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# Spare Part Warehouse Management Analysis Using 5S Approach and FIFO System

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***Abstract*—PT. Z is a company located outside Java, to be precise in the industrial area of Batam city, whose business process is to make to order. This company has a mission to build up goodwill and trust from their customer upon uncompromising quality and on time delivery that come with very competitive pricing. To achieve this mission, PT. Z has an adequate material and spare part supply system so that when there is an order from a customer, it will be done immediately without waiting for the spare part to arrive. The problem faced by this company is that there are many spare parts that are arranged untidy and difficult to find, besides that some items have been damaged due to too long accumulation in the warehouse. The application of the 5S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) approach and FIFO system in spare part management warehouse is used to reduce time waste caused by inefficient layout of spare parts. After applying these two methods in managing spare parts, there are some decreases in the activity time to find fast moving spare parts from 1.782 minutes to 0.983 minutes and the activity to search fast moving spare parts from 1.688 minutes to 0.9 minutes. While for the slow moving parts there is a time decrease of 0.881 minutes for storage activity and 1.471 minutes to search activity. For fast moving spare parts and slow moving spare parts both have increased efficiency. The percentage of store activity efficiency are 81% and 62%, while the efficiency of the activity to store spare parts are 87% and 55%. Fast moving parts and slow moving parts both have an efficient and effective layout with a systematic storage method.**

***Keywords—layout, efficiency, spare part, time study, warehouse***

## I. INTRODUCTION

PT. Z is a company engaged in the fabrication sector, namely assemblers of engineering machine parts, tools, dies, and oilfield mechanical equipment. This company also supplies electronic and industrial components, such as generators, repair work, pumps, all kinds of rubber, gears, seals and fasteners. Other services include the provision of various types of utilities and facilities according to client requests. 5S is the vocabulary that is mostly heard by those who carry out professions in the manufacturing world. As an employee of the manufacturing industry, the 5S concept, which comes from Japanese, has been inherent and continues to be implemented. This culture in the workplace was initially applied to companies originating from Japan. The 5S referred to in Japanese include Seiri, Seiton, Sheisou, Seiketsu, and Shitsuke. This concept is widely applied to companies both domestic and foreign companies because it has a large contribution to the success of a company.This concept was eventually adopted by companies in Indonesia with its 5R concept, which consists of: Ringkas, Rapih, Resik, Rawat dan Rajin. In general, there is no standard definition of each stage. There are principles in each of the 5S stages. These principles refer to the activities undertaken and mental attitudes required in carrying out each of the 5S stages. To create customer's satisfaction, companies must pay attention to the performance of the warehouse spare part division . In the early stages the researcher designed the 5S and FIFO procedures and then applied the two methods. The purpose of implementing these two methods is to increase the spare part warehouse efficient and well maintained.

The warehouse plays an important role to smooth the flow of material starting from suppliers to producers, then to distributors and consumers. To support the flow of goods and information required a warehouse arrangement well, including processes, goods, resources, and the supporting facilities. With good arrangement, expected parts can be received, stored, and issued from warehouse in that condition and quantity appropriate, and in the shortest time.

## II. METHOD

This study uses three methods, first method namely 5S, second method is time measurement and the last one we use FIFO principles. The main essence of 5S concept is actually to reduce waste time and change the behavior and habits of workers for the better. In the end, with high consistency these good habits develop into a culture in the workplace. The purpose of time measurement is to compare the time to store and to find the needed spare parts, before and after the spare parts are stored in warehouse by applying 5S approach and FIFO system.

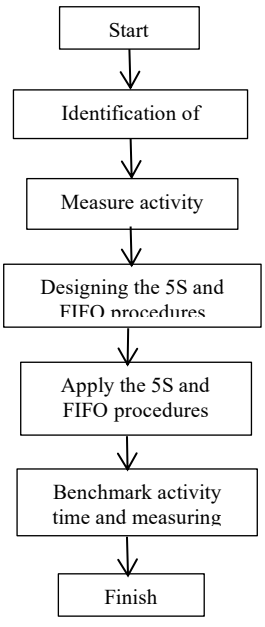


Fig 1 Research Process Flow Diagram

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A. *The 5S approach and FIFO system*

The 5S concept must become a work culture in every division in the company, including the warehouse division. The warehouse is divided into raw material warehouse, finish good warehouse and spare part warehouse.

The implementation of 5S in a warehouse is absolutely necessary because there will be many benefits for the company, starting from the efficiency of the storage area, the efficiency of moving warehouse employees, the accuracy of stock cards, tidiness of goods, safety of goods and many more benefits and benefits that can be achieved.

Seiri is the earliest step that must be done before moving on to the next step. The concept is very simple, namely sorting out which items are useful and still in use and which items are useless or no longer in use. Useful items are then stored while useless items are discarded. At this stage, there is usually a sign of useless goods using red tags. Items that have been given a red label are then put aside and collected at the shelter. Furthermore, these items will be viewed and re-evaluated by the management before finally being decided to be stored again or remain discarded.

Seiton is the second step in the 5S concept. The basic principle is to arrange items in the workplace so that they are easy to find when needed. In addition, by tidying up, these items become safer. At this stage, labeling the area is usually done stating that the area is where the items are located. This marking is useful in order to reduce the waste of time searching for the whereabouts of the items in need because the attached labels will make it easier to find.

Seiso is the third step. The principle is to clean the items that have been neatly arranged so that they are not dirty. Included in this risk is cleaning your work environment, production machines, both machines that are running or machines that are under maintenance. The effect of a clean workplace is to increase employee motivation and keep the workplace healthy and comfortable.

After the 3S principles above can be carried out well, the next step is to carry out maintenance. This stage is called Seiketsu. A work place that is compact, neat and clean must be cared for and standardized. These standards must be easy for all employees to understand and do. For this reason, it will usually be in the form of a 5S audit team consisting of employee representatives who have been given training and are trusted to become the auditor team. At this stage the 5S standards are written in the form of a checklist and will be audited regularly by the team that has been formed.

At the shitsuke stage the principles of 5S have become the culture in the company. With the existence of the fifth S, awareness has emerged in each employee about the 5S culture. At this level an employee will behave discipline and obey the applicable standards and regulations. Mutual respect between fellow employees and remind each other about the applicable standards. Having an attitude of shame if he violates existing standards. Willing to continue to make improvements. One important thing to underline is that no matter how good 5S concept announced by the company, all will return to the support and participation and awareness of each individual and the employees and leaders in the company. The following are the things that determine whether the 5R program will be successful or not, including there is active participation of all employees from the lowest level to the highest level in the company. There is strong support from company management to implement 5S culture in the company. The support provided must be continuous both in terms of facilities and others. There is a change in the mindset or mindset of employees in the company that the 5S program is no more than just a cleaning program. There are visual banners and instructions that strengthen the 5S program. Providing continuous training and education about 5S to all employees. 5S culture is not a work culture that is easy to implement in a company, but it is also not impossible to implement. The key is consistency of supervision, both by the 5S committee and support from the company's own management. Management support is absolutely necessary because to complete the 5S equipment and facilities requires a budget from the company. Without support from management, the 5S concept will only run in place and in the end it will not be successful to be applied.

Most companies sell goods in the same order as they were in the day goods purchased. This is especially true for non-resistant items old and items whose fashions and styles change frequently. FIFO method is a storage system spare parts that have rules of entry first, then the spare parts are the ones get out first. Therefore the spare part was issued sequentially or chronologically. The FIFO method is consistent with physical flows or movements goods. In this case, the FIFO method gives more or less results equals the results obtained from the specific cost identification method for every unit sold and that is still in stock. According to Tompkins (2010), this FIFO system has many advantages, among others, the quality of the goods will be more maintained. By using the FIFO system is expected that the first goods entered are also the first time out so that the goods are not stored in the warehouse for long. Items with the earliest expiration date will also come out the most early, so that the quality of goods can be guaranteed and anticipated the occurrence of mass damage to goods. The second advantage is guaranteed price control. The advantage of this system is the stability of the price of goods which is saved. The price is not always the same, sometimes the price goes up, but there are times when the price goes down. With this system it is hoped that the first entry goods are priced at a certain price will be the same price when issued later. Associated with the previous point was that the quality of the goods was still guaranteed, later the worry that the item will collapse can be avoided. In other words, the purchase price will not be more higher than the sales price. So you will get a maximum profit. The third advantage of FIFO system is the activity of recording goods in the warehouse easier. Registrar of incoming goods and outgoing goods will be easier control goods sequentially or chronologically. So the warehouse operator is usually unnecessary check all goods. Officers usually just check the number of goods that come out at that time is appropriate the amount at the time the goods were entered.

B. *Time Measurement*

Time measurement or time study is an attempt to determine length of work required an trained or qualified operator in completing a specific job at the level of work speed normal work environment at that time. Time measurement technique work is divided into two kinds, namely directly and indirectly. The direct work measurement technique consists of stopwatch time study and work sampling. Technique measurement of work indirectly consists of standard time data and predetermined time system data. Measurement of working time with stopwatch time study first introduced by Frederick W. Taylor around the 19th

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century ago. This method is especially well applied to jobs that are was short and repetitive. From the measurement results then you will get the standard time to complete one work cycle, which is this time will be used as a standard for completion of work for all workers who will carry out the same job as that (Wignjosoebroto, 2000). By looking at the time data of each element directly, the observer will soon be able to find out variations in time data during the work process takes place for each element of work. Too large variation of time data which could be the result of misreading or using the stopwatch or it could also be due to deviations that occur within implementation of work. The research process carried out is depicted in the diagram in Figure 1 below.

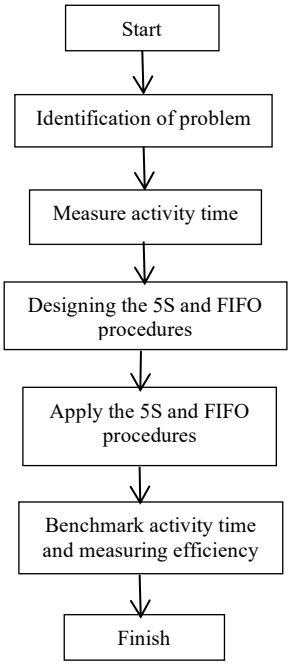


Fig 1. Research flow diagram

This research was conducted at PT. Z in the PPIC division who have problems with the arrangement and storage of spare parts in a material warehouse. Starting with designing 5S and FIFO procedures to manage spare parts, then measuring the standard time partman storing and looking for spare parts before and after the implementation of 5S and FIFO in the spare part warehouse using the time study method. The spare parts that are recorded and used as research are spare parts available in the storage warehouse

## III. RESULT

PT. Z has an area of 1,098 m2 and located in Executive Industrial Park Batam City, Riau Islands Province of Indonesia. From figure 2 we know the site layout of PT. Z and its manufacture or non manufacture facilities. This research was conducted at the material warehouse which is under the authority of the PPIC division. The production system used at PT. Z is make to order, where production activities are carried out based on orders from consumers. The production process is carried out in several stages, starting with the design section to be produced, the material cutting section, the machining process section, the installation or assembly section, the quality control section as well as product painting, the planning section, the control section and quality assurance. Process operation at PT. Z is divided into seven parts of the process, namely getting orders from customers, making design and job traveler, carrying out production, inspection, hardeness, assembly and the last one is quality control and finishing.

The problem faced in the company is the number of spare parts that are not neatly arranged and there is difficulty finding if the spare part is needed and there are items that have been damaged due to too long stacking. This condition results in wasted time in looking for spare parts and the subsequent process is delayed, even the process of fulfilling customer orders becomes obstructed. Specific problems that can be taken from the PPIC and warehousing divisions are the layout of grinding spare parts and tools. The implementation of 5S from a financing point of view is not exorbitant and hasn't changed that system much has been running within the company, so that the time needed to implement the policy will be shorter.

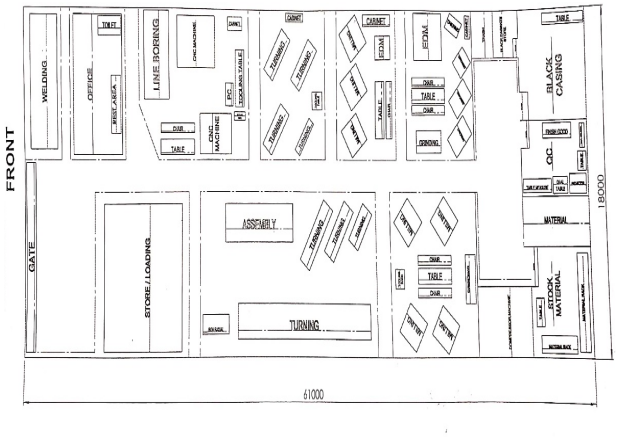


Fig 2. Company Lay out

As for the field conditions in the spare parts warehouse division before committing implementation 5S and FIFO can be seen in Figure 3. To achieve efficiency in every job, it should be able to reduce unnecessary movements. Some examples of wasteful movement are too much back and forth. It's a good idea to replace complex movements with simple ones. employees spend a long time searching for and storing spare parts in the storage warehouse, this is due to the irregularity of the spare part storage system by placing goods carelessly. To shorten the time for the preparation of spare parts, it is done by grouping the same types of parts in the same place, providing code and name of parts on the shelf regularly and providing spare part sheets that contain part codes according to the appropriate database owned by company. The order of storing spare parts is one that causes the spare part to be damaged because the spare part has passed the expired date of the item. One of the consequences of an item that has an expired date is corrosion and does not function optimally. To fix this problem, a standard operating procedure for storing spare parts was created, namely taking the part on the front first and putting the new spare part from the back. Here are the steps for implementing the FIFO system which are is after receiving the spare part in the reception area, then separating the spare part based on its condition , whether in good or bad condition, wet or dry, then match the spare part number with

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the shipping file. Grouping incoming goods with the same type of goods storage process policy is to put new spare parts on the side different from the pick-up place for one type of item. To spare part storage is placed behind or at the bottom of the spare part storage rack. The spare part is taken from the front or the top of the shelf, and by looking at the sticker code of the spare part.

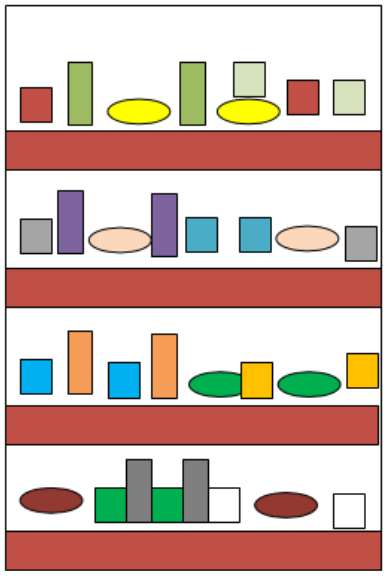

Fig 3. Warehouse lay out before improvement

Figure 4 describes the implementation of the 5S concept and the FIFO system in spare part management at the material warehouse. After applying the standard operating procedure for spare part warehouse management policies, the researcher measures the time needed to searching and storing spare part activity at the improved lay out.

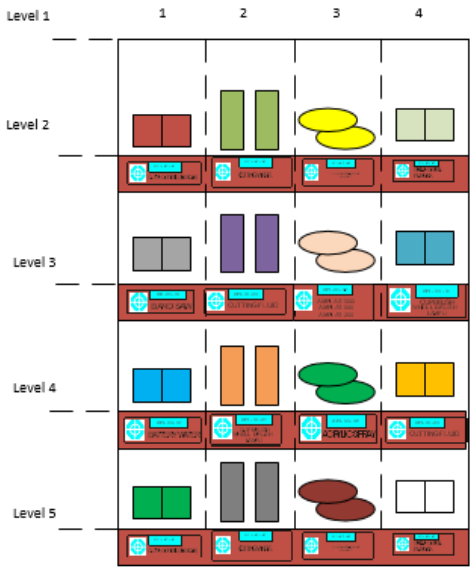


Fig 4 Warehouse lay out after improvement

There is significan time reduction and an increase efficiency for both activities. The comparison of the time before and after repairing the lay out of spare parts and the efficiency of the activities is shown in table 1. The efficiency calculations using this formula

$$\text{Efficiency} = \frac{\text{time before repair - time after repair}}{\text{time after repair}} \times 100\%$$

The result of time measurement before lay out to be improved for fast moving spare parts is 1.782 minutes for storing activity, while for searching activity it takes 1.688 minutes. Slow moving spare parts storing activity need 2.288 minutes and 2.642 minutes to search activity before the lay out improved. Both types of spare parts have reduction in activity time. Meanwhile the results of efficiency calculation of the two activities for all types of spare parts after the repair of the lay out were above 50%. In the time study, one partman was involved to determine the time to search and to store spare parts before the lay out repair and after the lay out repair in the storage warehouse. The grouping of spare parts is divided into two types, namely fast moving for partman who requires more power and slow moving for normal partman movement.

TABLE I. Comparison of Time and Efficiency Before and After Improvement

| Spare part classification | Activity | Average time before improvement (minutes) | Average time after improvement (minutes) | Efficiency (%) |
|---|---|---|---|---|
| Fast moving | Storing | 1.782 | 0.983 | 81% |
| Slow moving | Storing | 2.288 | 1.407 | 62% |
| Fast moving | Searching | 1.688 | 0.9 | 87% |
| Slow moving | Searching | 2.642 | 1.171 | 55% |

From the discussion above, the partman takes less time to search spare parts after improving the warehouse lay out with 5S standards and FIFO system, these two methods reduced time compared to pre-repair warehouse layout. From time studies show that after improving the warehouse, search activity for fast moving spare parts 0.788 minutes faster than before the warehouse arrangement process and for searching slow moving spare parts 1.171 minutes faster than before the structuring process warehouse. Storing activity is 0.799 minutes faster for fast moving parts and 0.881 minutes faster for slow moving parts. The efficiency are above 50% for all activity, but the efficiency of fast moving parts activity totally higher than the slow moving parts, this is because the operator spends more efforts for the fast moving parts than for the slow moving parts.

## IV. CONCLUSION

Based on design and the results of the implementation of the 5S and FIFO concepts obtained a good assessment at spare parts lay out in the material warehouse. This change is evidenced by the better conditions after implementation of the 5S and FIFO concepts. The warehouse layout conditions becomes more organized, tidier and the flow of movement becomes faster and makes it easier for operators to process orders from customers purchase order setup. The spare part arrangement with the 5S standard uses a Seiri concept that includes separating the necessary objects with the unnecessary, this concept is carried out to make space more efficient in the spare part warehouse. Seiton is neatly arranging and recognizing objects for make it easier to find it. The seiton process is done in a way making the name of the

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place, numbering spare parts and location coding on spare part racks as well as in order systems, makes it easy to search for spare parts. Seiso is always cleaning and maintain cleanliness. This concept is done by creating a procedure cleanliness in the spare part warehouse so that the warehouse is always kept clean. Seiketsu is a way to continuously maintain 3S (Seiri, Seiton, Seiso). Shitsuke is making workers accustomed to obeying the rules . The actions taken at this stage were making the 5S audit checklist in order to find out how well the implementation of 5S and FIFO in the warehouse. Testing the results of the spare part warehouse arrangement process with 5S and standard FIFO system is performed using the time study method, after the spare warehouse arrangement is done, storage time and spare part search time is more efficient and faster in the storage warehouse after repair the lay out.

## ACKNOWLEDGMENT

Thanks to PPIC division who has supported and helped provide data, also to the head of the warehouse for the opportunity to apply the 5S and FIFO methods in the material warehouse. Many thanks to the operator for simulating the measurement of time to by several times saving and looking for the spare parts needed in the warehouse.

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