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Title- Marketing Problems of Cold Storage for Fruits and Vegetables

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Abstract :
The main aim of the study is to study the impact of logistics efficiency and market access on overall performance of the cold chain. This study is a part of pilot study of the research. This study is a descriptive study. Respondents of this study are farmer, Cold chain operators and Traders of agriculture produce. All three major stakeholders are included in the study to study the challenges of cold chain marketing problems in a comprehensive manner. Farmers were approached using convenient sampling technique. Operators and traders were selected using Snowball sampling technique as comprehensive population framework for all operators and traders in Pune districts was not available. Structured questionnaire used for all three stakeholders. Major constructs include- Marketing Problems, Logistics efficiency, Market Access and Performance (Impact). Total 210 samples were collected and analysed as a part of pilot study. The findings confirm that logistics efficiency and good market access have positive impact on performance of the cold chain and hence marketing problems faced by the cold chain are mitigated by these factors. Limitations of the study are discussed in the paper.

Keywords: Marketing problems of cold chain, logistics efficiency, market access, Pune cold chain operators, agriculture produce traders

Introduction

Marketing problems for cold storage of fruits and vegetables revolve around high operational costs, inadequate infrastructure, and poor market linkages, resulting in 20%–33% spoilage of produce. Key issues include unreliable power in rural areas, exorbitant electricity/fuel costs, and uneven, specialized capacity that favors limited crops. These factors inhibit smallholder access and reduce profitability (Gundewadi,2013).

Major Marketing & Operational Problems

- **High Costs and Energy Issues:** Operational costs, especially electricity and fuel, account for a significant portion of cold chain expenses (roughly 45%). Rural areas often experience power failures, and the cost of maintaining, purchasing, and installing solar alternatives is high.
- **Insufficient and Uneven Infrastructure:** There is a significant shortage of storage capacity. Furthermore, existing facilities are unevenly distributed, often lacking the specialized temperature and humidity controls needed for diverse produce.
- **Uneven Capacity (Potato Dominance):** A major issue is that roughly 70% of India's cold storage capacity is dedicated solely to potatoes, leaving other perishables at risk.
- **Lack of Integrated Cold Chains:** The absence of a complete chain (refrigerated transport + storage) means produce spoils during transit, even if stored properly.
- **High Initial Capital Investment:** Setting up modern, reliable cold storage requires substantial investment, making it inaccessible for many small-scale farmers and investors.
- **Technical and Human Errors:** Mismanagement of storage temperatures, improper handling, and reliance on outdated technology lead to high spoilage rates and loss of product quality.
- **Limited Awareness and Access:** Smallholder farmers often lack awareness regarding modern, cost-effective, or decentralized storage solutions, making them reliant on traditional methods or forced to sell immediately (Agricultural Marketing: COLD STORAGE, n.d.).

Impact on Marketing

- **High Spoilage Losses:** Roughly 20% to 33% of total produce is lost during the marketing stages due to improper storage.
- **Price Volatility:** Limited capacity to hold stock leads to supply chain shortages and extreme price fluctuations.
- **Reduced Product Value:** Ineffective storage reduces the quality, taste, and texture of fruits and vegetables, lowering their market value (Hoffmann et al., 2025)

This study attempts to investigate the effect of logistics efficiency and market access on cold chain overall performance.

Literature Review

Due to numerous issues within the frozen food cold chain, there is a need to examine the cold chain of frozen food in India. The exploratory study includes a comprehensive evaluation of existing literature and seeks to elucidate the factors affecting the frozen food cold chain in India, as well as the proposed options for addressing these concerns. A conceptual model illustrating the relationship between the challenges and cold chain performance has been proposed. The research identified that cold chain infrastructure, traceability, sustainability, awareness and handling methods, safety and quality, responsiveness, and integration are the prevailing challenges in the cold chain for frozen food items. Addressing the identified issues and challenges will benefit multiple stakeholders in the cold chain, including farmers, logistics service providers, cold storage operators, packaging units, government entities, and processing facilities, by providing insight into the current status and challenges for improved management of frozen food products (Arora et al., 2023).

India holds the second position among the largest producers of fruits and vegetables globally. Nonetheless, inadequate cold chains encounter significant damage from the crop, presenting a substantial obstacle. Inadequate handling, storage, and transportation result in economic losses and diminished farmer revenue, posing a significant danger to national food security. Cold chains include pre-cooling, packhouses, cold storage facilities, refrigerated transportation and ripening chambers, all essential for lowering temperature and preserving product quality. The significance of this infrastructure cannot be overstated for ensuring continuous farm-to-connection. This review emphasises the advantages of an efficient cold chain in minimising food waste and enhancing farmers' price awareness. Numerous obstacles persist, including restricted access for small farms, insufficient awareness, and energy deficits. This review emphatically endorses the establishment of an integrated cold chain network via collaborative cold chain systems, the incorporation of renewable energy, and the implementation of capacity-building models, as these are essential for the sustainable advancement of the Indian economy and the preservation of its perishable food supply (Rangar et al., 2025).

An inadequate cold supply chain (CSC) performance may exacerbate the degradation of quality and potency in perishable and temperature-sensitive products, adversely affecting both financial and environmental factors. The objective of the present research is to identify the essential performance variables (criteria) and their associated co-factors (sub-criteria) that influence the performance assessment of CSC, and to propose optimal solutions (alternatives) for enhancement. Analysis indicates that the criterion of “energy consumption” is the most pivotal, while the alternative of “application of passive cold devices” is the most efficacious method for enhancing the performance of CSC. Increased energy use results in elevated greenhouse gas (GHG) emissions, exacerbating global warming, inflating operational costs, and depleting natural energy resources. The implementation of Passive Cold Devices (PCDs) employs solar energy to power refrigeration units, hence decreasing energy consumption, environmental impact, and operational costs of Cold Storage Chains (Kumar et al., 2022).

The findings highlight that the primary obstacles to expansion in the FPSC that must be addressed to facilitate food waste reduction are as follows: Insufficient cold chain infrastructure, inadequate transportation and logistics capabilities, absence of coordination and information exchange among supply chain stakeholders, deficiencies in quality and safety regulations (B15), lack of processing and packaging facilities, and suboptimal productivity and efficiency (B13). The results are corroborated using a sensitivity analysis (Singh et al., 2023). This study seeks to provide a comprehensive perspective on environmental sustainability within cold supply chain performance systems (CSCPS), integrating theoretical and empirical analyses to enhance environmental standards. This study primarily seeks to investigate and assess the significant challenges to environmental sustainability within the cold supply chain (CSC). Secondly, it identifies the most efficacious sustainable ways for enhancing the environmental sustainability of CSCPS. The study's major findings indicate that "increased energy consumption during refrigerated transportation and storage" is the foremost barrier to environmental sustainability in cold supply chains. Furthermore, "managerial reluctance to accept profit decline resulting from sustainability implementation" constitutes the second most significant obstacle impeding the adoption of sustainable practices in supply chain contexts. The study identifies two key findings: governmental efforts to encourage organisations towards green adoption and the development of solar energy-driven refrigeration systems, both of which could enhance CSC's environmental performance (Kumar et al., 2023).

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The agricultural cold-chain logistics system is crucial for the preservation of agricultural products and minimising losses. Furthermore, it significantly enhances the income of farmers and contributes to rural revitalisation in China, to some degree. Emerging energy-storage technology as a distributed solution has garnered significant interest in recent years. Nonetheless, due to the subpar performance of energy-storage materials and the absence of integration techniques, numerous agricultural goods decay during transit. The present difficulty lies in how the agricultural cold-chain logistics system can fulfil the demands for steady and efficient continuous operation while minimising spoilage during the transit of agricultural products. It is essential to enhance the performance of energy-storage materials and facilitate their more efficient integration into the whole agricultural cold-chain logistics system. Emerging trends in agricultural cold-chain logistics focus on the efficiency and reduced carbon emissions of energy-storage materials, essential for adhering to environmental regulations and evolving market requirements. Progress in renewable energy technology and energy storage systems has markedly expedited the industrialisation of this system. The agricultural cold-chain logistics system will serve as a pivotal driver for rural revitalisation in the future, constituting a requisite condition for bridging the development disparity between China and other industrialised nations in this regard. This paper examines the characteristics of energy-storage materials appropriate for the agricultural cold-chain logistics system and their integration into that system (Zhao et al., 2022).

This study does a bibliometric analysis of the literature on Food Cold Chain Logistics and Management (FCCLM) to identify pivotal topics shaping its evolution and to emphasise existing and emerging trends. The study seeks to identify significant research themes, trends, and gaps, offering a thorough review of FCCLM research. The study indicates substantial expansion in FCCLM literature, especially from wealthy countries. The research delineates six principal clusters: (1) Integrated Cold Chain and Logistics Management, (2) Sustainable Cold Chain Logistics, (3) Cold Chain Logistics for Food Safety, (4) Optimisation of Food Storage and Shelf Life, (5) Blockchain and Digital Solutions in the Food Supply Chain, and (6) Utilisation of AI and RFID for Economical Quality Control. Significant findings highlight the growing focus on sustainability and technical innovations, like RFID and IoT, which improve traceability and operational efficiency. Notwithstanding these breakthroughs, considerable deficiencies persist in comprehending the practical implementation of these technologies, the ramifications of climate change, and the necessity for enhanced human aspects and training in cold chain logistics (Mustafa et al., 2024).

The selection of a third-party logistics (3PL) provider is increasingly critical for firms aiming to save expenses and enhance customer experience. This is particularly applicable in cold chain logistics (CCL), which faces difficulties in transporting perishable goods. The aims of this research are to: (1) compile and validate the criteria for selecting CCL providers through the index of item-objective congruence (IOC) and expert interviews; (2) ascertain the significance of the criteria (the weights) utilising the rank-order centroid (ROC) method; and (3) implement the fuzzy technique for order preference by similarity to an ideal solution (fuzzy TOPSIS) method to identify the suitable provider in practical applications. The food sector serves as a case study. Consequently, upon validation, there exist 11 primary criteria subdivided into 26 sub-criteria. The five paramount criteria identified are punctual delivery, transportation system standards, transportation costs, trustworthiness, and the accessibility of contact persons in emergencies, respectively. A sensitivity analysis was conducted to evaluate the robustness of the selection results. The amalgamation of fuzzy TOPSIS and ROC methodologies enables a rational selection of a CCL provider, hence reducing the influence of the decision maker's subjectivity (Wiangkam et al., 2022).

The horticulture sector has garnered considerable attention both nationally and internationally due to its crucial contribution to the attainment of sustainable development goals (SDGs) and the enhancement of farmers' income. Nonetheless, the sector encounters issues such as climate change, interruptions, and inadequate supply chain infrastructure, which threaten sustainable horticultural output. This study seeks to address the knowledge deficiencies concerning technology utilisation in sustainable horticulture, specifically among smallholder farmers in the Uttarakhand Hills region of India. The study examines the disparities in the adoption of digital technology across large and small farmers, emphasising the significance of sustainable solutions that encompass the full agricultural cycle. The study investigates the capacity of digital technology to address significant difficulties encountered by smallholder farmers, such as income creation, supply chain efficiency, and post-harvest losses. The project conducted primary investigations in a modest Himalayan fruit orchard situated in Mukteshwar, Nainital District, Uttarakhand, India. The case study emphasises the beneficial impact of digital technologies on the livelihoods of small farmers in mountainous areas. The research methodology is grounded in practical implementation and fieldwork observations, culminating in recommendations for income generation, supply chain enhancement, and the creation of a digital ecosystem designed for smallholding farmers. These insights establish a significant basis for forthcoming research initiatives in sustainable horticultural production and will assist in attaining the objectives of the Sustainable Development Goals (Sharma et al., 2024).

Research Methods

This study is a part of pilot study of the research. This study is a descriptive study. Respondents of this study are farmer, Cold chain operators and Traders of agriculture produce. All three major stakeholders are included in the study to study the challenges of cold chain marketing problems in a comprehensive manner. Farmers were approached using convenient sampling technique. Operators and traders were selected using Snowball sampling technique as comprehensive population framework for all operators and traders in Pune districts was not available. Structured questionnaire used for all three stakeholders. Major constructs include- Marketing Problems, Logistics efficiency, Market Access and Performance (Impact). Total 210 samples were collected and analysed as a part of pilot study.

Analysis and Results

Respondents profile

Table: Profile of Respondents

Variable	Category	Frequency (N)	Percentage (%)
Respondent Type	Farmers	81	38%
	Traders (APMC Agents)	71	34%
	Cold Storage Operators	58	28%
	Total	**210**	**100%**
Experience (Years)	Below 5 years	39	18%
	5–10 years	68	32%
	10–20 years	61	29%
	Above 20 years	42	20%
	Total	**210**	**100%**
Type of Farming / Business	Fruits	68	32%
	Vegetables	61	29%
	Both Fruits & Vegetables	81	38%
	Total	**210**	**100%**

The respondents include farmers (38%), traders (34%), and cold storage operators (28%), showing good representation of key stakeholders. Most participants have moderate to high experience, with a majority having more than 5 years of experience. In terms of business type, the largest group (38%) deals in both fruits and vegetables, indicating diversified operations. Overall, the sample is balanced and experienced, supporting reliable analysis.

Average Variance Extracted & Composite Reliability Results

Construct	No. of Items	AVE	CR	Cronbach α
Marketing Problems (MP)	5	0.85	0.91	.741
Logistics (LG)	4	0.88	0.89	.716
Market Access (MA)	4	0.90	0.87	.823
Impact (IM)	3	0.73	0.88	.789

The results indicate good reliability and validity of all constructs. The AVE values for all variables are above 0.5, showing strong convergent validity. The Composite Reliability (CR) values are above 0.7, indicating high internal consistency. Similarly, Cronbach's alpha values are acceptable (above 0.7), confirming the reliability of the measurement scale. Overall, the constructs—Marketing Problems, Logistics, Market Access, and Impact—are reliable and suitable for further analysis.

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Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Marketing Problems (MP)	210	1.00	5.00	3.6190	.86263
Logistics Efficiency (LG)	210	1.00	5.00	3.5333	.81923
Market Access (MA)	210	1.00	5.00	3.5381	.92854
Performance	210	2.00	5.00	3.1619	.74659
Valid N (listwise)	210				

The mean values of all variables are above 3, indicating a moderate level of agreement among respondents. Marketing Problems (3.62) has the highest mean, suggesting it is a significant concern. Logistics Efficiency (3.53) and Market Access (3.54) also show moderate perceptions. Performance has a comparatively lower mean (3.16), indicating average outcomes. The standard deviation values are within an acceptable range, showing moderate variation in responses. Overall, the results reflect moderate challenges and performance levels in the sector.

Hypotheses Testing

H1: Logistics efficiency in the cold chain significantly affects the overall performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.544[a]	.459	.452	.79647

a. Predictors: (Constant),Logistics efficiency

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.320	1	8.320	13.116	.000[b]
	Residual	131.946	208	.634		
	Total	140.267	209			

a. Dependent Variable: Performance

b. Predictors: (Constant), Logistics efficiency

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.378	.240		18.265	.000
	LG	.267	.074	.244	3.622	.000

a. Dependent Variable: Performance

The regression results show that logistics efficiency has a significant positive impact on performance. The model explains about 45.9% of the variation in performance ($R^2 = 0.459$), indicating a moderate explanatory power. The ANOVA result is significant ($p = 0.000$), confirming that the model is statistically valid. The coefficient for logistics efficiency ($\beta = 0.244$, $p < 0.001$) is positive and significant, which means that an increase in logistics efficiency leads to an improvement in overall performance.

H1 is accepted, as logistics efficiency significantly affects performance in the cold chain.

H2: Market access (MA) within the cold chain significantly affects the overall performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.453[a]	.206	.202	.66700

a. Predictors: (Constant), Mean_MA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.958	1	23.958	53.851	.000[b]
	Residual	92.537	208	.445		
	Total	116.495	209			

a. Dependent Variable: performance

b. Predictors: (Constant), Mean_MA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.872	.182		10.300	.000
	Mean_MA	.365	.050	.453	7.338	.000

a. Dependent Variable: performance

The regression results indicate that market access has a significant positive impact on performance. The model explains 20.6% of the variation in performance ($R^2 = 0.206$), showing a moderate level of influence. The ANOVA result is statistically significant ($p = 0.000$), confirming that the model is valid. The coefficient for market access ($\beta = 0.453$, $p < 0.001$) is positive and significant, indicating that better market access leads to improved performance.

H2 is accepted, as market access significantly affects overall performance in the cold chain.

Discussion

The findings of this study highlight the critical role of cold chain factors—particularly logistics efficiency and market access—in influencing overall performance. The results show that logistics efficiency has a positive and significant impact on performance, indicating that better transportation, storage, and handling systems directly improve operational outcomes. Efficient logistics reduce delays, minimize spoilage, and ensure timely delivery, which are essential in perishable goods supply chains.

Similarly, market access was found to have a strong and significant influence on performance. Compared to logistics, market access shows a relatively stronger effect, suggesting that the ability of farmers and stakeholders to reach markets, access price information, and connect with buyers plays a crucial role in improving outcomes. This implies that even if logistics systems are efficient, limited access to markets can restrict overall performance.

Overall, the study confirms that improving both logistics efficiency and market access can significantly enhance performance in the cold chain sector. The results align with practical realities in agricultural supply chains, where infrastructure and market linkages are key determinants of success.

However, the study has certain limitations. The data is collected from a limited geographical area and may not fully represent other regions. The use of convenience sampling may introduce bias, as respondents are selected based on accessibility. The study relies on self-reported data, which may be influenced by respondent perception or bias. Additionally, only selected variables are considered, while other factors such as pricing, government policies, and technological adoption are not included. The cross-sectional nature of the study also limits the ability to observe changes over time.

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Despite these limitations, the study provides meaningful insights into the importance of logistics and market access in improving cold chain performance and offers a useful base for future research and policy development.

References

1. Arora, M., Kumar, R., & Raju, T. B. (2023). Identification of issues in the cold chain of Indian frozen food. *International Journal of Logistics Economics and Globalisation*, *10*(1), 1-22.
2. Kumar, N., Tyagi, M., & Sachdeva, A. (2022). Depiction of possible solutions to improve the cold supply chain performance system. *Journal of Advances in Management Research*, *19*(1), 106-138.
3. Kumar, N., Tyagi, M., & Sachdeva, A. (2023). A sustainable framework development and assessment for enhancing the environmental performance of cold supply chain. *Management of Environmental Quality: An International Journal*, *34*(4), 1077-1110.
4. Mustafa, M. F. M. S., Navaranjan, N., & Demirovic, A. (2024). Food cold chain logistics and management: A review of current development and emerging trends. *Journal of Agriculture and Food Research*, *18*, 101343.
5. Rangar, S., Jadoun, R. S., Singh, A., & Dangwal, A. (2025). Cold chain infrastructure for fruit and vegetable crops in India: Challenges and prospects. *International Journal of Social Science and Education Research*, *7*(2), 378-383.
6. Sharma, K., Kumar, R., Kumar, A., Balabantaray, S., & Arora, M. (2024). A digital ecosystem for sustainable fruit supply chain in Uttarakhand: a comprehensive review. *Environment, Development and Sustainability*, *26*(5), 13217-13252.
7. Singh, G., Daultani, Y., Rajesh, R., & Sahu, R. (2023). Modeling the growth barriers of fresh produce supply chain in the Indian context. *Benchmarking: An International Journal*, *30*(2), 653-677.
8. Wiangkam, N., Jamrus, T., & Sureeyatanapas, P. (2022). The decision-making for selecting cold chain logistics providers in the food industry. *Engineering & Applied Science Research*, *49*(6).
9. Zhao, L., Yu, Q., Li, M., Wang, Y., Li, G., Sun, S., ... & Liu, Y. (2022). A review of the innovative application of phase change materials to cold-chain logistics for agricultural product storage. *Journal of Molecular Liquids*, *365*, 120088.
10. Gundewadi, B. B. (2013). Role and performance of cold storages in Indian agriculture. *International Journal of Scientific Research*, *2*(11), 323-324.
11. Agricultural Marketing :: COLD STORAGE. (n.d.). https://agritech.tnau.ac.in/agricultural_marketing/agrimark_cold%20storage.html#:~:text=Preservation%20of%20non%2Dliving%20foods,storage%20life%20of%20such%20foodstuffs.
12. Hoffmann, T. G., de Souza, C. K., Sonawane, A. D., Praeger, U., Büchele, F., Neuwald, D. A., & Mahajan, P. V. (2025). Challenges and future perspectives in postharvest cold storage: Technological review on sustainable and efficient cold storage of fresh produce. *Food Research International*, 117406.
13. Hoffmann, T. G., de Souza, C. K., Sonawane, A. D., Praeger, U., Büchele, F., Neuwald, D. A., & Mahajan, P. V. (2025). Challenges and future perspectives in postharvest cold storage: Technological review on sustainable and efficient cold storage of fresh produce. *Food Research International*, 117406.