



# DESIGNING A WAREHOUSE LAYOUT USING THE SHARED STORAGE METHOD WITH THE FIFO PRINCIPLE AT PT LINTANG PRATAMA EXPRESSINDO JAKARTA

**Carissa Dewi Pratiwi**

Vocational School, Universitas Diponegoro, Indonesia  
([carissadewi25@gmail.com](mailto:carissadewi25@gmail.com))

**Riandhita Eri Werdani, S.M.B., M.S.M.\***

Vocational School, Universitas Diponegoro, Indonesia  
([riandhita@lecturer.undip.ac.id](mailto:riandhita@lecturer.undip.ac.id))

## ABSTRACT

**Introduction/Main Objectives:** This study examines warehouse layout optimization at PT. Lintang Pratama Expressindo, a freight forwarding company that requires efficient warehouse management to support smooth logistics operations and timely distribution using the shared storage method with the implementation of the First-In First-Out (FIFO) principle.

**Background Problems:** The warehouse currently stores goods based solely on available space without a systematic placement method, resulting in inconsistent FIFO implementation, delays in order picking and delivery, and reduced operational efficiency. These issues indicate that the existing warehouse layout does not adequately support effective warehouse management.

**Novelty:** This research proposes a practical warehouse layout solution for a small-scale freight forwarding warehouse without racking systems by integrating the shared storage method, floor mapping, workflow flowcharts, and Standard Operating Procedures (SOPs). The proposed approach offers a low-cost and systematic alternative tailored to the operational characteristics of small logistics businesses.

**Research Methods:** This study uses a descriptive qualitative approach. Data were collected through semi-structured interviews, direct observations, and documentation review. A fishbone diagram was employed to identify the root causes of warehouse management problems.

**Findings/Results:** The findings indicate that the primary cause of warehouse inefficiency is the absence of structured layout planning and standardized storage procedures. The proposed warehouse layout is expected to improve FIFO implementation, reduce handling errors, streamline goods movement, and increase overall warehouse operational efficiency.

**Conclusion:** The proposed warehouse layout demonstrates that implementing the shared storage method supported by floor mapping and SOPs can improve warehouse organization and strengthen



FIFO implementation in small-scale freight forwarding operations. These improvements contribute to more efficient and reliable warehouse management.

**Implementation Potential:** The proposed warehouse layout can serve as a practical reference for small logistics and freight-forwarding companies seeking to improve warehouse performance without significant infrastructure investment.

**Keywords:** FIFO; Fishbone Diagram; Shared Storage Method; Warehouse Layout; Warehouse Management

**JEL Classification:** M11, L91, R41, D24

## 1. INTRODUCTION

The logistics sector in Indonesia is becoming increasingly competitive, with the transportation and warehousing industry projected to grow by 12.53% in 2025, according to the Central Statistics Agency (BPS), as reported by Supply Chain Indonesia (SCI). To remain competitive, companies must manage not only delivery but also warehouse operations efficiently. Warehouses play a central role in the supply chain, where layout design directly affects efficiency, product flow, and customer satisfaction (Bartholdi & Hackman, 2019; Mawinata & Nurkertamanda, 2023). Poor layouts increase delays, errors, and customer dissatisfaction (Mohamud et al., 2023).

PT. Lintang Pratama Expressindo, a Jakarta-based logistics firm specializing in Business-to-Business (B2B) and project-based shipments, applies cross-docking but operates with limited space and lacks a standardized layout. Observations reveal inefficient storage practices, where goods are placed arbitrarily without priority, leading to order-picking delays and reduced customer retention. Certain areas, such as unused air-conditioned rooms, remain underutilized, while sensitive goods are stored in office spaces, further disrupting workflows.

Addressing these issues requires identifying root causes systematically. Using the Fishbone Diagram (Sulianta, 2024), this study explores layout solutions suited to the company's conditions. Shared storage emerges as a flexible option for transit warehouses (Francis et al., 1992), but to ensure order, it must be integrated with the First-In-First-Out (FIFO) principle. Although FIFO is practiced, the absence of a structured layout leads to inefficiency. Studies confirm that combining FIFO with systematic placement optimizes space use, reduces errors, and accelerates dispatch (Nirmala, 2024; Mulyati et al., 2020).

This research therefore proposes a warehouse layout design for PT. Lintang Pratama Expressindo using a shared storage method integrated with the FIFO system, aiming to improve space utilization, product flow, and customer satisfaction.

## **2. LITERATURE REVIEW**

Warehouse layout plays a strategic role in supply chain management, as it also directly influences service quality (Zhang & Khan, 2017). An effective warehouse layout facilitates systematic storage and retrieval processes while optimizing the use of available space. One storage approach that supports these objectives is the shared storage method, in which multiple products share the same storage location at different times, allowing more flexible space utilization and reducing storage requirements compared to dedicated storage (Francis et al., 1992). For warehouses implementing shared or randomized storage systems, the First-In First-Out (FIFO) principle is essential to ensure that goods are retrieved according to their arrival sequence, thereby preventing workflow disruptions and improving order fulfillment efficiency (Nirmala, 2024).

A warehouse layout redesign using *shared storage* and FIFO has been shown to reduce transfer distances and improve efficiency by placing frequently accessed items closer to exits (Mulyati, Numang, & Nurdiansyah, 2020). Unlike this study, which examined a large warehouse with advanced racking systems, PT. Lintang Pratama Expressindo operates with simpler infrastructure and serves multiple customers. This difference indicates a gap, as research has focused more on established warehouses, while fewer studies address developing logistics firms with constrained resources.

## **3. METHOD**

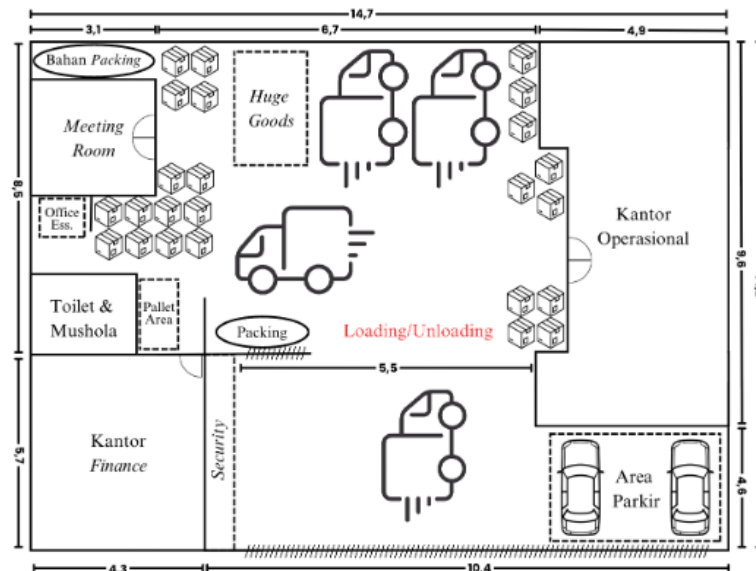
This study employed a qualitative descriptive approach to provide an in-depth understanding of field conditions based on information obtained from informants, while not excluding quantitative data. Data were collected from three informants at PT. Lintang Pratama Expressindo Jakarta, the Operational Manager, the Warehouse Operations Head, and the General Manager, through interviews, observation, and documentation, with source triangulation applied using in-depth interviews across different informants. Data analysis follows an interactive model,

consisting of data reduction, data display, and conclusion drawing or verification, where raw data are simplified, systematically presented, and interpreted to identify patterns, causal relationships, and potential theoretical insights (Miles & Huberman, 1994).

## 4. RESULTS AND DISCUSSION

### 4.1 Analysis of the Existing Warehouse Layout at PT. Lintang Pratama Expressindo Jakarta

PT. Lintang Pratama Expressindo has operated for over 15 years, but its warehouse remains underdeveloped, with goods arranged unsystematically. Serving mainly as a transit hub, the warehouse requires fast goods flow, yet its U-shape layout with a single main door for both inbound and outbound activities creates congestion and inefficiencies. The central placement of the warehouse among offices and meeting rooms further disrupts both logistics and employee movement, underscoring the need for dedicated access paths. Moreover, the lack of a designated buffer zone or staging area forces goods to be placed directly into storage, limiting flexibility and slowing down overall operations.



**Figure 1. Current warehouse layout of PT. Lintang Pratama Expressindo Jakarta**

#### **4.1.1 Inbound**

At receiving, goods are unloaded and inspected against purchase orders, then immediately placed into storage due to the absence of a buffer or staging area. While items are generally grouped by client or origin, the lack of a temporary holding zone often disrupts systematic placement and reduces efficiency during peak volumes.

#### **4.1.2 Storage**

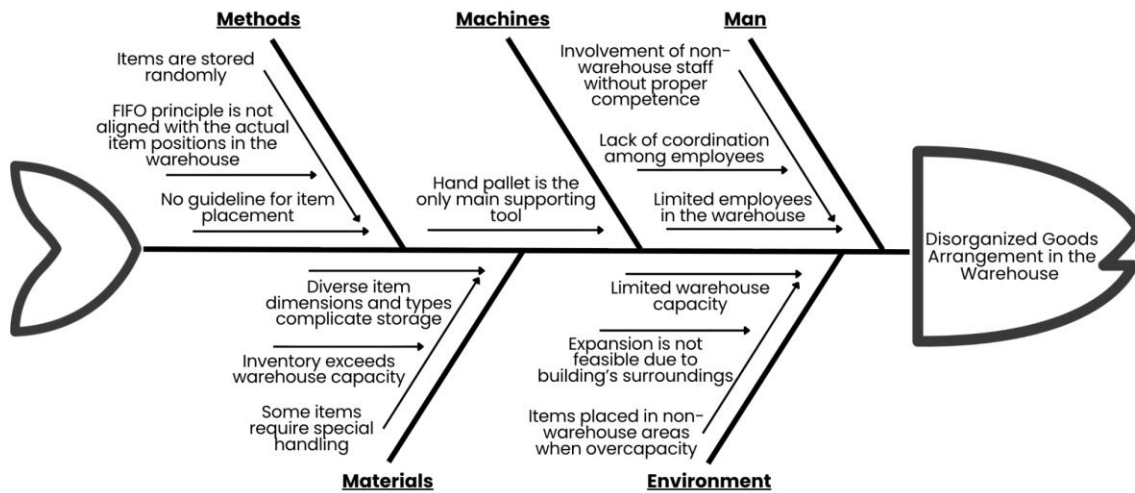
Goods are arranged based on available space. The warehouse attempts to apply the FIFO principle, but reliance on manual recording makes it difficult to maintain consistently. Limited capacity forces goods from different clients to be stored together, risking mix-ups and retrieval delays. At times, warehouse space is used for vehicle parking, further reducing efficiency. In March 2025, simultaneous shipments from two major clients highlighted these issues, as large machines occupied the warehouse space while smaller items had to be stored temporarily in office areas.

#### **4.1.3 Outbound**

The lack of systematic storage directly impacts order-picking, which is carried out manually and relies heavily on staff memory. Congested access paths further slow the process during peak periods. After items are retrieved, packing is done in the same area used for receiving and loading, creating workflow overlaps and congestion. Finally, goods are moved to the loading dock for shipment preparation, but the absence of dedicated zones across stages results in repeated delays.

### **4.2 Analysing the Causes of Warehouse Layout Problems at PT. Lintang Pratama Expressindo Jakarta**

The warehouse layout problems at PT. Lintang Pratama Expressindo Jakarta reflects a complex condition influenced by both internal and external factors. Based on interviews and field observations, several interrelated issues were identified. To analyze them systematically, a fishbone diagram was used, focusing on five aspects, which are Man, Methods, Machines, Materials, and Environment (Mother Nature).



**Figure 2. Fishbone Diagram of Warehouse Issues at PT. Lintang Pratama Expressindo Jakarta**

#### 4.2.1 Internal Factors

##### A. Man

The warehouse workforce has declined since the COVID-19 layoffs, creating shortages during peak shipments. Staff from other divisions are often involved, but their lack of warehouse expertise leads to errors in handling and recording. Miscommunication among employees further disrupts scheduling and operations, while weak supervision and the absence of systematic labeling increase mistakes.

##### B. Methods

There are no standardized procedures for inbound, storage, or outbound processes. Goods are placed wherever space is available, often blocking priority items and making FIFO difficult to implement. The system relies on staff memory, which slows down order-picking and increases the risk of errors, showing the need for structured work methods.

##### C. Machines

Material handling relies only on hand pallets, with no forklifts or racking systems. While forklifts would improve efficiency, the warehouse space is too limited for their

operation. The absence of racks forces horizontal storage, which becomes problematic during overcapacity and with the varied dimensions of client goods.

#### **4.2.2 External Factors**

##### **A. Materials**

Client goods vary widely in size, type, and handling requirements, complicating systematic storage. Electronics requiring cold storage are often placed in office rooms, while the absence of racks forces goods to be stacked on the floor, overcrowding the warehouse. Overcapacity occurs frequently, pushing goods into non-warehouse areas such as offices.

##### **B. Environment (Mother Nature)**

The warehouse is physically constrained by permanent surrounding buildings, making expansion impossible. Limited space forces offices and meeting rooms to be used as temporary storage, reducing their functionality. High ambient temperatures also make the warehouse unsuitable for sensitive goods, further reinforcing inefficient storage practices.

#### **4.3 Applying the Shared Storage Method with FIFO System at PT. Lintang Pratama Expressindo Jakarta**

Based on the analysis of current warehouse conditions and root cause identification, the proposed solution is a new warehouse layout design applying shared storage with the FIFO principle. Shared storage offers flexible space utilization by allowing multiple clients' goods to occupy the same area as needed, which suits the warehouse's limited capacity and fluctuating inflows. Combined with FIFO, it ensures faster goods flow and prevents congestion.

Using formulas adapted from Mulyati et al. (2020) and adjusted to actual conditions, the design emphasizes floor mapping and zoning (Zones A, B, C) by shipping priority, supported by aisle planning for efficient movement. The first step is measuring the average monthly

inflow/outflow, which in this case is equal. Using government-owned KN goods as an example:

$$\begin{aligned}
 \text{Number of Goods} &= \frac{\Sigma \text{Inflow/Outflow Goods per Month}}{\text{Number of Months}} \\
 &= \frac{98 + 112 + 117}{3} \\
 &= 109
 \end{aligned}$$

Next, space requirements are calculated. Since the warehouse has no racks, zoning is applied through floor mapping, based on direct floor usage. The Jakarta warehouse stores KN goods for distribution to 327 locations across Indonesia.

The first calculation is Maximum Capacity, which refers to the total theoretical number of goods that can fit into the warehouse if the entire floor is used for storage only:

$$\begin{aligned}
 \text{Maximum Capacity} &= \frac{\text{Warehouse Area}}{\text{Goods Area}} \\
 &= \frac{6,7 \text{ m} \times 5,3 \text{ m}}{0,55 \text{ m} \times 0,5 \text{ m}} \\
 &= \frac{35,51 \text{ m}^2}{0,275 \text{ m}^2} \\
 &= 129.12
 \end{aligned}$$

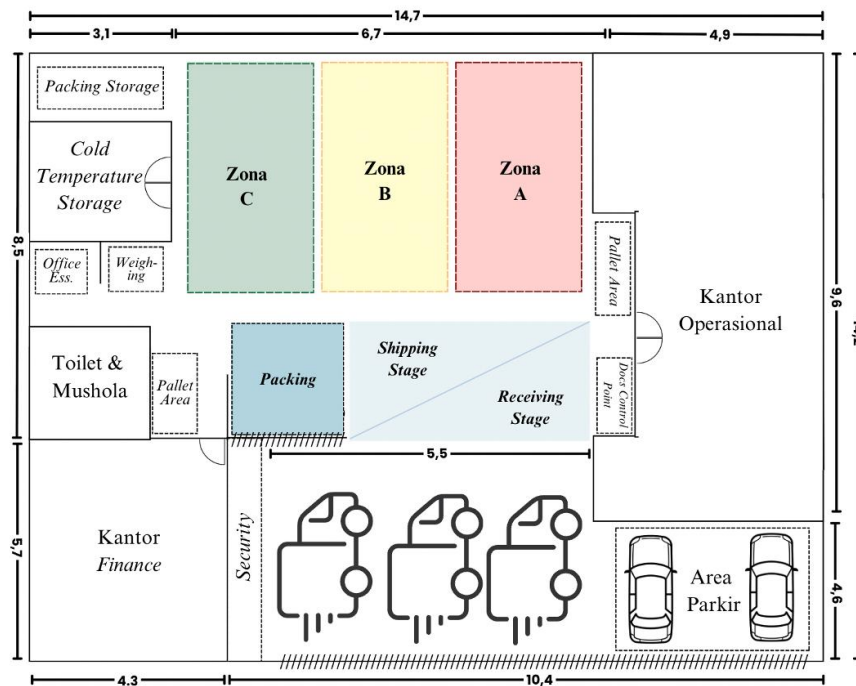
However, this figure does not account for operational needs such as aisles and work areas. Therefore, the capacity is adjusted to obtain the Effective Capacity, which better reflects realistic conditions:

$$\begin{aligned}
 \text{Effective Capacity} &= \text{Maximum Capacity} \times \% \text{ Effectiveness} \\
 &= 129.12 \text{ m}^2 \times 90\% \\
 &= 116
 \end{aligned}$$

With an effective capacity of 116 units, the warehouse can technically accommodate the monthly inflow of 109 units. Additional needs, such as cold storage, are allocated to repurposed air-conditioned rooms. To prevent overcapacity, shipments are staggered and coordinated with strict scheduling. In this case, because goods vary greatly in size and

handling requirements, exact allocation cannot be determined; therefore, zoning by arrival order offers a practical solution.

These capacity calculations serve as the foundation for the new warehouse layout. By knowing the effective storage limit, the warehouse can be mapped into functional zones (A, B, and C) to separate goods according to shipping priority. Zone A is allocated for fast-moving or earlier-arrived goods to speed up retrieval, Zone B for medium-priority items, and Zone C for slower-moving goods. Dedicated aisles are also integrated to minimize congestion and ensure smoother flow between inbound and outbound activities.



**Figure 3. Proposed Warehouse Layout Design at PT. Lintang Pratama Expressindo**

The proposed layout also serves as a guideline for warehouse staff in daily operations, ensuring goods are not placed arbitrarily and that process flows are visible and standardized. Incoming goods are checked at the unloading/loading dock, moved into the designated storage zones, and then processed in a packing zone located near the main door to facilitate dispatch. This systematic arrangement establishes a more organized workflow, reduces errors, and enhances overall operational efficiency. Furthermore, it provides a structured reference that can be consistently applied and monitored for continuous improvement.

## **5. CONCLUSION**

This study found that the warehouse at PT. Lintang Pratama Expressindo Jakarta, despite operating as a transit facility, has yet to adopt a systematic layout that meets basic warehouse management principles. The unstructured storage placement and limited application of FIFO have created inefficiencies that disrupt goods movement and increase the risk of errors. These conditions are further exacerbated by the use of warehouse space for non-storage purposes, ultimately reducing operational performance. To address these issues, a new warehouse layout was proposed as the main output of this study. The design applies a shared storage method combined with the FIFO principle, allowing flexible space utilization to reduce congestion and improve efficiency. This visual framework is intended to guide warehouse staff in daily operations, minimize errors, and provide a foundation for more standardized and effective warehouse management at PT. Lintang Pratama Expressindo Jakarta.

## **6. IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH**

The findings of this study highlight that the high variation in goods creates challenges in applying precise capacity calculations. This limitation underscores the importance of the proposed zoning system, which offers a more practical approach to organizing diverse items by shipping priority rather than fixed storage allocation. The zoning layout provides clearer guidance for staff and reduces disorganized placement, despite fluctuating inflows.

However, the study is limited by its reliance on a single case within PT. Lintang Pratama Expressindo Jakarta, making generalization to other logistics contexts cautious. In addition, the absence of rack systems and reliance on floor mapping may restrict scalability as shipment volumes increase. Future research could expand by integrating digital warehouse management systems, simulating zoning effectiveness under different product mixes, or applying the approach to warehouses with more advanced infrastructure. Such extensions would help validate and refine the applicability of shared storage with FIFO in varying logistics environments.

## REFERENCES

- Bartholdi J. J. & Hackman, S. T. (2019). *Warehouse & Distribution Science*. Atlanta: Georgia Institute of Technology.
- Francis, R. L., McGinnis L. F., & White, J. A. (1992). *Facility Layout and Location: An Analytical Approach*. New Jersey: Prentice Hall.
- Mawinata, L. G., & Nurkertamanda, D. (2023). *Perbaikan Penataan Tata Letak Spare Part pada Warehouse Berdasarkan Frekuensi Penggunaannya Menggunakan Metode ABC Analysis (Studi Kasus di Gudang A Rak Close PT Semen Gresik, Pabrik Semarang)*. *Industrial Engineering Online Journal*.
- Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis*. California: SAGE Publications.
- Mohamud, I. H., Kafi, M. A., Shahron, S. A., Zainuddin, N., & Musa, S. (2023). *The Role of Warehouse Layout and Operations in Warehouse Efficiency: A Literature Review*. *Journal Européen Des Systèmes Automatisés*, 56(1), 61–68.
- Mulyati, E., Numang, I., & Nurdiansyah, M. A. (2020). *Usulan Tata Letak Gudang dengan Metode Shared Storage di PT Agility International Customer Herbalife Indonesia*. *Jurnal Logistik Bisnis*, 10(2), 36–41.
- N.d. (2025). *SCI: 2025, sektor logistik tumbuh 12.5 persen*. *Jurnal Maritim*.
- Nirmala, I. (2024). *FIFO Method Improvement and Adjustment Design for PT. ABC Warehouse Plans*. *Jurnal Ilmiah Manajemen Kesatuan*, 12(3), 637–648.
- Sulianta, F. (2024). *Diagram Fishbone untuk Berbagai Kebutuhan*. Bandung: Universitas Widyatama.
- Zhang, Y. & Khan, S. A. R. (2017). *Importance of Warehouse Layout in Order Fulfilling Process Improvement*. *International Journal of Transportation Engineering and Technology*, 3(4), 49–52.