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Warehouse Arrangement Improvement Based on 5S Method for CV Javatech Agro Persada

Muhammad Tohari[1], Manik Mahachandra[2]
Department of Industrial Engineering
Faculty of Engineering, Universitas Diponegoro
Jl. Prof. Soedarto, SH, Kampus Undip Tembalang, Semarang, Indonesia 50275
muhammadtohari@students.undip.ac.id, mahachandra@lecture.undip.ac.id

Abstract

CV. Javatech Agro Persada is one of the companies engaged in the field of agricultural machine tools, both pre and post-harvest. As it is known that in a company, the storage system has an important role. Therefore, CV Javatech has a warehouse as a place to store supporting equipment for the production process. However, CV Javatech Warehouse experienced overcapacity which forced the company to store 30 of its *combine* products, namely outside the building. In addition, most of the items in the Javatech warehouse are placed on the floor directly, which makes it difficult for employees to find items. This poor warehouse arrangement system will certainly increase costs for the company. For this reason, this study aims to obtain recommendations for improving warehouse arrangements based on the 5S method. The 5S method is a work attitude application program that emphasizes the management of the physical condition of an organized workplace. Recommendations for improvement are given so that the use of warehouse space is more optimal through the 5S stages, namely at the stages of seiri (sort/concise), seiton (set in order/tidy), seiso (shine/dress), seiketsu (standardize/treat), and shitsuke (sustain/diligent). As much as 23% increase in 5s audit score after repairing the warehouse arrangement.

Keywords
Improvement, warehouse, 5S, audit and productivity.

1. Introduction

CV Javatech Agro Persada is one of the companies engaged in the field of agricultural machinery, both pre- and post- harvest. Like other manufacturing companies, it has a warehouse located in Gembong District, Pati. Warehouse is a part of company's logistics that stores products (raw material, parts, goods in process, finished goods) between source point (point-of-origin) and consumption point (point-of-consumption), and provides information for management regarding the status, condition, and disposition of stored items (Stock & Lambert, 2001). The warehouse of CV Javatech experienced overcapacity that force the company to store one of its products, which is *combine*, outside the building. In early 2021, it was recorded that approximately 30 products of *combine* had to be placed outside the building. Combine is one of company's superior products with selling price of around 400 million rupiah. In addition, the warehouse does not yet have organized management system. This can be seen from the goods and working tools placing system which are still disorganized. Most of the items in Javatech's warehouse are laid on the floor directly. According to the employees in the interview, they often experience difficulties in finding work items and equipment that will be used. These conditions will certainly bring losses towards the company. So, a good arrangement system which is in line with the maintenance is needed to be able to optimize the space usage continuously.

An active role and awareness from everyone involved in the warehouse is needed to be able to create an organized warehouse arrangement. Active role and awareness here is work culture that can support optimal warehouse management. One of the well-known work cultures is 5S.

2. Literature Review

Warehouse is a particular and permanent facility. It is designed to achieve the target level of service with the lowest total cost. Warehouse is needed in coordinating process of goods distribution, which emerge as a result of the unbalanced supply and demand process. The unbalance process of demand and supply drive the emergence of inventory that requires space as temporary storage area known as warehouse (Lamber, 2001). Meanwhile, according

to Apple (2001), warehouse is a place used to store various type of goods ranging from raw materials, items needed in production process, production supporting items (tools), work in process goods, to finished goods.
According to Wignjoeoebroto (2000), there are 3 objectives in warehousing department that are related to goods procurement, which are:

1. Supervision, is an administrative process that supervises and records the flow of incoming and outgoing (I/O) materials in the system. This objective is needed to maintain the stock of goods or products in accordance to the plan.
2. Maintenance, is the process of maintaining materials, goods, or products in warehousing system. So that, there are no defects that result on further delays in the production process.
3. Hoarding and storage, is the process of storing materials, goods, or products to maintain stock condition if needed by other production units.

While 5S method is a manufacturing technique in workplace organizations. It is used for lean conditions application. 5S is five Japanese reference that describe a standard method to improve work in an organization (M. & Qureshi, 2013). 5S method is explained in details as follows:

1. *Seiri* = sort
   Seiri/sort means arranging everything and sorting it according to certain rules or principles. This method includes eliminating items that are not needed at work.
2. *Seiton* = set in order
   Seiton/set in order means storing goods in the right place or in the right layout. So that, it can be found and used even on sudden condition.
3. *Seiso* = shine
   Seiso/shine means cleaning things. In this case, the process includes removing garbage, dirt, or other objects and cleaning everything. It is prioritized as inspection to cleanliness and to create a workplace that does not have any flaws.
4. *Seiketsu* = standardize
   Seiketsu/ standardize means maintaining continuously and repeatedly. This technique includes maintaining personal and environmental hygiene.
5. *Shitsuke* = sustain
   Shitsuke/ sustain means training and increasing ability to do what we want to do even if it is difficult.
   5S is a simple yet powerful practice that could help in identifying and eliminating waste in the workplace. It also helps to build and to maintain a productive and quality environment within an organization. This method can force the company to look at the issues that are often ignored, deeper and more serious.

Table 1. Form of 5S Audit

FORM of 5S PATROL						Document Number		
						Date of issued		
Location:						Revision		
Date:						Date of revision		
0		1	2	3	4		Inspector	
Haven't started 5S activities yet, there are no effort at all		Already started 5S activities, but there are a lot of major fixes (*fixing process take a few days*)	Pretty good, needs some minor improvement (*can be improved immediately*)	Good, needs a little improvement	Very good, the condition needs to be maintained			
5S	No.	Check Item	Description			**(0-4)**		
STEP 1: Seiri, sort			Activity of sorting and disposing items or files that are no longer used				Notes or comments	
	1	Foods	No foods in the work area					
	2	Components/materials	No unnecessary items in the work area					
	3	Ordner/ Documents	Odner/absolute documents are followed up based on the procedure					
	4	Announcement	Updated display content					
	5	Visual control	All unnecessary items are visible					
			STEP 1 TOTAL SCORE			0		
STEP 2: Seiton, set in order			Activity of tidying up all items and files				Notes or comments	
	6	Divide lLnes	All dividing lines are clear and have its own color					
	7	Shelf Labels	All shelves and items have clear labels					
	8	Jig/Equipments	Placed in a determined location					
	9	Toxic and Hazardous Waste	There are symbols, labels, & MSDS					
	10	Emergency Access	Unblocked safety device					
			STEP 2 TOTAL SCORE			0		
STEP 3: Seiso, shine			Activity of cleaning the work place, work room and work environment on a regular basis				Notes or comments	
	11	Floor	Clear floor and not slippery. There are a maximum of only 2 pcs parts.					
	12	Machine/equipment	Cleanliness is always maintained according to standard					
	13	Rubbish bin	The rubbish bin is not overloaded					
	14	Cleaning equipment	Cleaning equipment is sufficient and neatly arranged					
	15	Cleaning schedule	There is specific schedule for cleaning					
			STEP 3 TOTAL SCORE			0		
STEP 4: Seiketsu, standardize			Activity of maintaining Seiro, Seiton, and Seiso activities.				Notes or comments	
	16	Check sheet filling	Check Sheet is filled according to schedule					
	17	Dressed	No one dressed with dirt or oil stains					
	18	Environmental conditions	Clean air, a fresh and odorless					
	19	Visual Display	The standard conditions are pasted in a place that is easy to see					
	20	Safety Patrol	Safety patrol is done regularly at least every month					
			STEP 4 TOTAL SCORE			0		
STEP 5: Shitsuke, sustain			A habit and maintenance of an existing/on-going 5S program				Notes or comments	
	21	Company regulations	Trying to comply the company regulations					
	22	Dressed	Wearing PPE according to standards and ID card					
	23	Human Relationship	A friendly environment that can trig interaction					
	24	Garbage Separation	Obey the waste segregation regulations					
	25	General Evaluation	Inspector's impression in general					
			STEP 5 TOTAL SCORE			0		
			TOTAL SCORE			**0**		

Source: hsepedia.com

3. Methods

The research done in CV Javatech Agro Persada Pati on January 12th, 2021 until February 11th, 2021 with the warehouse located in Gembong, Pati, Central Java as the research object. The study is began by identifying problems through initial observation in CV Javatech Agro Persada and interview with the relevant management. It is known that CV Javatech Agro Persada is experiencing overcapacity which causes some products to be placed outside the building. One of the reasons is because of the disorganized items arrangement. Researchers conducted literature study related to 5S on the warehouse to help in providing solutions for the problems faced by CV Javatech Agro Persada.

Then, the data collection is done to understand the current condition of the company. In this research, data collection is carried out by direct observation and interviews with related parties. Then, data processing is done by using 5S audit checklist (Table 1). This instrument is used to assess on how far the company has implemented 5S. The audit results and suggestions then will be analyzed on each stage of 5S. The next step is implementation of improvement suggestions that are possible. Beside that, an audit is also carried out after warehouse arrangement improvement.

4. Results and Discussion

4.1 The Results of 5S Audit and Warehouse Condition Before Improvement

After conducting observations and interviews with Mr. Ali as related party of CV Javatech Agro Persada Warehouse, 5S autid is done with score as shown in Table 2.

Table 2. Score Recapitulation of 5S Audit in CV Javatech Warehouse Before Improvement

No.	Aspect	Score	Maximum Score
1	STEP 1: *Seiri*, sort	10	20
2	STEP 2: *Seiton*, set in order	7	20
3	STEP 3: *Seiso*, shine	14	20
4	STEP 4: *Seiketsu*, standardize	11	20
5	STEP 5: *Shitsuke*, sustain	10	20
Total Score		52	100

From the results of 5R audit, the score of Javatech warehouse is 52 out of 100. Based on the score criteria for each aspect, a warehouse is considered as good if the score is 3 or good in overall if the score is 75. Thus, it can be concluded that the implementation of 5R in Javatech warehouse is considered as pretty good. However, there are several things that are needed to be improved to maximize the usage of warehouse space. The following is the condition of warehouse before improvement (shown in Figure 1).

Figure 1. Warehouse condition before improvement

4.2 Analysis and Improvement Recommendations

1. Sort /*Seiri*

The first step on 5S method is *Seiri*. This stage includes sorting out the goods, equipment, components, and products based on their respective places. It means, distinguishing between the items needed and unneeded. CV Javatech itself still does not have any standard for classifying items that are needed or less needed.

Based on *Seiri*/Sort principle, this problem will result in the accumulation of goods that may not be needed. This can made the warehouse space will be filled quickly. So that, clear standard of items classification is needed to create a *Seiri*/Sort culture in the warehouse. There are three categories of items classification, which are the category of unneeded goods, needed goods, and work tools (Wiratmani, 2010). Discussions with warehouse management is conducted to create items categorization that is in line with the conditions of Javatech warehouse. The results of agreement is proposed standard criteria for goods based on the level of importance as shown in Table 3.

Table 3. Criteria of Goods Importance

Level of importance	Information	Sample item
Very important	The core items of Javatech's business processes. If this item is not available, it will cause losses or the business can not run.	Stock of sales products, work equipment.
Important	Supporting items of Javatech's business process	Cleaning tools, occupational health and safety (OHS) tools
Pretty important	The core items of Javatech's business processes.	Employee welfare support goods
Less important	Residual goods that can be reused, either in small or large quantities. But, the usage intensity is still small.	Waste that can be sold again, has selling value, packaging attribute of incoming goods.
Not important	Residual items that can not be used directly by Javatech. It does not have selling value. But, if it is left unchecked, it could pose health risk to the employees.	Toxic and hazardous items, *stock death* items that can no longer be used.

Table 4. Result Criteria of Goods Importance

Group of Items	Items
Very important	Big Combine Harvester, Medium Combine Harvester, Dryer, Automatic Packing and Measuring Machine, Paddy Husker, Rice Polisher, Color Sorter Machine, Grader, Power Thresher (PTH), Multipurpose Power Thresher (PTM), Rice Milling Unit (RMU), Corn Sheller (CSK), 4 Wheel Tractor, Paddy Transplanter, Jarwo Type of Paddy Transplanter, Corn Seeder/Corn Planter, Cultivator, Hand Pallet, Stacker, Water pump, Assy water pump, Water pump base, Pallet, Product components on a big box, Product components on a medium box, Product components on a small box, Combine roof, Agricultural equipment owner's card, Work tools, Component of Combine Implement 1
Important	Rachet rope, Bolts and nails, Electrical equipment and cables, Sweep and crack, New paint cans, Milling machine, Component of Combine Implement 2, Combine wheel spare parts, Spare parts for agricultural equipment in the form of a tube, Treasure component
Quiet important	Jerry cans filled with lubricating fluid, Speaker, Pick-up car, Portable disinfectant spraying room, Water hose, Table, Water gallons, Component of water pump.
Less important	Used cardboard, A set of drums, Components of agricultural equipment that are not used/not suitable but can still be used or can be sold, Employee's belonging
Not important	Used wooden box for spare parts, Wooden planks, Safety carton of water pump packaging, Pallets waste, Used paint cans, Broken components, Waste cardboard and styrofoam, Plastic waste

Table 4 shows the recapitulation of items classification in CV Javatech. Furthermore, the goods will be followed up based on these criteria. The following actions will be taken:

- For **not important** category, the goods will be disposed or destroyed because they are considered to be detrimental to the company in terms of costs and employee health.
- For **less important** category, it is recommended to dispose or reprocess the goods through scrap collectors.
- For items classified as **quite important, important and very important**, it is recommended to rearrange the goods by considering several aspects such as dimensions, the linkage between each item and the use of several tools that can save warehouse space.

2. Set in order /*Seiton*

The next stage is Set in order or *Seiton*. *Seiton*'s principle is to put goods and tools in the right place. The purpose of this stage is to make it easier to find, retrieve, and remove the items when it is needed. The problem faced by CV Javatech is the difficulty of finding the items because of the similar items position that are spread over several points in the warehouse.

In addition, the placement of several items such as water pumps and products components that are placed randomly on the warehouse floor takes up quite a lot of space. To overcome these problems, improvements can be made based on the Set in order /*seiton* aspects as follows:

a) Items Grouping
The items grouping aims to make it easier for warehouse managers to arrange the placement improvement. In this case, the goods that are not disposed will be grouped. There are five groups of goods, which consists of the finished product group, work tools, components, cleaning tools and others.

b) Layout Improvements
After the goods are grouped, the layout is redesigned by adjusting the warehouse capacity. In order to be able to further optimize the use of warehouse space, the improved layout adds the use of inventory shelves. This shelf will function to accommodate non-heavy equipment products that are still in the form of components, water pumps and several other items.

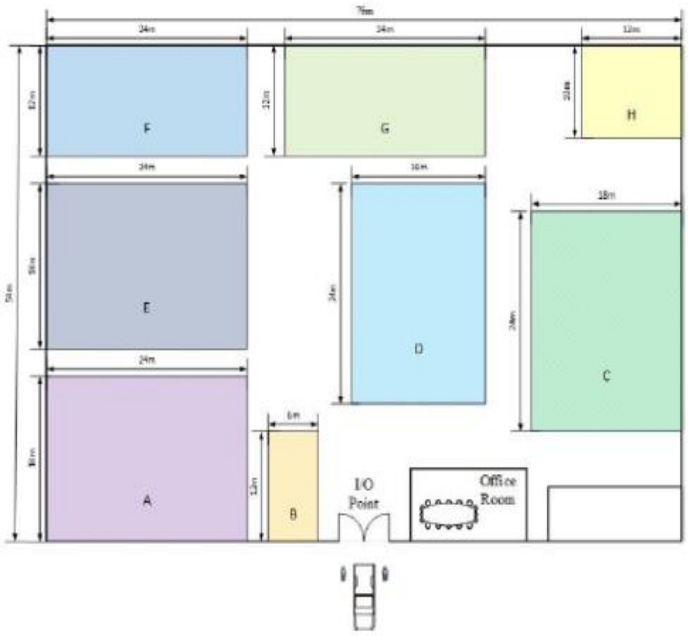

Figure 3. Layout of CV Javatech Warehouse Before Improvement

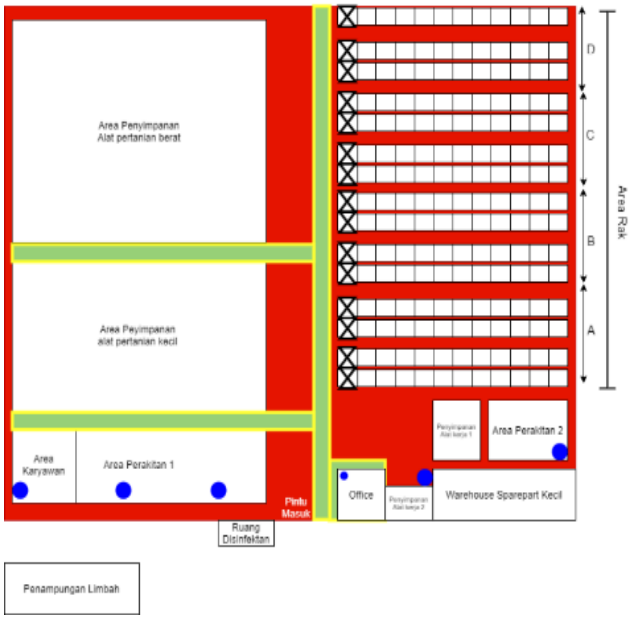

Figure 4. Recommendation of CV Javatech Warehouse Layout Improvement

c) Working tools collection point
The next step is to provide a working tools collection area. This area aims to facilitate the search for goods, maintenance and storage.d

d) Giving divide line
Divide line to keep the items in place. Some areas that need to be demarcated are assembly area 1, assembly area 2 and storage area for heavy equipment and non-agricultural equipment.

e) Making item name labels, MSDS Symbols and Posters
Labeling is done mainly on shelves that will be used as identification of related products. Normal human eyes can see objects at a distance of 20 feet or about 6 meters (Lestari, 2020). Using the Grandjien formula for font size in display design as follows (Grandjean, 1993):

$$Letter\ Height\ (H) = \frac{view\ distance}{200\ mm} = \frac{6000}{200} = 30\ mm$$

$$Letter\ Thickness\ = \frac{H}{6} = \frac{30}{6} = 5\ mm$$

$$Letter\ Spacing\ = \frac{H}{5} = \frac{30}{5} = 6\ mm$$

$$Lowercase\ Height\ = \frac{2H}{3} = \frac{60}{3} = 20\ mm$$

$$Spacing = \frac{2H}{3} = \frac{60}{3} = 20\ mm$$

The font size for labels that are read at a viewing distance of 6 m is 30 mm high, 5 mm thick, 6 mm spacing between letters and 20 mm. In selecting the letters, it is recommended to use *arial* type letters. Because, *arial* font style is the simplest and easiest for humans to understand and it doesn't take long to read. The compilation model is to use the uppercase model to create an impression of affirmation (Rudianto, 2017). The black and white color combination in writing the label name was chosen because this combination has very good legality for eyesight (Rudianto, 2017). Readers will be more focused on writing because of the difference in contrast between black and white.

f) Fire extinguisher installation
In CV Javaetech's warehouse area, fire extenguisher has not been installed. The installation of fire extinguishers cannot be done carelessly. One fire extinguisher ideally has a maximum area of 15x15 m. With a warehouse area of 75x54 m, at least 20 fire extinguishers are needed.

3. Shine /*Seiso*

After Set in order /*seiton* stage is done, the next step is the *seiso* stage, which is cleanliness. In general, the cleanliness of the CV Javatech warehouse is quite well maintained. However, in some corners of the warehouse, there are bottles of waste used for employee consumption. In addition, there are other wastes such as cardboard used as packaging of some product components that can be found in several warehouse corners. As for the cleanliness of the assembly area, it is quite well maintained, but there are still some unused bolts and small components scattered. Thus, there is a need for a benchmark or a standard that must be adhered to and implemented to create a clean warehouse environment. This hygiene standard is what is meant in the clean/*seiso* aspect at this stage.

The following is a proposed cleanliness standard for the CV Javatech Agro Persada warehouse:

Table 5. Proposed Hygiene Standards

No	Hygiene Criteria
Area	
1	There is no food or drink in the work area
2	No trash around the trash can
3	There are no rodents such as rats in the related area
4	No leftovers in the area
5	No distracting items in the green area
6	All items are in their place according to the placement of the label
7	No plastic waste in the area
Waste	
8	The waste generated is grouped based on the existing level of importance
9	There are trash bins in designated areas, which are located in employee area, assembly area 1, office and assembly area 2
10	Waste of broken iron, glass or other sharp waste is distinguished from plastic waste
11	Unused paint cans are separated
12	There are no used boxes in the area, except one for assembly purposes
Working tools	
13	Wrench, pliers and similar tools are in place when not in use
14	Hand pallet, unused Stucker is in place
15	Brooms, cranks, dusters, and other cleaning equipment are in place when not in use
16	All other working tools are in place when not in use
Infrastructure	
17	All tools are returned back to its place after used
18	Gallons of drinking water are always filled
19	Announcement whiteboard contains the latest information
20	All tools are placed in a location that is not dusty, clean and not moldy
Employees	
21	All employee belongings are in the placed in provided area
22	Workers wear neatly closed clothes according to the rules
23	Workers wear footwear and personal protective equipment according to standards

4. Standardize /*Seiketsu*

The basic essence of *seiketsu* design is to keep the work area in a Set in order and clean condition. In this case, it is how to keep the previous 3S maintained and implemented in CV Javatech warehouse. One thing that can be done in the implementation of *seiketsu* in the warehouse area is inspection. At CV Javatech warehouse, inspection activities are still limited to final checks that are only carried out by one person. In a warehouse with an area of 75x56 m, inspectors will have difficulty in checking the area as an effort to maintain the 3S implementation.

In order to implement and maintain the previous 3S in the warehouse, it is needed to design the inspection activities that are in accordance with the needs of the warehouse. These activities can be carried out in the following ways:

a) Routine inspection before going home
To ensure the warehouse area remains clean and tidy, regular checks are needed before working hours end. Before leaving the workplace, the work area must be neat and clean.

b) Division of Daily Cleaning Responsibilities
To facilitate the daily routine inspection, the division of responsibilities is very important. Because, they will assist the head of the warehouse in ensuring the neatness and cleanliness of the warehouse. By considering the warehouse area, the distribution and scheme of the person in charge of cleanliness can be done in the following ways:
- The warehouse area is divided into four major areas, which are consist of areas I, II, III, IV
- Each area has one person in charge of cleanliness who responsible in ensuring cleanliness and tidiness according to existing rules, ensuring other employees comply with existing rules, and filling out cleanliness check sheets
- Area rolling system for each person in charge of cleanliness

c) Cleanliness Check Sheets
After making a routine inspection schedule and selecting the person in charge of cleanliness, the next step is to make hygiene check sheets. These check sheets become a reference for the person in charge of cleanliness in maintaining the tidiness and cleanliness of the related warehouse area.

5. Sustain /*Shitsuke*

The last stage of 5S is *Shitsuke* or sustain. The main principle of being diligent is 5S as a work culture in daily activities. Implementing 5S is actually the same as changing everyone's habits. The implementation of 5S depends on everyone's willingness to change their habits.

The 5S habit itself has not been implemented in the warehouse. Mr. Ali as the party in charge of the warehouse, said that the habits or work culture of employees have not properly referred to 5S concept. This is due to the lack of employee knowledge about 5S culture. Beside, there are still no warehouse rules to create a 5S culture in the work environment. According to Irawati (2014), 5S culture is influenced by communication, training, reward and recognition systems, and also the role of top management. To be able to create diligent habits in the warehouse, the following actions are proposed:

a) Installation of 5S Posters in the work area
Posters are an effective medium in conveying information to readers. The 5S poster is an information reminder for readers, especially employees who are assembling in the warehouse. The following is an example of a poster that can be used as a medium to create 5S culture in the CV Javatech warehouse:

Figure 5. Poster Design of 5S

b) Management impromptu inspection once a month
Inspection is an activity to check something, both goods and a condition. In implementing 5S habits in the CV Javatech Warehouse, this inspection is carried out by the management. This activity is carried out on a scheduled and sudden basis, inspection activities on certain days. The function of this activity is to determine the progress of 5S implementation that has been achieved, and to maintain the consistency of 5S implementation.

c) Applying reward and punishment system
The reward and punishment system is intended to prevent violations in the implementation of 5S in the work environment.

d) Doing the 7 Minutes 5S movement
The design of '7 minutes 5S' aims to help in creating 5S culture on a daily work activities. This activity does not require excessive responsibility. But, this technique will have a positive impact if it is done seriously.

Implementation is carried out for 7 minutes before ending the work activities. In general, this activity requires employees who see equipment or objects that is unorganized to be returned to the provided place.

4.3 5S Audit Results and Condition of CV Javatech Warehouse After Improvement

After conducting the initial 5S audit and providing suggestions for improvement, 5S audit is carried out. This was done to verify the proposal given regarding 5S at CV Javatech Agro Persada Warehouse. After the 5S audit has been carried out, the final results are as shown in the table.

Table 6. Score Recapitulation of 5S Audit in CV Javatech Warehouse After Improvement

No.	Aspect	Score	Maximum Score
1	STEP 1: *Seiri*, sort	14	20
2	STEP 2: *Seiton*, set in order	15	20
3	STEP 3: *Seiso*, shine	16	20
4	STEP 4: *Seiketsu*, standardize	14	20
5	STEP 5: *Shitsuke*, sustain	16	20
Total Score		75	100

Based on Table 6, it is known that after suggestions for improvement are given, the results of the 5R/5S audit value in the CV Javatech warehouse have increased from 51 to 75. This shows that there is an increase in warehouse management that is in line with the 5S concept. Based on the results of discussions with the management of CV Javatech Agro Persada, the proposed improvement cannot be carried out directly and quickly. Due to the condition of the warehouse which is still full, it causes difficulties in moving objects. However, some proposals such as collection of items grouping can be applied directly.
The following is the condition of the warehouse after several improvements were made:

Figure 6. Improved Product Inventory Arrangement and Labelling

Figure 7. Arrangement of Combine Roof Components

Figure 8. 5S Poster in The Warehouse of CV Javatech

5. Conclusion

Based on the research at the CV Javatech Agro Persada warehouse, it can be concluded that there are several recommendations to optimize the use of space in solving overcapacity based on the 5S concept (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke):

1. *Seiri*/ sort Stage: grouping the goods based on the level of importance. Goods are classified into five categories, which are consists of very important, important, quite important, less important and not important. For unimportant items categories such as pallet waste, unused paint cans, and unused cardboard are disposed, while for goods in other categories, a further arrangement system is carried out.
2. *Seiton*/ set in order stage: improving the goods arrangement system in the warehouse by grouping goods by type of goods, improving warehouse layouts, using inventory shelves, providing boundary lines, installing fire extinguishers and labeling goods.
3. *Seiso*/ shine stage: making standards or rules in maintaining the cleanliness of the warehouse which is divided into cleanliness area, waste, work tools, infrastructure and employees.
4. To be able to continue to maintain the grouping system, arrangement and cleanliness in the warehouse, it is carried out by:
   a) *Seiketsu*/ standardize Stage: by ensuring the previous 3S is maintained in the warehouse. Actions that can be taken are carrying out routine inspections by management, division of responsibility for cleanliness, in charge of ensuring the implementation of the previous 3S through check sheets every day,
   b) *Shitsuke*/ sustain Stage: forming 5S habits in employees by implementing a reward and punishment system, posting 5S posters, impromptu inspections or inspections and carrying out 7 minutes 5S activities.

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