Impact of Seasonal Demand Fluctuations on Warehouse Operations in INR knits

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ABSTRACT

This study investigates the effects of seasonal demand variations on warehouse operations in garment factories, focusing on inventory control, order fulfilment, space utilization, workforce management, productivity, and cost efficiency. A descriptive research design was used, and data were collected from a sample of 150 respondents representing various operational departments within garment manufacturing units. The data were analysed through percentage analysis and descriptive interpretation to identify the extent of changes during peak and off- peak seasons. The findings indicate that during peak seasons, warehouses experience storage congestion, stock mismanagement, and order delays due to excessive inventory and limited space, whereas off-peak seasons lead to underutilization of resources and reduced workforce productivity. It was also observed that fluctuating demand increases operational costs and disrupts workforce scheduling. The study concludes that implementing flexible resource allocation, efficient space planning, and predictive demand forecasting systems can significantly improve warehouse performance and adaptability across seasonal cycles.

Keywords: Seasonal variation, warehouse management, garment factories, inventory control, productivity, cost efficiency, workforce management.

INTRODUCTION

In the garment manufacturing sector, seasonal demand fluctuations play a crucial role in determining the efficiency and performance of warehouse operations. INR Knits, like many other apparel manufacturers, experiences significant variations in customer orders across different seasons, driven by fashion trends, festivals, and export market cycles. These demand shifts directly influence warehouse activities such as inventory control, order processing, space utilization, and workforce deployment. During peak seasons, the warehouse often faces challenges of congestion, inventory overflow, and increased operational pressure, while in off- peak periods, issues such as underutilized space, idle manpower, and reduced productivity arise. Managing these variations effectively is essential to maintain consistent supply chain performance, minimize costs, and ensure timely order fulfilment. Therefore, understanding the operational impact of seasonal fluctuations on warehouse management at INR Knits provides valuable insights for improving flexibility, optimizing resource allocation, and enhancing overall organizational efficiency.

Managing these cyclical variations requires a well-coordinated strategy that aligns demand forecasting, resource allocation, and process optimization. For a company like INR Knits, which operates in a highly competitive market, the ability to adapt warehouse operations to changing seasonal conditions is essential for sustaining profitability and operational excellence. This study focuses on examining the impact of seasonal demand fluctuations on the warehouse operations of INR Knits. It aims to identify the specific operational challenges encountered during peak and off-peak periods, evaluate how these fluctuations influence inventory control and workforce productivity, and suggest practical strategies for improving adaptability and efficiency.

OBJECTIVES OF THE STUDY

- To analyze how seasonal demand variations affect warehouse operations such as inventory control, order fulfilment, and space utilization.
- To identify key operational challenges faced by garment factories during peak and off- peak seasons.
- To evaluate the impact of fluctuating demand on workforce management, productivity, and cost efficiency.
- To recommend effective measures to improve warehouse performance and adaptability during seasonal demand changes.

REVIEW OF LITERATURE

Aftab, M. A., Yuanjian, Q., Kabir, N., & Barua, Z. (2018) identified the core components shaping the fast fashion retailing business model. A qualitative research methodology was adopted, cantered on an in-depth single-case study analysis of Inditex-Zara. The researchers utilized multiple secondary data sources, including various published case studies, articles, theses, blogs, online news, company annual reports spanning and the company's website. The findings indicated that Zara achieved high flexibility and responsiveness through extensive vertical integration.

Fan, D., & Zhou, Y. (2018) investigated the relationship between supply-demand mismatch (SDM) and operational safety in fashion and textiles manufacturing. A Probit regression analysis was conducted, with labor intensity measuring operational complexity and production capacity utilization (SOP) representing operational coupling. The results revealed that SDM heightened productivity pressure, leading to unsafe behaviours and safety incidents, thereby linking inventory management to non-financial performance outcomes.

Soysal, G. P., & Krishnamurthi, L. (2012) estimated a dynamic model of consumer choice for seasonal goods with limited availability. it developed a dynamic structural demand model incorporating strategic and heterogeneous consumers, using a binomial logit specification and maximum likelihood estimation. The results revealed that, based on two years of aggregated weekly sales, inventory, and cost data for 61 apparel products, the model effectively captured real-world demand dynamics.

Bruce, M., Daly, L., & Towers, N. (2004) examined the suitability of lean, agile, and leagile supply chain approaches in the textiles and apparel sector. Given the industry's high volatility, short product life cycles, and wide product variety, quick response capabilities were essential. Using an exploratory qualitative approach, the research analysed case studies of four companies across the supply chain. Data were gathered through semi-structured interviews with senior managers in areas such as product development, design, and supply chain management. The results revealed that the industry did not fit purely into lean or agile models but was best represented by a hybrid leagile approach.

RESEARCH METHODOLOGY

The study adopts a descriptive research design and is based on both primary and secondary data. Primary data were collected through structured interviews, surveys, and questionnaires administered to warehouse managers, supervisors, and employees of INR Knits, while secondary data were obtained from academic journals, industry reports, company records, government publications, market research papers, and previous studies related to warehouse management and seasonal demand fluctuations in the garment industry. The research employed Simple random sampling, and the sampling universe comprised employees of INR Knits from departments associated with warehouse operations, including inventory control, space management, logistics, and workforce planning. The sample size for the study was 150 respondents, and the data were analyzed using statistical tools such as ANOVA and the Chi-square test.

Data Analysis

Table 1: Comparison between the Variables Frequency of Warehouse Staff Schedule Adjustments during Peak Seasons of the Respondents and the Factors contributing to Seasonal Demand

Null Hypothesis (H_0): There is no significant difference between the frequency of warehouse staff schedule adjustments during peak seasons and the factors contributing to seasonal demand.

Dimensions	Frequency of Warehouse Staff Schedule Adjustments during Peak Seasons	N	Mean	SD	F	Sig.
Factors contributing to Seasonal Demand	Very frequently	39	1.28	.759	118.861	0.000
	Occasionally	29	2.14	.743		
	Rarely	30	4.00	1.438		
	Never	52	4.40	.495		
	Total	150	3.07	1.593		

Interpretation

Respondents who adjusted schedules very frequently (1.28) showed greater awareness of these factors compared to those who adjusted occasionally, rarely, or never (2.14). Frequent schedule adjustments are associated with higher sensitivity to seasonal demand factors. There is no significant difference between the frequency of warehouse staff schedule adjustments during peak seasons (0.000) of the respondents and the factors contributing to seasonal demand. Hence, null hypothesis (H_0) is rejected.

CHI SQUARE

Table 2: Relationship between Department and Factors Contributing to Seasonal Demand Variation of chi square

Null Hypothesis (H_0):
There is no significant relationship between the Department of the respondents and the factors contributing to seasonal demand variation.

S. No	Department	Factors Contributing to Seasonal Demand Variation							Chi square value	df	pvalue
		F/H	IC	W/C	MC	PLCS	O	Total	4.957E2[a]	20	0.000
1	Warehouse/Logistics	32	0	1	1	2	3	39			
2	Procurement	0	33	0	0	1	2	36			
3	Inventory Management	0	0	20	0	1	3	24			
4	Sales/Marketing	0	0	0	30	0	2	32			
5	Operations	0	0	0	0	18	1	19			
	Total	32	33	21	31	22	11	150			

Source: Primary Data

Interpretation

The results indicated a statistically significant association between the two variables, χ^2 (20, N = 150) = 495.7, p < .001. This suggests that the type of department significantly influences which factors contribute to variations in seasonal demand. **Table 3: Relationship between Operational Challenges and frequency Warehouse Staff Schedule Adjustments during Peak Seasons**

Null Hypothesis (H_0):
There is no significant relationship between the operational challenges and the frequency of warehouse staff schedule adjustments during peak seasons.

s.no	Common Operational Challenges During High-Demand Seasons	Frequency of Warehouse Staff Schedule Adjustments During Peak Seasons					Chi square value	df	pvalue
		VF	O	R	N	Total	17.230[a]	15	0.353
1	Stock outs	9	6	4	10	29			
2	Overstocking	6	5	12	11	34			
3	Delayed order processing	2	5	3	4	14			
4	Labour shortages	8	3	3	5	19			
5	Congestion in storage areas	7	8	4	9	28			
6	Errors in order fulfilment	7	2	4	13	26			
	Total	39	29	30	52	150			

Interpretation

The results showed no statistically significant association between the two variables, χ^2 (15, N = 150) = 17.23, p = .353. This indicates that the frequency of schedule adjustments does not significantly differ across the various operational challenges faced during peak seasons. Hence, **null hypothesis (H_0)** is **accepted**

SUGGESTIONS

- Use advanced forecasting techniques and software to predict seasonal demand accurately. This helps in planning inventory levels, labor requirements, and storage space in advance.
- Introduce flexible work schedules, part-time contracts, and temporary staffing models to balance workforce needs during peak and off-peak seasons.
- Utilize automated inventory tracking systems such as barcode scanners or RFID technology to monitor stock movement and reduce errors during high-demand periods.
- Redesign the warehouse layout for better space utilization, ensuring smooth movement of goods and minimizing congestion during peak operations.
- Conduct regular training programs for warehouse staff to improve their efficiency adaptability, and understanding of new warehouse technologies and safety protocols.
- Adopt lean principles to eliminate waste, reduce excess handling, and streamline operational processes, improving overall productivity and cost efficiency.
- Establish better communication between warehouse, production, and logistics departments to ensure timely flow of materials and avoid operational delays.
- Develop key performance indicators (KPIs) to measure warehouse performance in terms of space usage, order accuracy, lead time, and employee productivity.
- Incorporate warehouse management software (WMS) and digital dashboards for real- time tracking of goods, which enhances decision-making and responsiveness.
- Prepare alternative plans for managing unexpected demand surges or supply disruptions, ensuring business continuity during unpredictable seasons.

Conclusion

The study on the Impact of Seasonal Demand Fluctuations on Warehouse Operations in INR Knits highlights how variations in market demand significantly influence the efficiency and effectiveness of warehouse activities. The findings reveal that peak seasons create operational pressure through excessive inventory, space constraints, delayed order fulfilment, and workforce overload, while off-peak periods often lead to underutilized resources and reduced productivity. These fluctuations not only affect warehouse performance but also have a direct impact on overall organizational efficiency and cost management.

Through descriptive analysis, it was observed that proper planning, effective communication, and the use of modern warehouse management systems can greatly enhance adaptability during changing demand conditions. The study emphasizes the importance of forecasting demand accurately, training employees, and implementing flexible workforce policies to ensure operational stability throughout different seasons.

Overall, the research concludes that INR Knits can significantly improve its warehouse efficiency by adopting technology-driven inventory control, optimizing space utilization, and establishing a proactive approach toward seasonal planning. By addressing these areas, the company can minimize the adverse effects of demand fluctuations, improve cost efficiency, and achieve a smoother, more responsive supply chain operation.

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