

**RESEARCH ARTICLE**

A study on the inventory management of perishable products

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Abstract

The project examines the vital role of inventory management in balancing customer demand and inventory availability to optimize business operations. Analysis of user demographics and responses about perishable products provides insight into consumer behavior and purchasing decisions. The study highlights the need for effective communication, real-time inventory monitoring and demand forecasting to increase customer satisfaction and reduce inventory. Key inventory management techniques such as just-in-time (JIT), economic order quantity (EOQ) and ABC analysis are highlighted for operational efficiency along with advanced technologies such as automation and radio frequency identification (RFID) for real-time visibility and warehouse operations optimized supply chain. Strategic recommendations are provided to retailers, emphasizing the diversification of product ranges and the refinement of inventory processes to better align with market dynamics. By applying these insights and recommendations, retailers can effectively manage the availability of perishable products, ensuring long-term success and customer loyalty in the dynamic retail industry.

Keywords: Inventory management, Consumer behavior, Perishable products, Real-time monitoring, Demand forecasting.

Introduction

Supply chain management (SCM), is a complex and multidimensional field that forms the backbone of contemporary businesses. It does this by intrinsically connecting different departments, stakeholders, and procedures to ensure the smooth transfer of products, services, capital, and information from suppliers to consumers. To achieve operational excellence and improve organizational performance, a complex network of interactions is involved that spans multiple levels and units within the supply chain network. These interactions include procurement, production, inventory management, transportation, warehousing, distribution, logistics, and customer service (Gioia *et al.*, 2022). The importance of SCM cannot be overemphasized as it is essential for increasing operational efficiency, reducing expenses, increasing

customer satisfaction, gaining competitive advantage, successfully managing risks, and promoting sustainability in a variety of industries. In supply chain ecosystems, it plays the role of strategic facilitator, promoting resilience, innovation, and value creation. SCM is basically about coordinating and streamlining the entire supply chain ecosystem to achieve specific goals and add value to all parties involved, including manufacturers, distributors, retailers, and users. Operational efficiency is a fundamental pillar of strategic SCM, focused on continuous improvement, waste reduction, resource optimization, and productivity improvement. Achieving operational efficiency involves streamlining workflows throughout the supply chain to eliminate bottlenecks, reduce unnecessary steps, and ensure smooth transitions in production, distribution, and delivery. This improves speed, agility, and responsiveness to customer requests and minimizes operational costs. Using Lean concepts is essential for improving operational effectiveness. With just-in-time (JIT) manufacturing, continuous improvement (Kaizen), and total quality management (TQM), lean approaches seek to do away with non-value-added tasks, lower inventory levels, and maximize resource utilization. These procedures shorten lead times and cut waste while increasing output, quality, and customer satisfaction. For supply chain management to operate efficiently, effective inventory control is essential. Putting in place reliable demand forecasting methods, inventory optimization software and inventory control systems allows for proactive decision-making, real-time

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visibility, and increased accuracy. Optimizing production schedules is also essential, as it requires alignment with demand forecasts, balanced capacity utilization and minimized delivery times (Yavari *et al.*, 2020). Adopting agile manufacturing, JIT production strategies and flexible scheduling systems improves resource allocation, reduces idle time and improves production efficiency.

Review of literature

Zhang *et al.* (2022): A lot of retailers have been selling their goods online and through physical channels in recent years. In 2020 saw a remarkable rise in the sales of perishable goods on e-commerce platforms. However, some retailers order more merchandise than is ideal because they are overconfident, which leads to significant losses because of product deterioration. In this work, we utilize the newsvendor model to examine how overconfidence affects the retailer's ability to make profitable decisions about order quantity, pricing, and other factors. Our model offers the overconfident retailer a workable and efficient way to modify the best possible ordering and pricing choices. We investigate the retailer's best choices in the cases of total rationality, overestimation, and overprecision through numerical investigations. It is consistently observed that the retailer who overestimates the quantity of products to be ordered, as opposed to the over-precision retailer, always orders fewer products than the ideal quantity. In certain cases, overconfidence significantly reduces the retailer's earnings. As a result, the overconfident retailer would be wise to modify its order quantity in light of our research findings.

Taparia *et al.* (2020): Inventory systems work by filling orders by issuing them, which are filled after a certain amount of time, known as the lead time, and by responding to a time-varying demand that is unknown in advance. These systems' goals are to satisfy demand and, depending on the type of goods, leave a certain amount of desired or minimum stock in the inventory. It is generally possible to forecast the demand based on a few previous samples and a trend. The replenishment orders constraint can be handled by model predictive control (MPC), which is widely recognized for its proficiency in handling constraints. Cost functions are designed to maximize profit while minimizing holding and shortage costs associated with inventory. The replenishment order control law is derived using the MPC strategy. The use of MPC to maximize profits from a perishable inventory is examined and analyzed. To assess effectiveness, simulations are run with respect to lost goods, orders placed, inventory on hand, profit margin, etc. The outcomes of the simulation are used to draw conclusions.

Kumar *et al.* (2021): Recent studies show that food waste has emerged as the world's largest issue, with the food supply chain accounting for 20 to 60% of global production losses. Fresh food companies encounter additional

difficulties in their supply chains because of the perishable nature of their products and their high cost. By integrating machine learning and loud, as well as taking into account supply chain constraints like supplier delivery times and the maximum and minimum number of orders, an order proposal is generated for every product for a week. The random forest regression algorithm is used throughout the entire prediction process. This study examines perishable commodities in particular and bases its analysis on the precision of testing and training.

Sajadi and Ahmadi (2022): Product category management, or PCM, is essential in today's big-box retailers. PCM is able to provide answers for issues like shelf space allocation (SSA) and assortment planning (AP). Whereas the SSA problem aims to arrange the chosen products in the available shelf space, the AP problem looks for a list of products and suppliers. These issues seek to maximize retailer sales while working within a variety of limitations, including a restricted purchasing budget, a limited amount of classroom space for product displays, and a minimum number of suppliers. An integrated mathematical model to optimize the integrated inventory control, SSA, and AP problems for perishable goods is attempted to be developed in this paper.

Statement of problem

Due to their short shelf life and high risk of deterioration, managing perishable products is extremely difficult (Muriana, 2020). Regulatory compliance, quality maintenance and effective distribution are important concerns. It is essential to use specialized handling, such as transport and temperature-controlled storage. Optimizing inventory turnover and reducing waste requires effective inventory management (Gioia *et al.*, 2023). Maintaining freshness while pursuing sustainability goals requires constant innovation in packaging and preservation. To ensure quality and prompt delivery of perishable products, addressing these issues requires the integration of effective distribution, solid inventory management procedures and creative packaging solutions.

Objectives

Primary objective: To study the inventory management of perishable items

Secondary objectives: To understand the company stock optimization strategies with respect to inventory management for perishable products. To analyze the customer perception towards product availability with reference to perishable products. To suggest measures for better and more efficient inventory management.

Methodology

Research design

The project is descriptive in nature. The sampling type is non-probability sampling and the sample size is 141.

Data Collection: The data used for this research is both primary data and secondary data. Primary data is collected by the questionnaire based on survey and observation. Secondary data for this research was obtained from previous research papers, websites, the internet, reports and other materials.

Plan of Analysis: The tools used for the presentation of data are tables and pie charts. The statistical tool used in the study is percentage analysis. Percentage analysis is used for finding the percentage of respondents who fall in a certain category or who agree/disagree with a statement.

Limitations of the Study: Sample size and representativeness may be limited by factors such as budget constraints, time constraints and access to relevant stakeholders. This may lead to sample bias and limit the generalizability of the results to the wider population. Second, challenges in data collection, including difficulties in obtaining complete responses from participants and accessing data in real time, may affect the depth of the investigation. Additionally, the focus of the study on a specific geographic area, such as Bangalore, India, may limit the applicability of the findings to other locations that have different material and infrastructure environments. Finally, in order to preserve the integrity of the research process, ethical issues like protecting participant confidentiality and gaining informed consent need to be carefully taken into account.

Results

Data analysis and interpretation

How would you rate the impact of product unavailability on your satisfaction with the overall shopping experience?

The data from Table 1 (Figure 1) shows that 35% were neutral about the impact of product unavailability on their satisfaction with the overall shopping experience. 22.9% said they had a positive impact, 7.9% said they had very positive experience. Another 22.9% said it had a negative impact, while 11.4% said they had very negative impact.

Have you ever switched to an alternative brand or product due to the unavailability of a specific perishable item?

Table 2 (Figure 2) shows that 76.8% of the participants responded Yes if they ever switched to an alternative brand or product due to the unavailability of a specific perishable item, while 23.2% responded No.

Table 1: Impact of product unavailability on your satisfaction with the overall shopping experience

Sl. No.	Number of respondents	Options	Percentage
1	16	Very negative	11.4
2	32	Negative	22.9
3	49	Neutral	35
4	32	Positive	22.9
5	11	Very positive	7.9
Total	140	Total	100%

PERCENTAGE

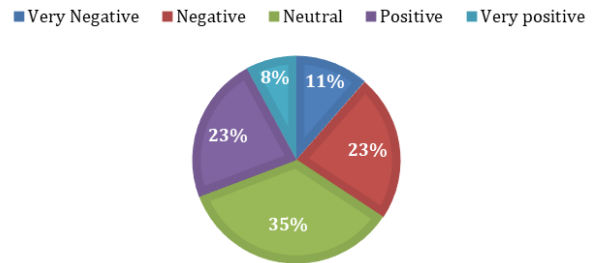


Figure 1: Impact of product unavailability on your satisfaction with the overall shopping experience

H1 Hypothesis: Product unavailability and customer perception towards perishable products are dependent on each other.

Hypothesis Testing Analysis:

As per the Chi-square test shown in Table 3 analyzed using SPSS version 28, the significance level is more than 0.05% for correlation as well as test of goodness fit. Therefore, we can conclude that consumer perception and product unavailability are not related to each other. Both variables are also independent of each other. Therefore, sustainable packaging and consumer purchase decisions are not dependent on each other (Murmu *et al.*, 2023). There are umpteen number of factors that contribute to customer perception.

Discussion

Finding

Demographic Analysis: The demographic analysis revealed that the majority of respondents, comprising individuals aged 18 to 25, form a significant portion of the user base. Conversely, there was minimal representation from the 45 to 50 age bracket, indicating a skew towards younger

Table 2: Switching to an alternative brand or product due to the unavailability of a specific perishable item

S. No.	Number of respondents	Options	Percentage
1	106	Yes	76.8
2	32	No	23.2
Total	138	Total	100%

PERCENTAGE

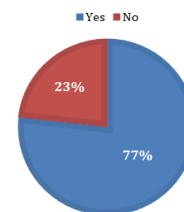


Figure 2: Switching to an alternative brand or product due to the unavailability of a specific perishable item.

Table 3: Chi-square tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-square	16.539 ^a	12	.148
Likelihood ratio	18.975	12	.089
Linear-by-linear Association	1.763	1	.184
N of valid cases	117		

consumers in the survey. This demographic skew suggests a particular focus on understanding the preferences, behaviors, and expectations of younger consumers in relation to perishable products and their availability in grocery stores.

Youthful User Base with Balanced Gender Ratios: The data analysis further highlights a youthful user base with balanced gender ratios. This finding suggests that both male and female consumers in the 18 to 25 age group are equally engaged in evaluating and considering the availability of perishable products when making their purchasing decisions. Understanding this demographic trend is crucial for tailoring marketing strategies and product offerings to effectively meet the needs of this demographic segment.

High Education Levels: Notably, a significant portion of respondents reported having completed graduation and post-graduation levels of education. This demographic characteristic indicates a level of education that can influence consumer behaviour, preferences, and decision-making processes regarding perishable products. Educated consumers may place a higher value on factors such as product quality, sustainability, and ethical sourcing, which can impact their perceptions of product availability.

Marital Status: The majority of respondents indicated that they were unmarried. This demographic aspect can influence shopping patterns, as unmarried individuals may have different household needs, consumption patterns, and priorities compared to married or family-oriented consumers. Understanding the preferences and behaviors of unmarried consumers is crucial for designing targeted marketing strategies and product offerings that resonate with this demographic segment.

Income Bracket: A significant majority of respondents fell under the income bracket of 0 to 2,50,000 rupees per annum. This income level can impact purchasing power, affordability, and willingness to spend on perishable products. Consumers in this income bracket may prioritize factors such as affordability, value for money, and product freshness when evaluating the availability of perishable items in grocery stores.

Satisfaction with Perishable Product Availability: The majority of respondents expressed a neutral stance regarding their satisfaction with the availability of perishable products in their preferred grocery store. This neutral sentiment suggests that there may be room for improvement in terms of ensuring consistent availability

and variety of perishable items to meet consumer demand and expectations.

Frequency of Unavailability: A significant number of respondents reported experiencing unavailability of specific perishable items they intended to purchase in the past month. This finding indicates potential challenges in inventory management, supply chain logistics, and stock replenishment processes that may impact customer satisfaction and shopping experiences.

Factors Influencing Availability Evaluation: Freshness and price emerged as the major factors influencing respondents' evaluation of the availability of perishable products. This finding underscores the importance of maintaining product freshness and offering competitive pricing strategies to attract and retain customers in the perishable goods segment.

Importance of Immediate Availability: Most respondents expressed a neutral stance on the importance of immediate availability of perishable items in influencing their overall shopping experience. This finding suggests that while immediate availability is valued, other factors such as product quality, variety, and pricing also play significant roles in shaping consumer perceptions and satisfaction.

Brand Switching due to Unavailability: A majority of respondents indicated that they switched to alternative brands or products due to the unavailability of specific perishable items. This behavior highlights the importance of consistent stock availability and the potential impact of stockouts on consumer loyalty and brand preferences.

Impact of Product Unavailability on Shopping Experience: A significant group of respondents expressed a neutral stance on the impact of product unavailability on their satisfaction with the overall shopping experience. This finding indicates varying levels of sensitivity among consumers regarding product availability and its influence on their overall shopping satisfaction.

Influence on Loyalty to Grocery Store: The majority of respondents believed that the availability of perishable items influences their loyalty to a specific grocery store. This perception underscores the critical role of product availability in building customer loyalty, repeat purchases, and long-term relationships with consumers.

Information Sources for Availability: Most respondents rely on online platforms and word of mouth to stay informed about the availability of perishable products in a store. This reliance on digital channels and social influence indicates the importance of maintaining updated and accurate information across online platforms to meet consumer expectations and facilitate informed purchasing decisions.

Recommendation Based on Availability: The majority of respondents stated that they would recommend or consider recommending a grocery store to friends and family based on the availability of fresh and perishable products. This finding highlights the potential impact of product

availability on brand advocacy, customer referrals, and positive word-of-mouth marketing within social networks.

Suggestions

Targeted Marketing and Promotions: Grocery stores can leverage digital platforms and social media channels to create targeted marketing campaigns aimed at the 18–25 age group, which constitutes the majority of respondents. Tailored promotions and advertisements can focus on highlighting product freshness, quality, and affordability to resonate with the preferences of younger, educated consumers.

Inventory Management Optimization: Streamlining inventory management procedures is crucial, with a focus on addressing the key factors of price and freshness that influence respondents' perceptions of product availability. Implementing demand forecasting models, efficient supply chain logistics, and real-time inventory tracking systems can reduce unavailability and enhance customer satisfaction (Ahmadi *et al.*, 2022).

Customer Communication and Engagement: Establishing effective communication channels through loyalty programmes, surveys, and feedback mechanisms allows grocery stores to gather valuable insights into customer preferences and behaviours. Utilizing this feedback enables personalized communication with customers, informing them about product updates, promotions, and addressing concerns related to perishable product availability.

Enhanced Online and Offline Integration: Seamless integration of online and offline channels is essential, given that most respondents rely on online platforms and word-of-mouth for information about product availability. Providing accurate, real-time information about product availability on websites, mobile apps, and social media platforms enhances the overall customer experience and promotes customer trust.

Product Assortment and Alternatives: Diversifying product offerings and ensuring adequate substitutes for perishable items can mitigate the risk of customers switching to alternative brands or products due to unavailability. Maintaining a robust backup plan and collaborating with multiple suppliers for high-demand perishable items minimizes stockouts and ensures efficient fulfilment of customer demand.

Customer Loyalty Programmes: Implementing customer loyalty programmes that reward engagement, referrals, and repeat business can foster greater customer retention and brand loyalty. Respondents' belief that the availability of perishable goods influences their loyalty underscores the importance of initiatives that incentivize continued patronage and advocacy.

Constant Monitoring and Improvement: Continuous monitoring of competitor strategies, market trends, and customer feedback is essential for strategic improvement and staying competitive in the market. Proactive management

of availability issues, adaptation to evolving consumer preferences, and a commitment to exceptional customer service are vital for sustained success and market relevance.

Conclusion

Detailed analysis of consumer demographics and responses to the availability of perishable products provided a nuanced understanding of retail consumer behavior. These insights highlight the critical role effective inventory management plays in meeting consumer expectations and preferences. The study highlights the importance of timely communication and engagement strategies to inform customers about promotions and product availability, thereby improving their shopping experience and loyalty. With advanced technologies for real-time inventory tracking, accurate demand forecasting and customer feedback, supermarkets can better serve their customers.

References

- Ahmadi, E., Mosadegh, H., Maihami, R., Ghalehkhondabi, I., Sun, M., & Süer, G. A. (2022). Intelligent inventory management approaches for perishable pharmaceutical products in a healthcare supply chain. *Computers & Operations Research*, 147, 105968.
- Gioia, D. G., Felizardo, L. K., & Brandimarte, P. (2022). Inventory management of vertically differentiated perishable products with stockout based substitution. *IFAC-Papers Online*, 55(10), 2683-2688.
- Gioia, D. G., Felizardo, L. K., & Brandimarte, P. (2023). Simulation-based inventory management of perishable products via linear discrete choice models. *Computers & Operations Research*, 157, 106270.
- Kumar, M. V., Snehalatha, S., Nageswari, C. S., Raveena, C., & Rajan, S. (2021). Optimized warehouse management of perishable goods. *Alinteri Journal of Agricultural Sciences*, 36(1), 199-203
- Muriana, C. (2020). Inventory management policy for perishable products with Weibull deterioration and constrained recovery assumption based on the residual life. *International Journal of Operational Research*, 39(4), 516-538.
- Murmu, V., Kumar, D., Sarkar, B., Mor, R. S., & Jha, A. K. (2023). Sustainable inventory management based on environmental policies for the perishable products under first or last in and first out policy. *Journal of Industrial and Management Optimization*, 19(7), 4764-4803.
- Sajadi, S. J., & Ahmadi, A. (2022). An integrated optimization model and metaheuristics for assortment planning, shelf space allocation, and inventory management of perishable products: a real application. *Plos one*, 17(3), e0264186.
- Taparia, R., Janardhanan, S., & Gupta, R. (2020). Inventory control for nonperishable and perishable goods based on model predictive control. *International Journal of Systems Science: Operations & Logistics*, 7(4), 361-373.
- Yavari, M., Enjavi, H., & Geraeli, M. (2020). Demand management to cope with routes disruptions in location-inventory-routing problem for perishable products. *Research in Transportation Business & Management*, 37, 100552.
- Zhang, M., Yang, X., Cheng, T. E., & Chang, C. (2022). Inventory Management of Perishable Goods with Overconfident Retailers. *Mathematics*, 10(10), 1716.