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Annual physical inventory stock taking lead time reduction a case study

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Abstract:

This paper focus on how well organized and systematic way of real time information system, new technology, lean techniques combinedly used to bring the reduction in number of days or lead time performed in traditional way of verifying the organizations stock keeping unit (SKU) the annual physical counts carried out during the end of each financial / calendar year and declaring to the statutory audit purposes. Also, mainly it focuses on eliminating the bottleneck of counting areas within four walls and the time spent by identifying wastes in entire process of an automotive component manufacturing industry.

Keywords: Annual physical inventory, Physical stock verification, Cycle counting, Material management (MM), Information System, New Technologies.

1. Introduction

This paper investigates the importance of physical inventory stock taking lead time reduction helps the organizations to have more available time to serve their customers without much interruptions in production and the same time, it also ensures the requirement of statutory laws are been adhered to protect them from any legal consequences.

2. Literature Review

The focus of literature review will be general and on comparison between widely practiced

methods within the manufacturing industries, which aims to bring down the lead time of stock taking and provide more available time for the operations to meet the customer demands. Notwithstanding identified the new technologies and information system in place to overcome the difficulties in achieving the objectives

Types of Stocks can be found in an industry:

Inventory basically falls into the overall categories of raw materials, work-in process, finished goods, consumables, service repair, operating supplies & spares

• **Raw materials:** Used to produce partial products or completed goods.

• **Work-in-process (WIP):** Items are considered to be the time raw material is being converted into partial product, subassemblies, and finished product. WIP should be kept to a minimum. WIP occurs from such things as work delays, long movement times between operations, and queuing bottlenecks.

• **Finished product:** This is product ready for current customer sales. It can also be used to buffer manufacturing from predictable or unpredictable market demand. In other words, a manufacturing company can make up a supply of goods during the year for predictably higher sales during the holiday season.

• **Consumables:** Light bulbs, hand towels, computer and photocopying paper, brochures, tape, envelopes, cleaning materials, lubricants, paint, dunnage (packing materials), and so on are used in many operations. These are often treated like raw materials.

• **Service, repair, replacement, and spare items:** These are after-market items used to "keep things going." As long as a machine or device of some type is being used (in the market) and will need service and repair in the future. [12]

Value of stock:

According to [11] organizations need accurate values for their assets – including stock – as this directly affects their reported performance. Any errors can bring serious consequences. At times of high inflation, for example, the valuation of stocks is often too low, and a company appears to have fewer assets than it really has. This may give an artificially high return on assets, and in extreme cases allows the company to be bought at a fraction of its true value. A rigorous view says that stock has no real value until it is actually sold or used, and any value assigned before

this is simply an accounting convenience. Nonetheless, organizations do need some reasonable view of their stock value, and the usual practice is to value stock at the lesser of unit cost or realizable value.

Then, for each item: Value of stock = number of units in stock × unit value

Purpose of a periodic (annual) inventory:

The primary purpose of a periodic (annual) inventory is to satisfy the financial auditors that the inventory records represent the value of the inventory. To planners, the physical inventory represents an opportunity to correct any inaccuracies in the records. Whereas financial auditors are concerned with the total value of the inventory, planners are concerned with item detail. The responsibility for taking the physical inventory usually rests with the materials manager who should ensure that a good plan exists, and it is followed. (George Plossl) once said that taking a physical inventory was like painting; the results depend on good preparation.[9]

There are three factors in good preparation: housekeeping, identification, and training. Housekeeping. Inventory must be sorted, and the same parts collected together so they can easily be counted. Sometimes items can be precounted and put into sealed cartons. Identification. Parts must be clearly identified and tagged with part numbers. This can, and should, be done before the inventory is taken. Personnel who are familiar with parts identification should be involved and all questions resolved before the physical inventory starts. Training those who are going to do the inventory must be properly instructed and trained in taking inventory. Physical inventories are usually taken once a year, and the procedure is not always remembered from year to year [9].

Physical inventory taking process:

1. Count items and record the count on a ticket left on the item.
2. Verify this count by recounting or by sampling.
3. When the verification is finished, collect the tickets and list the items in each department.
4. Reconcile the inventory records for differences between the physical count and inventory dollars. [9]

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Cycle counting:

Cycle counting is more systematic method of counting a statistically significant cross-section of your inventory frequently. This continuous counting leads to the discovery of discrepancies soon after they arise. By catching an error quickly, you can backtrack through both the paperwork and the stock movement of the item(s) to determine why that SKU's paper life became separated from its real life. Once the cause of the error is identified, it can be eliminated. Since this is a continuous process, as one cause of error after another is eliminated the system begins to operate more and more smoothly. Eventually all items move through a series of procedures that work.[12]

Difference between periodic cycle counting and physical inventory counting

Cycle counting not only improves accuracy of the count, but it allows for an annual review of each line or segment of products. An annual physical count is the counting of all SKU's within a specified time frame and is typically done once a year.

Generally Accepted Accounting Principles (GAAP) and IRS rules requires to either count the complete inventory on an annual basis or implement a perpetual counting system. So, the organization has to decide which counting system is right for them.

Cycle counting is a perpetual counting system where a small subset of inventory, in a specified location, is counted on a specified day. By performing cycle counts, it is regularly validating the accuracy of the inventory in your system. This method of counting is popular among large scale organizations that have a large number of items in inventory and cannot be closed for a long period of time to perform an annual physical inventory count. By utilizing cycle counts, organizations experience the following benefits:

- Reduce disruption in the operation, savesadditional expenditures,much time available than doing an annual physical count

Not only does cycle counting improve accuracy of the count, but it allows for an annual review of each line or segment of products. This process improves inventory turnover by giving buyers insight into what items should continue to be stocked and help analyze missed sales

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opportunities.

Although the benefits of cycle counting have made annual physical counts almost obsolete, some organizations that maintain a small inventory may decide on an annual physical count. An annual physical count is the counting of all SKU's within a short time frame and is typically done once a year.

Shutting down operations at the end of each year and counting inventory allows you to start the new year with a clean slate is one advantage to performing an annual physical count. Although starting the new year fresh is nice, the disadvantages of annual physical counts typically outweigh the benefits. Some of the drawbacks to annual physical counts include:

- Receiving, Production and shipping operations must be shutdown to count all inventory, which consumes time and resources, counting's are not automated have a higher likelihood of error

Some organizations opt to perform both an annual count and periodic cycle counts. This allows them to closely manage inventory variances and update accounting records. Implementing an effective inventory counting program has many benefits. Using the right counting method can help organizations discover process errors and inefficiencies, improve accuracy & productivity, and provide better customer service with more accurate records and having items in stock when they are ordered [1]

Lean management

With the publication of "The Machine that Changed the World: The Story of Lean Production" [13] the advantages of lean principles have been widely recognized. The term Lean implies a series of tools and techniques to eliminate wastes (Muda), reduce non-value-added operations, improve value added processes and maximize performance [14].

The identification and elimination of waste is a primary philosophy of lean. Removing the first, large layer of waste generally yields significant improvements in overall performance. At this point most of the improvements are the individual process level, not at the level of flow connecting processes. Subsequently cycles through the continuous improvement spiral will

connect processes and can have even larger impact and reinforce motivation to maintain the stability of individual processes [2].

Information systems & new technologies:

[10] stated that current business, the availability of information systems can allow business to make a great improvement for effective and efficient control of inventory and physical counting. Different types of Information Systems (IS) are currently used for providing information to support operations, management and the decision-making function in a firm, and inventory control is an important component in any IS offered by IT providers. Basically, the inventory system is implemented to help firms manage, control, and make sure the goods in stock are well managed and organized. Information systems is important to control inventories through the physical inventory role; however, the mentioned IT devices must be integrated to a WMS that is used by a firm. Bar coding functionality described it as a method of tracking inventory for controlling the level of inventory and reorder situation, and that enables to avoid any errors in terms of stock outages or overstocking. Furthermore, when a stock counter scans any stock item through the Barcoding system, the information is recorded in real time in the system for cross checking with the on-hand inventories in later stage. He also stated that the system is set to monitor the inventories after daily transactions carried out by the warehouse as the information can be provided on time for the current level of inventory, and thus warehousing is able to react quickly to find out any errors, pilferage, spoilage, and other factors that may distort the records. Another technique that is used in the physical inventory counting is Critical Value Analysis (CVA). The technique is opposite to the ABC analysis by paying more attention to C items rather than A items. CVA is an analysis conducted based on stockout rates. The stockout situation is a stock item or product is missing from the warehouse and not available to meet customer demands.

3. The problem and implementation details

The section 3.1 describes the situation prior to the implementation, identifying the problems that were found. The section 3.2 describes opportunities available to change. The section 3.3 describes the changes and the situation after its completion, besides internal management team, auditors and customers overall satisfaction regarding the implemented changes was also

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evaluated.

3.1 Status prior to the implementation

This case study was conducted in one of the manufacturing of an automotive component industry, major components are bought out in nature, not in house manufactured around 2500 varieties of parts, whichall put together in the following categories raw material, WIP, finished goods & MRO etc. During the physical inventory count all the components or parts are segregated with respect to part family or group within four walls in a restricted inflow and outflow as per regular standard practice on previous day or the same day when the clock starts for the physical verification and it may continue every day till midnight and following 3 to 4 days to complete entire counting and reconciling stocks in multiple manufacturing locations divided majorly on zones(receiving stage, quality inspection rooms, quarantined rejected stage, assembly line stage, warehouse, WIP on assembly conveyors or work stations and other locations around the factory floor).

3.1.1 Process flow diagram

The process flow shows the activities, which will be performed prior to one day and on physical inventory count days, entire duration approximately 3 to 4 days in a traditional way.

3.1.2 Interruption on daily transactions

Entire duration of physical verification stock days, till all activities get completed such time the production, receipt and shipments transactions are hold, which lead to loss of sales for the organization, interruptions at customers production and other expenses incurred for the personal involved in those activities.

3.2 Opportunity

It encourages the improvement required at various stages of the count points in the manufacturing floor and warehouse zones with more organized, systematic way of working, as much as possible figured out in below

- Identify the part group or family which was takinglong time to count

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- Identify the zone / area / locations, which was taking long time to count
- Identify the bottlenecks in the flow of activities
- Identify which new technologies available to reduce the lead time

3.3 Status after the implementation

The standardized processes and procedures with reference to lean philosophy, started the journey of waste identification and reduction of lead timewith other best practices integrated real time stock information system, barcode scanning brought the many benefits in the below number of days physical inventory taking performed has been reduced from average of 3.5 days to 1.5 days[2,3,4,5,6,7,8,9,10]

- Improved customer delight with no disruptions in supply
- Increased sales of the organization
- Reduced operating expenses of physical inventory count days
- Lead timereducedmore than 40%
- Reduced periodic or cycle counting time and man hours spent
- Improved visual controls on inventory managements
- Improved supplier planning
- Optimized inventory levels and reduced safety stocks
- Improved accuracy of supplier planning

4. Research Methodology

Section: I- Research Approach

The analysis of this paper is based on primary data collected from the organization and secondary data, including online databases, digital libraries, books, journals, conference papers, etc.

4.1 Objectives

Theobjective is to monitor the stock take exercise by observing the effectiveness and strict adherence to the recommended/statutory stock taking procedures which includes among others:

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- To ensure all inventory items are counted appropriately within a specified targeted time less or equal to one day
- To ensure counting zones/areas are properly pre-arranged and captured in information system on real time basis prior to counting
- To ensure accurate valuation of stock items in all stages reported quickly to conclude the activity

4.2 Identifying problems& prioritizing

- Major contributor in terms of classification of part group / family leadsto delay in counting
- Major contributor in terms of zone/location leads to delay in counting
- Various disorganized activities in the entire counting process

4.3 Important attributes affecting thephysical stock counting

(1) Overall value / quantum of inventory stocks held at the time

- Excess inventory
- Individual components/ part groups stock with (list of Item code, description, unit of measure etc.)
- Fast, Medium & slow moving
- Size of the components/parts

(2) Team involved in counting, their knowledge and skills

- Basic read, write skills in inventory tags
- Usage of computer, hardware (Scanners, Barcode etc. & software skills data entry, interpretations, analysis& reporting etc.)
- Previous working knowledge on the items
- Tag entry manual and systems
- Reconciliation and re-verifications

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(3) Segregation and identification of parts and locations

- Condition of stocks held, unpacked or packed as it arrived from supplier or not been touched after internal receipt verifications

(4) Multiple varieties of components/parts

- Parts with most similar look or naturearranged together or very nearer to each other

(5) Layout, Zone/Location,type of storage and retrieval systems

- All inventory placeswere identified, labeled in all shelves, boxes, containers and locations

Section: II- Research Tools

Choice of tools used as follows, Flow chart, Bar chart, Pareto chart, case study, PDCA [7], Cause and Effect diagram, 5S, Seven types of deadly waste, ABC inventory classification, Critical value analysis (CVA) [10], JIT [16].

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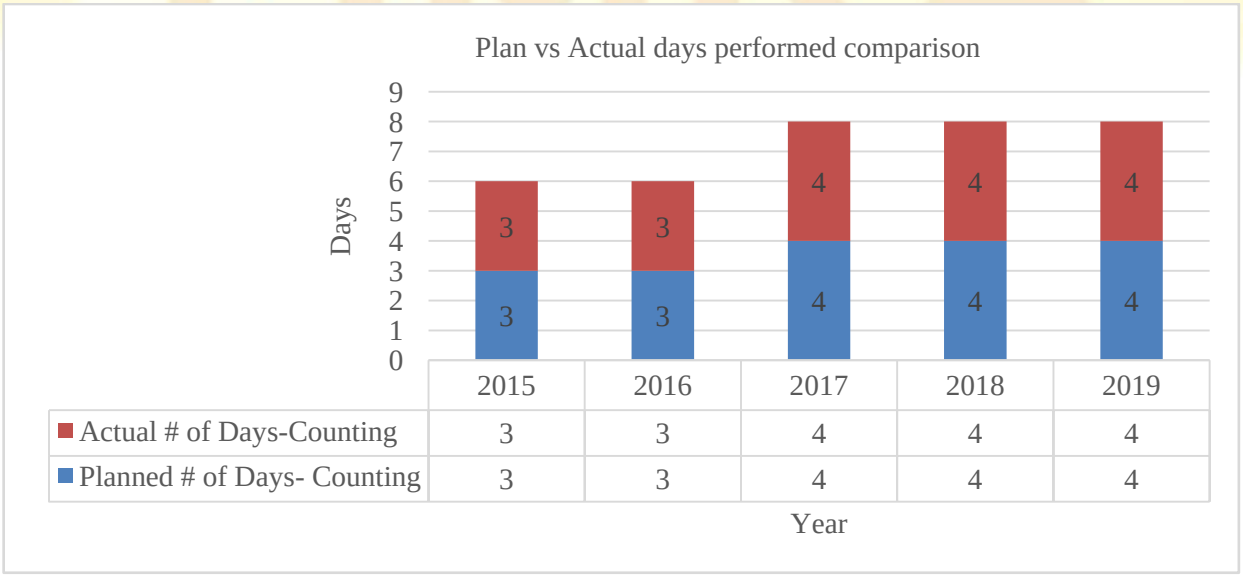
5. Case study and analysis

In this section, it is explained the results of research and at the same time is given the comprehensive discussion. Accordingly, the entire model of all parts put together comes around 2500 parts in all category information has been consolidated to further study [15]

Step: 1 Basic data collection

- Past history about the parts information in terms of volume (Part #, Description, Unit of measure, weight, shapes, number of boxes / packages, dimensions, storage location, classification, counting method (Based on visual box count, weigh the sample and count, manual count each component pieces etc.)
- Planned and actual time / days was performed previously for physical counting for the 5 years on manufacturing assembly line wise, classification wise, storage locations / zone wise collected and prioritizing the implementation.
- Inventory accuracy achieved for the past 5 years various area and classification in type of inventory forms

Comparison between Plan vs Actual for the previous 5 years



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Inventory accuracy analysis for the previous 5 years

Description	UOM	2015	2016	2017	2018	2019
Pre Inventory ERP Value	USD K	$893.89	$1,239.26	$2,505.43	$3,053.46	$4,774.93
Post Inventory Physical Value	USD K	$911.41	$1,265.56	$2,549.94	$3,098.71	$4,860.79
Difference Value	USD K	$ 17.52	$ 26.30	$ 44.51	$ 45.25	$ 85.86
Overall accuracy level	%	**98.08%**	**97.92%**	**98.25%**	**98.54%**	**98.23%**
Total # of Parts- Finished Goods	PCS	50	72	81	94	103
Total # of Parts- WIP	PCS	20	28	34	36	42
Total # of Parts- Raw materials	PCS	665	715	841	831	874
Total # of Parts- MRO	PCS	343	457	480	614	787
Total # of Parts all category	PCS	**1078**	**1272**	**1436**	**1575**	**1806**
Accuracy level of Finished goods 100%	PCS	50	72	81	94	103
Accuracy level of WIP 100%	PCS	20	28	34	36	42
Accuracy level of Raw materials 100%	PCS	478	502	623	632	713
Accuracy level of Raw materials 99% to 99.9%	PCS	84	114	101	127	104
Accuracy level of Raw materials < 99%	PCS	103	99	117	72	57
Cumulative Accuracy level of Raw materials 100%	%	**72%**	**70%**	**74%**	**76%**	**82%**
Cumulative Accuracy level of Raw materials 9% to 99.9%	%	**13%**	**16%**	**12%**	**15%**	**12%**

*Currency in USD K

Zone / location &classification wise cross combination time analysis for the previous 5 years

Zone / location	Year wise time in hours					# of Parts as on Y-2020	Classification
	2015	2016	2017	2018	2019		
North Zone- Small parts Light duty rack	16	16	24	24	24	630	C
MRO Parts AS/RS storage	8	8	12	12	12	950	C
Intermediate AS/RS storage	8	8	12	12	12	65	C
North Zone- Heavy duty Racks storage old	6	6	8	8	8	200	A
North Zone- Heavy duty Racks storage New	2	2	8	8	8	64	A
South Zone	4	4	4	4	4	200	B
Assembly Line 4 LC	4	4	4	4	4	74	ABC
Intermediate Heavy-duty Racks storage	4	4	4	4	4	71	B
Assembly Line 3 R	4	4	4	4	4	60	ABC
Assembly Line 1 H	4	4	4	4	4	52	ABC
West Zone	4	4	4	4	4	51	A
Assembly Line 2 F	4	4	4	4	4	48	ABC
North Zone- Floor	4	4	4	4	4	35	B
# Total hours	**72**	**72**	**96**	**96**	**96**	**2500**	
# Total Days	**3.0**	**3.0**	**4.0**	**4.0**	**4.0**		

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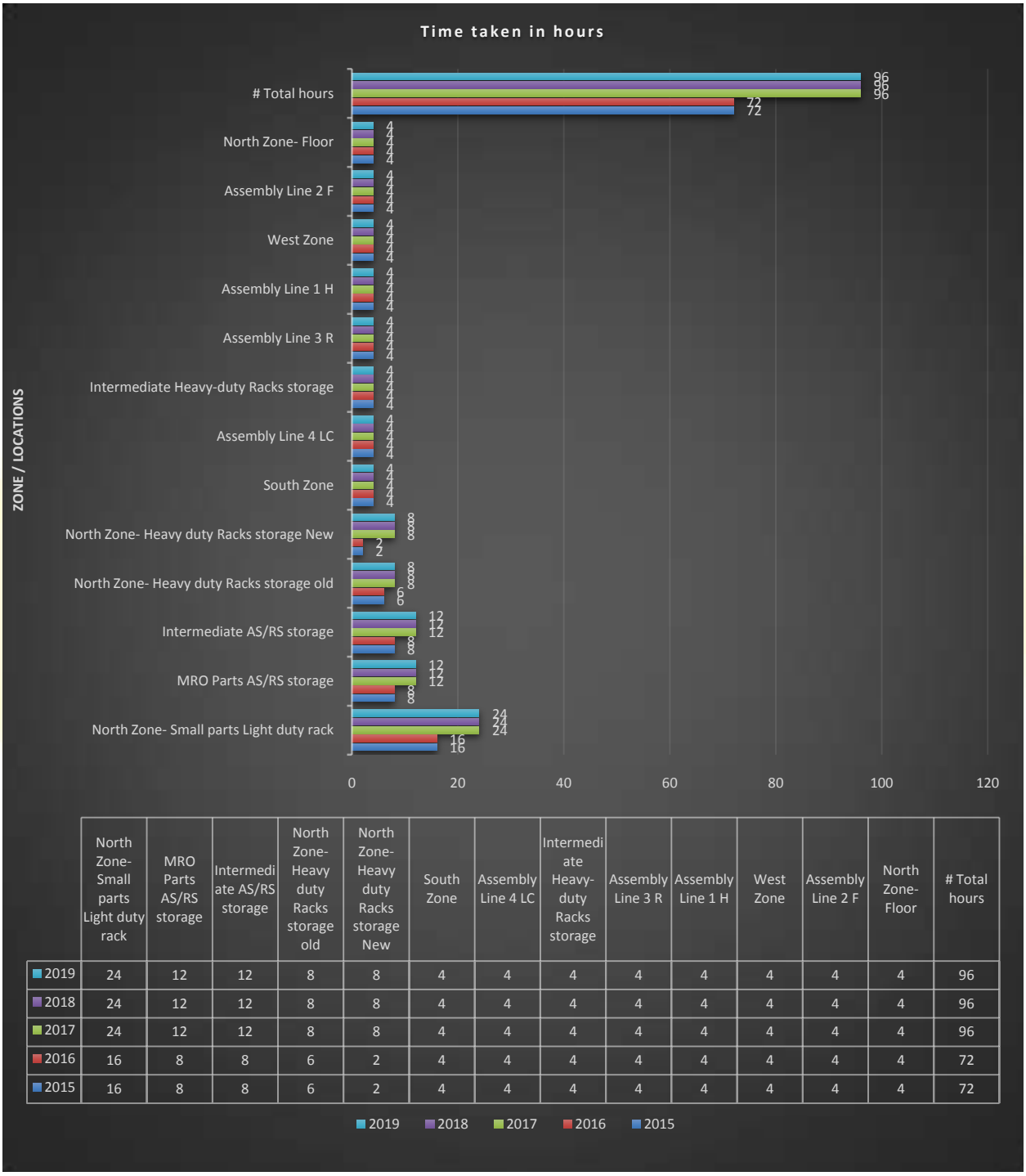
Critical value analysis (CVA) Zone / Location wise comparison



	North Zone- Small parts Light duty rack	MRO Parts AS/RS storage	Intermediate AS/RS storage	North Zone- Heavy duty Racks storage old	North Zone- Heavy duty Racks storage New	South Zone	Assembly Line 4 LC	Intermediate Heavy-duty Racks storage	Assembly Line 3 R	Assembly Line 1 H	West Zone	Assembly Line 2 F	North Zone- Floor	# Total hours
2019	24	12	12	8	8	4	4	4	4	4	4	4	4	96
2018	24	12	12	8	8	4	4	4	4	4	4	4	4	96
2017	24	12	12	8	8	4	4	4	4	4	4	4	4	96
2016	16	8	8	6	2	4	4	4	4	4	4	4	4	72
2015	16	8	8	6	2	4	4	4	4	4	4	4	4	72

The above chart shows most time-consuming parts is stored at North zone, and class C parts which is small in size.

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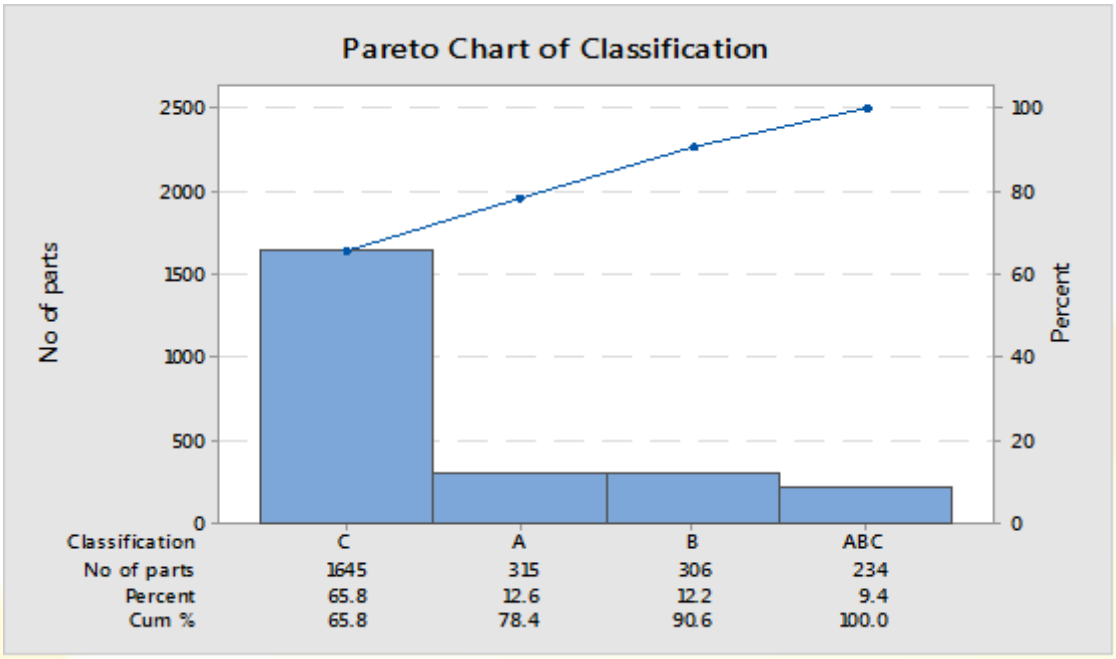
Pareto analysis classification wise

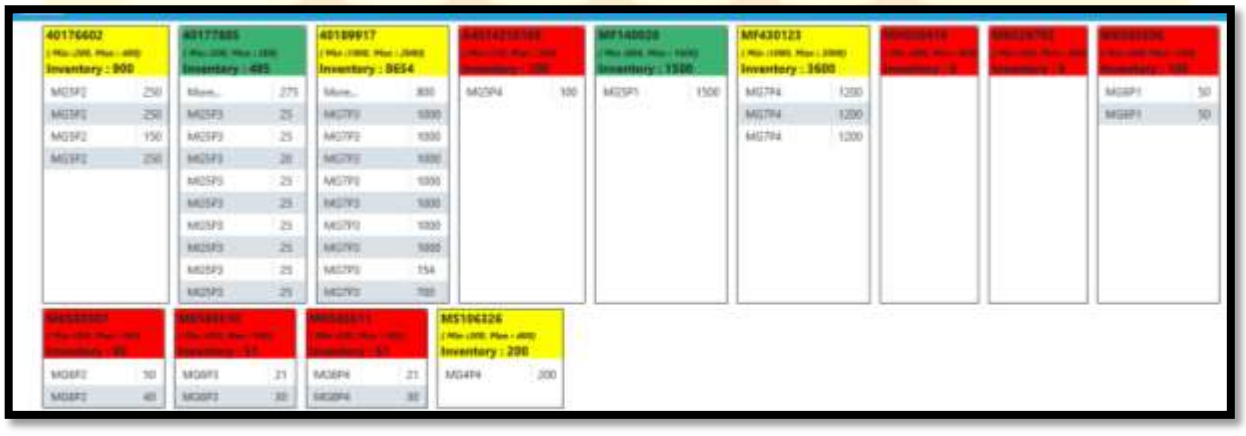


Consequentlyobserved major cause in class of parts falls under "C" and need more attention and further study to reduce lead time occurrences on these parts counting zones / locations [6].

Step: 2 Design of real time inventory management informationsystem

The real time inventory management information system is configured for the major counting time consuming class "C" parts at North zone, which shown on pareto vital few area

*Inventory dashboard with Min Max visual management with FIFO (Red- less than min stock,



Yellow-more than max stock, Green- between Min & Max stock) with mail communication

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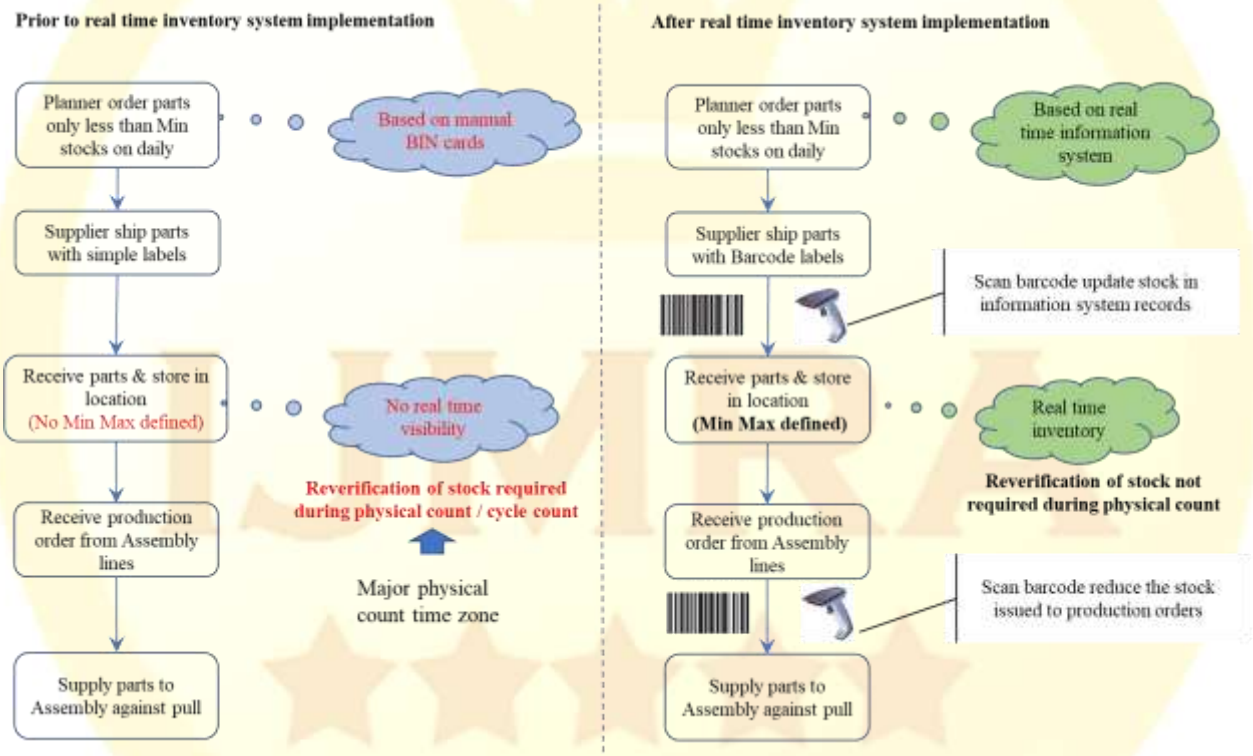
configured to the respective planners and related members

Mail alert systemto planners for replenishing daily stocks on pull production

Step: 3 Developing the process flow for the selected critical zone parts



Step: 4 Design of audit system

- Daily random verification audit performed to ensure the correctness of inventory accuracy by supervisors on scheduled interval and surprise audit plan developed by finance accountant periodically.

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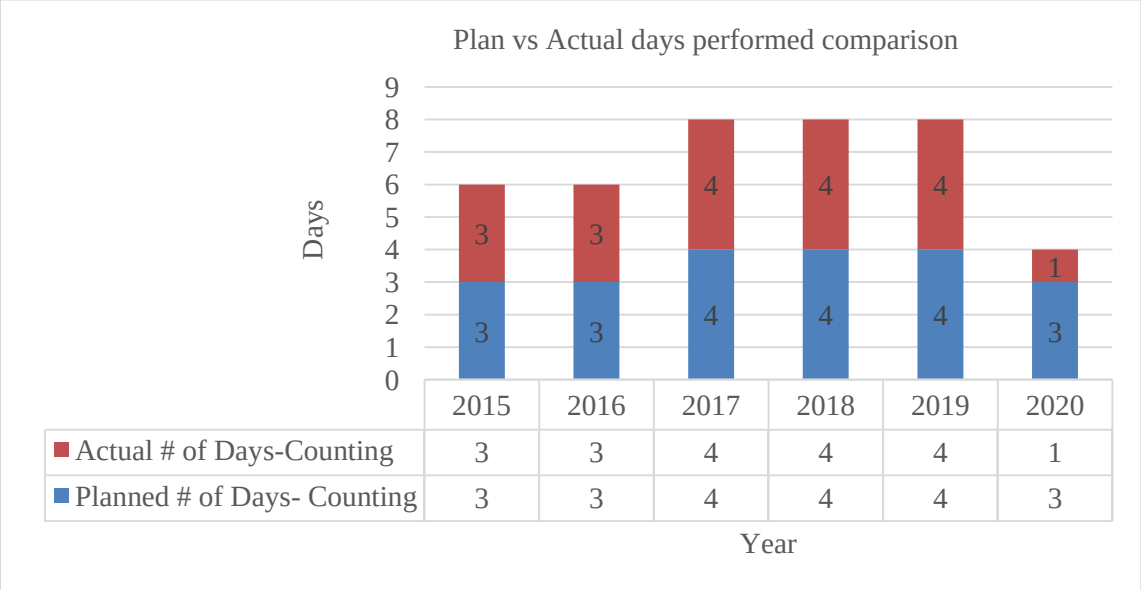
6. Conclusionand results

In this paper, the case study main focus was the duration reduction of physical inventory counting activity, moreover it depends on the method followed prior to the actual count being performed on everyday transaction in and out from receipt of parts to the shipping within four walls. The people who work in this system requires high level of standards in terms integrity, discipline and involvement is much more important.

6.1 Physical count days reduction trend comparison with previous 5 years vs year 2020



Inventory accuracy comparison previous 5 years vs year 2020

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Post Inventory Physical Value	USD K	$ 911.4	$ 1,265.6	$ 2,549.9	$ 3,098.7	$ 4,860.8	$2,737.81
Difference Value	USD K	$ 17.5	$ 26.3	$ 44.5	$ 45.3	$ 85.9	$ 9.90
Overall accuracy level	%	**98.08%**	**97.92%**	**98.25%**	**98.54%**	**98.23%**	**99.64%**
Total # of Parts- Finished Goods	PCS	50	72	81	94	103	178
Total # of Parts- WIP	PCS	20	28	34	36	42	73
Total # of Parts- Raw materials	PCS	665	715	841	831	874	1299
Total # of Parts- MRO	PCS	343	457	480	614	787	950
Total # of Parts all category	PCS	**1078**	**1272**	**1436**	**1575**	**1806**	**2500**
Accuracy level of Finished goods 100%	PCS	50	72	81	94	103	178
Accuracy level of WIP 100%	PCS	20	28	34	36	42	73
Accuracy level of Raw materials 100%	PCS	478	502	623	632	713	1116
Accuracy level of Raw materials 99% to 99.9%	PCS	84	114	101	127	104	163
Accuracy level of Raw materials < 99%	PCS	103	99	117	72	57	20
Cumulative Accuracy level of Raw materials 100%	%	**72%**	**70%**	**74%**	**76%**	**82%**	**86%**
Cumulative Accuracy level of Raw materials 9% to 99.9%	%	**13%**	**16%**	**12%**	**15%**	**12%**	**13%**

*Currency in USD K

Zone / location & classification wise cross combination time comparison previous 5 years vs year 2020

Zone / location	Year wise time in hours						# of Parts as on Y-2020	Classification
	2015	2016	2017	2018	2019	2020		
North Zone- Small parts Light duty rack	16	16	24	24	24	4	630	C
MRO Parts AS/RS storage	8	8	12	12	12	4	950	C
Intermediate AS/RS storage	8	8	12	12	12	4	65	C
North Zone- Heavy duty Racks storage old	6	6	8	8	8	4	200	A
North Zone- Heavy duty Racks storage New	2	2	8	8	8	4	64	A
South Zone	4	4	4	4	4	2	200	B
Assembly Line 4 LC	4	4	4	4	4	2	74	ABC
Intermediate Heavy-duty Racks storage	4	4	4	4	4	2	71	B
Assembly Line 3 R	4	4	4	4	4	2	60	ABC
Assembly Line 1 H	4	4	4	4	4	2	52	ABC
West Zone	4	4	4	4	4	2	51	A
Assembly Line 2 F	4	4	4	4	4	2	48	ABC
North Zone- Floor	4	4	4	4	4	2	35	B
# Total hours	**72**	**72**	**96**	**96**	**96**	**36**	**2500**	
# Total Days	**3.0**	**3.0**	**4.0**	**4.0**	**4.0**	**1.0**		

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