



Improving On-Time Delivery Through Warehouse Management System (Wms) And Manpower Management In A 3pl Warehouse: A Study With Reference To Stockarea

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Abstract

The growing demand for faster and reliable deliveries has increased the importance of warehouse efficiency in third-party logistics (3PL) operations. This study analyses how Warehouse Management System (WMS) usage and manpower management influence on-time delivery performance in a multi-client warehouse environment. Operational data collected before and after process improvements, along with employee feedback, were used for the analysis. The results show that better workforce planning and improved coordination with WMS helped reduce processing delays and improve operational flow. After implementation, on-time delivery increased from 72% to 85%, while average processing time decreased from 30–40 minutes to 23–27 minutes. The study shows that warehouse efficiency depends not only on technology, but also on how effectively manpower is planned and utilized during daily operations.

Keywords: 3PL Warehouse; Warehouse Management System (WMS); Operational Efficiency; On-Time Delivery (OTD); Manpower Management; Labour Productivity; Warehouse Operations; Process Optimization.

1. Introduction

In modern supply chain operations, warehouses have become more than storage locations. They now play an important role in maintaining delivery speed, order accuracy, and customer satisfaction. This is especially important in third-party logistics (3PL) warehouses where multiple clients, different product categories, and fluctuating order volumes are managed every day.

To improve operational control and inventory tracking, many organizations use Warehouse Management Systems (WMS). These systems help warehouses monitor stock movement, process orders efficiently, and reduce manual errors. However, the effectiveness of WMS depends largely on how efficiently warehouse employees use the system during daily operations.

In many warehouse environments, delays still occur due to manpower shortage, improper task allocation, lack of coordination, and high workload pressure. These operational issues directly affect processing time and On-Time Delivery (OTD) performance.

This study focuses on analysing the operational efficiency of a selected multi-client 3PL warehouse by examining how manpower management and WMS usage influence delivery performance. The study aims to provide practical insights into improving warehouse operations through better coordination between workforce management and system-based activities.

1.1 Research Objective

The primary objective of the study is to evaluate the operational efficiency of a 3PL warehouse by analysing the impact of Warehouse Management System (WMS) usage and manpower management on improving On-Time Delivery (OTD).

The study also aims to:

- Analyse the relationship between manpower and processing time
- Identify the major causes of delays in warehouse operations
- Evaluate how WMS supports operational performance and workflow management

2. Research Design

The study follows both descriptive and analytical research methods to understand warehouse operations and identify factors affecting operational efficiency. The descriptive approach was used to observe daily warehouse activities such as receiving, storage, picking, packing, and dispatch operations. The analytical approach helped in understanding how workload, manpower, processing time, and inward activities influence delivery performance.

The study compares warehouse performance during two operational phases — before implementation and after implementation of improvements. This comparison helped in measuring changes in processing efficiency, labour productivity, and On-Time Delivery (OTD).

Operational records from the Warehouse Management System (WMS) and employee responses were used together to gain both practical and measurable insights into warehouse performance.

2.1 Research Approach

A combination of descriptive and analytical approaches was adopted for the study.

The descriptive approach involved observing day-to-day warehouse activities and identifying practical operational challenges such as manpower shortages, delays during dispatch, uneven workload distribution, and process bottlenecks.

The analytical approach focused on examining the relationship between labour availability, order volume, processing time, and On-Time Delivery (OTD). This helped in understanding how operational factors directly affect warehouse performance.

Using both approaches together helped the study reflect real warehouse conditions while also supporting the findings with operational data and performance analysis.

2.2 Data Source and Collection

The study is based on both primary and secondary data sources.

Primary data was collected through direct observation of warehouse operations and structured questionnaires administered to warehouse employees. Employee responses helped identify operational issues related to workload pressure, manpower sufficiency, coordination, and WMS usage.

Secondary data was collected from Warehouse Management System (WMS) reports and daily operational records maintained within the warehouse. The data covered two operational phases:

- Before implementation
- After implementation

The collected operational data included:

- Number of orders processed
- Inward activities
- Labour availability
- Average processing time

- On-Time Delivery percentage
- Labour productivity

The combination of operational records and employee feedback provided both quantitative and practical insights into warehouse performance.

2.3 Analytical Techniques

The study uses practical analytical techniques to interpret both operational data and employee responses in a meaningful manner.

Frequency analysis and percentage analysis were used to analyse questionnaire responses collected from warehouse employees. These techniques helped identify common operational issues such as workload pressure, manpower shortage, and system-related challenges.

Comparative analysis was used to compare warehouse performance before and after implementation. This helped in understanding how improvements in manpower allocation and workflow management affected operational efficiency.

The study also calculated key performance indicators (KPIs) related to warehouse operations:

On-Time Delivery (OTD)

OTD measures how many orders are dispatched within the expected time.

Formula:

$$OTD(\%) = \frac{\text{On-Time Orders}}{\text{Total Orders}} \times 100$$

Processing Time

Processing time measures the average time taken to complete one order.

Formula:

$$\text{Processing Time} = \frac{\text{Total Processing Time}}{\text{Total Orders}}$$

Labour Productivity

Labour productivity measures the number of orders completed per worker.

Formula:

$$\text{Labour Productivity} = \frac{\text{Total Orders}}{\text{Number of Workers}}$$

These analytical methods helped convert raw operational data into measurable insights related to warehouse efficiency and delivery performance.

2.4 Limitations of the Methodological Approach

Although the study provides useful operational insights, certain limitations exist.

The study was conducted in a single warehouse environment, which may limit the applicability of the findings to other warehouses with different operational structures or client requirements. The number of employee responses collected was also limited, which may affect the diversity of opinions.

The research mainly focuses on internal warehouse activities and does not include external factors such as transportation delays, traffic conditions, or customer-side delivery issues, which can also affect On-Time Delivery performance.

In addition, the analysis is based on a limited operational period before and after implementation, which may not fully represent long-term operational variations or seasonal demand fluctuations.

Despite these limitations, the study provides practical understanding of how manpower management and WMS utilization influence warehouse efficiency.

3. Need for the Study

In today's competitive logistics environment, customers expect faster and more accurate deliveries, making warehouse efficiency an important factor in supply chain performance. In a third-party logistics (3PL) warehouse, operational efficiency depends not only on technology such as Warehouse Management Systems (WMS), but also on effective manpower management and coordination of daily activities.

Many warehouses face challenges such as manpower shortage, high workload, longer processing time, and delays in order dispatch, which directly affect On-Time Delivery (OTD) performance. Although WMS helps in inventory tracking and order processing, operational delays can still occur if manpower planning and workflow management are not properly handled.

The need for this study arises from the requirement to understand how manpower management and WMS utilization together influence warehouse performance in a real operational environment. The study aims to identify practical operational issues, analyse their impact on delivery performance, and suggest improvements that can help increase efficiency, reduce delays, and improve customer satisfaction in 3PL warehouse operations.

4. Scope of the Study

The study focuses on analysing the operational efficiency of a 3PL warehouse by examining the role of Warehouse Management System (WMS) usage and manpower management in improving On-Time Delivery (OTD).

The research mainly covers key warehouse activities such as:

- Receiving
- Storage
- Picking
- Packing
- Dispatch operations

The study analyses operational data collected during two phases — before and after implementation — to understand how manpower allocation, processing time, workload, and WMS utilization affect warehouse performance.

The scope of the study is limited to internal warehouse operations and operational performance indicators such as:

- On-Time Delivery (OTD)
- Processing Time
- Labour Productivity
- Workload Management

External logistics factors such as transportation delays and supplier-side issues are not included in the study.

5. Results

The operational analysis shows a noticeable improvement in warehouse performance after implementing better manpower planning and workflow management practices.

The average On-Time Delivery (OTD) improved from 72% before implementation to 85% after implementation. At the same time, the average processing time reduced from around 30–40 minutes to 23–27 minutes per order.

The increase in manpower from 5–7 workers to 7–9 workers helped reduce workload pressure and improved order handling efficiency. Daily warehouse activities such as picking, packing, and dispatch were completed more smoothly after workforce allocation improved.

Employee responses also supported these operational findings. Most employees reported high workload pressure during peak periods, and manpower shortage was identified as one of the main reasons for operational delays.

The analysis clearly indicates that manpower availability, processing time, and proper coordination directly influence warehouse efficiency and delivery performance.

6. Discussion

The study shows that warehouse efficiency improves when manpower management and system-based operations work together effectively. Although Warehouse Management Systems (WMS) help in inventory tracking, order monitoring, and process visibility, operational performance still depends heavily on workforce coordination and execution.

Before implementation, workers handled multiple activities simultaneously during high workload periods, which increased processing time and delayed dispatch operations. Limited manpower also created pressure during inward and outward operations.

After workforce allocation and workflow planning improved, warehouse activities became more organized, and processing delays reduced significantly. This improvement directly contributed to better On-Time Delivery performance.

The operational observations also support practical industry understanding that warehouse performance depends on multiple connected factors such as manpower availability, process planning, coordination, and effective system utilization.

7. Conclusions

The overall study makes it clear that both manpower management and WMS usage play an important role in improving warehouse efficiency and maintaining better delivery performance.

Before implementation, the warehouse faced operational challenges mainly due to limited manpower, high workload pressure, and longer processing time. These issues reduced operational efficiency and negatively affected On-Time Delivery performance.

After improving manpower allocation and workflow coordination, the warehouse was able to process higher order volumes more efficiently. Processing time reduced significantly, labour productivity improved, and On-Time Delivery increased from 72% to 85%.

The study also highlights that WMS alone cannot guarantee operational efficiency. Its effectiveness depends on proper workforce coordination, accurate system usage, and operational planning.

Overall, the findings show that proper manpower planning, balanced workload distribution, and effective use of WMS are essential for improving warehouse operations and delivery performance in a 3PL environment.

8. Theoretical Applications

This study contributes to logistics and supply chain management literature by explaining how manpower management and Warehouse Management System (WMS) usage together influence warehouse efficiency in a practical 3PL environment.

The study highlights that warehouse performance cannot be explained only through technology implementation. Human factors such as labour availability, workload management, and operational coordination also play a major role in achieving efficiency.

By linking operational metrics such as processing time, labour productivity, and On-Time Delivery, the study provides a practical understanding of how internal warehouse activities influence overall operational performance.

The findings help bridge the gap between theoretical warehouse concepts and real-world operational practices.

9. Managerial Applications

The findings of the study provide practical insights for warehouse managers and logistics professionals involved in 3PL operations.

The study shows that proper manpower planning based on expected workload is essential for maintaining smooth warehouse operations. Increasing workforce availability during high-volume days can help reduce delays and improve delivery performance.

The research also highlights the importance of proper task allocation and workload balancing. Clearly assigning operational responsibilities such as picking, packing, and dispatch helps improve coordination and reduce operational confusion.

Continuous monitoring of operational metrics such as processing time, productivity, and On-Time Delivery can help managers identify inefficiencies and take corrective actions quickly.

The study further emphasizes that employees should receive proper training for effective WMS usage, as system errors and incorrect updates can negatively affect warehouse operations.

Overall, the study suggests that warehouse efficiency improves when manpower management and WMS utilization are managed together effectively.

10. Future Research Suggestions

Future studies can examine how advanced technologies such as automation, robotics, and artificial intelligence influence warehouse efficiency along with manpower and WMS utilization.

Research can also focus on integrating WMS with real-time manpower planning systems to improve task allocation based on workload and operational priority.

Further studies conducted across multiple warehouses and over longer operational periods may provide broader understanding of warehouse efficiency and supply chain performance.

11. Author Contributions

Raja D: Conceptualisation, data collection and curation, formal analysis, methodology design, writing — original draft preparation, writing — review and editing.

Dr. Jayasree Krishnan: Supervision, methodology guidance, writing — review and editing.

Mr. Balaji L: Data support, operational insights, writing — review and editing.

All authors have read and agreed to the published version of the manuscript.

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13. Data Availability Statement

The data supporting the findings of this study were obtained from warehouse operational observations, employee questionnaire responses, and Warehouse Management System (WMS) reports collected during the academic internship period.

Summary statistics and operational findings are included within the article. However, detailed raw operational records are not publicly available due to organisational confidentiality requirements. Data access may be provided for academic purposes upon reasonable request to the corresponding author, subject to necessary approval.

14. Conflicts of Interest

The authors declare no conflicts of interest. The research was conducted as part of an academic internship at Stockarea. The company provided data access but had no role in study design, analysis, interpretation, or the decision to publish.

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