International Journal of Scientific Research and Management Studies (IJSRMS)
ISSN: 2349-3371 **Volume 1 Issue 3, pg: 88-99**

LINE CALL REDUCTION USING PROCESS IMPROVEMENT IN AN AUTOMOBILE COMPANY: A SIMPLIFIED APPROACH

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ABSTRACT

The aim of this paper is to decrease the chances of inventory going below the set minimum by eliminating the factors causing shortages and delays. When inventory goes below set minimum it is then called as line call, where the customer (Set Part Supply Department) demands immediate supply of those product undergoing shortage. The aim is to reduce the number of line calls by eliminating root causes for line calls. The reasons for line calls will be identified using root cause analysis and after studying the causes, counter measures for each cause will be identified and implemented. Some of these measures involve in changing processes and adding new equipment to reduce overall work and some involve statistically finding the problem areas in the data set. After all the two counter measures were implemented, we were able to reduce 85% of overall line calls leading to a large saving to the plant in terms of equipment area and man power. Also with the implementation of this concept, work burden to employees is reduced, thus creating an enjoyable work place.

KEY WORDS: *Line call, Inventory, Cycle time, Lead time, In House Logistics Control Department (ILCD), Set Part Supply (SPS).*

I. INTRODUCTION

Effective inventory management is all about knowing what is on hand, where it is in use, and how much finished product results. Inventory management is the process of efficiently overseeing the constant flow of units into and out of an existing inventory. This process usually involves controlling the transfer in of units in order to prevent the inventory from becoming too high, or dwindling to levels that could put the operation of the company into jeopardy. Competent inventory management also seeks to control the costs associated with the inventory, both from the perspective of the total value of the goods included and the tax burden generated by the cumulative value of the inventory.
Internal Supply chain management is the management of a network of interconnected business activity involved in the provision of product and service packages required by the end customers in a supply chain. Internal Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from procurement to dispatch inside a factory.
Welding is a fabrication or sculptural process that joins materials, metals. This is often done by melting the work pieces and adding a filler material to form a pool of molten material that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. In the shop floor about 400 body parts are welded to shape them into the form of a car.

ILCD Introduction:

ILCD - In House Logistics Control Department. Here, we RECEIVE, STORE and DELIVER the Right Parts, Right Quality at Right Time. The TARGET is : ZERO LINE STOP, ZERO WRONG PART and ZERO ACCIDENT.

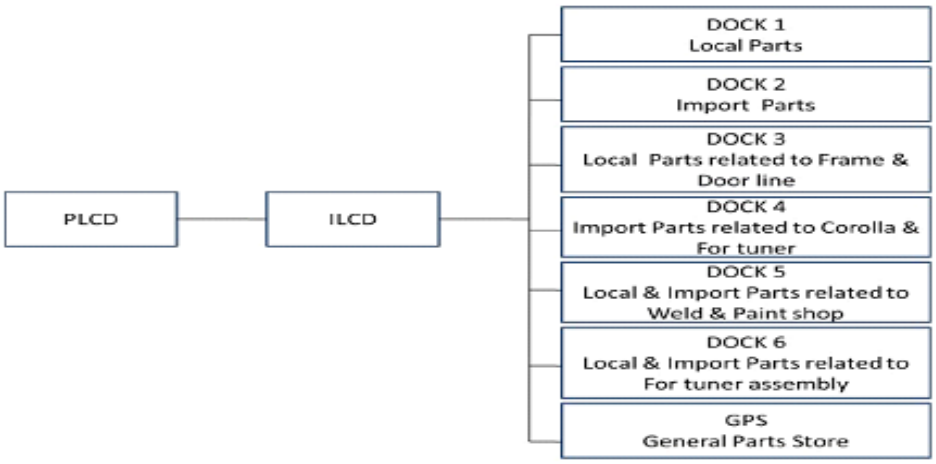

Figure 1 (PLCD-ILCD Process)

ILCD Processes:

Unloading: It is the process of removing the parts stored in pallets from the truck and placing it in the manifest area. This operation is done using internal forklifts

Manifest checking area: It is the area where all the pallets are checked if the parts have arrived as per the order.

Progressive lane (P lane): It has 16 lanes where each lane holds all product that is required for that hour. That means all part in the first p lane will be consumed during the first cycle of the day. There are 16 cycles in a day hence 16 lanes. At least 3 planes must be full during any time of the day.

Sorting area: It is the area where the parts in each pallet are sorted as per the course that it follows. There are 21 destination (delivery course). Each destination has a code which is called conveyances code which is available on the kanban ID.

Baton pass lane (B lane): After sorting the part the parts are stored in a location called B lane which has 21 lane.(one lane for each destination). A delivery members picks the part from b lane and goes to SPS to feed the part.

Set part supply (SPS): It is a line where parts are picked by SPS members in controlled quantity and supply it to the the assembly line just 2.5 mins before it is to be used.

Parts control Zone (PC zone): It is temporary zone where parts are stored. That have
a low frequency of arrival. Hence stock of these materials needs to be maintained in a larger area. Import parts and part coming from Delhi, Pune are stored here.

Devanning: It is a process of removing module from containers as per instruction given by CKD group. Each module has a set number of parts for set number of vehicles. Number of cars per module is called module efficiency.

Unpacking: It is the process of removing parts from modules which are in plastic boxes, carton boxes or gunny bags and then arranging them in PC-ZONE.

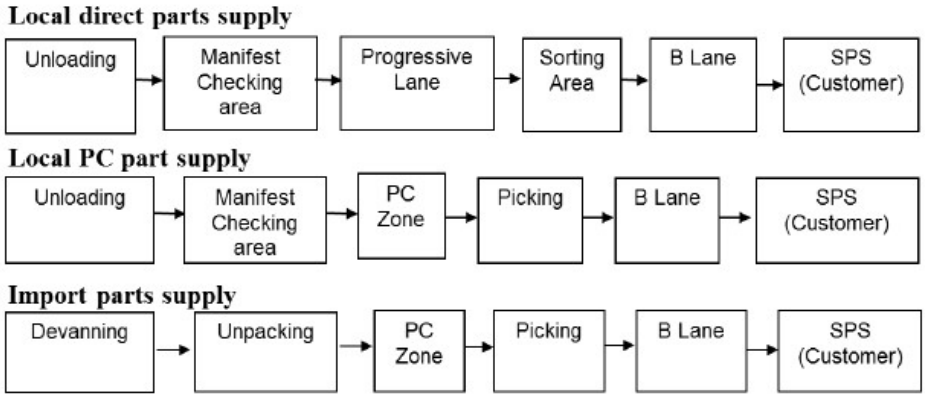

Figure 2 (ILCD Process)

Company Inventory:

Table 1: Inventory

Lead Time	=	PC Safety	+	PC Delivery	+	Line Side Safety	+	Line Side Delivery	=	Total
PC Parts	=	60 Mins	+	60 Mins	+	60 Mins	+	60 Mins	=	240 Mins 04 Hrs
Direct Parts	=	00 Mins	+	00 Mins	+	60 Mins	+	120 Mins	=	180 Mins 03 Hrs
Minomi Parts	=	60 Mins	+	60 Mins	+	N Peak * 930	+	N Peak * 930		
M/T & W/W Parts	=	60 Mins	+	1 Truck Freq	+	N Peak * 930	+	N Peak * 930		

Each part has a required inventory level. These level are calculated based internal lead time. That is the time required to move stock from one position to the next inside the company. Based on the supplier lead time and internal lead time the total safety stock that the company requires is decided.

Line Calls:

Line call is term used when the inventory in SPS (set part supply) becomes less than the set minimum (1 hr.). This means that that part may undergo shortage unless the part is filled immediately. This prevents stock out in SPS, thus the line stop does not occur due to non-availability of the part.

Special delivery methods:

Jundate (Sequential supply): One technique adapted to save space on assembly line side. Taking example of a bulky part like engine or Fuel tank which requires a larger storage area on Shop floor, and if for example 3 models of vehicle are being produced, then a minimum quantity of these bulky parts will have to be present on line side, requiring of lot of space. The solution was found in supplying the part of requisite model as is needed on the station. Thus the sequential supply system for bulky parts has reduced the required storage space on line.

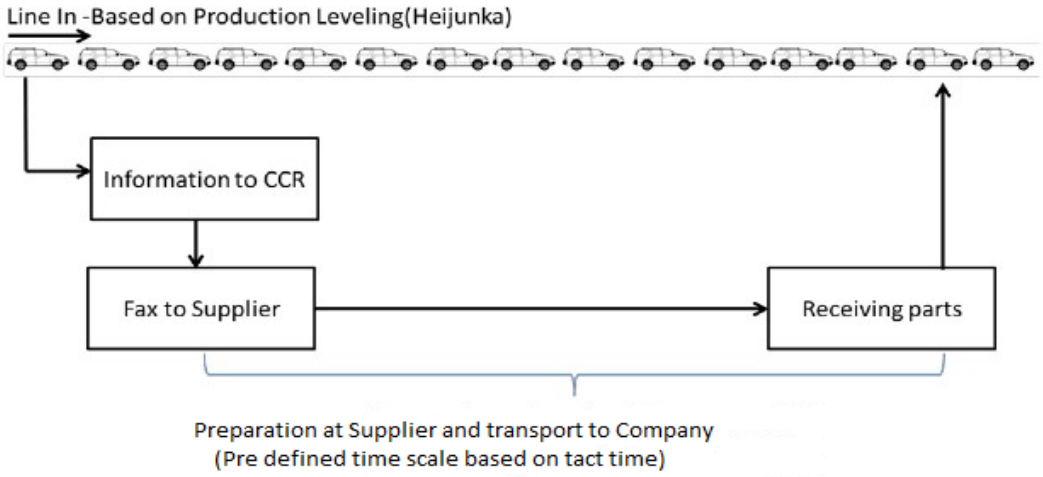

Figure 3

Jumbiki (Sequential supply): This process is exactly like Jundate but the sequence comes arranged by the supplier. This becomes possible when there are online site suppliers. This process is followed for seats, window glass, etc.

Minomi (box less Delivery): means car parts and components without its container or packaging delivered at the right time and quantity matching the demands of a moving assembly line. To put it in another way, minomi is like delivering peanuts without its shell so that the person can consume it right away without the hassle of opening boxes or unpacking the component. This is to save time, money and effort.

Chorukyu(Small parts supply): It is the process of supplying small parts to assembly line like bolts, nuts, washers, etc. These part are filled in glasses and set on a tray. Assembly line has many point where these parts are required. So the delivery member takes the old tray and places the new tray. The old tray is the sent for refilling. 3 sets of tray moves in cyclic method (1 in refilling, 1 in transit,1 in delivery).

Mikara (Empty box collection): It is the process of collection of empty boxes from the area of usage. Carton boxes are scrapped and plastic boxes are sent back to the suppliers. No kanban is used for this type of supply.

Just-in-time:

Making only "what is needed, when it is needed, and in the amount needed!". Producing quality products efficiently through the complete elimination of waste, inconsistencies and unreasonable requirements on the production line.

Kanban system:

The kanban system has also been called the "Supermarket method" because the idea behind it was borrowed from supermarkets. Such mass merchandizing stores use product control cards upon which product-related information, such as a product's name, code and storage location, are entered. Because Toyota employed kanban signs for use in their production processes, the method came to be called the "kanban system".

3Ms (Muda, Muri, Mura):

Wastes can be defined as all activities and tools that do not add value to the customer. A customer will not pay for the wastes which add to the cost of production. The different types of wastes are classified as muda, muri and mura.

Cycle time:

Storing inventory is costly to a business. It takes up storage space, must be insured, may be stolen or damaged, may become obsolete before it is sold and may require refrigeration or increase utility bill costs in other ways. Staying competitive in a dynamic economy means a small business must be able to calculate accurately its average inventory, inventory turnover ratio and inventory period, as well as take steps to reduce the amount of time it takes to cycle through its inventory.

Lead time:

A lead time is the latency (delay) between the initiation and execution of a process. For example, the lead time between the placement of an order and delivery of a new car from a manufacturer may be anywhere from 2 weeks to 6 months.

II. STATEMENT OF THE PROBLEM

Parts in SPS must be maintained so that there is no shortage or excess in SPS. When there is a shortage then the SPS group leader calls out an emergency for the part. The part must be found in the B lane or P lane and must be immediately fed into SPS. If this is not done then there is a chance of line stop, which costs the company due to production loss. The average line calls from past data is 1203 per month and using the category wise line call chart, we can identify the cause for which line calls are attributed to. Thus the aim of this paper is to improve the process to avoid line call in the first place-that is preventing the SPS parts from reaching the minimum.

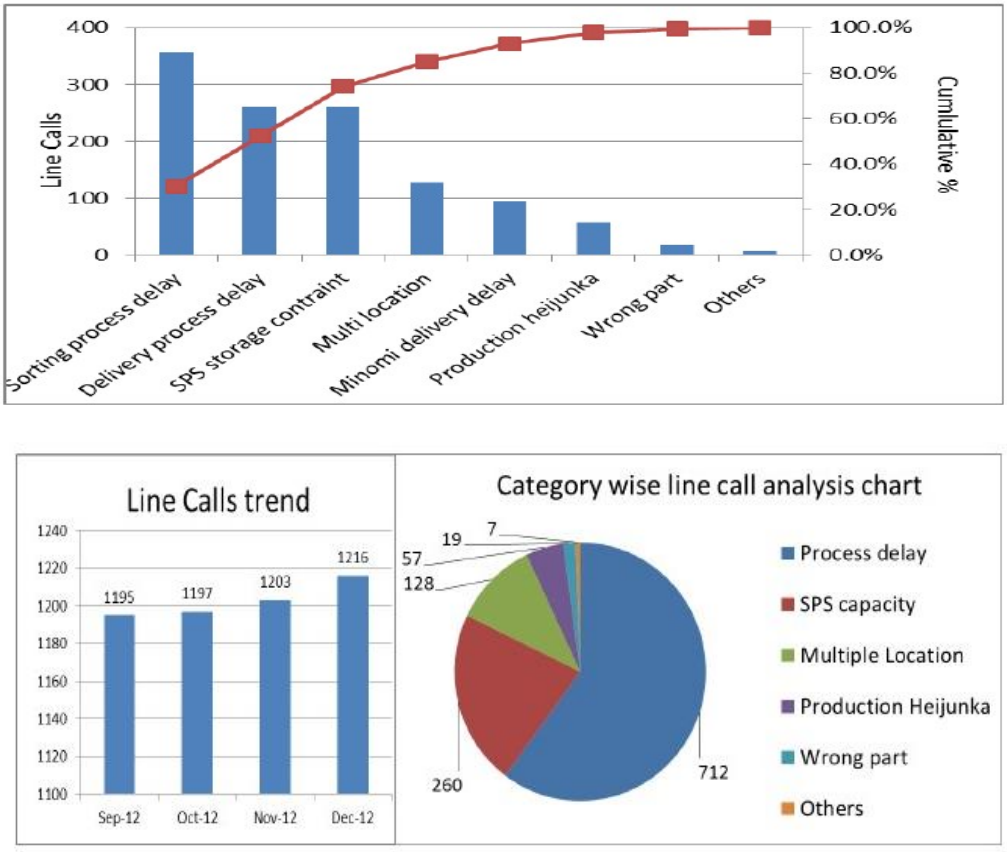

Figure 4 (Line Calls trend)

Based on the data, we select significant factor causing line calls using pareto chart. We check for feasibility in these factors before working on them.

Table 2: Feasibility

REASONS	*SIGNIFICANCE*	*FEASIBILITY*
Sorting process delay	Yes, 30.2%	Yes, reduction of non-value added work
Delivery process delay	Yes, 22%	Yes, reduction of non-value added work
SPS storage constraint	Yes, 22%	Yes, statistically finding low capacity SPS locations
Multi location	Yes, 10.8%	Yes, statistically finding repeated locations in SPS
Minomi delivery delay	Yes, 8%	No, exists in different building
Production Heijunka	No, 4.8%	No, system changes requirement
Wrong part	No, 1.6%	No, difficult to identify as they occur due to mistakes

By checking the pareto chart and feasibility, we have picked the first four factors which cause 85% of line calls- **Sorting process delay, Delivery process delay, SPS storage constraint and Multi location.** In this paper, we look into the methodologies to reduce line calls due to **Sorting process delay and SPS storage constraints.**

III. METHODOLOGY

a) Sorting Process Delay

Process Flow Of Sorting Member

Table 3: SPD

PROCESS	DISTANCE (mtr)	REMARKS
Select a Box	0	Any box can be picked. No standardized work
Find its Kanban ID	0	50% of boxes have their Kanban ID facing opposite direction
Check its conveyance code	0	Must check the conveyance code
Lift the box	0	Boxes handling rules must be followed
Carry the box to allocated dolly	4.05 mtr (avg)	Closest dolly 1.25 mtr (high freq. routes) Farthest dolly 20 mtr (low freq. routes)
Keep the box in the dolly	0	Stacking must be proper. Boxes must not fall off during transportation
Return to flow rack	4.05 mtr (avg)	Avoid colliding with another member.

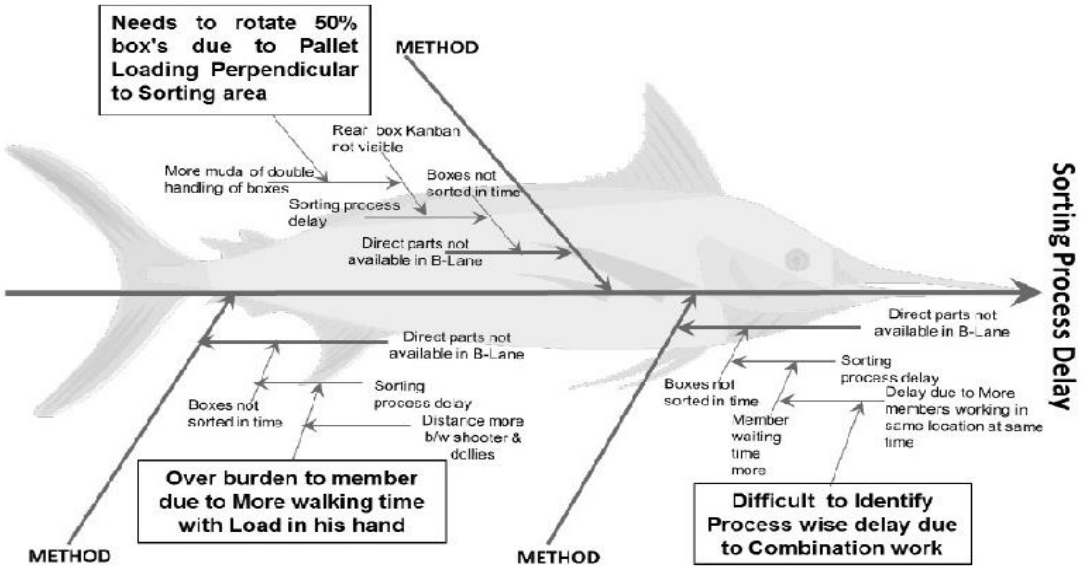

Figure 5 (Fish Bone diagram)

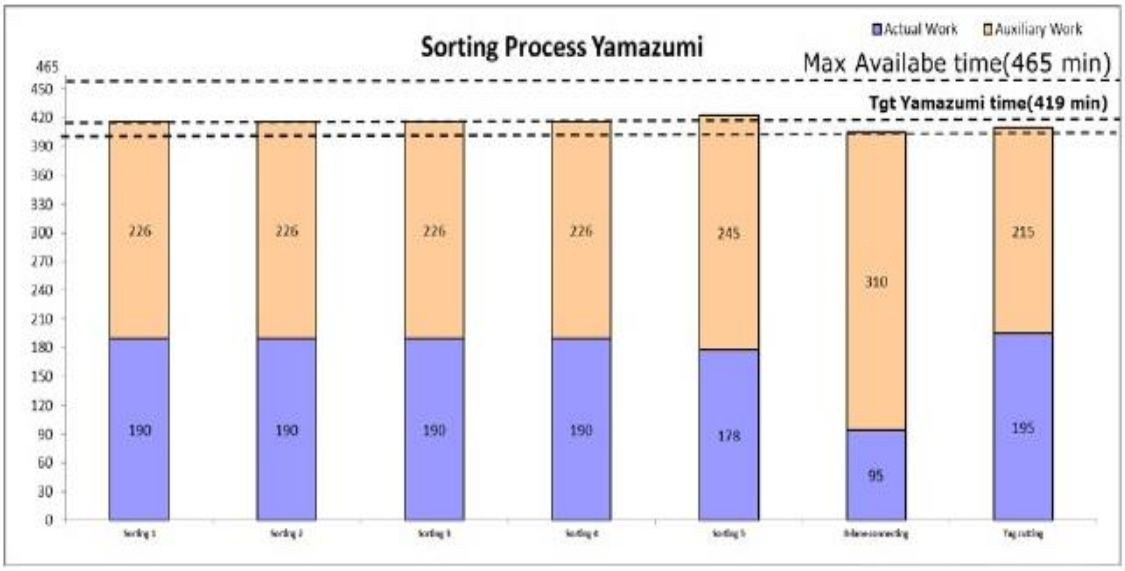

Figure 6 (Sorting Process)

Root causes for process delay in sorting area

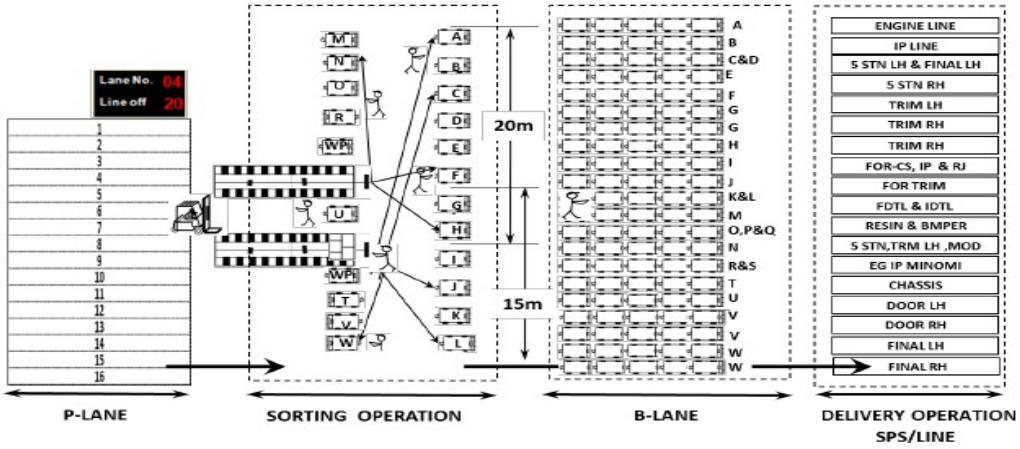

Figure 7 (Root causes for process delay)

Increased Distance travelled by sorting member

Average distance = 8.1 mtr/box	127 boxes/hr	8 hours/shift
	1.03 km/hr	8.23 km/shift

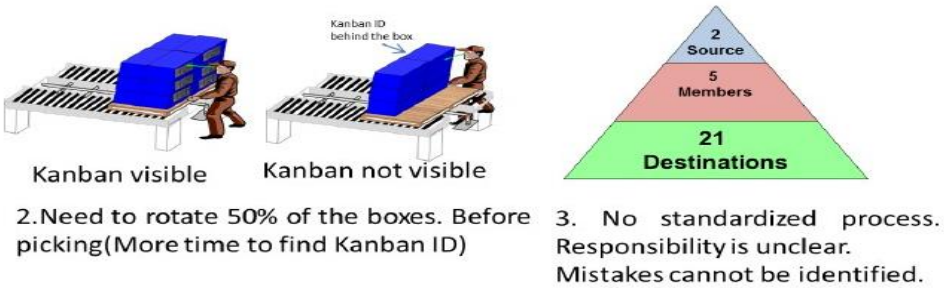

Figure 8 (Kanban)

Counter Measure 1

As the main concern was that the member moves large distances which is a non-value added work.

This can be achieved by moving the material where the member are stationary similar to conveyer belt concept. As electric conveyer cost Rs. 35 lac. Decision was to build a single long roller shooter using old scraped shooter. It was built was in-house with the help of kaizen team. Sorting member will be on both side of the shooter. Dolly will be on both sides. Each Member is to sort boxes of 3 routes (Standardized work). Andon board was provided to call team leader when abnormality occurs.

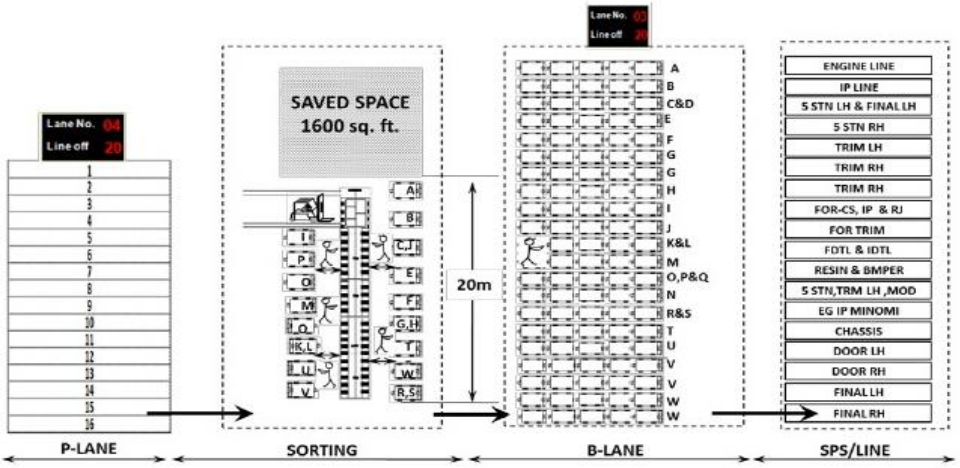

Figure 9 (Counter Measure)

After implementation some new concerns were raised by members. These concernswere solved by tackling one concern at a time.

Table 4

CONCERNS	SOLUTIONS
Sorting members could not reach top box in the pallet as its height was over 2 mtr.	Provide a 0.5 mtr ramp which has the same inclination that of the shooter
There was chance of top pallet falling in the sorting member 1	Barricading was provided to prevent the top pallet from falling
Fork was projected outside the pallet which could hurt the sorting member 1	A jig was provided to reduce the length of the fork so that the fork remains inside the pallet
Member needed to bend more to lift the empty wooden pallet	Hydraulic lift was provided to lift the wooden pallet
Materials used to move due to gravity even before the member has picked all boxes from the pallet. It could not be stopped easily.	Double sided stopper was provided so that any member could stop the pallet from moving before the required boxes are picked

After counter measure 1:

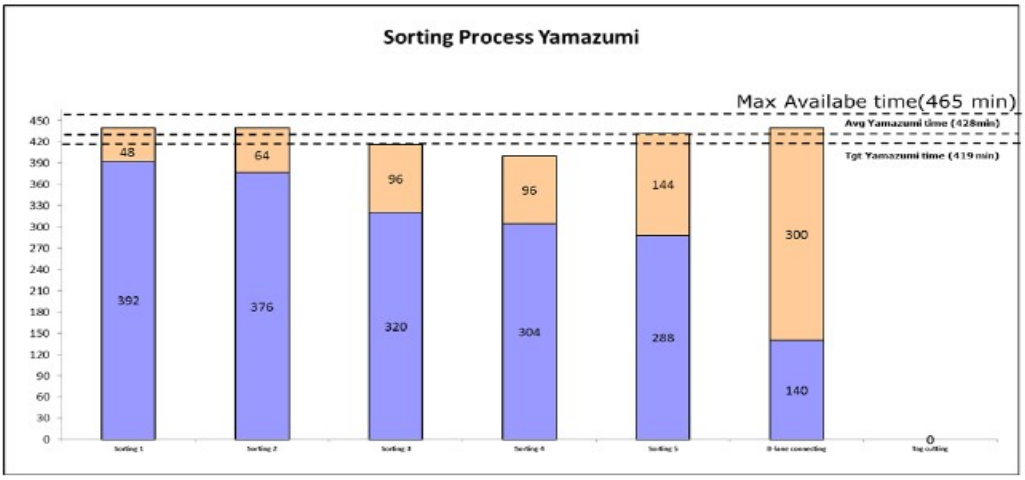

Figure 10 (Sorting Process after counter measure)

Average distance = 1.25 mtr/box	127 boxes/hr	8 hours/shift
	160 mtr/hr	1.27 km/shift

Auxiliary work of travelling towards dolly and back to shooter was reduced by reducing distance needed to be travelled. Distance travelled was reduced from 8.23 km to 1.27km per shift. Each member was allocated courses such that they get equal boxes to sort.(ie. 1 high volume and 2 low volume routes) Work of tag cutting was allocated to sorting 1 member and empty pallet handling was done by sorting 4,5 members. Thus requirement of one member was reduced in the overall process. As sorting takes place on both sides, kanban ID will be visible. If the visible kanban ID is of the opposite member then the members has to turn it for him. (ie. Sorting 2 member turns boxes belonging to Sorting 1,3 and Sorting 3 turn for Sorting 2. Sorting 4,5 member turn each other's boxes when required.)
1600sq ft. Area was saved which was later used to move the minomi part area into the plant.

b) SPS Storage constraints

In SPS racks, a minimum of 1hr stock and a maximum of 3hrs stock is to be stored. Using the consumption rate of the part, maximum stock and minimum stock can be found. If all the stock in SPS can be consumed in less than 3 hrs then that location is said to be having a storage constraint.

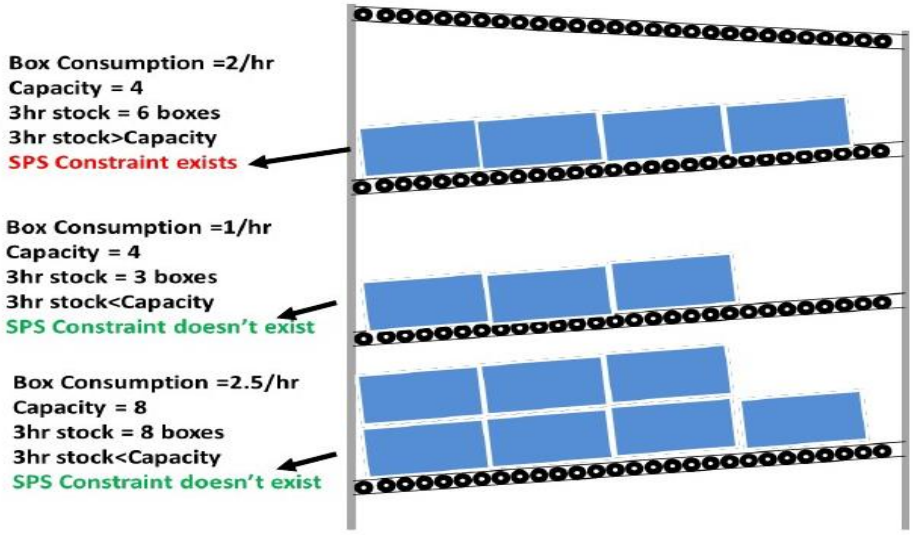

Figure 11 (SPS Storage)

Counter measure 2:

We collected data regarding SPS capacity, Location , minimum and maximum number of parts to be filled. Detail from the part list was collected from system. Using this data, detail such as box quantity, N-peak were linked to the collected data using vlookup.

"=VLOOKUP(lookup_value, table_array, col_index,_num , [range_lookup])"

box quantity – number of pieces or units in a box.

N-peak – In monthly production master schedule, every part is required in a certain quantity every day. On a fully functional day there is a certain requirement of pieces of part. The max ordered quantity in the whole month is considered as N-Peak. In general terms it is the number of part used in 16 hours.

• We found the usage rate using the formula
"N-peak/(16*box qty.)" (Boxes / hr)
• We found no. of hours stored in SPS rack using formula
"Capacity/usage rate"
• Sorted no. of hours stored in SPS rack in ascending order to find those parts with capacity lower than required.

Kanban ID	N-peak (pieces)	Usage rate (boxes/hr)	Capacity (number of boxes)	Buffer in SPS (hrs) (Capacity/Usage rate)
IB12	308	3.21	4	1.246753
IB13	308	3.21	4	1.246753
1648	370	4.63	6	1.297297
1738	308	4.81	7	1.454545
1696	168	2.63	4	1.523810

• Anything less than 2.5 hours considered will have a storage constraint.

• Similar procedure was followed to find storage constraint using company collected data.(ARS information)

Found manually	
Kanban ID	**Number of hours stored in SPS**
I976	1.21
I582	1.25
I748	1.30
I894	1.47
IB07	1.80
I625	1.87
I626	1.87
I400	2.49
IA76	2.49
IA77	2.49

Found from ARS Master	
Kanban ID	**Number of hours stored in SPS**
IB12	1.25
IB13	1.25
I648	1.30
I738	1.45
I696	1.52
IA25	1.79
I493	1.82
I899	1.82
I491	1.95
I706	2.08
I802	2.08
I800	2.29
I801	2.29
I610	2.39
I995	2.39
IB99	2.42

Table 5

• Suggestion was given to increase the capacity by providing extension to the rack or providing another rack for same product ID.

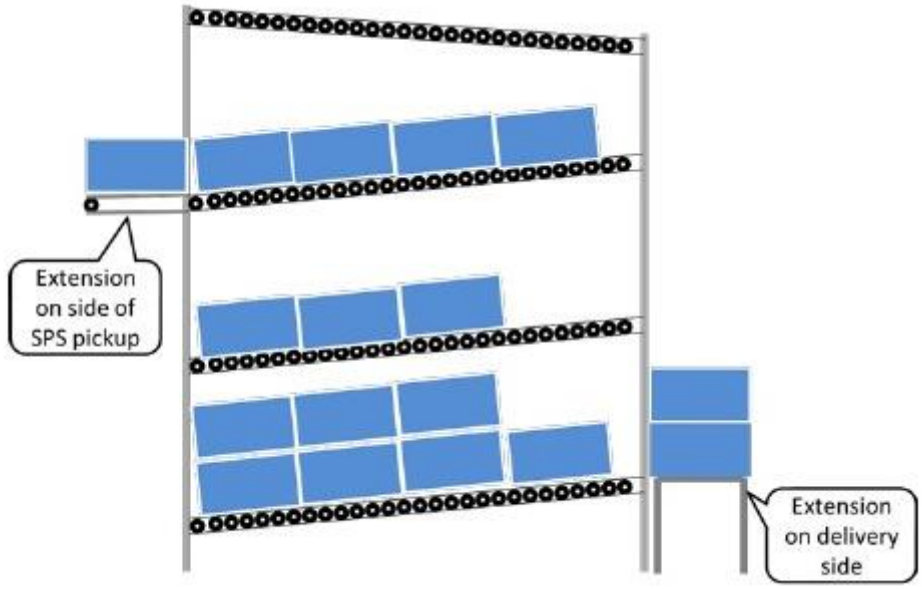

Figure 12 (SPS Storage after counter measure)

IV. CONCLUSION

The methodology adopted and the counter measures implemented effectively resulted in the following:

- Increase in Productivity
- Elimination of MUDA
- Reduction in stress on the worker
- Reduced auxiliary work
- Reduced manpower requirement
- Overall increase in Yamazumi efficiency
- Improvement in safety
- Reduction in accidents
- Reduced overall Inventory cost
- Improvement in Process control
- Improvement in Quality
- Delivery of the product at the right time and in the right quantity.

ACKNOWLEDGEMENTS

The author thankfully acknowledges the support and encouragement provided by the Management, Principal and staff of the Department of Industrial Engineering and Management, Dr. Ambedkar Institute of Technology, Bangalore during the preparation of this paper.

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