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# Integrating 5S and Layout Redesign for a Small General Affairs Warehouse: A Diagnostic Case Study at PT. XYZ

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## ABSTRACT

Warehouses that support administrative functions are often managed informally, although their performance affects the efficiency of daily organizational operations. This study diagnoses warehouse management problems in the General Affairs (GA) warehouse of PT. XYZ and proposes improvement strategies from an industrial management perspective by integrating the 5S methodology with warehouse layout redesign. A descriptive qualitative case study was conducted through direct observation, semi-structured interviews, document analysis, an observation checklist, and stock-taking of three illustrative stationery items. The findings reveal unorganized and unzoned storage, unlabeled racks, oversized items placed on the floor, irregular housekeeping, damaged and obsolete items mixed with active stock, the absence of standard operating procedures, and discrepancies between physical and recorded inventory; the stock-taking also showed that items whose recorded quantity was accurate could still be unusable. The proposed improvements apply the five 5S principles (Sort, Set in Order, Shine, Standardize, and Sustain), introduce five functional storage zones with a zone-rack-shelf location code, standardize inventory procedures, and redesign the layout of the 4.0 m × 1.8 m warehouse using SketchUp to increase vertical storage and create a dedicated circulation path. The proposals have not yet been implemented or measured; they are expected to improve inventory accuracy, shorten searching time, and optimize storage utilization without major capital investment. The study offers a low-cost improvement model for managers of very small warehouses with diverse inventories and suggests that inventory audits should consider item usability, not only quantity.

**Keywords**:

5S; General Affairs; inventory accuracy; lean warehouse; storage zoning; warehouse layout

## Introduction

Warehouse management has become one of the most critical operational functions in modern industrial and supply chain management. A warehouse no longer serves merely as a storage facility but also as a strategic component that maintains inventory accuracy, supports operational continuity, reduces operating costs, and ensures the timely availability of goods. Efficient warehouse management directly influences organizational productivity and overall operational performance [1]. From an industrial management perspective, warehousing is a support process whose design and control determine how efficiently the transformation process of an organization can run [2], and both warehouse layout and warehouse operations have been shown to influence warehouse efficiency jointly [3]. Consequently, many organizations continuously improve warehouse operations through process standardization, digital inventory systems, warehouse management systems (WMS), and Lean Warehouse practices.

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One of the most widely implemented approaches for improving workplace and warehouse performance is the 5S methodology, which originates from the Lean production principles developed in Japan [4], [5], [27]. The 5S concept, consisting of Seiri (Sort), Seiton (Set in Order), Seiso (Shine), Seiketsu (Standardize), and Shitsuke (Sustain), emphasizes workplace organization, cleanliness, standardization, and continuous discipline. Previous studies have shown that 5S can reduce unnecessary activities, improve workplace safety, increase operational efficiency, and strengthen employee discipline [6]–[8]. In the warehousing sector, a systematic review of recent studies concluded that 5S improves efficiency, shortens item retrieval time, and makes better use of storage space, although employee resistance and sustaining discipline remain challenges [9]. Warehouse layout redesign complements 5S by optimizing storage capacity, reducing travel distance, and improving accessibility to stored items [10], [11].

Despite technological advances in warehouse management, many organizations still face operational challenges caused by inadequate storage planning and weak inventory control [12], [13]. Common problems include mixed storage locations, the absence of item categorization, inaccurate stock records, inefficient layouts, poor housekeeping, and prolonged searching time. These issues increase operational costs, delay service processes, reduce employee productivity, and negatively affect organizational performance.

The General Affairs (GA) warehouse at PT. XYZ represents one example of these challenges. Field observations conducted during an internship program identified several warehouse management problems. The storage area was not systematically organized; office stationery, operational equipment, and administrative documents were stored together without clear categorization; and the racks had no labels or storage zoning. In addition, several oversized items could not be accommodated on the existing racks because the rack compartments were not designed according to item dimensions. These items were therefore placed on the warehouse floor, reducing accessibility and limiting the effective use of storage space.

Stock-taking further revealed discrepancies between the physical inventory and the records maintained in the company's information system. Some stationery items showed shortages due to manual recording errors during stock issuance, while others showed excess quantities because obsolete or damaged items remained in storage without appropriate documentation. Further observations revealed the absence of standardized warehouse operating procedures, irregular housekeeping schedules, inadequate segregation of damaged inventory, unclear responsibility for stock verification, and a lack of visual management elements such as rack numbering, storage labels, and designated storage zones. From a managerial standpoint, these conditions indicate weaknesses in process control that may affect procurement planning, budgeting accuracy, and operational decision-making.

Previous studies have demonstrated that the integration of 5S with storage zoning, labeling, and layout improvement enhances warehouse performance. Combining a warehouse re-layout with kaizen 5S reduced spare-part searching time and substantially increased storage capacity [10], while action research in an operating warehouse showed how 5S can be implemented without interrupting operations and which pitfalls should be avoided [14]. The application of 5S together with layout and standard operating procedure (SOP) redesign has also reduced stock opname discrepancies [15] and shortened retrieval and storage times [16]. Similarly, layout redesign based on class-based storage and systematic layout planning has been shown to reduce material handling distance [17]–[19].

However, most of these studies focus on production-related warehouses, spare-part stores, or logistics facilities, as a recent review of 5S in warehousing also indicates [9]. Comparatively limited attention has been given to GA warehouses, whose primary function is to manage office supplies, maintenance equipment, and administrative inventories. Such warehouses hold indirect materials, which are typically characterized by many low-value items, sporadic demand, and often no clear process owner, and the GA warehouse of PT. XYZ also has very limited space of about 7.2 $m^2$. These characteristics call for improvement strategies that differ from those commonly implemented in industrial warehouses. Lean approaches have also been applied to other support processes, such as incoming material handling [20] and warehouse and flexible production areas [21], which suggests that they can be extended to administrative warehouses.

This study addresses that gap by integrating workplace organization through 5S with a warehouse layout redesign tailored to the characteristics of a General Affairs (GA) warehouse. Its focus is a low-cost improvement model for a very small warehouse with high item diversity, in which inventory problems are examined not only in terms of recorded quantities but also in terms of item usability. The objectives of this study are (1) to analyze warehouse management problems in the GA warehouse of PT. XYZ, (2) to formulate improvement strategies based on the 5S methodology and warehouse layout redesign, and (3) to derive managerial implications for managers of small GA warehouses.

## Methods

### Research Design and Object

This study employed a descriptive qualitative case study design to identify warehouse management problems and formulate improvement strategies for the General Affairs (GA) warehouse at PT. XYZ. A qualitative approach was selected because it enables an in-depth understanding of existing warehouse conditions, operational activities, inventory management practices, and organizational issues that influence warehouse performance. The study focused on describing actual conditions rather than testing statistical relationships between variables. The warehouse stores office stationery, maintenance equipment, operational supplies, and administrative documents. Data were collected during the authors' internship period; because of this position, observations were compared with interview results and documents to limit the influence of the researchers' own perspective.

### Data Collection

Primary data were collected through direct observation of the warehouse layout, storage conditions, rack utilization, housekeeping practices, material flow, and accessibility of stored items. Direct observation is a common method for understanding operations as they actually occur [2]. The observation results were documented using field notes and photographs. In addition, semi-structured interviews were conducted with GA personnel responsible for warehouse operations to explore inventory procedures, stock recording practices, operational challenges, and employee perspectives on warehouse organization. Document analysis was performed by reviewing inventory records, stock-taking reports, and warehouse documentation, and the physical inventory was compared with system records to identify discrepancies.

An observation checklist was used as the main assessment instrument. The checklist evaluated rack organization, storage zoning, inventory labeling, housekeeping conditions, damaged inventory management, and the consistency between physical and recorded stock. These indicators were derived from warehouse management principles and Lean workplace organization concepts, in line with the use of 5S audits to assess warehouse conditions [15].

### Data Analysis and Improvement Design

Data were analyzed using descriptive qualitative analysis consisting of three stages: data reduction, data presentation, and conclusion drawing. Observation notes, interview results, and documents were organized and classified according to the identified problems, and the findings were then interpreted by comparing existing practices with warehouse management principles and the 5S methodology [5], [6].

Based on the problem identification, improvement proposals were developed through two complementary approaches. First, 5S implementation was proposed to improve workplace organization, inventory classification, housekeeping, standard procedures, and employee discipline. Second, a warehouse layout redesign was developed using SketchUp software to optimize storage capacity, establish storage zoning, improve accessibility, and create a more efficient configuration, following facility planning principles [22], [23]. The redesign considered the available warehouse dimensions, rack specifications, circulation space, and the type of items stored.

The research framework consists of four sequential stages: (1) identification of existing warehouse conditions through observation, interviews, and documentation; (2) analysis of operational problems using descriptive qualitative analysis and the 5S framework; (3) development of improvement recommendations through 5S implementation and layout redesign; and (4) evaluation of the proposed improvements against warehouse management principles.

## Results and Discussion

### Existing Warehouse Conditions

The General Affairs (GA) warehouse at PT. XYZ functions as a supporting warehouse that stores office stationery, operational equipment, maintenance supplies, archived documents, and various administrative materials. Although it does not directly support production, its performance affects the efficiency of daily organizational operations. Field observations revealed that the warehouse had not implemented a systematic storage management system. Different categories of goods were stored together without classification by item type, usage frequency, or storage characteristics, and the racks had no location codes, rack numbers, or labels, as shown in Figure 1. As a result, item identification depended on employee experience rather than on a standardized system.



Figure 1. Condition of the GA warehouse before improvement

The limited warehouse dimensions also contributed to inefficient space utilization. Several oversized items could not fit into the existing rack compartments and were placed on the floor, reducing aisle width and restricting movement during picking and storage. Such conditions increase the risk of product damage, create safety hazards, and reduce operational efficiency. The observation checklist further identified the absence of storage zoning, inadequate housekeeping, inconsistent stock recording, and poor segregation of damaged inventory. Damaged or obsolete office supplies were still stored together with active stock, and dust accumulated on the racks.

According to warehouse management theory, an effective warehouse should apply systematic storage assignment, standardized location coding, visual management, and organized material flow [1], [24]. The observed conditions indicate that these principles had not yet been implemented. The absence of zoning and labeling increased searching time and created unnecessary movement during retrieval. Similar problems have been reported in other warehouses before 5S implementation [14], [16].

### Analysis of Inventory Discrepancies

One of the most significant findings was the discrepancy between the inventory recorded in the warehouse information system and the physical inventory identified during stock-taking. Inventory accuracy is an important indicator of warehouse performance because it directly influences procurement planning, replenishment decisions, and inventory control [1], [13]. Three stationery items were selected as illustrative cases for verification; they are not a statistically representative sample of the warehouse inventory. The results are summarized in Table 1.

Table 1. Summary of stock-taking results

| Item | System stock | Physical stock | Difference | Main cause |
|---|---|---|---|---|
| Snowman black pen | 19 | 12 | −7 | Manual recording error during issuance |
| Joyko glue | 11 | 16 | +5 | Unrecorded physical units, including obsolete stock |
| Deli glue | 7 | 7 | 0 | No discrepancy; 2 of 7 units unusable (dried adhesive) |

(Source: stock-taking results, processed)

For the Snowman black pen, the system recorded 19 units, whereas only 12 units were found physically, a shortage of seven units (Figures 2 and 3). Interviews indicated that this discrepancy resulted mainly from manual recording errors, as several items were issued without being recorded in the system. Conversely, Joyko glue showed an excess of five units: the system recorded 11 units, while 16 units were found, several of which were obsolete products with expired adhesive. A physical surplus means that units were present on the shelf without being recorded in the system, for example because obsolete units had been written off in the system without being physically removed or because receipts had not been recorded; the available documents did not show which of these occurred. For Deli glue, the recorded and physical quantities matched, but two of the seven units were no longer usable because the adhesive had dried out. Although the numerical accuracy appeared satisfactory, item usability had not been incorporated into the inventory evaluation, which suggests that inventory audits in GA warehouses should record both quantity and usability.




Figure 2. System stock record of the Snowman black pen




Figure 3. Physical stock of the Snowman black pen

Such discrepancies may lead to inappropriate purchasing decisions, excessive inventory, stock shortages, and higher operating costs, and they reduce employee confidence in the information system. These findings emphasize the need for standardized recording procedures and regular stock verification. Periodic cycle counting has been shown to maintain high inventory accuracy in warehouse operations [25], and a structured PDCA cycle that combines 5S, layout and SOP redesign has reduced stock opname discrepancies by more than half [15].

### Analysis Based on the 5S Methodology

The identified problems were further analyzed using the 5S methodology, which provides a systematic framework for improving workplace organization and operational efficiency. A summary of the problems and proposed actions for each principle is presented in Table 2.

Table 2. Summary of problems and proposed actions based on the 5S methodology

| 5S principle | Problem identified | Proposed action |
|---|---|---|
| Seiri (Sort) | About fourteen damaged or obsolete items mixed with active stock | Separate damaged items; designate a disposal area |
| Seiton (Set in Order) | No storage zoning, rack numbers, or location labels | Group items by function; assign zones; label racks with location codes |
| Seiso (Shine) | Dust on racks; items stored on the floor | Weekly cleaning schedule; routine rack inspection |

| 5S principle | Problem identified | Proposed action |
|---|---|---|
| Seiketsu (Standardize) | No documented procedures for issuing, recording, and verifying stock | SOPs, inspection forms, and warehouse checklists |
| Shitsuke (Sustain) | Delayed stock recording due to workload | Warehouse coordinator, briefings, SOP monitoring, periodic audits |

(Source: observation and interview results, processed)

### *Seiri (Sort)*

The first principle focuses on separating necessary items from unnecessary ones [5]. Approximately fourteen damaged stationery items were stored together with active inventory, reducing counting accuracy and effective storage capacity. Implementing Seiri requires identifying obsolete inventory, separating damaged items from active stock, and establishing a designated disposal area, which increases available space and simplifies operations.

### *Seiton (Set in Order)*

The second principle emphasizes the systematic organization of storage locations [6]. The warehouse lacked storage zoning, rack numbering, and location labels, so employees spent additional time searching for items. The proposed improvement groups inventory into functional categories, assigns storage zones by product type, labels each rack, and establishes standardized location codes, thereby enabling faster retrieval and reducing unnecessary movement.

### *Seiso (Shine)*

Warehouse cleanliness is closely related to safety and inventory preservation. Dust accumulation on racks and products indicated that cleaning was not performed consistently, and items stored on the floor made cleaning difficult and increased the possibility of deterioration. Evidence from manufacturing workplaces shows that systematic cleaning within 5S improves efficiency, safety, and employee morale [8]. Weekly cleaning schedules, routine rack inspections, and the immediate removal of unnecessary materials are therefore proposed.

### *Seiketsu (Standardize)*

Warehouse operations lacked standardized work procedures; issuing, recording, and verifying stock were performed according to individual habits. Implementing Seiketsu includes developing SOPs for receiving, storing, issuing, and verifying inventory, together with standardized documentation, inspection forms, and checklists, as applied in warehouse improvements that combined 5S with SOP redesign [15].

### *Shitsuke (Sustain)*

The long-term sustainability of warehouse improvements depends on employee discipline and organizational commitment [5]. Interviews revealed that stock recording was occasionally delayed because of workload, which caused discrepancies between physical and recorded inventory. The proposed improvement includes assigning a dedicated warehouse coordinator, conducting routine briefings, monitoring SOP implementation, and performing periodic audits. Experience from other warehouses shows that 5S programs often stall after the first three steps when planning, team composition, and management alignment are weak [14], while continuous improvement cycles supported by monitoring and supervisory coaching help sustain behavioral change [26].

### *Comparison with Previous Studies*

The findings are consistent with previous research showing that 5S improves warehouse organization, inventory accuracy, and operational efficiency. Systematic workplace organization has been reported to reduce non-value-added activities and improve employee productivity [5], [6], and 5S combined

with re-layout reduced the time needed to search for parts [10]. Compared with studies that primarily focus on production-related or spare-part warehouses [10], [16], [21], this study suggests that the same principles can be used to diagnose problems and plan improvements in a GA warehouse with limited space and diverse inventory, although their effects there have yet to be measured.

## Warehouse Layout Redesign

The analysis indicated that workplace organization alone would not fully resolve the problems in the GA warehouse. A layout redesign was therefore necessary to optimize storage capacity, improve accessibility, and support a more systematic inventory process. Layout planning plays a critical role in minimizing unnecessary movement, maximizing space utilization, and improving material handling efficiency [3], [22].

### *Existing Warehouse Layout*

The existing layout was characterized by irregular storage arrangements and inefficient use of space (Figure 4). Racks were positioned without considering inventory categories or movement frequency, and oversized items were placed on the floor. As a result, aisles became narrower, employee mobility was restricted, and searching required additional time, which reduced productivity and increased the risk of inventory damage [1]. There was also no clear distinction between areas for office stationery, maintenance equipment, archived documents, and infrequently used materials, and no dedicated circulation path.



Figure 4. Existing warehouse layout

### *Proposed Warehouse Layout*

Based on the identified problems, a new layout was developed using SketchUp (Figure 5). The redesign aims to maximize vertical storage capacity while improving accessibility and workplace safety. The proposed design incorporates functional storage zones, standardized rack dimensions, a designated circulation space, and visual management elements [23]. Frequently used items are placed at ergonomic heights to reduce picking time, whereas archived documents and low-turnover items are stored on upper shelves.

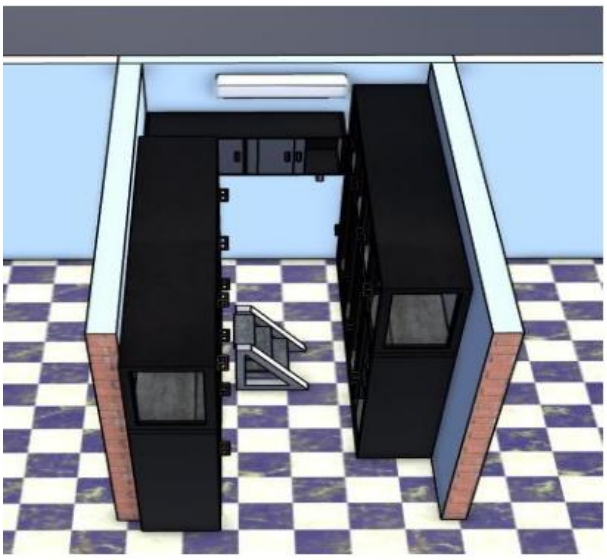


Figure 5. Proposed warehouse layout (SketchUp model)

***Warehouse and Rack Dimensions***

The proposed layout was developed according to the actual dimensions of the GA warehouse, which measures approximately 4.0 m in length, 1.8 m in width, and 3.5 m in height. These constraints required the optimization of vertical storage capacity without reducing employee mobility [22]. The main rack was designed with a height of approximately 3 m and divided into a lower section of 2 m for frequently accessed supplies and an upper section of 1 m for archived documents and slow-moving inventory (Figure 6). The compartment dimensions were adjusted to product characteristics to minimize unused space (Figures 7 and 8). Because racks are placed along both long walls and the circulation path is at least 1.2 m wide in a room 1.8 m wide, the rack depth on each side cannot exceed about 0.3 m. Such shallow racks suit stationery and documents, but oversized items cannot be stored on them, so they require a dedicated location that does not obstruct the circulation path. Because the upper section lies above 2 m, the racks should be anchored to the wall, a step ladder suited to the narrow aisle should be provided, and archive boxes placed in the upper section should be kept light; the most frequently retrieved items should be placed between about 0.7 and 1.5 m, which is the most accessible height range.

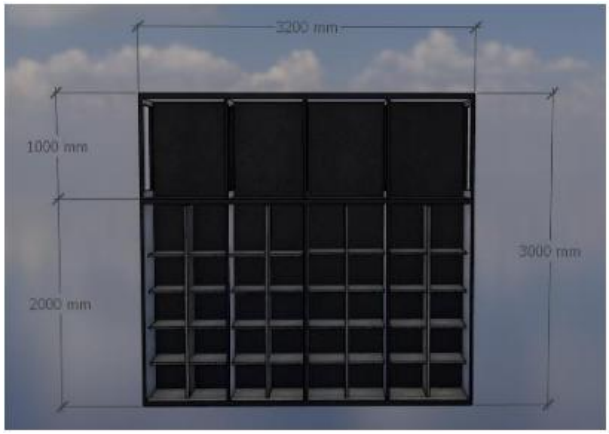



Figure 6. Main rack dimensions

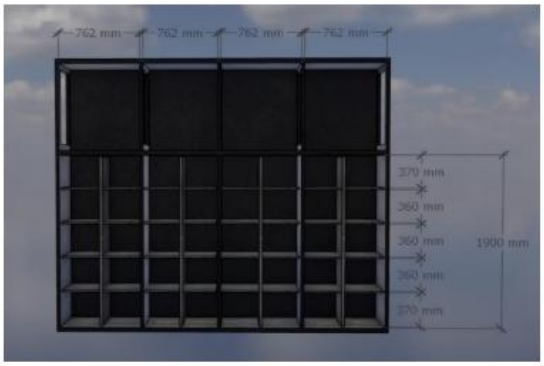



Figure 7. Rack compartment dimensions

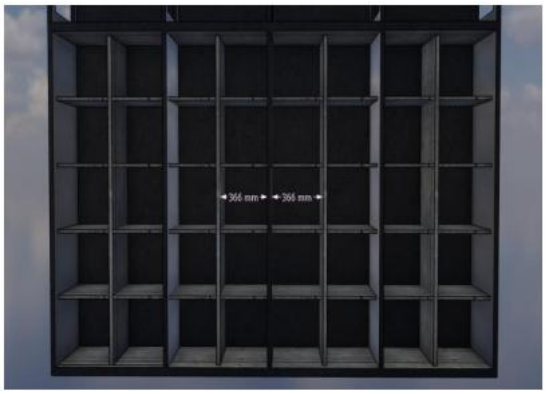



Figure 8. Internal shelf dimensions

### *Storage Zoning and Labeling*

A major improvement in the redesigned warehouse is storage zoning, in which items are grouped according to their operational function so that employees can locate materials more efficiently. This functional (dedicated) zoning differs from class-based storage, which groups items by retrieval frequency or value and has been shown to shorten material handling distance in other warehouses [17], [18]. In a warehouse of this size, the main benefit of functional zoning is shorter search and identification time rather than shorter travel distance. The proposed zones are presented in Table 3.

Table 3. Proposed storage zones

| Zone | Item category |
|---|---|
| A | Office stationery |
| B | Employee operational equipment |
| C | Information technology equipment |
| D | Archived documents |
| E | Maintenance supplies |

(Source: proposed design)

Each storage location is identified by a standardized code consisting of the zone, rack number, and shelf number. For example, code A-01-02 indicates Zone A, Rack 01, Shelf 02. This labeling system improves inventory visibility and supports systematic recording and retrieval [1]. Visual management through labels also reduces dependence on individual experience, making operations more standardized and easier for new personnel.

Archived documents (Zone D) differ from consumable supplies because they are subject to retention, confidentiality, and protection requirements. A retention schedule should therefore be applied so that inactive records are disposed of or transferred to a dedicated archive and do not keep occupying the limited storage space.

### *Material Flow*

The redesigned layout also improves material flow [24]. Previously, receiving, storage, and retrieval frequently overlapped because of limited circulation space and irregular placement. The proposed flow follows a sequential process: receiving, inspection, storage, inventory recording, picking, and distribution. This sequence reduces unnecessary movement and the possibility of misplacement, in line with layout planning approaches that arrange activities to shorten material handling distance [19]. A dedicated circulation path with a minimum width of 1.2 m was incorporated into the layout (Figure 9).

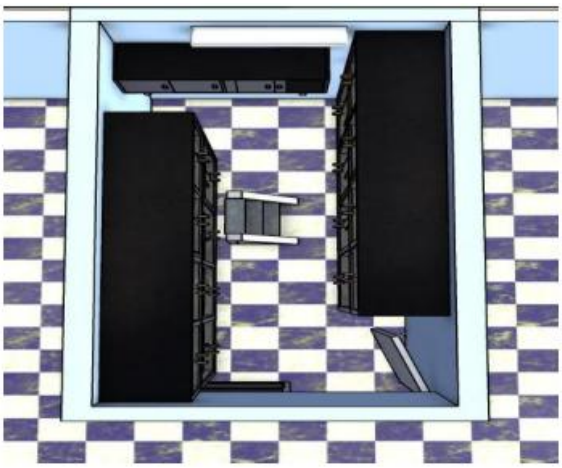


Figure 9. Top view of the proposed warehouse layout

### *SketchUp-Based Warehouse Design*

Three-dimensional modeling in SketchUp provides a realistic visualization of the proposed arrangement before physical implementation. The model enables management to evaluate storage capacity, accessibility, rack dimensions, and circulation space without interrupting daily operations. Evaluating layout alternatives with digital models before implementation has also been used to improve warehouse capacity and throughput [11]. The model indicates that capacity can be increased mainly through better vertical utilization rather than by expanding the floor area, although this increase has not yet been quantified, and it supports communication between warehouse personnel and management. The upper cabinet and sliding door designs are shown in Figures 10 and 11.

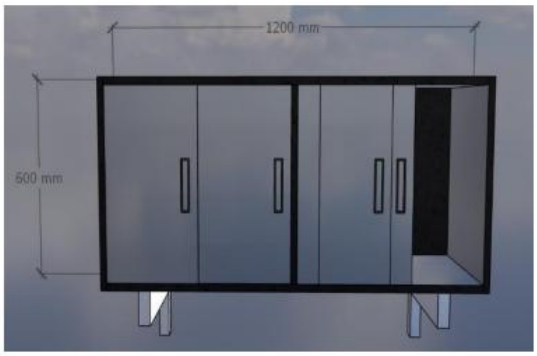



Figure 10. Upper cabinet design

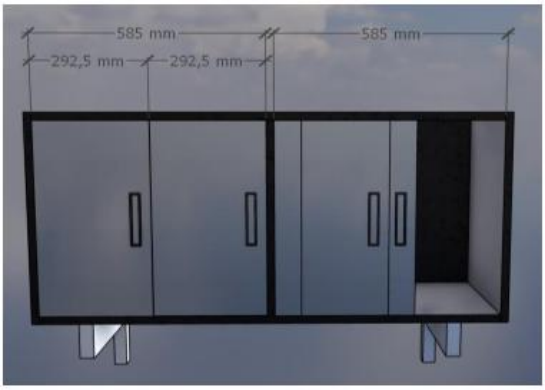



Figure 11. Sliding door design

### *Expected Efficiency Improvements*

The proposed redesign is expected to improve efficiency in several respects. First, zoning and labeling reduce searching time because employees can immediately identify storage locations. Second, better rack utilization increases effective capacity without additional floor space. Third, a dedicated circulation path reduces unnecessary movement during handling [3], [10]. Furthermore, separating damaged items from active stock improves inventory accuracy and simplifies verification. Although this study does not quantify these improvements through time and motion analysis, the proposal is consistent with evidence that organized layouts improve warehouse productivity and space utilization [11].

To turn these expectations into measurable results, implementation should follow a clear sequence: Seiri first, to remove damaged and obsolete items, followed by the installation of racks and cabinets,

labeling with location codes, and the introduction of SOPs and the cleaning schedule. A warehouse coordinator should be responsible for the sequence, and progress should be monitored with simple indicators recorded first as a baseline, such as inventory record accuracy, average time to locate an item, percentage of labeled locations, monthly 5S audit score, and number of obsolete items.

### Managerial Implications

From an industrial management perspective, the findings show that the problems in the GA warehouse originate mainly from the absence of process ownership, standards, and control mechanisms compounded by limited space and racks that did not match item dimensions. Managers of support functions should therefore treat the warehouse as a managed process with a designated coordinator, documented SOPs, visual controls, and simple performance indicators such as inventory accuracy and searching time. Because the proposed measures require little capital investment, they can be implemented incrementally according to organizational priorities. Sustaining the results, however, requires visible management commitment, a properly composed implementation team, and routine audits [14], as well as a collaborative continuous improvement cycle in which employees and supervisors jointly monitor performance [26].

### Research Contribution and Novelty

This study contributes to the warehouse management literature by suggesting that the integration of 5S and layout redesign can be used not only in production and distribution warehouses [9], [12] but also in GA warehouses that manage administrative and operational support inventories. Its contribution lies in a low-cost improvement model for very small warehouses with diverse inventory, which is most suitable where problems stem from missing standards and process ownership rather than from a lack of technology, and in the finding that inventory audits should consider item usability, not only recorded quantity. The use of SketchUp supports the practicality of the proposal by allowing organizations to evaluate layout alternatives before implementation.

## Conclusion

This study examined warehouse management practices in the General Affairs (GA) warehouse of PT. XYZ and found that fundamental warehouse management principles had not been implemented. Storage areas lacked systematic organization and zoning, racks were not labeled, damaged and obsolete items were mixed with active stock, and standardized procedures were absent. Stock-taking confirmed discrepancies between physical and recorded inventory caused mainly by manual recording errors and undocumented obsolete items. To address these issues, this study proposed an integrated strategy that applies the five 5S principles to eliminate unnecessary items, organize storage locations, improve cleanliness, standardize procedures, and sustain discipline, combined with a SketchUp-based layout redesign that introduces five functional storage zones, a zone-rack-shelf location code, standardized rack dimensions, increased vertical storage, and a dedicated circulation path. These measures are expected to improve inventory accuracy, shorten searching time, and optimize storage utilization at low cost, and they suggest how 5S and layout principles can be applied to administrative support warehouses.

This study has several limitations. Stock verification covered only three illustrative items, no data on retrieval frequency were available, the feasibility of the proposed rack dimensions has not been tested in practice, the number of informants was limited and the researchers were interns at the company, and no cost estimate was prepared. Future studies should implement the proposals and evaluate inventory accuracy, search time, storage utilization, and productivity quantitatively, and should

consider low-cost tools such as simple barcodes or stock cards before more complex WMS or RFID technologies.

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