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Unravelling the Bottlenecks: Identifying and Addressing Inefficiencies in the Logistics Distribution of Fast-Moving Consumer Goods in India

Pradeep Chauhan[1*]

[1*]School of Business, UPES Dehradun

Abstract
The Fast-Moving Consumer Goods (FMCG) sector is a cornerstone of modern economies, providing essential products for daily life. Despite its pervasive reach, the industry operates on razor-thin profit margins due to the complexities of distribution. The supply chain is at the heart of these operational challenges, where inefficiencies in logistics can lead to significant financial losses. This study primarily focussed on identifying and analyzing the root causes of inefficiencies within the FMCG supply chain. Secondly, the study suggests few most effective solutions which might help overcoming the existing inefficiencies in FMCG supply chain. A Hierarchical model containing the inefficiencies or challenges, and the proposed remedial solutions was developed and analysed empirically to visualize the relative significance of the model factors. A methodology based on Fuzzy Analytical Hierarchy Process (FAHP) has been proposed in this study to analyse the developed model empirically. Common issues such as delays, product damage, stockouts, and excess inventory erode profitability, making supply chain optimization a strategic imperative for survival and growth. By examining the most severe distribution challenges and the most effective remedial strategies to overcome them, this research seeks to provide FMCG companies with actionable insights to streamline operations, reduce costs, and enhance customer satisfaction. Finally, the study opens the window for few most potential future research opportunities in the targeted domain of FMCG supply chain.

Keywords*: FMCG, logistics efficiency, logistics management, physical distribution, FAHP,*

1. Introduction

The Fast-Moving Consumer Goods (FMCG) sector is a vital component of modern economies, encompassing a wide range of essential products used in daily life (Shakur *et al.*, 2024). However, this sector is frequently confronted with industry-specific concerns, particularly in logistics management. The intricate nature of FMCG logistics involves strict timelines, higher inventory levels, vast distances between supply chain partners, and demands for greater transparency and reliability (Balocco *et al.*, 2011). Failure to optimize the supply chain can have significant financial consequences, jeopardizing profitability. Stock that does not move quickly can become obsolete, resulting in net losses. Over the past 30 years, the FMCG industry's supply chain has evolved dramatically, impacting both upstream and downstream processes (Prashar, 2023). The nature of products, distribution partners, and resources determine many stages of the FMCG distribution chain, often beyond the firm's control. In India, the effective physical distribution of FMCG goods is hindered by several issues. These factors include inadequate supply chain coordination and integration, infrastructure problems, outsourcing, ineffective transportation and warehousing, poor forecasting, and technological challenges (Prashar, 2023).

From the previous few decades the FMCG supply chain has appeared as a blooming for the industrial as well as the academic research community. Despite having the various significant potential requirement for the research, very few research are available specifically focussing on the challenges and critical issues related with the FMCG supply chain but the boundaries lie within the specific applications. For example, Končar et al. (2020) presented the study to analyse the scope of IoT implementation in FMCG supply chain to improve the sustainability traits of the same during the COVID-19 pandemic. In an another study conducted by Shakur et al. (2024), various challenges for Industry 4.0 implication in FMCG supply chain were analysed under the constraints of its applicability for the emerging countries only. Muhalia, Ngugi, and Moronge (2021) has analyse the effect of transportation management performance of FMCG supply chain in Kenya context. Aggarwal (2018) conducted a study to lower down the carbon emissions from FMCG supply chain. Prashar (2023) conducted a study to analyse the sustainability drivers for the FMCG supply chain in Indian context.

Further, the FMCG players operating in India because this sector has a significant role to play in India's GDP today and is characterized by very thin margins. However, the presence of various issues in the identified in the distribution which just not only hampering logistics distribution performance but has also resulted in massive losses and wastage. This is truly a source of concern for the diverse stakeholders of the FMCG supply chain, as it is impeding the growth and economic benefits that could otherwise be realized.

From the above literature analysis, it has been observed that although the FMCG supply chain plays a significant role in logistics and supply chain sector of respective countries as well as whole world, a very little literature is available that focussed on identifying and analysing the critical challenges and inefficiencies in FMCG supply chain in Indian context. Therefore, a need arises to identify the most crucial challenges causing the inefficiencies specifically in Indian context.

Therefore, this research paper aims to delve into the issues leading to inefficiency in the logistics distribution performance of FMCG SC in India. By identifying and analyzing the root causes of these inefficiencies, the study seeks to provide actionable insights for FMCG companies to streamline their operations, reduce costs, and enhance customer satisfaction. Ultimately, this will lead to improved financial performance and a stronger market position, benefiting both consumers and the broader economy.

1.2 Research Objectives

By conducting a comprehensive literature review, observed research gaps and from the above motivations, the study framed following research questions (RQs) has been framed to conduct the study systematically:
RQI: What factors contribute to poor logistics performance in the distribution of FMCG sector's supply chain?
RQ2: How these factors can be tackled to mitigate the risks?

To answer the framed research questions, the study primarily conducts a comprehensive literature review, secondly it conducts various discussion sessions with the academic as well as the industrial domain professionals of the Northern region of India. Based on, the following research objectives (ROs) have been formed:
RO1: Identify and analyse the various critical challenges causing the inefficiencies in Indian FMCG logistics.
RQ2: Propose few most significant remedial strategies to mitigate the severity of the identified challenges.

1.3 Structure of the study

The upcoming phases this research work has been organized as follows: the upcoming section (section 2) provides the glimpse of the literature review conducted to build the foundation of the study and identify the challenges for the Indian FMCG logistics. In section 3, the research methodology adopted to achieve the objectives has been discussed. In section 4, the implication of the proposed methodology and the results of the study have been discussed. In section 5, the discussion on results have been made. Section 6 concludes the research with highlighting the potentials research implications and the future opportunities from the research.

2. Literature Review

Logistics infrastructure directly contributes to a country's economic growth, and India's development is threatened by its lack of such infrastructure (Colicchia *et al.*, 2017). Asian Development Bank study (2012) highlights that rapid urbanization has led to delivery vans struggling to enter cities due to inadequate urban traffic management. Additionally, old, inefficient vehicles exacerbate the problem, compounded by poor road conditions and traffic issues, leading to increased wear and tear and breakdowns. The fragmented nature of the truck industry and informal operations, such as non-roadworthy vehicles operating without insurance or licenses and overloading, further damage the infrastructure (Hsiao *et al.*, 2010).
Logistics partners must work in a unified and coordinated manner. Gadde (2021) describes coordination as the active cooperation of members and resources, leading to the synchronization of various elements and harmonious adjustment of interactions to ensure different components work together.

Third-party logistics (3PL) service providers play a strategic role in supply chains. However, outsourcing logistics can increase vulnerability. König and Spinler (2016) proposed a risk management strategy comparing outsourcing to internal resources. Rigid 3PL providers face drawbacks like lack of security, poor infrastructure, and ineffective collaboration (Charles and Benson Ochieng, 2023).
Adopting new technology can reduce cycle times, scale operations, and improve supply chain efficiency and customer service (Nozari *et al.*, 2022). Integrating new technology into existing operations enhances customer service, decreases cycle times, and streamlines supply chains (Schianchi, 2023).

India's transportation system is highly inefficient by international standards, posing a significant obstacle to economic development. Despite having one of the largest rail networks, India's rail freight capacity has not kept up with market growth, decreasing from 85% in 1950 to 29% now. High transportation costs and an unstructured economy further exacerbate transportation-related challenges.
Effective inventory management enhances stock availability and reduces logistics costs. Factors such as product life cycles, promotion plans, and supply chain capacity complicate forecasting (Konita and Rijanto, 2024).
Many authors have presented the increased stock keeping units (SKUs), demand fluctuations, short product lifecycles, and intensified marketing as the key challenges of Warehousing (Končar *et al.*, 2020; Osato Itohan Oriekhoe *et al.*, 2024; Turgay, 2023)

An exhaustive literature review conducted to identify and understand the issues affecting the distribution of fast-moving consumer goods (FMCG). The review included academic journals, industry reports, case studies, and other relevant

sources. The primary aim was to gather comprehensive insights into the factors contributing to poor logistics performance in the FMCG sector. Based on the literature review, the major categories of issues impacting the logistics distribution of FMCG were identified.

Table 1 Summary and conceptualization of the identified challenges

S. No	List of Issues	Description	Reference
1	Lack of Coordination and Integration	Coordination and integration are critical components of any supply chain's success.	(Gadde, 2021; Muhalia *et al.*, 2021; Shukla *et al.*, 2012)
2	Logistics Infrastructure Issues	Logistics infrastructure has a significant impact on trade and distribution cost. Poor infrastructure increases the distribution cost	(Chinna, 2019; Nozari *et al.*, 2022; Rodrigues and Potter, 2013; Shakur *et al.*, 2024)
3	Challenges associated with outsourcing	Logistics outsourcing is a commonly used practice, which is followed by most of the companies especially in physical distribution.	(Alicke *et al.*, 2017; Hsiao *et al.*, 2010; Ilmu and Volume, 2017; Shakur *et al.*, 2024)
4	Transport Inefficiencies	Transportation management has a straight effect on SC performance.	(Melkonyan *et al.*, 2020) (Colicchia *et al.*, 2017) (Mishra *et al.*, 2024)
5	Inventory & forecast related issues	Accurate forecast and effective Inventory management are critical factors for supply chain efficiency.	(Konita and Rijanto, 2024; Lee *et al.*, 2023; Suwignjo *et al.*, 2023; Turgay, 2023)
6	Warehouse Inefficiencies	Warehouse performance has a direct impact on effective distribution.	(Chen *et al.*, 2020; Genevieve and Joseph, 2024; Khan, 2023)
7	Technological Issues	The prime reason that contributes to inefficiencies in the overall distribution of fast-moving consumer goods is poor technology integration in different.	(George and Hovan George, 2023; Prashar, 2023; Schianchi, 2023; Shakur *et al.*, 2024)

3. Research Methodology

The prime objective of the presented study is to identify and analyse the various critical challenges causing the inefficiencies in Indian FMCG logistics. Figure 1 shows the pictorial presentation of the research methodology of the presented work.

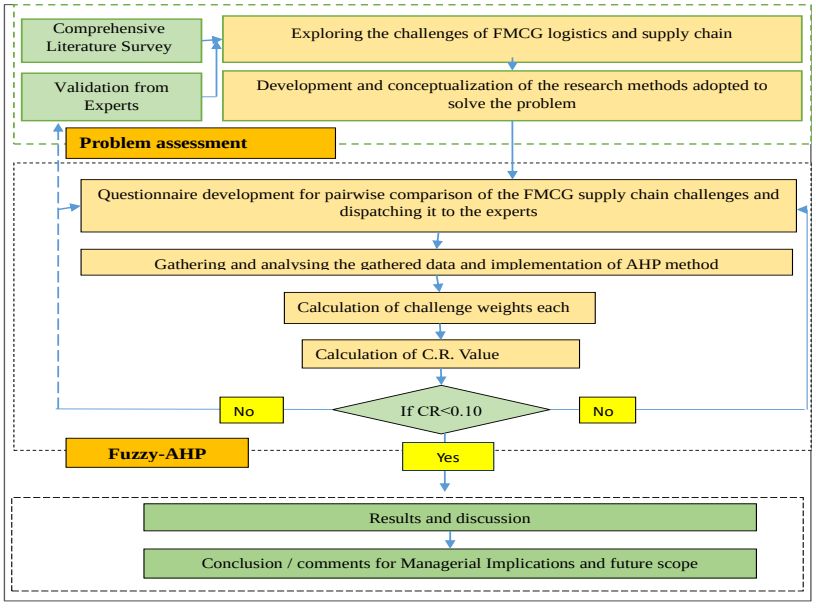

Figure 1 The flow chart for the research methodology

To identity the challenges a comprehensive literature survey was conducted. To validate and refine the identified challenges, various discussion sessions with academic and industrial experts were conducted. These experts included supply chain managers, logistics professionals, and academic researchers specializing in FMCG logistics. Their insights ensured that the categories were relevant and comprehensive. To visualize the mutual behaviour and prioritize them based on their severity rate, Analytical Hierarchy Process (AHP) has been employed. The relevant information regarding the challenges severity was gathered from the various industrial and academic experts which often shows some extent of biasness or uncertainty due to human nature. Therefore, to remove such biasness or uncertainty from the final decision-making process, fuzzy set theory has been integrated with AHP methodology.

3.1 Fuzzy- Analytical Hierarchy Process (F-AHP)

The AHP (The Analytic Hierarchy Process) is a multi-criteria decision making (MCDM) method extensively used to determine the priority order or weights of the criteria or attributes (Kumar *et al.*, 2022). Due to its applicability to both subjective and objective type weight determination MCDM problems, it is extensively used by the academic and industrial practitioners to solve the ral life problems. For example, Kumar *et al.* (2021) used fuzzy AHP method to determine the severity order of the critical key performance indicators of the cold supply chain in Indian context. Similarly in another study, Beşikçi *et al.* (2016) used fuzzy AHP method to determine the priorities of the energy efficiency measures of the ship operations. Faisal *et al.* (2023) used fuzzy AHP method to determine the priority order of the capital measurement indicators of the organization.

The steps of implementing the fuzzy AHP method to determine the priority order for the considered case are as follows:

Step 1. Develop the pairwise comparison matrix for the identified challenges of the FMCG logistics and supply chain in Indian context (used scale for the pairwise comparison matrix is given in table 2).

Table 2. Relative significance and linguistic scale for FMCG logistics challenges and their corresponding TFNs

Definition	Importance Score	Corresponding TFN
Equally significant	1	1,1,1
Weakly significant	3	2,3,4
Strongly significant	5	4,5,6
Very strong significant	7	6,7,8
Absolutely more significant	9	9,9,9
Intermediate significant between two adjacent judgements	2,4,6,8	(1,2,3),(3,4,5),(5,6,7),(7,8,9) for 2,4,6,8 respectively

The pairwise comparison matrix must follow the following conditions

x_{ij}= 1, when i = j; and $x_{ji} = \frac{1}{x_{ij}}$ **(1)** Where; i indicates ith row and j for jth column

Step 2. In the next step, the crisp numeric values are converted into triangular fuzzy number (TFN) using the scale as given in table 2.

The reciprocal of the fuzzy number can be formed by using following equation 2.

If (a, b, c) denotes a TFN and $\tilde{F}$ denotes any crisp numeric value, then

$$\tilde{F}^{-1} = (a,b,c)^{-1} = \left(\frac{1}{c}, \frac{1}{k}, \frac{1}{a}\right) \quad \textbf{(2)}$$

Step 3. In the next step, fuzzy geometric mean ($\tilde{r_i}$) of the pairwise comparison matrix is calculated both for the rows and columns.

$$(\tilde{r_i}) = \left(\sqrt[n]{\prod_1^n c_i}, \sqrt[n]{\prod_1^n a_i}, \sqrt[n]{\prod_1^n b_i}\right) \quad \textbf{(3)}$$

Step 4. Finaly the fuzzy priority weights for the challenges are calculated using the equation (4);

$$\widetilde{w_i} = \tilde{r_i} \times (\sum_1^n \tilde{r_i})^{-1} \quad \textbf{(4)}$$

Step 5. The final weights of the criterion can be calculated using equation (5).

$$\text{CWi} = \frac{\sum_1^n \widetilde{w_i}}{n} \quad \textbf{(5)}$$

Step 6. Perform the consistency checks. As per the Saaty's boundary conditions for the pairwise comparison matrix to be consistent, mathematical determinants of the consistency (consistency ratio, C.R.) should be less than 0.1.

4. Data Collection and Analysis

To achieve the stated objectives of the current study, at first, seven most critical challenges have been identified for the FMCG logistics supply chain. The identified challenges are: Lack of Coordination and Integration (C1), Logistics Infrastructure Issues (C2), Challenges associated with outsourcing (C3), Transport Inefficiencies (C4), Inventory & forecast related issues (C5), warehouse inefficiencies (C6), and Technological Issues (C7).in order to determine their severity rate, the relevant information has been collected from the various experts of academia and industries situated in the Northern region of India. For the same a questionnaire was structured and sent to 210 targeted survey participants out of which 43 respondents replied on the questionnaire. During the response checks, it was found that 5 responses were inaccurate or provide the incomplete information, so discarded from the final analysis. Therefore, 38 responses received were used to calculate the weights of the identified challenges through fuzzy AHP method. Table 3 shows the pairwise comparison matrix for the challenges of the FMCG logistics and supply chain

Table 3 Pairwise Comparison Matrix of the challenges

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
C1	1	5	3	1/3	1/3	1/3	1/3
C2	1/5	1	1/3	1/7	1/5	1/5	1/5
C3	1/3	3	1	1/7	1/3	1/3	1/5
C4	3	7	7	1	3	3	3
C5	3	5	3	1/3	1	3	1/3
C6	3	5	3	1/5	1/3	1	1/3
C7	3	5	5	1/3	3	3	1

Table 4 The fuzzy pairwise comparison matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
C1	(1,1,3)	(3,5,7)	(1,3,5)	(1/5,1/3,1)	(1/5,1/3,1)	(1/5,1/3,1)	(1/5,1/3,1)
C2	(1/7,1/5,1/3)	(1,1,3)	(1/5,1/3,1)	(1/7,1/7,1/5)	(1/7,1/5,1/3)	(1/7,1/5,1/3)	(1/7,1/5,1/3)
C3	(1/5,1/3,1)	(1,3,5)	(1,1,3)	(1/7,1/7,1/5)	(1/5,1/3,1)	(1/5,1/3,1)	(1/7,1/5,1/3)
C4	(1,3,5)	(5,7,7)	(5,7,7)	(1,1,3)	(1,3,5)	(1,3,5)	(1,3,5)
C5	(1,3,5)	(3,5,7)	(1,3,5)	(1/5,1/3,1)	(1,1,3)	(1,3,5)	(1/5,1/3,1)
C6	(1,3,5)	(3,5,7)	(1,3,5)	(1/7,1/5,1/3)	(1/5,1/3,1)	(1,1,3)	(1/5,1/3,1)
C7	(1,3,5)	(3,5,7)	(3,5,7)	(1/5,1/3,1)	(1,3,5)	(1,3,5)	(1,1,3)
C2	(1/7,1/5,1/3)	(1,1,3)	(1/5,1/3,1)	(1/7,1/7,1/5)	(1/7,1/5,1/3)	(1/7,1/5,1/3)	(1/7,1/5,1/3)

Table 5 Fuzzy geometric mean (FGM) of the TFN (a, b, c) of pairwise comparison matrix

	FGM (a)	**FGM (b)**	**FGM (c)**
C1	0.4664	0.7859	1.9442
C2	0.1979	0.2580	0.4962
C3	0.2877	0.4396	1.0000
C4	1.5838	3.2666	5.1172
C5	0.7387	1.4724	3.0793
C6	0.5594	1.0000	2.0914
C7	1.0876	2.1678	4.0661

Table 6 De-fuzzified and normalized (final) weights of the challenges and their priorities

Criteria Code	Fuzzy Weights			De-fuzzified	Normalized Weights	Rank
	L	M	U			
C1	0.02621	0.083693	0.395039	0.168314	0.10321	**5**
C2	0.011123	0.02748	0.100824	0.046476	0.02850	**7**
C3	0.01617	0.046818	0.203188	0.088725	0.05441	**6**
C4	0.089007	0.347867	1.039745	0.492206	0.30183	**1**

C5	0.041512	0.156794	0.625671	0.274659	0.16843	**3**
C6	0.031437	0.106492	0.424945	0.187625	0.11506	**4**
C7	0.06112	0.230856	0.826179	0.372719	0.22856	**2**

To check the consistency of the pairwise comparison matrix of the identified challenges of the FMCG logistics and supply chain challenges, consistency test has been conducted. The results of the consistency checks are summarized in table 7.

Table 7 Results of the consistency checks

Eigenvector (λ max)	Consistency Index (CI)	Consistency Ratio (CR)
7.5993	0.0999	0.0757

From the above table, it can be observed that the calculated C.R. value for the consistency test is 0.0757 which is less than 0.1 and satisfies the Saaty's boundary conditions for the comparison matrix to be consistent. Therefore, the constructed matrix is consistent, and the calculated weights can be considered for the final decision making.

5. Results and Discussion

The prime objective of this study was to identify the critical challenges for the effective and efficient logistics and supply chain of the FMCG company. For the same, based on literature review, a list of seven most crucial challenges are identified which are further validated with the industrial practitioners working the domain of FMCG company and its supply chain. Further, to empirically analyse the severity of the identified challenges of the FMCG supply chain, fuzzy AHP method has been proposed. The results of the fuzzy AHP method has been shown in table 6 and figure 2.

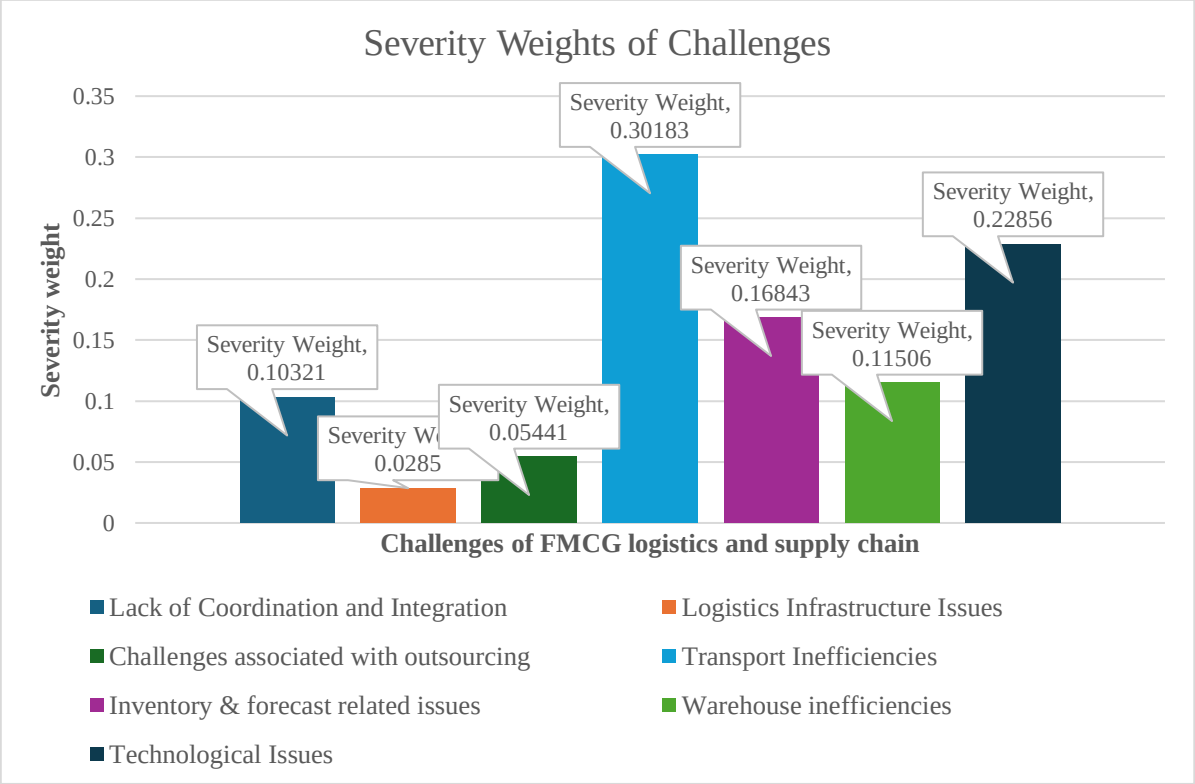

Figure 2 Bar chart showing the severity weight of the FMCG supply chain challenges

From the figure 2, it is clearly whispered that the among the seven identified challenges, challenge C4 (Transport Inefficiencies, severity weight =0.30183) is the most crucial challenge and must be on the prime focus of the top management to mitigate its negative impact. The transport inefficiencies in the FMCG supply chain are due to the reason of unavailability of the transport facility and poor transport infrastructure. On the other side, the challenge, C2 (Logistics Infrastructure Issues, severity weight = 0.02850) appeared as the least severe challenge among their parent group. Further, the challenges C7 (Technological Issues, severity weight = 0.22856) and C5 (Inventory & forecast related issues, severity

weight = 0.16843) appeared as the second and third most severe challenges respectively. Othe challenges, C6 (warehouse inefficiencies), C1 (Lack of Coordination and Integration), and C3 (Challenges associated with outsourcing) acquired the severity weights of 0.11506, 0.10321, and 0.05441 respectively and are the fourth, fifth, and sixth most severe challenges observed in FMCG logistics and supply chain.

6. Conclusion

Based on the limited literature available and expert opinion, it is possible to conclude that the fast-moving consumer goods (FMCG) distribution is plagued by a number of issues that are seriously affecting its performance. An analysis of the extant literature on MCDM, particularly FAHP, suggests that models are tested based on computational approaches disregarding their practical significance. After analysis interestingly the highest rank was attributed to Transport inefficiencies followed by technological related issues, inventory and forecast related issues, warehouse inefficiencies, lack of coordination and integration, challenges associated with outsourcing, lack of logistics infrastructure respectively. The methodology outlined above ensured a systematic and thorough investigation into the issues affecting FMCG logistics distribution, providing valuable insights for improving efficiency and performance. To ensure the robustness of the findings, a validation process was conducted. This involved cross-checking the results with additional expert consultations.

6.1 Recommendations

This study detailed the identified issues, their priority rankings, and their impact on logistics distribution performance. Based on the findings, these recommendations can help the FMCG companies streamline their operations, reduce costs, and enhance customer satisfaction.

Table 8 Proposed strategies for overcoming the challenges leading to inefficiencies in FMCG companies

Issues related to third-party challenges	• Efficient Contract Management-Long term Contracts with clear scope, expectations, and service levels. •
	• Effective 3PL selection strategies should be adopted with an adequate description of service and service levels.
	• Effective and regular training to permanent personnel for a better understanding of tools and processes.
Issues related to transportation inefficiencies.	• Use of Transport Management Systems (TMS) with advanced features like automatic scheduling of vehicles.
	• Use of Vehicle capacity utilization software for better utilization of trucks in terms of volume and weight.
	• A relay model should be adopted to address unnecessary delays en-route like unplanned stops.
Lack of Coordination and Integration related challenges	• Involvement of functional departments for better coordination.
	• Designing appropriate key performance indicators (KPIs) to capture inefficiencies
	• Use of information sharing software EDI/ERPs for proper information sharing
Issues related to warehousing inefficiencies.	• Use of Inventory Management software like WMS, and ERP Modules.
	• Use of Layout software and cubical utilization of space for better utilization of space within a warehouse.
	• Use of information sharing software EDI/ERPs for proper information sharing
Inventory & forecast related issues	• Use inventory management software and linking it with upstream and downstream supply chain.

	• Diversifying suppliers to minimize supply chain disruptions
	• By using software tools and systems, such as inventory management software, barcode scanners, RFID tags, and cloud computing. Continuous Replenishment System (CRS) can automate inventory tasks, such as ordering, receiving, tracking, and reporting.

6.2 Future scope of research

This research opens new avenues for future exploration. The findings and challenges provide a strong groundwork for working in fast-moving consumer goods distribution. Future studies could apply different methods like case-based reasoning, experiments, decision tree analysis, ANP, PROMETHEE, and TISM to expand on this work. Additionally, since this study focused only on key variables related to inefficiency, further research may explore other relevant factors.

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