Assessing Barriers to Circular Supply Chain Management in the Plastic Industry of Bangladesh

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Abstract

This paper offers a comprehensive perspective on the implementation of Circular Supply Chain Management (CSCM) in the plastic industry within emerging economies, with a special focus on Bangladesh. As a developing country, Bangladesh is increasingly directing its attention towards green initiatives, sustainability, and robust waste management practices. The nation's commitment to these principles is pivotal in shaping responsible industrial practices and contributing to global sustainability goals. CSCM, integrating Circular Economy (CE) principles into supply chain management, presents a novel approach aligned with Bangladesh's dedication to environmentally conscious development. Despite the potential benefits, the practical application of CSCM encounters challenges attributed to various barriers. This study, conducted in the context of Bangladesh, not only characterizes these obstacles but also incorporates insights from subcontinental researchers who have delved into this field. Their valuable contributions provide a deeper understanding of the challenges and opportunities associated with CSCM in the Bangladeshi plastic industry. Through an extensive literature review and industry experts, barriers have been identified and categorized into major groups. The paper employs the Multiple Criteria Decision Making (MCDM) method to systematically prioritize these barriers. By adopting the MCDM approach, this research not only adds valuable insights into the impediments of CSCM implementation in the Bangladeshi plastic industry but also serves as a foundational resource for managers and policymakers. It provides a roadmap for navigating the challenges associated with sustainable practices, thereby contributing to the broader discourse on responsible and environmentally friendly industrial operations in the context of Bangladesh's development trajectory.

Keywords
Circular Supply Chain Management (CSCM), Waste Management, Plastic industry, Multiple Criteria Decision Making (MCDM) methodology.

1. Introduction
In recent years, the global discourse on sustainable business practices has witnessed a paradigm shift from the conventional linear economic model to the innovative Circular Economy (CE) framework. Central to this transition is the emergence of Circular Supply Chain Management (CSCM), a holistic approach that integrates circular economy principles into supply chain operations. The amalgamation of the CE approach along with supply chain management is called circular supply chain management (CSCM); (Khan & Ali 2022). Recognized as a superior alternative to the traditional "take, make, and dispose" model, CSCM has garnered significant attention in academia and industry alike. Circular Supply Chain Management (CSCM), which integrates the philosophy of the circular economy into supply chain management, offers a new and compelling perspective to the supply chain sustainability domain (Farooque et al. 2019). However, despite the growing interest in CSCM, a critical examination of the existing literature reveals a notable gap in providing a comprehensive and integrated view of this emerging concept.

The absence of a unified definition and a clear distinction from other sustainability concepts hinders the progression of CSCM research. This necessitates a thorough investigation and classification of related terminologies to lay the groundwork for a cohesive understanding of CSCM. The following study identifies key directions for further research, highlighting areas such as design for circularity, procurement, biodegradable packaging, collaboration, consumption, and technological aspects. Furthermore, the relevance of CSCM is underscored by its potential to address pressing environmental concerns, resource scarcity, and escalating waste levels. Circular supply chain management is a recent innovation to save resources and reduce waste in the supply chain of any industry (Amiri et al. 2022). The urgency of adopting circular principles in supply chains is exemplified by the challenges faced by diverse industries, ranging from pharmaceuticals to plastics, in their pursuit

of sustainable and responsible practices. As industries worldwide grapple with the imperative to incorporate circularity into their supply chains, the findings of these studies offer valuable perspectives and contribute to the ongoing dialogue on fostering sustainability and responsible industrial practices. The adoption of CE is the need for the hour for organizations to minimize and manage waste effectively and remain sustainable in the current scenario of resource depletion and environmental protection (Khandelwal et al. 2022). As a developing nation increasingly embracing green initiatives and stringent waste management strategies, Bangladesh stands at a critical juncture in shaping responsible industrial practices. The change from a linear economic model to a circular economy is beneficial for companies: cost efficiency, increased competitive advantage, and reduction of negative environmental and community impacts (Hartini et al. 2021). Besides, understanding the barriers and complexities associated with implementing CSCM in this context becomes imperative, not only for the industry stakeholders but also for policymakers aiming to steer the country's developmental trajectory toward sustainable and environmentally friendly industrial operations.

1.1 Objectives
The objectives of this research are:
- To review the impact, and identify and categorize the multifaceted barriers hindering the successful implementation of CSCM.
- To assess Multiple Criteria Decision Making (MCDM), to systematically prioritize the valuable insights into the relative significance and impact of these obstacles, aiding stakeholders in allocating resources and devising targeted strategies to overcome them.
- To evaluate and develop a comprehensive and sustainable framework to guide stakeholders in navigating the intricate challenges associated with implementing CSCM anchored in fostering responsible and sustainable industrial practices aligned with the country's developmental goals.

2. Literature Review
Traditional world economies run on the concept of the linear economy, which works on the principle of make, use, and dispose of principle, which does not only create waste but it is also not a sustainable form of economy (Khan et al. 2022). In response to the escalating challenges of pollution and global warming, there has been a pronounced shift towards embracing sustainable practices, particularly within industries like construction, pharmaceuticals, and manufacturing. The concept of Circular Economy (CE) has gained substantial traction due to its potential in aligning with Sustainable Development Goals (SDGs) and curbing carbon emissions. Circular Economy describes an economic system based on business models that replace the "end-of-life" concept by reducing, reusing, recycling, and recovering materials in production/distribution and consumption processes (Uribe-Toril et al. 2022). Notably, integrating CE principles within supply chain operations, especially in the construction sector, has demonstrated lowered emissions and heightened economic growth.

As a sustainable economic method, CE reduces the extraction of raw materials and enables the recirculation of resources, thereby creating advantageous environments for both societies and industries (Ada et al. 2021). However, implementing Circular Supply Chain Management (CSCM) faces barriers, including limited collaboration among supply chain managers. In developing nations, the adoption of CE encounters greater hurdles due to technological limitations and inadequate infrastructure. For instance, in Bangladesh, obstacles in implementing CSCM in various industries range from inadequate regulations to a lack of tax incentives for environmental protection. The pharmaceutical industry, with its complex supply chain involving multiple stakeholders, encounters unique challenges. Current linear supply chains contribute significantly to waste generation, underscoring the necessity for closed-loop supply chains and responsible disposal of expired medicines. Addressing these challenges necessitates a multifaceted approach. Developed nations have the regulatory policies, technological know-how and modern infrastructure to adopt a circular supply chain model. Thus, encouraging responsible consumer behavior, establishing return-back programs for medicines, and leveraging Industry 4.0 technologies become crucial. Recent studies emphasize Green Supply Chain Management (GSCM) in pharmaceuticals, highlighting key barriers such as insufficient environmental knowledge and regulations.

2.1 Overview
The circular economy is increasingly recognized as a better alternative to the dominant linear (take, make, and dispose) economic model. Circular Supply Chain Management (CSCM), which integrates the philosophy of the circular economy into supply chain management, offers a new and compelling perspective to the supply chain sustainability domain (Farooque et al. 2019). The study focuses on the imperative need for the pharmaceutical industry to embrace Circular Supply Chain Management (CSCM) as a means to address its environmental impact. The paper presents a novel framework aimed at assisting pharmaceutical companies in integrating CSCM into

their operations. The integration of a circular economy in a smart supply chain transportation system is based on different principles, and takes into consideration various features (energy and resources consumption, costs, pollution, emissions) **(**Hala et al. 2022). This framework is constructed through a two-phase study: the identification of ten barriers hindering CSCM adoption and the subsequent identification of twelve enablers to counter these obstacles**.** The prioritization of barriers would help the pharmaceutical industry to systematically overcome any impediments in the application of the CSCM approach **(**Khan et al. 2022). In the initial phase, the study identifies significant barriers obstructing the implementation of CSCM within the pharmaceutical sector. Through the utilization of a hybrid methodology combining fuzzy multi-criteria decision-making (MCDM) technique known as the fuzzy full consistency method (F-FUCOM), three key barriers are highlighted: "lack of financial resources and funding," "market challenges," and "lack of coordination and collaboration among the entire supply chain network." These barriers are identified as the primary challenges inhibiting the adoption of CSCM within pharmaceutical supply chains. Subsequently, the study progresses to the second phase, where it identifies twelve enablers crucial for overcoming the aforementioned barriers. Leveraging the fuzzy quality function deployment (FQFD), three prominent enablers emerge: "industrial symbiosis," "Reverse Logistic (RL) infrastructure," and "blockchain technology." These enablers are deemed essential for facilitating the integration of CSCM practices within pharmaceutical companies.

2.2 Qualitative Analysis

Circular Economy (CE) is considered a significant sustainable initiative for waste minimization in manufacturing firms (Ahasan et al. 2021). Implementation of circular practices is different in developing countries as compared to developed countries due to the differences in specific government laws, technology, infrastructure, and social conditions that exist (Ardra et al. 2022). The current sustainability approach in pharmaceutical manufacturing falls short and requires a Circular Economy (CE) integration throughout its supply chain. The pharmaceutical sector's supply chain, encompassing raw material sourcing, manufacturing, distribution, logistics, and pharmacy delivery, produces challenging and health-hazardous waste. Thus, a comprehensive framework is essential to minimize and manage this waste effectively within the industry's supply chain network. Ultimately, this study is a pioneering effort poised to revolutionize supply chain practices within the pharmaceutical sector, steering it toward a more sustainable and environmentally conscious future. The study's emphasis on key challenges such as financial constraints, market fluctuations, and the critical necessity for improved coordination within supply chain networks underscores the pivotal areas demanding immediate attention within the pharmaceutical sector.

Addressing these challenges head-on becomes imperative to initiate and sustain the shift toward sustainable supply chain practices. Furthermore, the identification and prioritization of specific enablers like industrial symbiosis, Reverse Logistic (RL) infrastructure, and blockchain technology present actionable insights. These insights serve as a practical toolkit, offering tangible strategies and technological solutions that can effectively drive the adoption of CSCM within pharmaceutical operations. The study's significant contribution lies not only in identifying hurdles but also in offering tangible solutions. Providing a detailed roadmap tailored specifically to the pharmaceutical industry, it provides a nuanced understanding of the barriers and enablers critical for successful CSCM integration. This nuanced understanding is pivotal in guiding pharmaceutical companies toward making informed decisions and strategic investments necessary for embracing sustainable practices in their supply chains. The innovative hybrid methodologies employed in this research not only set it apart but also lay the groundwork for future studies and applications. These methodologies represent a cutting-edge approach, showcasing the potential for amalgamating diverse decision-making techniques to address complex challenges in supply chain management.

Overall, this study contributes a pioneering framework tailored for the pharmaceutical sector, offering a nuanced understanding of barriers and enablers crucial for effective CSCM implementation. The utilization of innovative hybrid methodologies adds uniqueness to this research, paving the way for more sustainable practices in pharmaceutical supply chains.

3. Methodology

This research employs a dual-phase hybrid methodology to pinpoint and prioritize barriers. In the first phase, we identify obstacles to the adoption of CSCM in the Bangladeshi plastic industry by synthesizing information from a literature review and gathering insights from experts. The subsequent phase entails assessing and ranking these barriers and their sub-components through the application of the fuzzy Analytic Hierarchy Process (AHP). The proposed research design is represented in Figure 1.
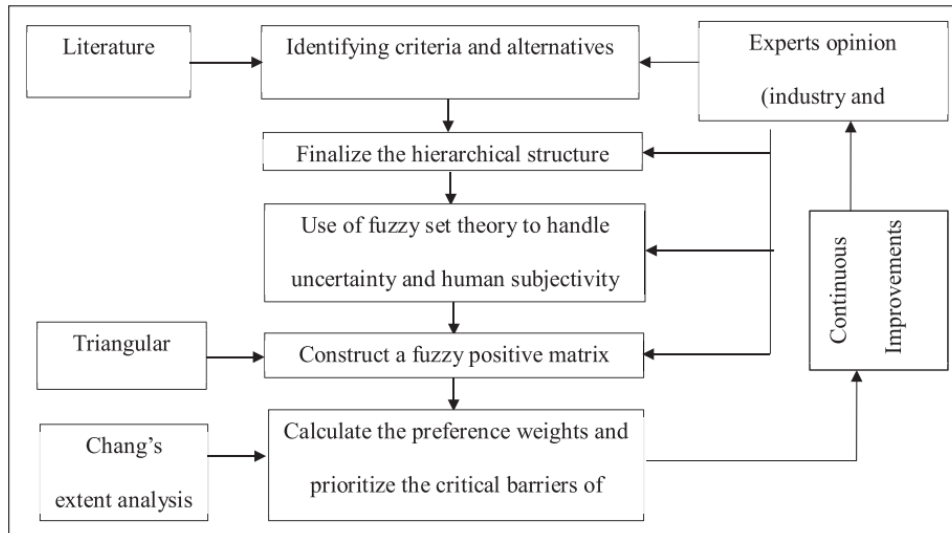
Figure 1. Proposed Research Design

3.1 Barriers of CSCM Implementation in Emerging Countries

In recent years, scholars have increasingly focused on implementing Circular Economy (CE) initiatives in the supply chain, with particular attention to the Bangladeshi plastic industry (Batista et al. 2019; De Angelis et al. 2018; Farooque et al. 2019; Masi et al. 2018; Paletta et al. 2019; Rizos et al. 2016). Despite this, the adoption of Circular Supply Chain Management (CSCM) in developing countries, including Bangladesh, remains at an early stage due to various barriers (Patwa et al. 2020).

This article categorizes identified barriers into five major groups based on the literature review and expert consultations from the perspective of Bangladeshi producers. The barriers, detailed in Table 1, are organized into the following categories:

1. Legislative Barriers: Developing nations face challenges with weak enforcement of environmental regulations, lack of global standards for CSCM performance measurement, informal waste disposal practices, and absence of tax rebate policies (Kabra & Ramesh, 2015; Mangla et al. 2018; Zhang et al. 2019).

2. Organizational Barriers: Key impediments include insufficient commitment from senior management, lack of strategic planning, adherence to traditional business models, and a dearth of incentives for CSCM adoption (Gupta & Barua, 2016; Luthra et al. 2016; Paletta et al. 2019; Satapathy, 2017).

3. Technical Barriers: Challenges involve the novelty of Circular Economy (CE) practices, limited technology for end-of-life product design, insufficient technical expertise, and inadequate collection and recycling infrastructure (Geng & Doberstein, 2008; Rizos et al. 2016; Sharma et al. 2019).

4. Market-related Barriers: Concerns include the lack of a market for reused products, consumer skepticism about the quality of recycled materials, pricing issues, and inadequate information sharing among supply chain partners (Gupta & Barua, 2018; Mathiyazhagan et al. 2016; Sivakumar et al. 2018).

5. Financial Barriers: High costs, limited funding support, fear of failure, and the competitive pricing of virgin plastic products hinder organizations from investing in eco-friendly materials and adopting CSCM (Ghisellini et al. 2016; Prakash & Barua, 2015, 2016; Tura et al. 2019).

These barriers collectively pose significant challenges to the widespread adoption of CSCM in the plastic industry.

Table 1. Identification of CSCM Implementation Barriers

Major Barrier	Barrier Code	Sub-criteria
Legislative barriers	LB1	Weak enforcement of rules and regulations for environmental protection
	LB2	Lack of global standards to measure the performance of CSCM
	LB3	Informal disposal of waste from recovered plastics
	LB4	Lack of tax rebate policies to promote CSCM
Organizational barriers	OB1	Poor support and commitment from management
	OB2	Lack of strategic planning
	OB3	Strong industrial focus on traditional business model of 'take-make-dispose'
	OB4	Lack of interdepartmental flexibility and coordination
	OB5	Lack of incentives to promote CSCM
Technical barriers	TB1	Limited technology to design for end of life of products
	TB2	Lack of useful models and technical expertise
	TB3	Insufficient collection centers and recycling plants
	TB4	Poor availability of resources
	TB5	Lack of an information system to track recycled materials
Market-related barriers	MRB1	Lack of training and development among stakeholders
	MRB2	Skepticism about the quality of refurbished and recycled products
	MRB3	Lack of information sharing among supply chain partners
	MRB4	Lack of customer awareness about the return of used products
	MRB5	Lack of a cohesive reverse logistics network
Financial barriers	FB1	High cost of eco-friendly materials' purchase and packaging
	FB2	High cost of waste collection and segregation
	FB3	Short-term perspective towards economic benefits
	FB4	Higher price of recycled products
	FB5	Limited financial resources to implement CSCM

3.2 Data Collection

A survey questionnaire, constructed from a comprehensive literature review, was distributed among experts and decision-makers in the field. The objective was to gather insights from these individuals, who were selected from both industry and academia to mitigate potential biases associated with industrial affiliations. The chosen decision-makers, totaling eight individuals, possess extensive expertise in plastic manufacturing and recycling, each boasting over a decade of experience.

These experts were instrumental in identifying common barriers hindering the implementation of Circular Supply Chain Management (CSCM) in the Bangladeshi plastic industry.

Through a collaborative effort, a total of 24 barriers were meticulously categorized into five major groups based on the amalgamation of findings from the literature review and the perspectives of the seasoned experts. This categorization is presented in detail in Table 1. The culmination of their insights was used to formulate a pairwise

Table 2. Pairwise Comparison of the Five Major Barriers

	LB	OB	TB	MRB	FB
LB	(1,1,1)	(1,2,3)	(I, 2, 3)	(2,3,4)	(0.25,0.33, 0.50)
OB	(0.33, 0.50, I)	(1,1,1)	(0.33, 0.50, I)	(3, 4,5)	(0.25,0.33,0.50)
TB	(0.33, 0.50, I)	(1,2,3)	(1,1,1)	(0.33,0.50, I)	(2, 3, 4)
MRB	(0.25, 0.33, 0.50)	(0.20, 0.25, 0.33)	(1,2,3)	(1,1,1)	(1,2,3)
FB	(2,3,4)	(2,3,4)	(0.25, 0.33, 0.50)	(0.33,0.50,	(1,1,1)

decision matrix. For a comprehensive overview of the study's methodology and outcomes, a graphical representation of the fuzzy Analytic Hierarchy Process (AHP) framework is provided in Figure 3.
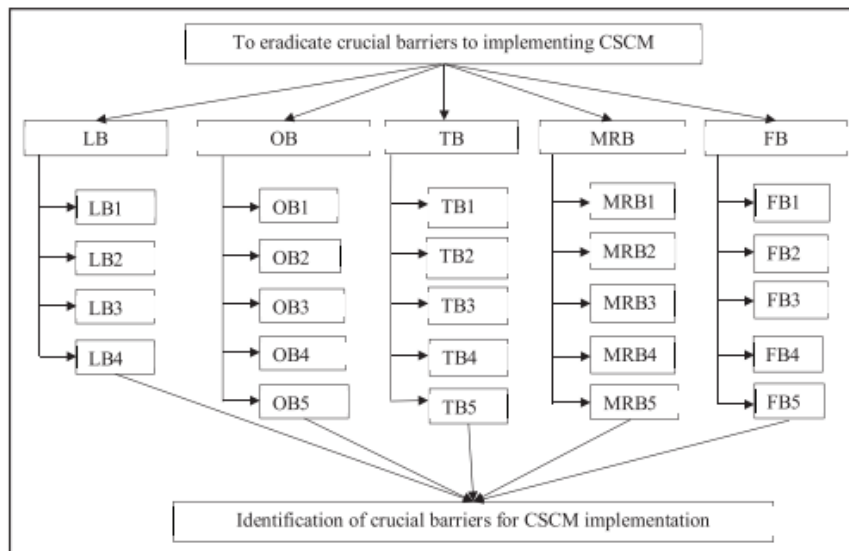

Figure 2. Fuzzy AHP Hierarchical Framework of Barriers to Implementing CSCM

3.3 Calculation of the Value of Fuzzy Synthetic Extent
The group of decision-makers made a pairwise assessment of barriers and criteria using a TFN scale, as shown in Table 3. The pairwise ratings derived using linguistic statements and expressions of the primary barriers are shown in Table 2.

Table 3. Priority Weight of Significant Barriers

Criteria	Preference Weights	Ranking
LB	0.2273	1
OB	0.1848	4
TB	0.2026	3
MRB	0.1675	5
FB	0.2179	2

Table 4. Pairwise Comparison of Sub-barriers in 'LB'

	LB1	LB2	LB3	LB4
LB1	(1,1,1)	(2, 3,4)	(0.33, 0.5, 1)	(3, 4,5)
LB2	(0.25, 0.33, 0.5)	(1,1,1)	(0.33, 0.5, 1)	(1, 2,3)
LB3	(1, 2,3)	(1, 2, 3)	(1,1,1)	(0.25, 0.33, 0.5)
LB4	(0.2, 0.25, 0.33)	(0.33, 0 0.5, 1)	(2,3, 4)	(1,1,1)

Table 5. Pairwise Comparison of Sub-barriers in 'OB'

	OB1	OB2	OB3	OB4	OB5
OB1	(1,1,1)	(3,4, 5)	(0.33, 0.5, 1)	(2, 3, 4)	(0.2, 0.25, 0.33)
OB2	(0.2, 0.25, 0.33)	(1,1,1)	(2, 3, 4)	(0.25, 0.33, 0.5)	(1, 2, 3)
OB3	(1, 2,3)	(0.25, 0.33, 0.5)	(1,1,1)	(1, 2, 3)	(0.33, 0.5, 1)
OB4	(0.25, 0.33, 0.5)	(2, 3, 4)	(0.33, 0.5, I)	(1,1,1)	(0.33, 0.5, 1)
OB5	(3, 4, 5)	(0.33,0.5, 1)	(2,3,4)	(1,2,3)	(1,1,1)

Table 6. Pairwise Comparison of Sub-barriers in 'TB'

	TB1	TB2	TB3	TB4	TB5
TB1	(1,1,1)	(0.2, 0.25, 0 0.33)	(3, 4, 5)	(0.25, 0.33,0.5)	(1, 2,3)
TB2	(3, 4,5)	(1,1,1)	(0.33, 0.5, 1)	(0.2, 0.25, 0.33)	(0.25, 0.33, 0.5)
TB3	(0.2, 0.25, 0.33)	(1, 2, 3)	(1,1,1)	(2, 3, 4)	(1, 2, 3)
TB4	(2, 3, 4)	(3, 4, 5)	(0.25, 0.33, 0.5)	(1,1,1)	(1,2,3)
TB5	(0.33, 0.5, I)	(2,3, 4)	(0.33, 0.5, 1)	(0.33, 0.5, 1)	(1,1,1)

Table 7. Pairwise Comparison of Sub-barriers in 'MRB'

	MRBI	MRB2	MRB3	MRB4	MRB5
MRBI	(1,1,1)	(0.25,0.33,0.5)	(0.2,0.25,0.33)	(3,4,5)	(0.25,0.33,0.5)
MRB2	(2,3,4)	(1,1,1)	(2,3,4)	(0.33, 0.5,1)	(1,2,3)
MRB3	(3,4,5)	(0.25,0.33,0.5)	(1,1,1)	(1,2,3)	(0.2,0.25,0.33)
MRB4	(0.2,0.25,0.33)	(1, 2,3)	(0.33,0.5,1)	(1,1,1)	(2,3,4)
MRB5	(2,3,4)	(0.33,0.5, 1)	(3,4,5)	(0.25,0.33,0.5)	(1,1,1)

Table 8. Pairwise Comparison of Sub-barriers in 'FB'

	FB 1	FB2	FB3	FB4	FB5
FBI	(1,1,1)	(2, 3, 4)	(1,2,3)	(0.2, 0.25, 0.33)	(2, 3, 4)
FB2	(0.25, 0.33, 0.5)	(1,1,1)	(0.33, 0.5, 1)	(3, 4, 5)	(0.33, 0.5, 1)
FB3	(0.33, 0.5, 1)	(1, 2, 3)	(1,1,1)	(2, 3, 4)	(0.25, 0.33, 0.5)
FB4	(3, 4, 5)	(0.2. 0.25, 0.33)	(0.25, 0.33, 0.5)	(1,1,1)	(0.33, 0.5,1)
FB5	(0.25, 0.33, 0.5)	(1, 2, 3)	(2, 3, 4)	(1, 2, 3)	(1,1,1)

4. Results and Discussions

The systematic AHP approach offers a logical solution to simplify the comparison of two barriers, aiding decision-makers in identifying the most crucial obstacle by prioritizing and ranking processes. This study employs this methodology to analyze obstacles to implementing Circular Supply Chain Management (CSCM) in the Bangladesh plastic industry. It encourages organizations to comprehend the challenges in adopting a circular system in their supply chain, fostering a commitment to sustainability. The article presents a ranking of barriers based on their prioritized weightage values, revealing that legislative, financial, technical, organizational, and market-related barriers follow a descending order, as outlined in Table 3. Legislative barriers emerge as the most significant hurdles to CSCM adoption.

To effectively implement CSCM, one viable approach involves the development of government policies and frameworks. However, organizations have not warmly embraced these, as noted in previous studies (Luthra et al. 2016; Prakash & Barua, 2015). The findings align with past research (Govindan & Hasanagic, 2018), highlighting legislative policies and regulations as critical barriers to circular practices adoption. Poor enforcement of these policies and regulations may negatively impact organizational intent to adopt circular practices (Bhandari et al. 2019). The relative importance of the sub-criteria under the category of legislative barriers is LB4 > LB1 > LB3 > LB2, which depicts that the lack of tax rebate policies to promote CSCM and weak enforcement of rules and regulations relating to environmental protection are the major hurdles in adopting CSCM.

Taxation policies related to waste collection and treatment can serve as incentives for organizations to transition from a linear to a circular model (Mangla et al. 2018). However, the existing government policies aimed at

compelling plastic companies to adopt circular practices have faced opposition from organizations due to their strict nature and unclear procedures (Aryan et al. 2019). This aligns with prior research indicating that the absence of tax rebate policies poses a significant challenge to the initiation of circular practices (Khandelwal & Barua, 2020; Mathiyazhagan et al. 2016; Narayanan et al. 2019; Rizos et al. 2016; Singh & Sarkar, 2019; Sivakumar et al. 2018).

Financial barriers emerge as the second most prominent obstacle, underscoring the necessity of financial support for plastic organizations to embrace Circular Economy (CE) practices. Despite this need, a well-established capital investment system for such practices is lacking, leading plastic organizations to struggle to secure financial resources for effective waste management (Zhang et al. 2019). Consistent with earlier studies (Agyemang et al. 2019; Bhandari et al. 2019), cost- and finance-related factors stand out as the most pertinent barriers to the successful implementation of Circular Economy initiatives. Among the financial category's sub-barriers, the high cost of eco-friendly materials' purchase and packaging acts as a major impediment and carries the topmost priority, and the sub-barriers are ranked as FB1 > FB5 > FB3 > FB2 > FB4.

Essential for waste collection and segregation, infrastructure, and technology rely on financial support from both public and private entities, a support system that is frequently unavailable (Prakash & Barua, 2015). Another significant hurdle ranks as the third major barrier: technical challenges. While technology and innovation are crucial for adopting Circular Economy (CE) practices, plastic organizations face obstacles in establishing an effective circular model and acquiring the necessary technical expertise to design products with consideration for their end-of-life (Sivakumar et al. 2018). Within the plastic industry, the lack of technological advancement is attributed to a deficiency in eco-literacy, posing challenges for organizations in developing efficient waste management mechanisms and effectively monitoring material flows. The sub-criteria ranking of technical barriers is TB4 > TB3 > TB1 > TB5 > TB2, which implies that the lack of availability of resources to implement CSCM is the most significant sub-barrier in this category.

To ensure long-term sustainability, any organization must possess adequate resource capabilities (Satapathy, 2017). In the context of plastic companies, a lack of resource capabilities becomes a hindrance to the recycling and reusing of products or materials. This inadequacy in resources stands out as a major obstacle to the implementation of Circular Supply Chain Management (CSCM) (Gupta & Barua, 2018). Additionally, within this category, the absence of a cohesive reverse logistics network for transporting recovered plastic emerges as a significant sub-barrier. This finding aligns with the observations made by Sivakumar et al. (2018). Organizational barriers' ranking stands as OB5 > OB1 > OB2 > OB3 > OB4, implying that the very few incentives to promote CSCM and inadequate support and commitment from the management rank highest in this category. In response to various political, economic, social, and technical changes, coupled with the challenges posed by a competitive market, management is compelled to devise policies and strategies aimed at transitioning towards circular business practices (Gupta & Barua, 2016; Kumar & Dixit, 2018; Luthra et al. 2016; Prakash & Barua, 2015). Finally, market-related barriers' ranking is MRB2 > MRB5 > MRB3 > MRB4 > MRB1, which depicts that in this category, lack of customer awareness about the return of used products is the most critical barrier in the way of implementing CSCM.

5. Conclusion

Organizations are increasingly adopting circular practices in their supply chains, driven by the escalating risks of resource scarcity and the imperative to transition to sustainable business models. However, the implementation of Circular Supply Chain Management (CSCM) in the plastic industry faces significant challenges in developing nations like Bangladesh. The complexity of these challenges hinders decision-makers from making effective choices, as overcoming multiple barriers simultaneously proves to be a formidable task in practical application.

This study employs a robust Multiple Criteria Decision Making (MCDM) method to identify and prioritize 24 barriers categorized under five major groups, as identified through literature review and expert consultations, for implementing CSCM in the Bangladeshi plastic industry. The application of the fuzzy Analytic Hierarchy Process (AHP) methodology produces rankings for the influence of each barrier. The proposed approach is supported by an empirical case from a plastics company. The study's results highlight that the most significant barriers to CSCM implementation include unsupportive government taxation policies, weak enforcement of rules and regulations, high costs associated with the purchase and packaging of eco-friendly materials, and the prevalence of informal

waste collection mechanisms. These findings offer valuable insights for decision-makers and government bodies, guiding the formulation of comprehensive and concrete regulations that incentivize organizations to embrace CSCM. Additionally, a sensitivity analysis is conducted to assess the variations in barrier rankings when adjusting criteria weights, adding a nuanced understanding of the study's outcomes.

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Biographies

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