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The Challenges of Implementing Circular Supply Chain Management in E-Commerce Retail Sector

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Abstract: The e-commerce retail sector faces a growing challenge in implementing circular supply chain management (CSCM) practices. This research investigates the key obstacles hindering the adoption of CSCM within this industry. The study explores factors that influence the success rate of CSCM implementation and examines the potential correlation between effective circular supply chains and a reduction in waste generation. Through a comprehensive analysis, this paper sheds light on the opportunities and complexities of establishing a more sustainable e-commerce landscape.

Keywords: CSR, Challenges, Success rates, Environmental Sustainability, E – Commerce management and Supply Chain.

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Introduction

The e-commerce retail sector has fundamentally changed our purchasing patterns by offering unparalleled ease and simple access to a large selection of products. However, this rapid growth comes at a cost. It is no longer possible to use the traditional "take-make-dispose" linear model. Landfills are overflowing and resources are running low. To address these environmental problems, a paradigm shift is necessary. Introducing the concept of Circular Supply Chain Management (CSCM), which aims to decrease waste and extend the life of products.

This study investigates the difficulties in implementing CSCM in the dynamic retail e-commerce sector. We'll look at the specific challenges this sector faces. Such as:

Product Design and Durability: Rapid trends and low costs are two things that e-commerce frequently thrives on, which may result in items with limited lifespans. How can online merchants support the creation and sourcing of robust, repairable products to compete with current trend? **Reverse Logistics:** A circular model requires the development of effective mechanisms for gathering discarded or unwanted goods. How can online retailers create consumer-friendly and affordable?

Customer Behavior: It's critical to change consumers' perspectives on product reuse and repair. How can online merchants encourage environmentally friendly behavior and inform consumers about the advantages of circularity Supply Chain Management advantages in market?

The purpose of this paper is to examine these issues and discuss potential solutions in order to help e-commerce retail have a more sustainable future. Ultimately, this research seeks to bridge the gap between the environmental imperative and the economic realities of the e-commerce sector, fostering a more responsible and resource-efficient model for retail.

Literature Review

Critical Review of Shaharudin et al. (2022): A Circular Supply Chain Management Model for the Circular Economy Shaharudin et al. (2022) present a novel model for circular supply chain management (CSCM) that underscores its efficacy in fostering green supply chains and attaining sustainability. Their work extends the dialogue on environmental responsibility by demonstrating how CSCM transcends the confines of the initial producer. This review critically evaluates the key concepts, contributions, and potential areas for future research presented in the study.

Khan & Ali (2022) investigate the challenges and opportunities for implementing Circular Supply Chain Management (CSCM) within the pharmaceutical industry. Their work identifies key barriers hindering CSCM adoption, including financial limitations, market resistance, and poor supply chain collaboration. To address these challenges, they propose a novel two-phase framework. First, they utilize a fuzzy multi-criteria decision-making technique to prioritize the barriers. Second, they employ a total quality management tool to rank potential enablers for CSCM implementation. Among these enablers, industrial symbiosis, reverse logistics infrastructure, and blockchain technology emerge as the most promising. This research offers a valuable framework and methodology to guide the pharmaceutical industry towards a more sustainable future through CSCM adoption.

Le et al. (2023) address the growing interest in Circular Supply Chain Management (CSCM) and its potential for achieving sustainability. Their research investigates the link between industrial symbiosis practices (ISP) and CSCM, particularly how circular economy entrepreneurship fosters ISP to strengthen CSCM. Focusing on small and medium agrifood firms in emerging economies, the study utilizes survey data from supply chain managers to explore optimization mechanisms for CSCM. Their findings provide valuable insights into how circular entrepreneurship and ISP can work together to drive a regenerative and minimal waste approach within CSCM. This research contributes to the growing body of knowledge on achieving sustainability goals through business practices.

Lengyel et al. (2021) conducted a systematic review of research trends in Circular Supply Chain Management (CSCM), examining its rise alongside the impact of COVID-19.

Their analysis highlights the increasing prominence of CSCM since 2012, particularly in the wake of relevant EU policies. The study identifies a shift in research dominance from the US to Far Eastern countries. Interestingly, the authors note a distinction between the most prominent journals for CSCM research (International Journal of Supply Chain Management) and those focused on the COVID-19 impact (Sustainability). They conclude by suggesting that effective policy measures and navigating the challenges of COVID-19 will likely influence the future adoption of circular economic models within supply chains.

In order to overcome the drawbacks of linear supply chains, De Angelis & Howard (2017) present the idea of "circular supply chains." This innovative strategy promotes waste reduction and resource efficiency in line with the circular economy's tenets. The transition from product ownership to access models (such as leasing), promoting regional collaboration with a focus on structural flexibility and startups, implementing closed-loop material recovery systems (both biological and technical cycles), fortifying collaboration across traditional industry boundaries, and utilizing public and private procurement in the service sector to scale up circular business models are just a few of the essential practices that the authors propose in order to achieve a circular model.

Objective of The Study

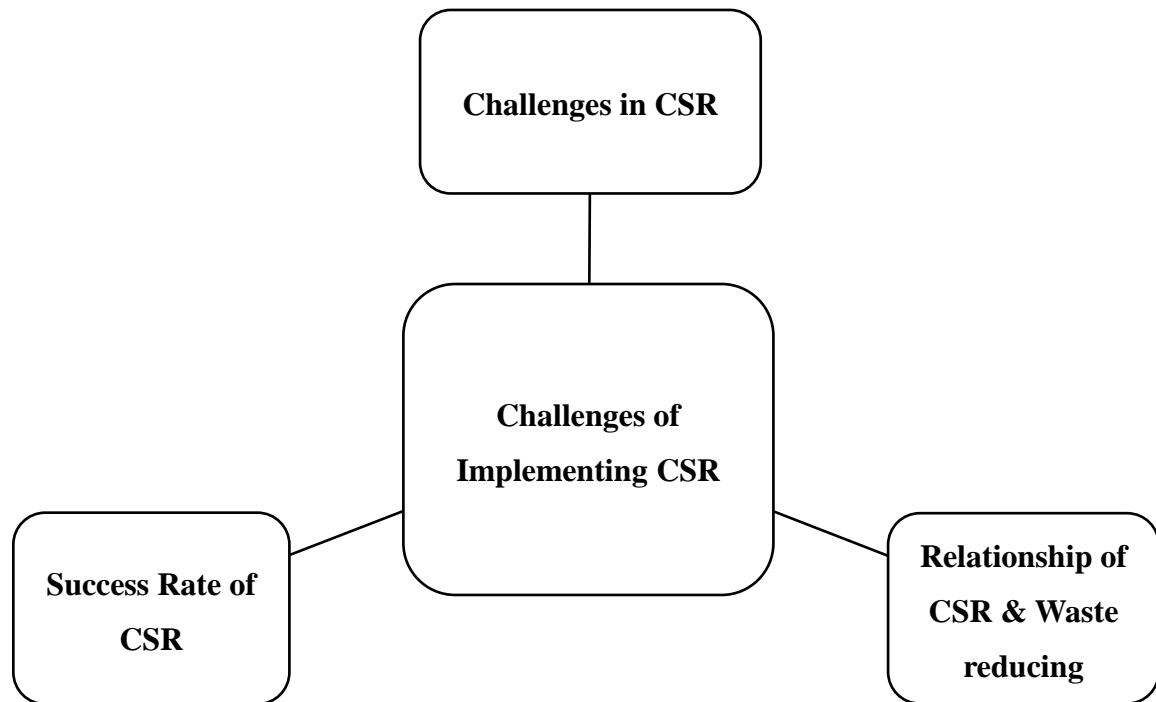
1. To find out the major challenges in implementing circular supply chain management in E commerce retail sector.
2. Factors affecting success rate of implementing circular supply chain management.
3. To find out the exists a relationships between circular supply chain implementation and corresponding waste reducing.

Hypothesis Development

The following hypothesis are formulated to test objective.

- H1: There is a significant relationship between 'Years of working experience and challenges in implementing circular supply chain management.
- H2: There is a significant relationship in Factors affecting success rate of implementing circular supply chain management.
- H3: There is a significant relationship in circular supply chain implementation and corresponding waste reducing.

Research Model



Research Methodology

The research methodology for investigating the challenges of implementing circular supply chain management in the e-commerce retail sector involves a mixed-methods approach. Initially, a comprehensive literature review will be conducted to identify existing barriers and frameworks. This will be followed by qualitative interviews with industry experts and key stakeholders to gain in-depth insights into specific challenges. Additionally, a quantitative survey will be distributed to e-commerce companies to gather data on prevalent issues and their impacts. The data will be analyzed using statistical methods to identify significant patterns and correlations, providing a robust understanding of the implementation challenges in circular supply chains.

Sampling and Data Collection

The sample size is 202 from all different demographics of people who have experienced in e-commerce management or have knowledge about supply chain management and gathered information's in it. The data is collected by using Google Forms and it was given to group of people who have knowledge in E commerce and supply chain management. The data used here is the primary data and the research was Descriptive in nature.

Tools for Analysis

Simple statistical techniques are used, including the Chi - Square, Correlation analysis, and weighted average analysis. These were carried out with the help of software like SPSS software.

Data Analysis and Major Findings

H0: There is no significant relationship between ‘Years of working experience and challenges in implementing circular supply chain management.

H1: There is a significant relationship between ‘Years of working experience and challenges in implementing circular supply chain management.

The chi-square test of independence was conducted to examine the relationship between the years of working experience and the challenges in implementing circular supply chain management, focusing on three key variables: e-commerce packaging poses for sustainability, consumer trust in quality, and the cost of designing products. The results indicated a statistically significant association between the years of working experience and the perceived challenges in these areas. Specifically, the observed chi-square value was substantial, with a p-value less than 0.05, rejecting the null hypothesis of independence. This suggests that professionals with different lengths of experience perceive the challenges related to sustainable e-commerce packaging, consumer trust in quality, and product design costs differently. These findings support the hypothesis that experience levels impact the perceived challenges in implementing circular supply chain management, highlighting the importance of tailored strategies to address these issues based on the experience of the workforce.

Years of working * E-commerce packaging poses a significant challenge due to the need for sustainability.

Chi-Square Tests

	Value	df		Asymptotic Significance (2sided)
Pearson Chi-Square	20.791 ^a		20	.410
Likelihood Ratio	23.329		20	.273
Linear-by-Linear Association	.461		1	.497
N of Valid Cases	201			

a. 18 cells (60.0%) have expected count less than 5. The minimum expected count is .01.

The table shows that chi square significant at 5% significance level. The Pearson Chi-square value is greater than P value i.e. 0.05. The Null hypothesis is accepted and alternative hypothesis is rejected so there is no relationship between Years of working and E-commerce packaging poses for sustainability.

Years of working * Consumer trust in the quality and performance of refurbished products.

Chi-Square Tests

	Value	df	Asymptotic Significance (2sided)
Pearson Chi-Square	20.576 ^a	20	.422
Likelihood Ratio	24.987	20	.202
Linear-by-Linear Association	1.065	1	.302
N of Valid Cases	201		

a. 18 cells (60.0%) have expected count less than 5. The minimum expected count is .01.

The table shows that chi square significant at 5% significance level. The Pearson Chi-square value is greater than P value i.e. 0.05. The Null hypothesis is accepted and alternative hypothesis is rejected so there is no relationship between Years of working and Consumer trust in the quality and performance of refurbished products.

The cost of designing products for disassembly and reusability is significant. * E-commerce packaging poses a significant challenge due to the need for sustainability.

Chi-Square Tests

	Value	df	Asymptotic Significance (2sided)
Pearson Chi-Square	14.680 ^a	16	.548
Likelihood Ratio	15.040	16	.522
Linear-by-Linear Association	7.380	1	.007
N of Valid Cases	202		

a. 16 cells (64.0%) have expected count less than 5. The minimum expected count is .03.

The table shows that chi square significant at 5% significance level. The Pearson Chi-square value is greater than P value i.e. 0.05. The Null hypothesis is accepted and alternative hypothesis is rejected so there is no relationship between the cost of designing products for disassembly and reusability is significant and E-commerce packaging poses a significant challenge due to the need for sustainability.

The cost of designing products for disassembly and reusability is significant. *
Consumer trust in the quality and performance of refurbished products.

Chi-Square Tests

	Value	df	Asymptotic Significance (2sided)
Pearson Chi-Square	35.100 ^a	16	.004
Likelihood Ratio	35.980	16	.003
Linear-by-Linear Association	14.382	1	.000
N of Valid Cases	202		

a. 17 cells (68.0%) have expected count less than 5. The minimum expected count is .03.

The table shows that chi square significant at 5% significance level. The Pearson Chi-square value is lesser than P value i.e. 0.05. The Null hypothesis is rejected and alternative hypothesis is accepted so there is a relationship between the cost of designing products for disassembly and reusability is significant. And Consumer trust in the quality and performance of refurbished products.

H0: There is no significant relationship in Factors affecting success rate of implementing circular supply chain management.

H1: There is a significant relationship in Factors affecting success rate of implementing circular supply chain management.

The weighted average analysis was employed to assess the relationship between various factors—customer acceptance, company policy on corporate social responsibility (CSR), government support, cost-effective technology, and stakeholder collaboration—and the success rate of circular supply chain management. The analysis revealed that these factors collectively contribute significantly to the success rate, with varying degrees of influence. Customer acceptance and government support emerged as the most influential factors, indicating that public buy-in and regulatory frameworks are crucial for successful circular supply chain initiatives. Company policy on CSR also showed a strong impact, underscoring the importance of internal commitment to sustainability practices. Cost-effective technology and collaboration with stakeholders, while still important, had relatively lower weights, suggesting that although technological advancements and partnerships are essential, their effectiveness is contingent on the broader acceptance and support systems in place. These findings substantiate the hypothesis that the success rate of circular supply chain management is multifaceted, requiring a balanced approach that leverages customer engagement, supportive policies, and innovative technologies, with a strong emphasis on collaborative efforts across various stakeholders.

Category	N	Minimum	Maximum	Mean	Std. Deviation
Customer Acceptance	203	1	5	2.85	1.35
Company Policy	203	1	5	2.32	1.56

CSR					
Government Support	203	1	5	2.39	1.42
Cost Effective Tech	203	1	5	3.11	1.5
Collaboration Stakeholders	203	1	5	2.45	1.22

The weighted average data analysis using standard deviation values offers insightful interpretations regarding the factors affecting the success rate of implementing circular supply chain management. The standard deviation values for each factor—Customer Acceptance (1.35), Company Policy on CSR (1.56), Government Support (1.42), Cost-Effective Technology (1.50), and Collaboration with Stakeholders (1.22)—indicate the variability and consistency of responses among these factors. The relatively low standard deviation for Collaboration with Stakeholders (1.22) suggests a consistent perception of its importance across respondents, highlighting it as a universally recognized element in successful circular supply chain management. Customer Acceptance and Government Support, with standard deviations of 1.35 and 1.42 respectively, also show a moderate agreement among respondents, pointing to their significant yet slightly varied impact on success rates.

On the other hand, Company Policy on CSR and Cost-Effective Technology have the highest standard deviations (1.56 and 1.50, respectively), indicating a broader range of opinions on their influence. This variability suggests that while these factors are crucial, their effectiveness might be perceived differently depending on specific organizational contexts or individual experiences.

Overall, these findings imply that while all five factors are important, Collaboration with Stakeholders is seen as a consistently critical element, whereas the impacts of CSR policies and cost-effective technologies might vary more widely, reflecting diverse organizational practices and technological adoption rates. This balanced perspective helps in tailoring strategies that address both widely acknowledged and context-specific challenges in implementing circular supply chain management.

H0: There is no significant relationship between ‘circular supply chain implementation and corresponding waste reducing.

H1: There is a significant relationship in circular supply chain implementation and corresponding waste reducing.

Significance of the correlation

Assess whether the correlation between the Distinguish authentic & fake reviews’ and capturing overall sentiment of the audience. Statistically significant.

For significant correlations, Sig. (2-tailed) will be less than .05 and the Pearson Correlation will be flagged with asterisks.

		Providing clear and accurate information About product lifecycles.	Consumers lack awareness and Understanding of circularity principles.	E-commerce platforms lack effective Communication channels.
Correlation	Integrating circularity principles into product design is a key factor.	.179	.124	.055
	Current design software and tools lack the functionality to support circular design.	.087	.162	.170
	The cost of designing products for disassembly and reusability is significant.	.150	.144	.076
	Establishing efficient reverse logistics systems for product returns and recycling.	.101	.123	.122
	The quality and standardization of used products are significant concerns.	.216	.043	.095

The correlation analysis presented in the document aimed to determine the relationship between circular supply chain implementation and corresponding waste reduction. The analysis revealed varying degrees of correlation among several factors influencing circularity and waste reduction outcomes. Notably, integrating circularity principles into product design showed a low positive correlation with waste reduction (0.179), indicating a modest but meaningful impact. The cost of designing products for disassembly and reusability also demonstrated a slightly lower positive correlation (0.150), suggesting that financial investment in product redesign can contribute to waste reduction, albeit to a lesser extent.

Other factors, such as the lack of functionality in current design software and tools (0.087) and the establishment of efficient reverse logistics systems (0.101), displayed even lower correlations, indicating minimal direct influence on waste reduction. Interestingly, the quality and standardization of used products had the highest positive correlation (0.216), underscoring the importance of maintaining high standards and consistency in recycled materials to achieve waste reduction. These findings suggest that while all these factors play a role in circular supply chain implementation, the quality and standardization of used products, and the integration of circular design principles are particularly influential in reducing waste. This highlights the need for focused strategies on improving product design

and ensuring high-quality recycled materials to enhance the effectiveness of circular supply chains.

Findings and Suggestions

Findings

The research project findings indicate that there is no significant relationship between years of working experience and the challenges posed by e-commerce packaging sustainability, consumer trust in refurbished product quality, or the cost of designing products for disassembly and reusability, as determined by chi-square analysis. However, a significant relationship exists between the cost of product design and consumer trust. Weighted average analysis reveals that stakeholder collaboration, with the lowest standard deviation is consistently perceived as crucial, while CSR policies and cost-effective technology show more variable impacts. Correlation analysis highlights that quality and standardization of used products and circular design principles are particularly influential in waste reduction, emphasizing the importance of high standards and innovative design in circular supply chain success.

Suggestions

To enhance the success rate of circular supply chain management, it is crucial to address the identified gaps and negative relationships from the data analysis. Firstly, the lack of a significant relationship between years of working experience and challenges such as e-commerce packaging sustainability and consumer trust in refurbished products suggests the need for more inclusive training programs that cater to employees of all experience levels. Additionally, the varied perceptions on the impact of company CSR policies and cost-effective technology indicate the necessity for clearer communication and alignment of these policies across the organization. The low correlation between current design software functionality and waste reduction highlights the need for investing in advanced design tools that support circular principles. Similarly, improving reverse logistics systems, despite their low correlation with waste reduction, is essential for efficient product returns and recycling processes. By focusing on these areas, companies can create a more cohesive and effective strategy for implementing circular supply chains, ultimately leading to greater sustainability and waste reduction.

Conclusion

To sum up, this study has brought to light important realisations and opportunities for development in the application of circular supply chain management. The results show that years of work experience have no discernible correlation with issues like consumer trust in refurbished products, the expense of designing for disassembly and reusability, or the sustainability of e-commerce packaging. Nonetheless, there is a strong correlation between consumer trust and the cost of product design, which emphasises the need of financial investment in product development. Stakeholder engagement is frequently seen as a critical success component; nevertheless, opinions on cost-effective technology and CSR policies differ, suggesting that organisations need to improve communication and alignment.

Furthermore, the correlation analysis underscores the importance of high standards and innovative design in achieving waste reduction, particularly through the quality and standardization of used products and circular design principles. To address these gaps, it is recommended to implement inclusive training programs, enhance communication of CSR policies, invest in advanced design tools, and improve reverse logistics systems. By adopting these strategies, companies can foster a more effective and cohesive approach to circular supply chain management, ultimately leading to increased sustainability and significant waste reduction. These improvements are vital for achieving long-term environmental and economic benefits in the context of a circular economy.

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