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Enhancing Inventory Control: Approaches for Managing Perishable Goods with Time-Sensitive Demand

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Abstract

Efficient stock control is vital for companies handling perishable products that degrade over time. This paper investigates inventory frameworks that accommodate fluctuating demand tied to time, pricing variations, and item perishability. Drawing on a synthesis of research by Sharma and associates spanning 2015 to 2024, it explores methods to streamline stock levels, cut costs, and boost supply chain performance. Key tactics such as adaptive pricing, partial backordering, and demand prediction are emphasized as critical to effective inventory systems. The study offers practical insights for retailers, producers, and logistics professionals while suggesting avenues for further exploration.

Keywords: *Stock control, perishable goods, time-sensitive demand, adaptive pricing, partial backordering.*

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Introduction

Effective stock control is a cornerstone of supply chain success, especially for industries managing perishable items like food, medicines, and seasonal merchandise. Unlike conventional models that presume steady demand, real-world conditions demand advanced strategies that address demand variability and product degradation (Sharma, 2022). Recent work by Sharma (2024) underscores how time-sensitive demand and pricing adjustments can refine inventory management. This paper integrates insights from various studies (Sharma & Bansal, 2016; Sharma et al., 2023) to examine inventory approaches designed for perishable goods thoroughly. Topics include:

1. The impact of degradation rates on stock decisions.
2. How price responsiveness shapes demand trends.
3. Techniques like partial back ordering to address shortages.

LITERATURE REVIEW

I. Models for Perishable Inventory

Sharma (2019a) describes perishable goods as those losing utility over time due to spoilage, obsolescence, or expiration. His research contrasts various degradation patterns, such as:

a) Exponential decline models (Sharma, 2020).
b) Linear decay rates (Sharma & Bansal, 2016).

Evidence indicates that firms should tailor ordering schedules to product shelf life and storage conditions to curb losses (Sharma, 2019b).

Figure 1: Strategies for managing Perishable Inventory

II. Time-Driven Demand Trends

Demand for perishable items often exhibits non-linear patterns, including:

a) Trapezoidal demand curves (Sharma, 2015).
b) Seasonal variations (Sharma, 2022).

Sharma et al. (2023) argue that adaptive pricing can synchronize stock levels with demand spikes, minimizing waste and enhancing revenue.

III. Managing Shortages with Backordering

In cases of supply shortages, partial backordering enables delayed order fulfillment while risking lower customer retention (Sharma & Bansal, 2016). This approach suits high-demand perishables like vaccines or fresh produce.

METHODOLOGY

This research employs a qualitative method, reviewing peer-reviewed works by Sharma and collaborators (2015–2024) to uncover patterns in perishable inventory modeling. The process unfolds in three stages:

I. Data Gathering

a) Studies were chosen based on terms like perishable inventory, time-sensitive demand, and adaptive pricing.
b) Only articles from reputable indexed journals were included for credibility.

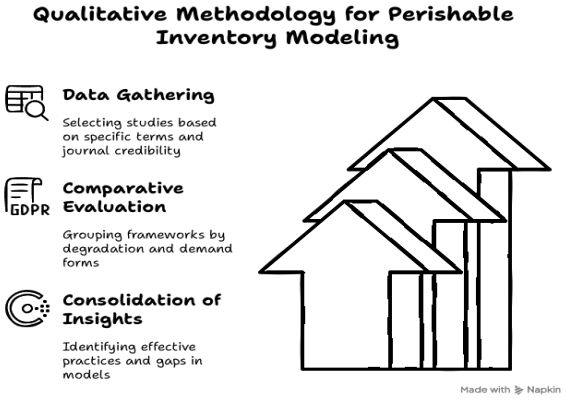

Figure 2: Qualitative Methodology for Perishable Inventory Modeling

II. Comparative Evaluation

1. Frameworks were grouped by degradation type (linear, exponential, constant) and demand forms (trapezoidal, uniform, seasonal).
2. Variables such as storage costs, shortages, and backordering rates were assessed across studies.

III. Consolidation of Insights

- Effective practices, such as ideal restocking intervals and pricing tactics, were distilled.
- Gaps in current models, like assumptions of uniform degradation, were identified for future investigation.

This structured approach ensures a robust, evidence-backed analysis of stock optimization techniques.

FINDINGS AND DISCUSSION

I. Effective Restocking Methods

- Constant degradation models suggest shorter restocking intervals for rapidly decaying items (Sharma, 2020).
- Flexible pricing strategies reveal that markdowns near expiration can drive sales (Sharma, 2024).

II. Cost Reduction Approaches

- Just-in-Time (JIT) ordering lowers storage expenses but heightens shortage risks (Sharma, 2022).
- Combined models of backordering and adaptive pricing offer superior cost savings (Sharma & Bansal, 2016).

III. Technology Adoption

AI-powered demand forecasting tools can sharpen inventory precision, though implementation challenges linger (Sharma et al., 2023).

CONCLUSION AND FUTURE DIRECTIONS

This paper consolidates a decade of scholarship on perishable inventory systems, offering valuable lessons for supply chain enhancement. It reveals that static inventory methods fall short in tackling issues like perishability and demand swings. Notable findings show that time-responsive pricing (Sharma, 2024) and tailored restocking cycles (Sharma & Bansal, 2016) markedly reduce waste and improve profits. Three practical strategies emerge:

1. *Adaptive Pricing Adoption*: Linking price changes to degradation rates cuts excess stock (Sharma et al., 2023).
2. *Mixed Backordering Systems*: Partial backordering balances customer retention and storage costs during shortages.
3. *Demand-Adaptive Restocking*: Trapezoidal demand models excel for seasonal goods (Sharma, 2015).

However, challenges remain, including reliance on theoretical premises and limited real-world testing. Future studies should focus on:

- AI-enhanced forecasting for better demand accuracy.
- Sustainability measures to assess environmental effects of stock policies.
- Industry-specific trials in sectors like healthcare, farming, and retail.

These insights advocate shifting from uniform stock systems to adaptable, data-informed frameworks for researchers. As supply chains navigate growing uncertainty, adopting these proven strategies will be key to thriving in perishable goods markets.

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