Reducing Overflow by Using Storage Analysis Chart at PT. Mitratama Autopart Company

Aliyuslita[1], Anastasia L. Maukar[2]
[1,2]Faculty of Engineering, Industrial Engineering Department, President University
Jl. Ki Hajar Dewantara
Kota Jababeka,Cikarang, Bekasi - Indonesia 17550
Email: aliyuslita@gmail.com, almaukar@gmail.com

ABSTRAK

Pabrik adalah salah satu lokasi dalam sebuah lingkup industri dimana paling banyak ditemukan masalah di sebuah perusahaan manufaktur. Ketika penelitian dilaksanakan, pada part lokal yang digunakan dalam kebutuhan produksi welding plant 1 di PT.Mitratama, beberapa part ada yang sering kembali ketika proses supply. Hal ini disebabkan karena flow rack pada line produksi tidak dapat menampung semua box yang telah di supply. Sehingga dibutuhkan perubahan pada jumlah part yang terdapat di dalam sebuah box untuk mengurangi penggunaan jumlah box ketika proses supply berikutnya. Salah satu solusinya dengan meningkatkan jumlah kapasitas box dan di sisi lain dengan menstandarkan flow rack. Oleh karena itu, Storage Analysis Chart dapat diterapkan untuk mengidentifikasi kapasitas produksi regular, safety stock, tipe flow rack dan luas area yang dibutuhkan. Faktor-faktor yang meliputi internal lead time dan kapasitas stock pada flow rack juga berpengaruh dalam penerapan metode tersebut. Storage Analysis Chart dapat memberikan peningkatan dengan mengoptimalkan ukuran dan jarak antar flow rack. Sehingga pengunaan rak akan meningkat dimana dapat menampung semua box yang di supply ke line produksi. Setelah melakukan standarisasi, overflow akan menurun 1.54% dan area direct supply juga berkurang 50%.

Keywords: *Internal Lead Time, Storage Analysis Chart, Safety Stock*

ABSTRACT

Factory is a very common location in industrial field, where the most problem occurred. By observing the local part that is used for production welding plant 1 in PT. Mitratama, some part are often returned. The problem was happening because the capacity flow rack cannot hold all of the box supplied. Resulting in re-arrangement of the quantity in box, so the number of box used is decreasing for the next supply. One of the solutions is increasing the box capacity and the other one is by standardize the flow rack measurement. Therefore, Storage Analysis Chart is used to identify the capacity of regular production safety stock, type of rack, and the area requirement. Internal lead time and stock capacity in the flow rack of production line also become consideration. Storage Analysis Chart can provide the improvement by optimizing the measurement and its space. Then standardization is implemented so the rack capacity will be improved. So, all the box from the progress lane can be supplied to production. The results of the standardization that has been implemented are the overflow will be reduced by 1.54% and the area of direct supply also reduced by 50%.

Keywords: *Internal Lead Time, Storage Analysis Chart, Safety Stock*

1. Introduction

Overflow part is happened because these parts that cannot fit on the racks along the production line and they end up on the floor or otherwise temporarily stored nearby. Overflow is one of problem in Supply Chain Management which is one of implementation system in several industries. The process that is involved in Supply Chain Management is the process from the supplier until the process of delivering the part to production line.

PT XYZ is a car manufacturer, located in Karawang. Some parts are provided by suppliers using plastic boxes. Those parts are categorized based into *small* and *big parts* and distributed using vehicle according to parts size. All the parts from suppliers are collected in Progress Lane, then they will be moved to the stacking part. Next, all parts will be sorted based on type of frame and body and put the sorted parts into empty dolly based on it. Body part is divided into four types, such as; Under Body, Shell Body, Side Member, and Minomi. The dolly is pulled by towing to Production Line. All supply parts in Production Line will be stored in the flow racks, close to the operator. The number of each parts stored in flow rack depends on production demand and safety stock.

Flow rack in the production line as a storage units has a function for holding supplies until they are needed by the production operations. The advantage of rack is to maximize cubic space usage (Meyers. 1993).

Management tries to expand the production floor and implement a new supply system from Progress Lane to production line, called *Direct Supply*. By implementing this system, the flow rack area near Progress Lane will be reduced because all of the small parts will be directly supplied to the production line. This system caused the shortage of store area for safety stock of each small part. The parts that should be brought back to the store again but does not have place to be stored, called overflow. To overcome this problem, it is needed a research to manage the parts and flow racks for supplying the production line. This research aims to reduce the overflow parts.

2. Research Methodology

The research is conducted in factory area welding plant 1 of PT. Mitratama and focused on local parts. The objective of this observation is to reduce overflow by upgrading the capacity of plastic box. This research focus on small local parts, especially shell. The assumptions have been made for this research, such as; rack position in Production Line are fixed, and all parts are always available in the progress line. There are several steps to do this research, the detail is shown in Figure 1.

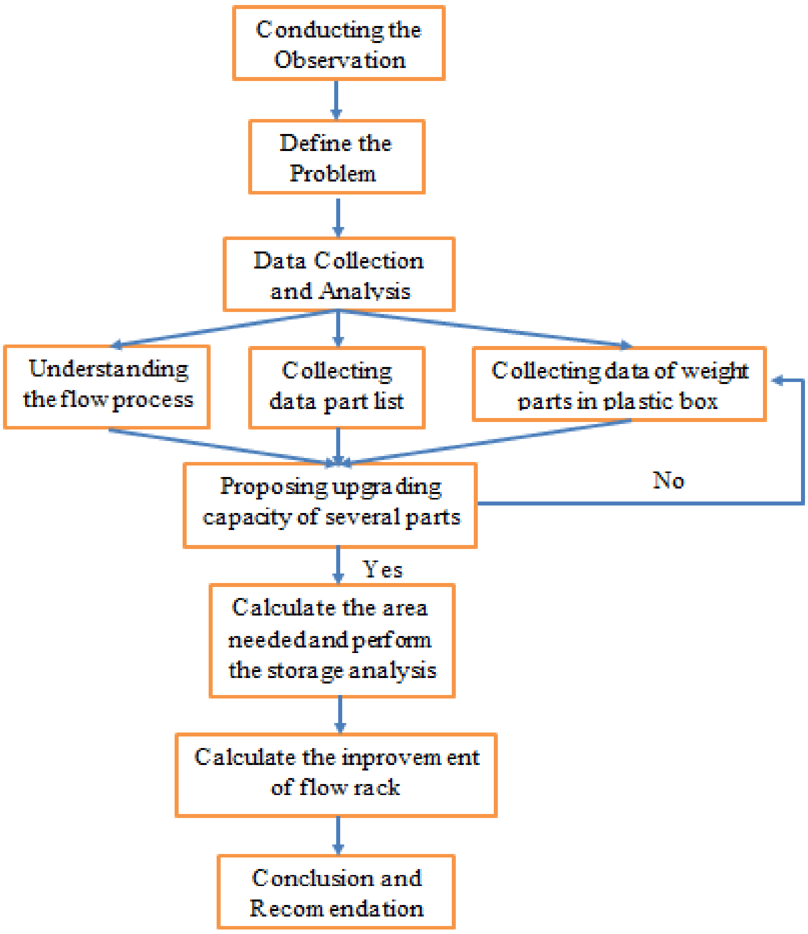

Figure1. Frame work of the Research

2.1 Storage Analysis Chart

Storage analysis chart is one of methods to calculate of space requirements of temporary storage. By using storage analysis chart method the information can be sorted into three categories, such as physical characteristics of material stored, quantities of materials stored, and storage method and space required (Lodewijks, 2011). Tompkins (2003) state storage chart analysis can be used to facilitate the calculation of space requirements for storage and warehousing. The first five columns of the storage analysis chart will be given the data required. It is shown in the Figure 2.

The maximum and average quantities of unit loads stored (the sixth and seventh columns) are directly related to the method of controlling the inventory and inventory control objectives. The planned number of unit loads for each material to be stored may be determined by considering the receiving schedule and the method of assigning materials to storage locations. The amount of space planned for SKU (stock-keeping unit) is directly related to the method of assigning space. There are several formulas to calculate reorder point, maximum quantity and the average quantity.

$$Reorder\ point\ =\ (safety\ stock\ in\ minutes)\ (demand/minute)\ \ +(lead\ time\ in\ minutes)(demand\ /minute) \tag{1}$$

$$Maximum\ quantity\ to\ be\ stored = (safety\ stock) + (order\ quantity) \tag{2}$$

$$Average\ quantity\ to\ be\ stored\ =\ ½\ (order\ quantity)\ +\ (safety\ stock) \tag{3}$$

To maximize throughput, the stock should be assigned to storage location based on the cycle of their activity to the number of delivering to the SKU. The SKU having the highest cycle is assigned to the preferred openings and so on, with the lowest-cycle SKU assigned to the least-preferred openings. Because “fast movers” are up front and “slow movers” are in back, throughput is maximized. The sum of space requirements for all items to be stored is the total storage requirement.

Date September 14, 1997 | Raw Materials X

In-Process Goods ____
Company J.D.S., Inc.
Prepared by B. Huddock | Sheet 1 of 1 | Plant Supplies ____
Finished Goods ____

Space ____

Description (1)	Unit Loads: Type (2)	Capacity (3)	Size (4)	Weight (5)	Quantity of Unit Loads Stores: Maximum (6)	Average (7)	Planned (8)	Storage Space: Method (9)	Specs (10)	Area ft2 (11)	Ceiling Height Required ft (12)
Aluminum rails, three runner 288	Bundles	50 pcs	18"*28"*288"	1250 lbs.	14	5	12	Cantilever rack	Four Arm dual rack 4'*12'*6'	192	24
Glass, 1/4"thick, 8'*4' sheets	Racks	4 sheets	8'*4'*4'	400 lbs.	20	13	15	Pallet Rack	4'*4'*22' (4 levels)	240	24

Source:Tompkins, 2003

Figure 2. Storage Analysis Chart

2.2. Movement Analysis

The FSN – Fast-Moving, Slow-Moving and Non-moving analysis – checks stock rotation and identifies the items which have low cycle. Not all items are required at the same frequency. This analysis is particularly useful for spare parts. Each organization’ culture has their own method related to the cut-off periods for fast moving, slow moving, and non-moving according to the class of items. In term of selling, each organization has their own pattern. For instant, raw material and regular components move faster than spare parts. Many organizations consider items with at least one withdrawal in a quarter as fast-moving, one issue in a year as slow-moving, and no issue in a year as non-moving. The duration can be changed to suit the individual organization's needs. For instance, in a sales organization, many may consider at least one sale in a week as fast moving and no sale in a year as non-moving. Other method to categorize the parts into fast, slow or non-moving items is performing turnover ratio analysis. Each part has to be are sorted and analyzed according to its turnover ratio (Mitra et al., 2015).

3. Result and Discussion

According to data collection and analysis after conducting the research and observation using several methods (storage analysis chart and movement analysis) related to the improvement stock capacity in storage, there also several result of calculation. These will be shown in the next sub chapter.

3.1 Reorder Point, Maximum quantity, and Average Quantity

Calculation of Reorder point, Maximum quantity, and Average quantity is conducted to get basic value before they continue to design the proper storage facility. By using the result of these, the flow rack can hold the maximum capacity, so the overflow can be reduced and the system more effective and efficient. The part which has delivered can be stored in the flow rack of production line.

Table 1. Summary Result of Reorder Point, Maximum Quantity of Each Part

Reorder Point	Round Up	Maximum quantity to be stored	Round Up	Average quantity to be stored	Round Up
2.036	2	0.6936	1	0.6673	1
6.618	7	2.2543	2	2.1686	2
7.636	8	2.6011	3	2.5022	3
2.074	2	0.9330	1	0.8670	1
6.618	7	2.2543	2	2.1686	2
7.636	8	2.6011	3	2.5022	3
9.164	9	3.1213	3	3.0026	3
7.636	8	2.6011	3	2.5022	3
9.164	9	3.1213	3	3.0026	3
7.636	8	2.6011	3	2.5022	3
1.659	2	0.7464	1	0.6936	1
1.659	2	0.7464	1	0.6936	1
0.603	1	0.1690	1	0.1646	1
1.207	1	0.3380	1	0.3292	1
1.659	2	0.7464	1	0.6936	1
1.659	2	0.7464	1	0.6936	1
2.036	2	0.6936	1	0.6673	1

The summary of the result of **reorder point**, **maximum quantity part to be stored** and also **the average quantity to be stored** can be looked at Table 1. This result become the value of the average and standard quantity in the new flow rack. The maximum quantity is using the data that already given. The data related to the maximum quantity and average quantity in the table are shown two parts that has value below 0.5 but still round up as 1. The reason is because there is should be at least one box to make the production run. Then the next step, it is needed to calculate required area for storing those parts in production line. The area is calculated from the dimension of rack and the ceiling height, which is calculated from the height of the building minus with the height of rack. Since all rack heights are same, so all ceiling heights are same too. Finally, the result will be implemented in Storage Analysis Chart as the summary all of calculations.

3.2 Storage Analysis Chart

Currently, the overflow of parts occurred in production line. It is caused by short on quantity of the flow rack Therefore, to store the over parts, the flow rack should be redesigned and standardized.

Based on Figure 3, each part has its own number of rack to hold it and it also has different type of box. The specification of all racks used in flow rack is standardized. The standardized width and height are 2 m and 1.55 m. The length of rack is adjusted to accommodate the number of boxes.

Description (1)	Part No. (2)	Rack No. (3)	Type (4)	Capacity (box) (5)	Size (cm) (l*w*h) (6)	Weight (kg) (7)	Max (box) (8)	Avg (box) (9)	Planned (box) (10)	Method (11)	Specs (m) (l*w*h) (12)	Area m2 (13)	Ceiling Height Required (m) (14)
BAR SUB-ASSY RR DOOR WDO DIVISION RH	1229	1	LL	40	134*33*18	17	1	1	1	Flow rack	3.3*2*1.55	6.6	3.7
HINGE ASSY RR DOOR UPR RH	1235	2	S	24	33*33*9	9	3	2	2	Flow rack	0.55*2*1.55	1.1	3.7
HINGE ASSY RR DOOR LWR RH	1237	2	S	21	33*33*9	6	4	3	3	Flow rack	0.55*2*1.55	1.1	3.7
EXTENSION RR DOOR INS PNL REINF RR LH	4169	4	S	30	33*33*9	4	2	1	1	Flow rack	0.55*1*1	0.55	3.7
HINGE ASSY RR DOOR UPR LH	1236	5	S	24	33*33*9	8	3	2	2	Flow rack	0.55*2*1.55	1.1	3.7
HINGE ASSY RR DOOR LWR LH	1238	5	S	21	33*33*9	6	4	3	3	Flow rack	0.55*2*1.55	1.1	3.7
HINGE ASSY FR DOOR UPR RH	1231	7	S	18	33*33*9	8	4	3	3	Flow rack	0.55*1*1	0.55	3.7
HINGE ASSY FR DOOR LWR RH	1233	7	S	21	33*33*9	7	4	3	3	Flow rack	0.55*1*1	0.55	3.7

Figure 3. Storage Chart Analysis

Description (1)	Part No. (2)	Rack No. (3)	Type (4)	Capacity (box) (5)	Size (cm) (l*w*h) (6)	Weight (kg) (7)	Max (box) (8)	Avg (box) (9)	Planned (box) (10)	Method (11)	Specs (m) (l*w*h) (12)	Area m2 (13)	Ceiling Height Required (m) (14)
HINGE ASSY FR DOOR UPR LH	1232	8	S	18	33*33*9	8	4	3	3	Flow rack	0.55*2*1.55	1.1	3.7
HINGE ASSY FR DOOR LWR LH	1234	8	S	21	33*33*9	7	4	3	3	Flow rack	0.55*2*1.55	1.1	3.7
PLATE HOOD HINGE MOUNTING	1058	9	M	100	33*33*18	7	2	1	1	Flow rack	2.2*2*1.55	4.4	3.7
HOOK SUB-ASSY HOOD LOCK	3723	10	L	10	67*33*18	10	1	1	1	Flow rack	0.55*1*1	0.55	3.7
REINFORCEMENT COWL TOP INNER NO.2	3730	13	S	80	33*33*9	6.5	1	1	1	Flow rack	3.3*2*1.55	6.6	3.7
REINFORCEMENT COWL TOP INNER NO.1	3616	13	M	20	33*33*18	4	1	1	1	Flow rack	3.3*2*1.55	6.6	3.7
PANEL COWL TOP SIDE INNER RH	1066	15	M	35	33*33*18	12	1	1	1	Flow rack	1.1*2*1.55	2.2	3.7
BRACKET COWL TOP OUTER PANEL NO.3	1070	15	M	50	33*33*18	3.5	1	1	1	Flow rack	1.1*2*1.55	2.2	3.7
BAR SUB-ASSY RR DOOR WDO DIVISION LH	1230	17	ML	40	100*33*18	16	1	1	1	Flow Rack	1.65*2*1.55	3.3	3.7

Figure 4. Storage Chart Analysis (Continue)

3.3 Summary Result

By increasing the quantity of the part number for each box, it will help the effectiveness of using the space of the production line flow rack. It also relates to reduce the empty box. The summary result of improving the process will be shown in Table 2 below.

Table 2. Summary Result

Description	Before	After
Overflow	4.8%	3.26%
Space	30 m * 15 m	15 m *15 m
Flow Rack	No Standard	Standard

From Table 2 above, it is shown that current overflow part 4.8%, and it can be reduced to 3.26%. or reduced by 1.54%. Current system employs non-standard flow racks and needs area of 30 x 15 m^2. After the implementation, the production line is using the standard flow racks and only needs 15 x 15 m^2. By implementing the standardized rack flow, the area could be reduced by half of the current area.

4. Conclusion

In conclusion, the part overflow can be reduced by increasing capacity of the store box and applying the standardized flow racks. In addition, by knowing the production rate is 1.6 minutes/unit the increasing quantity can help on reducing the overflow of parts without making the line stop working.

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