financial constraints requires a multi-pronged approach that involves collaboration between stakeholders. International organizations, governments, and private sector entities can play crucial roles in providing financial support, technical expertise, and capacity-building initiatives. Such collaborations can mitigate the burden of financial constraints and accelerate the transition towards CSCM. Moreover, the potential economic gains from adopting circular practices, such as job creation in the repair and recycling sectors, underscore the notion that the initial investments can yield long-term economic benefits (Molla et al., 2022). While financial limitations present challenges, they also emphasize the importance of strategic planning and prioritization. Developing countries must strategically allocate available resources, focusing on initiatives that offer the highest potential for impact. This strategic approach can help overcome financial hurdles by optimizing resource utilization and targeting areas that align with broader sustainability and economic development objectives.

Technical Expertise Gap: To effectively design, manage, and optimize circular supply chains, a deep understanding of processes related to material recovery, refurbishment, and remanufacturing is indispensable (Amir et al., 2023; Chen, Feng, & Soto, 2022). However, in many developing countries, the necessary technical expertise is often limited or absent. This knowledge gap can obstruct efforts to transition from linear to circular models, as the lack of expertise affects both strategic decision-making and practical implementation (Shang, Saeidi, & Goh, 2022). Developing countries can leverage international partnerships to access expertise from countries with advanced circular economies, enabling knowledge transfer and capacity-building. Furthermore, local innovation and entrepreneurship can emerge as solutions to bridge the technical expertise gap (Leckel, Veilleux, & Dana, 2020). Communities often innovate out of necessity, leading to the development of localized circular solutions that cater to specific challenges and contexts (Suchek et al., 2021; Brown, Bocken, & Balkenende, 2019). Support for grassroots initiatives and start-ups can catalyze the development of local expertise, fostering a self-sustaining ecosystem of circular practitioners. While overcoming the technical expertise gap is undoubtedly challenging, the potential benefits are vast. Equipping developing countries with

the knowledge and skills needed for efficient CSCM practices can lead to increased resource efficiency, reduced environmental impact, and enhanced economic resilience (Ozkan-Ozen, Kazancoglu, & Mangla, 2020).

Access to Markets: Quality standards and product certification are critical components of international trade. Circular products must adhere to stringent quality benchmarks to gain acceptance in global markets (Wang, Burke, & Zhang, 2022). Developing countries, often in the early stages of embracing circular practices, may struggle to meet these standards, hindering their ability to participate in international trade networks. Trade barriers further exacerbate the challenge. Tariffs, quotas, and regulatory requirements can create obstacles that disproportionately affect developing countries seeking to export circular products (Holtman, Aguiar, & Devadoss, 2022). The intricate web of trade regulations can impede the smooth flow of goods, making it difficult for these countries to capitalize on their circular initiatives. To address this challenge, developing countries require a multi-pronged approach. Collaborative efforts between governments, businesses, and international organizations are essential to advocate for fair trade policies that consider the unique circumstances of circular economies. Moreover, investing in capacity-building programs to enhance product quality and certification processes is crucial to bridge the gap between local circular practices and global market requirements (Borrello et al., 2023). Strategies should also encompass the development of partnerships that facilitate access to markets (Armitage et al., 2020). Collaborative initiatives that involve international organizations, local enterprises, and trade associations can collectively advocate for streamlined trade processes, while also assisting developing countries in meeting quality standards and obtaining certifications.

Data and Information Gap: The data and information gap further complicates the formulation of evidence-based policies and strategies. Informed decision-making requires a reliable foundation of data that reflects the intricate dynamics of supply chains and their environmental impacts. The absence of such data can hinder the development of targeted interventions, potentially delaying progress toward circular practices (Awan, Sroufe, & Shahbaz, 2021). Addressing this challenge calls for concerted efforts to enhance data collection, management, and sharing mechanisms. Governments, in collaboration with international organizations, can invest in building data infrastructure that captures material flows and environmental impacts accurately (Bibri & Krogstie, 2020). Public-private partnerships can also play a pivotal role in promoting transparency and data sharing across supply chains. Moreover, capacity-building initiatives are crucial for empowering local stakeholders to collect and interpret data effectively. Workshops, training programs, and knowledge-sharing platforms can elevate the data literacy of individuals involved in supply chain management, enabling them to gather and leverage data for informed decision-making.

3. Opportunities and Initiatives

CSCM offers a range of promising opportunities and initiatives for developing countries to embrace sustainable practices, drive economic growth, and address pressing environmental challenges. By strategically leveraging these avenues, these nations can create a positive impact while aligning with the principles of the circular economy.

Policy and Regulatory Frameworks: In the realm of CSCM, robust policy and regulatory frameworks stand out as a fundamental strategy for developing countries aiming to transition to more sustainable and circular economies (Maguire & Robson, 2023). These frameworks offer a structured approach to reshaping supply chain practices, aligning business incentives with environmental objectives, and fostering a conducive environment for circularity. Key within these frameworks are Extended Producer Responsibility (EPR) programs, placing the responsibility on manufacturers to manage their products' entire lifecycle, from creation to disposal. EPR incentivizes producers to design products for easier recycling and disassembly, catalyzing circularity (Stumpf, Schöggl, & Baumgartner, 2021). This shift in economic incentives from linear to circular business models enhances resource efficiency and reduces waste generation. Additionally, policy mechanisms that provide incentives for circular practices hold significant potential. By offering tax benefits, subsidies, grants, and reduced import duties, developing countries encourage businesses to adopt sustainable supply chain approaches (Zhou, et al., 2024). These incentives alleviate financial burdens associated with circular processes, stimulating activities like recycling, remanufacturing, and refurbishment.

This approach not only drives economic growth but also contributes to waste reduction and resource conservation (Razzaq et al., 2021). Successful CSCM policies extend beyond isolated initiatives, integrating circular economy principles into national development strategies (Berardi & Brito, 2021). By infusing circularity into broader economic planning, governments drive a systemic shift towards sustainable practices. This involves crafting long-term roadmaps prioritizing circular design, resource efficiency, and waste reduction (Razzaq et al., 2021). Such integration attracts international investment, enhances domestic innovation, and positions developing countries as sustainability leaders. To conclude, policy and regulatory frameworks play a pivotal role in shaping the trajectory of CSCM in developing countries. Through the implementation of EPR programs, incentivizing circular practices, and integrating circular economy principles into national agendas, these frameworks provide the necessary structure for businesses, industries, and governments to collaboratively transition towards circular supply chains. This holistic approach fosters economic growth while mitigating environmental impacts, contributing to a more sustainable and resilient future.

Local Innovation: Local innovation serves as a dynamic catalyst for advancing CSCM practices in developing countries. By tapping into the creative potential of communities, these nations can reshape their approach to waste, unleashing inventive strategies for upcycling, repair, and community-based recycling. Upcycling, a prominent facet of local innovation, involves reimagining discarded materials as valuable resources (Reddy, et al., 2023). This approach gains traction in developing countries, where materials are repurposed to divert waste from landfills. Examples include fashion items made from reclaimed fabrics, furniture crafted from salvaged wood, and decorative pieces from discarded glass (Crini et al., 2020). Beyond prolonging material lifecycles, such practices also stimulate local economies by fostering markets for upcycled products. In tandem with upcycling, the repair ethos thrives as a sustainability pillar in CSCM. Developing countries champion repair cultures through initiatives like repair cafés and community workshops. Empowering individuals to mend items that would otherwise be discarded, these efforts extend to electronics, appliances, clothing, and accessories (Moalem & Mosgaard, 2021).

The outcomes include waste reduction, resource conservation, and the cultivation of valuable skills within communities, bolstering local economies and employment prospects. Community-based recycling initiatives further underscore the influence of local innovation. Navigating resource constraints, these solutions hinge on communal collaboration. By mobilizing communities to collect, sort, and process recyclable materials, these initiatives create virtuous cycles of conservation and engagement (Nolasco, et al., 2021). Local buy-back programs, waste separation incentives, and responsible disposal practices foster both environmental consciousness and a sense of ownership, addressing waste management challenges. In essence, local innovation drives the advancement of CSCM in developing countries. Through imaginative practices in upcycling, repair, and community-based recycling, these nations convert waste into valuable assets, nurturing sustainable habits and enriching communities. Celebrating and amplifying these innovative solutions chart a path toward more sustainable, circular economies that serve the well-being of people and the planet.

Collaborative Partnerships: Collaborative partnerships stand as a linchpin in advancing CSCM practices, particularly within the context of developing countries where the journey towards circular economies is fraught with unique challenges and opportunities. These partnerships represent a harmonious convergence of efforts from various stakeholders - governments, businesses, non-governmental organizations (Lv & Shang, 2023), and international entities - each bringing their distinct strengths and perspectives to the forefront, collectively steering the course toward sustainable and circular supply chains (Dagilienė, Varaniūtė, & Bruneckienė, 2021). In the realm of CSCM, the synergy between governments and businesses assumes paramount importance. Such collaborations play a pivotal role in sculpting the policy landscapes that underpin CSCM initiatives. Governments, as catalysts of change, can engineer an enabling environment by formulating regulations and incentives that stimulate circular practices (Kazancoglu, Sagnak, & Mangla, 2021). These endeavors often involve extensive dialogues with industry stakeholders, fostering cooperative policymaking that strikes a delicate balance between environmental responsibility and economic viability.

An illustrative example lies in governments mandating the use of recycled materials in products, thereby incentivizing businesses to embrace circular strategies while staying aligned with evolving sustainability standards (Iacovidou, Hahladakis, & Purnell, 2021). Furthermore, partnerships between non-governmental organizations and businesses bridge the divide between societal and commercial interests, rendering them crucial in the CSCM landscape. Such alliances engender initiatives that raise awareness about the merits of

circular consumption (Liu et al., 2020). Collaborative campaigns educate consumers on recycling practices, eco-friendly products, and the profound significance of supporting circular supply chains. Beyond cultivating sustainable behaviors, these alliances bolster the corporate reputation of businesses as socially responsible entities, nurturing positive relationships within communities and engendering a shared sense of responsibility. Moreover, international organizations serve as catalysts, amplifying the impact of CSCM initiatives through cross-border collaborations. These entities provide platforms that facilitate the exchange of knowledge, the dissemination of best practices, and the implementation of capacity-building programs.

Partnerships that span borders, often between developing countries and international organizations, result in collaborative projects aimed at tackling shared challenges like waste management and resource scarcity (Ul-Durar et al., 2023). These collaborations harness the collective expertise and resources of multiple nations, yielding solutions that transcend geographical boundaries and expedite the transition towards circular economies. Lastly, within the private sector, collaborations assume a pivotal role in driving the adoption of CSCM practices, fostering innovation, and elevating sustainability standards (Du, Bstieler, & Yalcinkaya, 2022). Businesses operating within the same industry often unite their forces to create closed-loop supply chains (Kazancoglu et al., 2022). In these partnerships, resources, expertise, and best practices are shared.

These alliances extend beyond mere competition, promoting advancements across the entire industry in areas like recycling, remanufacturing, and waste reduction (Holzer et al., 2022). By conferring competitive advantages and reducing operational costs, they collectively propel the sector towards circularity and responsible practices. Thus, collaborative partnerships, operating within the milieu of CSCM, represent indispensable agents of transformation for establishing sustainable and circular supply chains, especially in developing countries (Cerqueira-Streit et al., 2021). Through the amalgamation of efforts by governments, businesses, NGOs, and international organizations, these partnerships lay the foundational groundwork for a future marked by resilience, resource efficiency, and sustainability. By fostering cooperative policymaking, orchestrating awareness campaigns, facilitating cross-border cooperation, and forging industry alliances, they empower stakeholders to collectively steer the trajectory towards circular economies, ushering in a greener and more sustainable world (Kumar et al., 2023).

4. Strategies for Promoting Circular Supply Chain Management

In the context of developing countries, where resource constraints and waste management issues are often acute, promoting CSCM becomes especially crucial. To foster the adoption of CSCM in these regions, a multifaceted approach involving capacity building, incentives, education, policy recommendations, and international partnerships is essential. One of the first steps towards embracing CSCM in developing countries is to invest in capacity building. This involves training programs, knowledge sharing, and skill development to cultivate a local pool of experts (Ashok et al., 2021). By empowering individuals and organizations with the requisite knowledge and skills, countries can harness their internal capabilities to implement CSCM effectively (Ghana Urbanisation Think Tank, 2019). Capacity building extends beyond theoretical education; it encompasses hands-on training in areas such as material recovery, remanufacturing, and reverse logistics. These skills are vital for ensuring the efficient flow of materials within a circular economy. To catalyze the transition towards CSCM, it's essential to identify strategies for attracting investment in circular infrastructure. Developing countries often face financial limitations, which can hinder the adoption of circular practices (Mishra, Chiwenga, & Ali, 2021).

As a solution, incentives and financing mechanisms can be employed to incentivize businesses and investors to participate in the circular economy. Tax benefits, subsidies, grants, and reduced import duties for companies embracing sustainable supply chain approaches can reduce the financial burden. Additionally, innovative financing models, such as green bonds or impact investment, can mobilize funds specifically for circular infrastructure development. Promoting CSCM requires changing consumer behavior and fostering a culture of circular consumption (Farooque et al., 2019). Education and awareness campaigns are crucial to this endeavor. These campaigns need to resonate with local communities, highlighting the benefits of reusing, recycling, and reducing waste. The message should extend beyond environmental aspects to encompass economic and social advantages (Raza et al., 2021). By demonstrating that circular practices can create jobs, stimulate local economies, and conserve resources, education and awareness campaigns encourage consumers to make more

sustainable choices. Developing countries often face distinct challenges in implementing CSCM, and these challenges necessitate customized policy frameworks. One-size-fits-all policies may not be effective in regions with different socioeconomic, infrastructural, and cultural contexts (Esposito et al., 2021).

Tailoring policy recommendations to suit the unique needs of developing countries is essential. Governments should focus on regulations that drive the adoption of recycling and remanufacturing practices while considering local economic and industrial dynamics. They should also aim to foster innovation and provide incentives for businesses to design products with circularity in mind. International collaborations can significantly enhance the promotion of CSCM in developing countries. By leveraging international partnerships, nations can access expertise, resources, and best practices. Collaborations with governments, businesses, NGOs, and international organizations can facilitate knowledge-sharing and capacity-building programs. These partnerships can lead to joint projects that address common challenges, such as waste management and resource scarcity. The exchange of experiences and solutions can help accelerate the adoption of CSCM by drawing on the global community's collective knowledge and resources.

Future Outlook: There are several anticipated trends and developments that characterize the CSCM future outlook in developing nations. These nations are expected to witness a surge in circular business models, with companies increasingly embracing practices like remanufacturing and designing products for recyclability. This shift will not only reduce waste but also stimulate local economic growth by creating jobs and new markets. Furthermore, there will be a paradigm shift in how waste is perceived, with it being recognized as a valuable resource that can be repurposed, recycled, and upcycled, contributing to more sustainable economies. Local circular ecosystems, involving a diverse range of stakeholders, will flourish, optimizing material flows, reducing waste, and fostering innovation (Nogueira, Ashton, & Teixeira, 2019). Modern technology that improves the supply chain will lead to more environmentally friendly logistics. For example, real-time tracking and circular material flows will help cut down on pollution from transportation and waste. Technological advancements will be pivotal in shaping the future of CSCM. Blockchain technology will ensure transparency, traceability, and accountability in supply chains, enhancing consumer trust (Cao, et al., 2021). The Internet of Things (IoT) will provide real-time data on product conditions and locations, leading to more efficient supply chain monitoring and waste reduction (Bhutta & Ahmad, 2021). Artificial intelligence and data analytics will optimize processes and identify opportunities for further waste reduction (Benzidia, Makaoui, & Bentahar, 2021). Moreover, increasing global awareness of environmental issues and sustainability will drive change.

Consumers will demand eco-friendly products and transparent supply chains, compelling businesses to adopt circular practices. Global initiatives and agreements will exert pressure on governments and corporations to embrace circularity and reduce their environmental footprint. The roles of academia, businesses, and governments will be pivotal in shaping the future of CSCM. Educational institutions will prepare the workforce for CSCM by tailoring curricula to equip students with the knowledge and skills necessary for circular practices. They will also contribute to research and innovation, driving the development of new circular technologies and best practices. Due to consumer demands and the pursuit of increased profitability, businesses will remain at the forefront of this transformation. They will invest in research and development, engage in collaborations to optimize circular supply chains, and implement innovative technologies (Sehnem et al., 2019). Governments will create the regulatory framework for CSCM, fostering an environment where circular practices can thrive. Policies, incentives, and international cooperation will play crucial roles in enabling the transition towards more sustainable and circular supply chains in developing countries. In summation, the future of CSCM in developing nations holds immense promise, with evolving trends, technological advancements, and heightened global awareness driving the adoption of circular practices and academia, businesses, and governments collectively shaping a more sustainable future.

5. Conclusion and Recommendations

In this comprehensive exploration of CSCM in developing countries, we have uncovered a complex landscape characterized by challenges, opportunities, strategies, and a promising future. This conclusion recaps essential insights from the article, highlighting the crucial role of CSCM in advancing sustainable development in these regions. It also serves as a resounding call to action for stakeholders, including governments, businesses, academia, and international organizations, to continue fostering circular practices and collaborations. CSCM is

especially hard in developing countries because they do not have enough waste infrastructure, people are not educated or aware of the problems, they do not have enough money, they cannot get to markets easily, and they do not have enough data and information. All of these things make it harder for people to adopt circular practices. These barriers underscore the necessity for tailored solutions that consider local realities and provide a robust foundation for CSCM in these nations. Amid these challenges, some significant opportunities and initiatives offer hope for progress. Robust policy and regulatory frameworks, local innovation in upcycling and repair, collaborative partnerships between governments, businesses, NGOs, and international organizations, and the adoption of cutting-edge technologies all play pivotal roles in advancing CSCM.

These initiatives demonstrate that with concerted effort, it is possible to overcome barriers and pave the way toward the adoption of circular supply chains. To drive the adoption of CSCM in developing countries, stakeholders must implement a multifaceted strategy. Capacity building through knowledge sharing and training programs is essential to develop local expertise. Incentives and financing mechanisms should be devised to attract investments in circular infrastructure. Education and awareness campaigns are vital for changing consumer behavior and fostering a culture of circular consumption. Policymakers should tailor frameworks to meet the unique needs of developing countries, and international partnerships must be strengthened to access expertise and resources. Looking to the future, several trends and developments in CSCM for developing countries become apparent. These include the emergence of circular business models, a shift from waste management to resource utilization, the growth of local circular ecosystems, and the optimization of circular supply chains. Technological advancements, including blockchain, IoT, and data analytics, are set to revolutionize CSCM. Additionally, increasing global awareness of environmental issues and sustainability will drive change. Academia, businesses, and governments will play pivotal roles in shaping this future, fostering sustainability and environmental responsibility. The significance of CSCM for sustainable development in developing countries cannot be overstated.

Circular practices effectively address critical challenges like waste management, resource scarcity, and environmental degradation. They offer the potential to rejuvenate local economies, create jobs, and reduce the environmental footprint. CSCM is a catalyst for sustainable development, offering a path toward resilience and prosperity. It not only mitigates the challenges posed by linear supply chains but also positions developing countries as leaders in sustainable and circular development. Governments must craft policies and regulations that facilitate CSCM, taking into account the unique context of their nations. Businesses must adopt circular practices as a strategic imperative, investing in innovation and sustainability. Academia must continue to educate and empower the workforce with the skills and knowledge required for CSCM. International organizations and NGOs must strengthen partnerships to provide support, expertise, and resources to developing countries. The responsibility falls on all stakeholders to continue fostering circular practices and collaborations. It is only through collective and concerted efforts that the challenges posed by linear supply chains can be surmounted. The future of developing countries and the planet hinges on a commitment to sustainability, circularity, and responsible resource management. As we navigate the path to a more sustainable and circular future, the role of CSCM becomes increasingly pivotal, offering a beacon of hope and serving as a transformative force for the betterment of our world.

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