# DESIGN OF ITEM LAYOUT WITH SHARE STORAGE METHOD AT PT. SISTAMA PARTNER

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## ARTICLE INFO

## ABSTRACT

Warehouses are used to store company-owned goods, both raw materials and finished goods. Good warehouse conditions can help carry out all activities in the company. According to. Therefore, design patterns and warehouse layouts are very important to simplify and increase company productivity. The use of storage methods and warehouse management systems that have less effect on the operations and smooth running of the goods. so that all operational activities run smoothly. The use of the correct storage method can also maximize the existing warehouse capacity. With warehouse conditions that are not well organized, it also has an impact on the less than optimal order processing because the location of the goods is not organized and orderly. The application of this method is a shared storage method because by applying this method the distance of taking ordered goods is faster. That way you can increase the total order that can be completed.

**Keyword:** Warehouse, Layout With Shared Storage

## 1. INTRODUCTION

Warehouse is an important part of the company. Warehouses are also used to store company-owned goods ranging from raw materials to finished goods. Good warehouse conditions can help carry out all activities in the company. According to Tomkins, White, Bozer and Tachoco (2010), warehouses play an important role in supporting the company's supply chain. The warehouse mission is to effectively deliver any product to the next step in the supply chain without damaging or changing the original shape of the product.

PT. Mitra Sistama has a warehouse of around 600m2. This warehouse has an important role in warehouse process activities and delivery of customer product distribution quickly and precisely. The warehouse must be designed so that the product can fill the maximum space capacity both vertically and horizontally. Good warehouse management requires a system that can be built and controlled properly. A good warehousing system is a warehousing system that is able to utilize space for storage

effectively in order to increase space utilization and minimize distance or material handling costs (Heragu, 2017). Companies as warehousing service providers must be able to manage their business well to meet consumer needs and must have good warehouse layout management to support activities in the warehouse. The definition of vertical and horizontal is that the product must be filled on the shelf evenly sideways or piled up so that there is no empty space. Layout is one of the problems that can always occur in activities.



**Figure 1. Early 2020 Warehouse Condition**
Source: Personal documents

The process of picking up goods based on orders. The Picker team will take the item based on the shipping label and submit it to the packer team for packaging the product. Picking is manual and takes about 3-5 minutes for 1-3 SKUs. Depending on the quantity and type of order, the difference in the number of orders can make different processing times. The process of searching for goods begins by moving the boxes that have piled up, opening the boxes, checking what types of goods are in the boxes, and picking up items that match the order list. If the box containing is not the item you are looking for, the process will be repeated from the beginning of the box transfer.

Based on the identification of problems that have been carried out, it is known that there are several problems that occur in the warehouse. The problem that occurs is that the layout of the goods in the warehouse is not arranged properly, resulting in productivity not running optimally. These problems can be solved with Warehouse Layout Design and Warehouse Layout Design Management System With Share Storage Method. Good warehouse layout design is expected to reduce the time in the process of finding goods so that production time is faster

So with the layout design and pattern system for storing goods in the warehouse, it can have a direct impact on the flow of work processes that are more efficient, effective, and well organized. Based on the identification of the problem, it can be formulated as follows: The current state of the warehouse layout?, What storage layout methods can be applied to the warehouse. Research Objectives, Knowing the current warehouse layout, Analyze the most suitable warehouse layout method to apply.

## 2. LITERATURE REVIEW

Definition of management according to experts. Management is the science and art of managing the process of utilizing other resources efficiently, effectively and productively which is the most important thing to achieve a goal. Rivai (2018;2), Management is the science and art of managing the process of utilizing human resources and other resources effectively and efficiently to achieve a certain goal. Hasibuan (2018;2), So in my opinion, management is a science to regulate the course of an activity or work to be more efficient and effective. Operational Management is a process that is mutually sustainable and effective in using management functions to efficiently integrate various resources in order to achieve goals. Harjanto (2016). From this definition I can conclude that operational management is the management of the use of all existing production factors into various kinds of products or services.

The definition of the warehousing management system itself according to Warman (2017) is an

information system regarding warehousing management that is used to control activities in the warehouse starting from receiving (receiving), storing goods (putaway), moving (moving), choosing (choosing), and shipping ( delivery). The warehousing management system aims to control the movement of entry, entry, storage, and retrieval of goods effectively and efficiently. The purpose of warehouse management is to efficiently and effectively activate all processes and activities that exist in the Tompkins warehouse (2017). So researchers from some of the understanding above can be the key to warehousing management that warehousing management does involve so many processes and seems very complex.

According to Lambert, (2017) the term productivity has different meanings, depending on its use according to certain needs. Productivity is generally defined as the relationship between output (goods or services) and inputs (labor, materials, money). Productivity is a measure of productive efficiency. Comparison between output and input (Sutrisno, 2018). According to Ardana (2017) it is stated that productivity is influenced by factors such as: education, skills, discipline, mental attitude and work ethic, motivation, nutrition and health, income level, social security, work environment and climate, Pancasila industry. relationships (relationships between highly human work), technology, means of production, management, and opportunities for achievement.

A warehouse is a permanent facility, designed to achieve the targeted service level at the lowest total cost. Warehouses are needed in the process of coordinating goods, which arise as a result of an imbalance between supply and demand processes. The portion of supply and demand that is not balanced which encourages the emergence of inventory (inventory), inventory requires space as a temporary storage area known as a warehouse. Lambert (2015).

The definition of warehouse according to Lambert, (2017) is part of a company's logistics system that stores products (raw materials, spare parts, goods in process, finished processes) at and between points of origin (point-of-origin). and points of consumption, and provide information to management regarding the status, condition, and position of stored goods.

Purnomo (2014). solves storage problems across the enterprise, from receipt, to production to delivery. Overall design, problem, storage activities can be solved in the following categories;
a. Receiving, the process of receiving and before distribution
b. Inventory, storage of raw materials and purchased finished goods until production is needed
c. Equipment, which is non-productive goods used to support the production function
d. In the middle of the process, namely semi-finished goods and are waiting for the next operation
e. Finished components, which are waiting for assembly (can also be stored in the middle of the process or assembly area)
f. Waste, which is the material or part of the product that will be processed back into a useful form again
g. Building, namely the accumulation, selection, and distribution of goods that are no longer useful
h. Various kinds of equipment, equipment and so on, which are useless to be reused in the future
i. Finished products are products that are ready for production or stored for a long period of time
j. One that greatly affects the function or not of a warehouse is the capacity of the warehouse itself.

In determining the capacity of the warehouse, which must be considered is the maximum state. Warehouses that reach maximum conditions at the time of packaging preparation have not been used, material delays, while the order date is faster (Lechman, 2017).

To calculate the amount of warehouse capacity that must be met, data about;
a. The number of orders (order quantity) in a certain period is done
b. Amount of specified packaging inventory
c. Lead time variation
d. Usage fluctuation

The finished product warehouse is concerned with proper storage and production of finished products. This repository is responsible for Apple (2017);
a. Receipt of finished products from production
b. Store items safely and neatly

c. Taking orders for delivery
d. Packing for shipping process
e. Keeping proper records

    The general purpose of this method of storing goods is;

a. Maximum use of building capacity
b. Efficient use of time, need, and completion
c. Ease of finding raw materials
d. Fast and easy transportation of goods
e. Identify good items
f. Maximum item maintenance
g. Neat and organized appearance.

    The activities that dominate in the warehouse are looking for, picking up, preparing, and delivering the requested goods (order picking). So the warehouse layout needs to be made so that the process runs smoothly. Basically, the warehouse layout design is a layout arrangement that follows the operating system (order picking system) that has been set. The first is the determination of each other's position (receiving, retrieval, storage, inspection and delivery) and taking into account the mutual relationship between the parties.

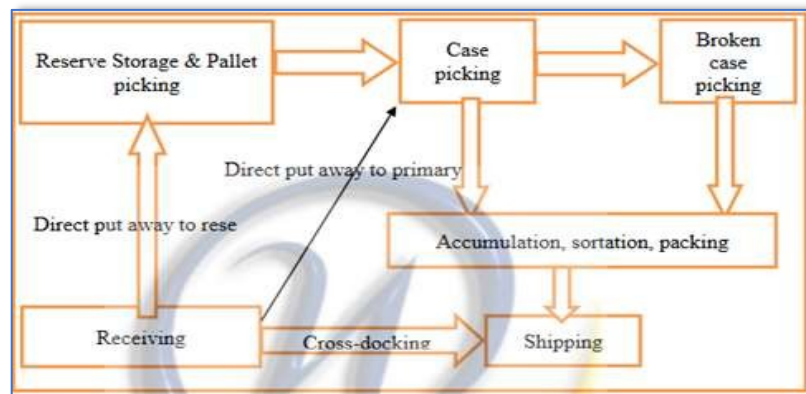    In general, the function and flow of warehouse activities according to (Tomkins, 2016) is as follows :



**Figure 2. Function And Flow Of Warehouse Activities**
Source: Tomkins (2016)

    The basic warehouse activities are as follows

a. Receiving (Inbound)
   1) Receipt of incoming goods in accordance with warehouse rules and in accordance with delivery orders (DO) from related vendors
   2) Quality Control (QC) checking that the goods received are in accordance with the physical and document

b. Putaway
   Placement of materials or goods that have been received into certain storage locations according to the category and type of goods.

c. Storage or inventory
   Material storage while waiting for the material to be used for the next process. The storage and handling methods of the product or material depend on the size, quality and characteristics of the product or material.

d. Order picking
   The process of taking goods according to the customer's order list

e. Order packing

The process of packaging the goods that have been taken according to the order list

f. Finished good and hanover to 3PL

Goods that have been packaged and in Quality Control (QC) then it will be handed over to the relevant shipping company.

The purpose of the warehouse is as a place to store, while the general function of warehousing is to maximize service to customers with limited resources. Warehouse and warehousing resources are space, equipment and personnel. The warehousing function is to be able to get the desired goods accurately and quickly in good condition. So in designing a warehouse and warehouse management system the following things are needed (Purnomo, 2018)

1) Maximize the use of space
2) Maximize the use of equipment
3) Maximize the use of labor
4) Maximizing the ease of receiving all materials and receiving goods.

Layout is a decision to determine the efficiency of an operation in the long term, the layout has many strategic impacts, because the layout determines the capacity, process, cost, and quality of the work environment, as well as customer contact and corporate image. An effective layout can help an organization achieve a strategy that supports differentiation, low cost, or fast response. The purpose of the layout is to build an economical layout that meets the competitive needs of the company (Heizer and Render; 2018:532).

Effective layouts can help companies achieve the following (Heizer and Render, 2018)

a. Greater use of space, equipment and people
b. Better flow of information, raw materials and people
c. Make it easier for consumers
d. Improved employee morale and more comfortable working conditions

According to Render and Jay Heizer (2018) the definition of layout is as follows: "layout is one of the decisions that determines the efficiency of the company's operations in the long term".

According to Render and Jay Heizer (2018) that an effective layout can help company operations achieve the following:

a. Greater utilization of space, equipment and people.
b. Better flow of information, raw materials and people.
c. Make it easier for consumers.
d. Improved employee morale, and safer working conditions.

Given the importance of the layout factor in a company, layout planning must be done properly in order to meet the company's needs to remain competitive.

According to Jay Heizer, et al (2018) in his book "Modern Production Management" the objectives of layout planning include:

a. Minimizing Material Hadling Cost

On the other hand, a good layout will support the production process efficiently. Furthermore, the implications of an efficient production process can be stated as:

1) The efficiency of using production equipment can be improved.
2) Reduction of waiting time.
3) Build-up of work in progress can be reduced.
4) Maintenance of production facilities made easy.
5) Increased company productivity.
6) Effective use of factory space.
7) The level of use of manufacturing labor.

8) Reducing the smooth running of the production process.
9) Facilitate communication.

According to (Miranda & Tunggal, 2017) this capacity planning is very important, if at the time of setting up a factory or expanding an activity. With the estimated flow of goods, the planned warehouse size. Several factors that need to be considered in determining the size of warehouse capacity include;

1) Dimensions of the size of each item to be stored. The larger the size of the item will require a large space.
2) The lead time of ordering goods, if the grace period is faster then the storage space must be bigger.
3) The number or number of items that must be stored and the frequency of entry and exit of goods. The more items that are stored have a big impact on the area that must be prepared. If the frequency of entry and exit of goods is small, the impact is the same as a large warehouse area.
4) Factors to be taken by the warehouse management which include the lack of storage space when the goods arrive.

In addition to the size of the warehouse space, warehouse capacity is also determined by the way the goods are stored. Warehouses with irregular layouts are certainly less efficient. In addition, there are things that must be considered, namely the types of goods stored are classified into the following groups;

1) Fast moving, namely goods that circulate in and out quickly. Fast moving, ie fast circulation goods. Or called a best seller



**Figure 3. Level Of Purchase Of Goods In The Last 3 Months**
Source: Document PT. System Partner

2) Slow moving, ie slow circulation goods, usually goods that are less desirable.
Layout is closely related to all processes of planning and arranging raw materials and other existing supporting equipment.
The facility planning stage is traditionally stated as follows (Tompkins, 2017);
1) Definition of the problem (define the problem)
2) Analyze the problem
3) Create several alternatives (generate alternative design)
4) Evaluation of the alternative (evaluate the alternative)
5) Choose the best (select the preferred design)
6) Implement the design.

5S is the use of the workplace which includes all aspects such as equipment, documents, buildings and rooms to train the habits of workers in an effort to improve work discipline. A neat, clean, safe and comfortable workplace that produces high quality products, regular savings, more time efficient, guaranteed safety, high morale and guaranteed work environment.
1) Seiri (Concise)

Selection of goods as needed in the completion of work, so that the work area is more efficient, there are not many items.

2) Seiton (Tidy)

Selection of items that meet the needs in completing the work and placed neatly without being messy

3) Seiso (Clean)

Clean or clean, is to make the work environment area always clean

4) Seiketsu (Treatment)

This stage is also called the maintenance stage, which is the standardization and consistency of each individual to continue to carry out the previous stages

5) Shitsuke (Diligent)

The maintenance of personal discipline includes a habit and the maintenance of an already running 5S program.

In building a company must be in accordance with the planning and design in accordance with the requirements of the establishment of the company. With the planning and design of the layout of this facility, it is expected that the process flow and material transfer from one place to another can run smoothly. A smooth production process can minimize costs and optimize profits. In addition, planning and designing the layout of this facility is also useful for optimizing the relationship between activities. (Murdifin & Mahfud, 2017)

Warehouses must be designed with the speed of movement of goods in mind. Fast moving items are better placed close to the pick-up point, thereby reducing back and forth motion. In a storage warehouse, a very large factor affects the handling of existing goods, the location and design of the building where the goods are stored. The general purpose of the method of storing goods is (wignjosubroto; 2017; 72)

a. Maximum use of building volume
b. Good use of time, labor and equipment
c. Ease of getting materials
d. Fast and easy transportation of goods
e. Identify good items
f. Maximum item maintenance
g. Neat and organized appearance.

There are several retention policies (methods) commonly used, including (Francis and White, 2017):

1) Dedicated Storage Method.

Dedicated storage is also known as fixed storage (fixed slot storage) which places a specific storage location or address for each item that is stored. This is because one deposit location is assigned to a specific product.

Two variations of dedicated storage that are commonly used are part number sequence storage and throughput-based dedicated storage. Part number sequence storage is often used because it is simpler. The product storage location is based solely on the given part number. Low part numbers are assigned to the "best" location in the stockpile and higher part numbers are assigned to less "good" locations. In particular, it presents a randomly generated part number regardless of the activity present. Therefore, if a single section with a very large number of sections with high activity then multiple trips will occur in a very bad storage location.

Throughput-based dedicated storage is a method that takes into account differences in activity levels and storage requirements between products to be stored. more sorts of storage part numbers when there are significant differences in activity levels or inventory levels of stored items. Because it is often used, throughput-based dedicated storage is now often called dedicated storage.

With dedicated storage, the number of storage locations assigned to the product must meet the product's maximum storage requirements. With some products, the required storage area is the maximum amount of storage required for each product. This rule takes into account the level of storage and retrieval (S/R) activity developed for different items.

2) Shared Storage Method

Shared storage can be thought of as a fast-moving goods system for a product, if each pallet is filled in a different warehouse area over time. Shared storage can take advantage of the inherent differences in the time each pallet is left in the warehouse. In an effort to reduce the storage space requirements of dedicated storage, some warehouse managers use storage variations particularly where product placement is managed more carefully. In particular, from time to time different results use the same storage slot, even though the final product occupies that slot only once.

For consideration of shared storage, if it comes from 100 pallets with a large number of "fast transfers" of products to be stored. Pallets in bulk will be reused and will be sent as many as 5 pallets per day in a span of 20 days. Materials can be moved manually or using automated methods, materials can be moved once or thousands of times.

If there are two work stations/departments I and j whose coordinates are shown as (x,y) and (a,b), then to calculate the distance between the two midpoints of dij, several methods can be used, namely:

a. Rectilinear Distance

Distances are measured along the trajectory using lines perpendicular to each other. An example is material moving along a rectilinear aisle in a factory. $d_{ij} = |x - a| + |y - b|$.

b. Euclidean Distance

Euclidean distance is measured along a straight line path between two points. The distance can be illustrated as a straight conveyor crossing two work stations. $d_{ij} = [(x_2 - x_1)^2 + (y_2 - y_1)^2]$

c. Squared Euclidean Distance

Distance is measured along the path that passes between two points. For example, in a guided vehicle system, running vehicles must follow the directions that have been set on the controlled track network. So the flow path distance can be longer than rectilinear or Euclidean. $d_{ij} = (x - a)^2 + (y - b)^2$ 8

In an effort to reduce the storage space requirements of dedicated storage, some warehouse managers use special storage variations in which the final product placement is managed more carefully. In particular, from time to time, different results use the same storage slot, even though the final product occupies that slot only once.

To support co-storage considerations, if the arrival of 100 pallets with a large number of "fast-moving" products to be stored in storage slots. Pallets with large quantities will be reused and will be sent as many as 5 pallets per day within a span of 20 days.

With randomized storage, 100 free space slots are selected "randomly" for the product there is no guarantee that the result is a fast move. With dedicated storage, on the other hand, at least 100 free slots must be available between the selected primary locations for fast switching to occur. If storage is randomized each time a palletized load is removed from the storage space, a slot is available for use by the product that needs the next storage space. However with dedicated storage, every pallet removal from the storage space makes it impossible to fill empty slots at the earliest until the arrival of the next shipment of the same product.

Shared storage can be considered as a fast movement of goods for a product, if each pallet is filled in a different warehouse area from time to time. Depending on the number of products in the warehouse at the time the shipment arrives, it is possible that 5 pallets of contents will be in the warehouse for only 1 day. Another 5 pallets in the same shipment will be in the warehouse for 20 days. From the perspective of the position of the storage space in the warehouse, 5 pallets will move very quickly; the remaining palettes look slower, maybe shifting a bit.

Shared storage can take advantage of the inherent difference in the time allotted for each pallet to stay in the warehouse. The variables of the shared storage method to know are:
a. Processing time
b. Delivery time of each product
c. Number of products per order
d. Frequency of orders per time period
e. The distance of each storage area to the entrance and exit
f. Space requirement

Based on the product and variable setting steps of the shared storage method, in the process of preparing a warehouse layout based on shared storage, there are several stages, namely:
a. Calculation of area capacity in warehouse (long processing time, delivery time, number of products)
b. Classify products based on customer
c. Calculation of area requirements for each item.
d. Determination of the order of moving for each area (sorting of areas based on the distance to the I/O entrance and exit)
e. Determination of layout The storage space requirements for shared storage range from those required for randomized storage and those required for dedicated storage, depending on the amount of information available regarding inventory levels over time for each product.
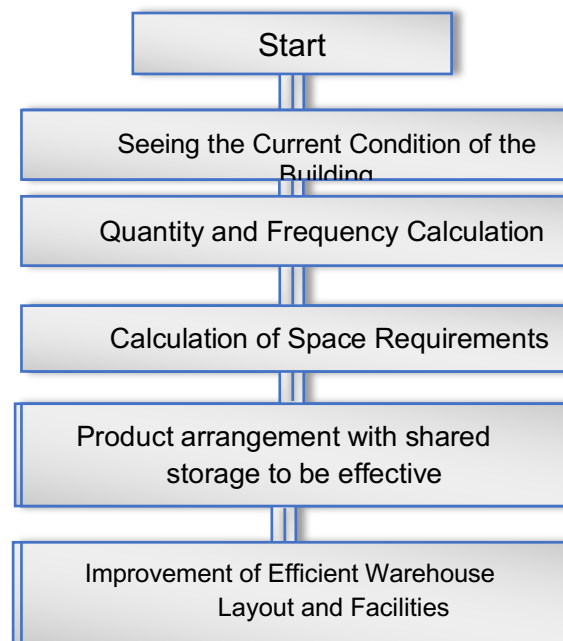


**Figure 4. Framework Research**

## 3. METHODS

The data collection method is carried out by processing literature, articles, journals, and other written media related to the discussion topic of this research. The analytical method used in this study is the Structural Equation Model (SEM) using the AMOS version 23 program. According to Ferdinand (2002), SEM is basically a set of statistical techniques that allow the simultaneous testing of a relatively complex series of relationships. In addition, the SEM method can also identify the dimensions of a

concept and simultaneously can measure the influence of the relationship between each factor whose dimensions are identified. The number of respondents is 200.

The data collection method is carried out by collecting all primary data from interviewees and direct observations in the field. The data sources have passed the publication test by PT. System Partner.

## 4. FINDINGS AND DISCUSSION

Data processing using the Shared Storage method at the warehouse PT. Mitra Sistama Indonesia is an irregular warehouse condition. The absence of a racking system makes the location of the goods unclear, the laying of pallets is also irregular and makes work maneuvers narrow. It all made it difficult for the Picking officer to find the ordered items. Make time to process the order to be long. The method used is a storage method with the Shared Storage method, where goods that are quickly sent are placed in the storage area closest to the I/O entrance and exit. Alternative layout design based on forklift diagonal so that the process of removing goods is effective and efficient. The results based on the area of the storage area for all goods to the door from the layout proposal 1 obtained a value of 79m and the proposal layout 2 with a value of 70m, the author then uses the proposal layout 2 to compile the warehouse layout because after researching that layout 2 is more efficient in terms of distance. With a savings of 11.39%.

## 5. CONCLUSION AND RECOMMENDATION

1) The application of the shared storage method is very good for the company, because the company produces to order which requires high activity in the warehouse and on time delivery.
2) Companies can use the proposed storage with the Share Storage method, if you want to rearrange the warehouse layout to be more efficient and effective.
3) The current condition of warehouse capacity is sufficient, but if there is an increase in market share in the future, the company needs to consider using a racking system that has not been described in more detail in this study.

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