

“Optimization of Inventory regarding Power Tiller”

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Abstract - The cost-effective management of spare parts is crucial for manufacturing and service companies. Managing and controlling stock level is one of the most difficult challenges for effective managing of spare parts, to achieve first rate service degree, specially in areas such as aircraft industry face high unreliability in the spare parts demand. There is increasing pressure upon manufacturing firms to make their processes more excellent and effective. An important factor for improving these manufacturing processes is production and inventory management, and variety of production and inventory management information systems such as Material Requirements Planning (MRP)/Enterprise Resource Planning (ERP) have thus been developed. However, MRP has an important records of implementation problems. An extended desirous heuristic is proposed for cost and time effective inventory control.

A new proposal to the management of manufacturing and operation becomes developed with the aid of Goldratt in the late 1984. Currently known as Theory of Constraints (TOC), it provides a constant management concept for running an organization. Theory of Constraints is a key to identify Constraints or Bottleneck and then eliminates or rejects. This study is implemented in the supply chain department of a manufacturing plant of Power tiller to recognize the benefits of implementation of Theory of Constraints has been outcomes in better profits, optimization in Inventory level. A TOC's is basic terminology highlights its philosophy and its three measures. Throughput of any company equals to income revenue minus direct materials cost ($\text{Throughput} = \text{Income revenue} - \text{Direct material cost}$) it measures the speed at which the company makes money. Inventory is the fee of raw substances tied up in work in process and finished goods. Large amount of inventory unwanted because it means that the company has spent money for production that hasn't generated revenue. The company's revenue is dependent on the total money for producing the product. TOC's main goal is increasing the company's throughputs and decreasing inventory and operating expenses, increasing the throughput level means that the rate at which the company is making money is increasing.

Key Words: MRP, ERP, ABC analysis, Theory of Constraints, Excel.

1.INTRODUCTION:

Inventory management is the complete process of managing inventories from the raw materials to the finished products.

Inventory management tries to correctly streamline inventories to keep away from every extra amount and insufficient of raw materials, work in process (WIP) parts and finished parts in any Management system. Inventory management is necessary to a company's strength because it helps to make sure that there is hardly having exorbitant stock or too inadequate stock on hand, proscribing the hazard of stockouts and erroneous intending or records of data. Two major methods for inventory management are Just-in time (JIT) and Materials Requirement Planning (MRP). A company's inventory is one of its most valuable assets. In retail, manufacturing, food services, and other inventory intensive sectors, a company's inputs and finished products are the keys of its business. An inadequate of an inventory when and where it's needed can be extremely detrimental. on the identical time, inventory may be concept of as a liability (if not in an accounting sense). A huge inventory contains the danger of spoilage, theft, damage, or shift in demand. Inventory stock need to be insured, and if it isn't offered in time, it is able to need to be disposed of at clearance prices or genuinely destroyed. For those reasons, inventory Stock management is important for business of any size. Knowing when to restock inventory, what quantities to purchase or produce, what price to pay in addition when to promote and at what rate can effortlessly grow to be complicated choices. Small commercial enterprise will frequently preserve track of stock manually and determine the recorder points and portions the use of spreadsheet (Excel) formulation. Massive companies will use specialized enterprise resource planning (ERP) software.

Inventory management enables companies pick out which and what sort of stock to order at what time. It tracks inventory from purchase to the sale of products. Once sold, inventory becomes revenue. Before it sells, inventory (despite the fact that mentioned as an asset at the balance sheet) ties up cash. consequently, an excessive amount of stock costs money and reduces coins go with the flow. One dimension of correct inventory management is inventory turnover. An accounting measurement, inventory turnover displays how regularly stock is sold in a period. An enterprise does not want extra inventory than income. Terrible inventory turnover can cause lead to dead stock, or unsold stock. Theory of Constraints (TOC) was designed by way of an Israeli physicist Dr. Eliyahu M. Goldratt. Principle of Theory of Constraints is a management philosophical system which focuses on separates the faint point in the operation of the system. The concept started in the 1984, whilst Goldratt and his group were working on programming software to optimize the production systems,

they called it optimized production technology (OPT). The name TOC slowly acquired and was put forth by Goldratt in the book. The book is *The Goal* in the year 1984. The application program of TOC has been extended to various areas, such as Marketing, Supply Chain Management and retail. TOC philosophy which considers all processes in system as rings of the same chain, they all are dependent on each other. TOC philosophy focuses on the weakest (Bottlenecks) and constraints in the chain (system). TOC aims to maximize throughput contribution whilst reducing funding and working prices. From organizations view, the bottleneck or constraint can be from any functional areas like Finance, Marketing area, Production line, Procurement or strategic planning and TOC is useful in all these areas. Mostly, constraints can be in the form physical resources like shortage supply of raw material, lack equipment capacity, or the constraint can be conducting or policy related which can limit the production capabilities. This study is done in Power tiller production plant where TOC is implemented in the supply chain management department for the buffer management (daily stock) of the plant by using a new concept on the bases of excel sheet buffer Management by colour coding.

2. LITERATURE REVIEW:

Investigation emergence on “New retail” that produces a great effect on the inventory management of retail companies, by using a ASY company as the study object. In that the Analytical Hierarchy process (AHP) technique is used for to achieve the weight information of each thing before and after the brand-new retail seems. There are six influencing factors i.e., management system, personnel capabilities, delivery method, sales method, product categories and resources limitation on this basis it analyses how new retail affects the inventory management of ASY company (Zhou Chuanpeng¹, Zhang Yi,2021). The demand forecasting is the basis of the inventory management. The quadratic exponential smoothing technique to set up the mathematical version and the ABC classification management method is used to clear up the inventory management issues in that, A category is key materials, so they should be conducted monthly and the most accurate demand forecasting is needed. B category is second key substances, so warehouse keeper ought to enforce a regular manage, general frequency inspections and general worries with the traditional recording. C category materials are less important, so they need just regular inspections (normally six months or a year). ABC classification approach can assist draw close the important thing, and distinguish between primary and secondary, shop manpower and fabric assets to achieve a multiplier effect (Xi Jia, Sha Pingba, 2013). In particular, mainly a promising studies location concerns assembly systems with uncertain lead time, for which the principle issue comes from the inter-dependence of additives inventories also deals with random lead-times studies and uncertainties. That means that the time had to receive an issue may also vary from forecasted. As with

random demand, lead-time uncertainties provoke either some shortages or surplus in inventories. These uncertainties have been omitted for a long time in favor of studying call for uncertainties. Troubles of uncertainties aren't restricted to versions of the for level, however also fluctuations at the lead-times (Alexandre Dolgui, Aly Ould Louly and Caroline Prodhon 2005). Improving operational performance in a production gadget through enterprise resource planning (ERP). By ERP improving the powerful verbal exchange amongst departments to meet delivery dates. ERP framework changed into designed to reduce work in progress on the store ground floor and inventory. ERP software which automates information update and incorporate best practices to facilitate rapid decision making, cost reduction and greater managerial control for improved organizational competitiveness (Ignatio Madanhirea, Charles Mbohwa² 2016). According to TOC, the goal of any company is to make income now and within the future. The author studied the process involving making of the frame and fork assembly. In the manufacturing plant, a bicycle is assembled using 18 different components or subassemblies. These materials are received from different suppliers spread throughout the country the employees which are facing raw materials shortage which is one of the most important constraints faced. There are two reasons for the shortage of raw materials faced. One is that the plant procures raw materials form various part of the country and major parts from the northern India area whereas the plant is situated in the southern India. This may results delay in delivery. Urgent parts deliveries cannot meet because of distance involved. For continuous monitoring of the raw material inventory a colour coded system is used in the department. Inventory is classified as follows and colours are used to indicate the criticality of situation.

Buffer, 90% above - White (crime)

90% to 60% - Green (Ok)

60% to 30% - Yellow (Ideal)

30% to 1% - Red (danger)

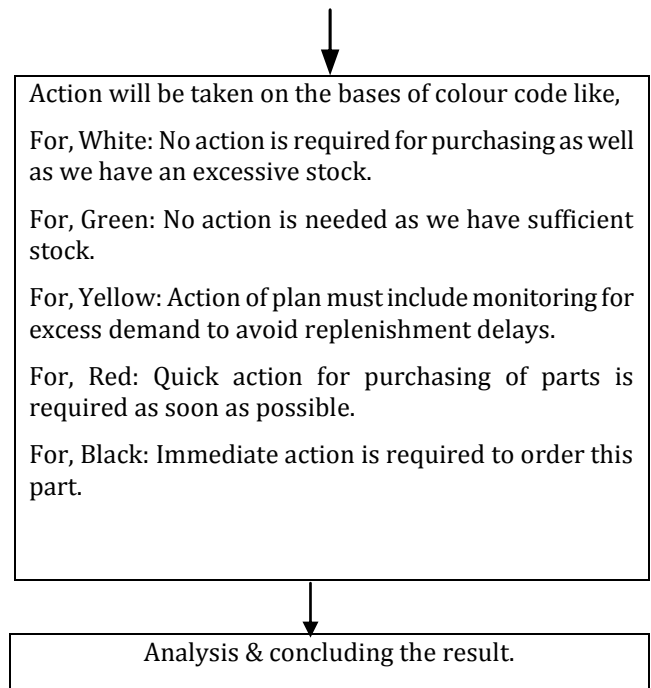
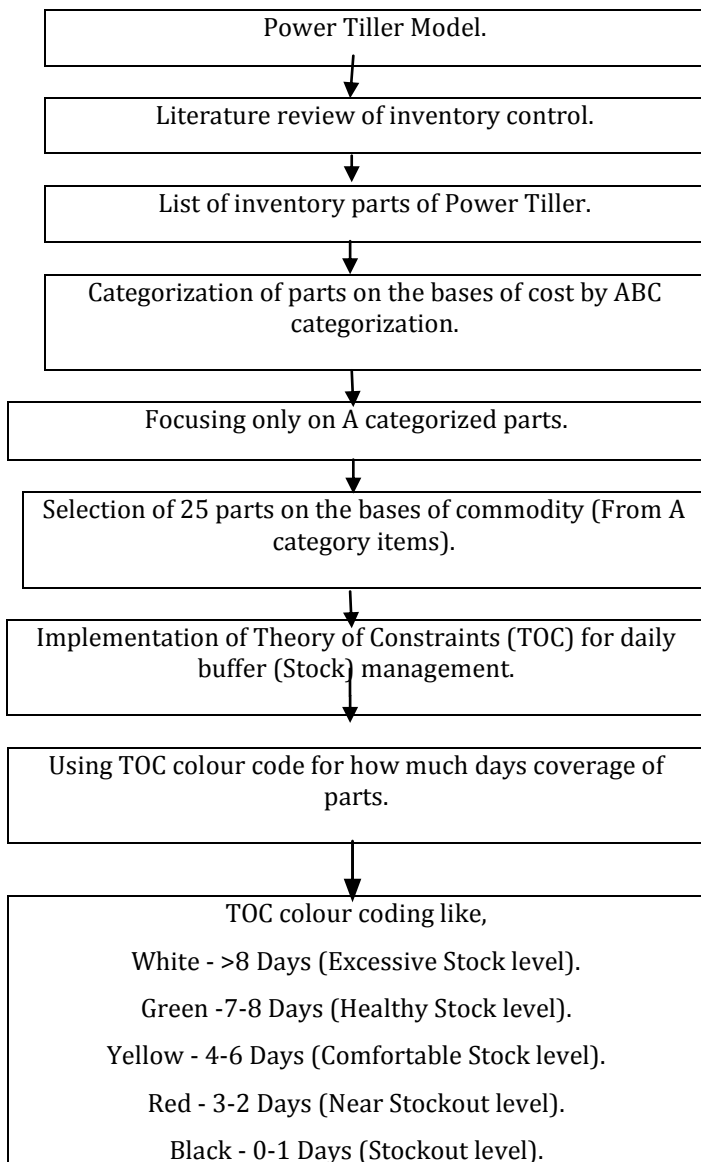
At 0% - Black (highly critical).

The TOC offers a number of benefits including reduced inventory levels, solving bottlenecks.

in raw material procurement, improved coordination between various departments. TOC also helps to reduces work pressure among employees and organization (Harish U.C. 2019). Theory of Constraints (TOC) turns into an essential theory which specializes in the weakest rings in the chain. Concentration on the weakest points which are bottleneck for the entire organization and try to determine the relationship of these bottleneck. In order to make money, Throughput of the system should be increased while its inventory and operating expenses

are being decreased (Zeynep Tugce Simsit, Noyan Sebla Gunay 2014). Theory of Constraints used for replenishment solution for aggregate inventory buffers at the imperative warehouse in plant and changing the mode of operation in push to pull. TOC states that the aggregating the inventory and holding it at the plant warehouse. TOC includes such a method of buffer management and has three objectives, which includes protecting throughput, reducing inventory, decreasing operating expenses. TOC which has divided the buffer into three controlled zones: Green zone, Yellow zone, Red zone. The buffer function works as a warning mechanism. The size of the safety buffer does not affect the maximum buffer size, but does affect the nervous of the system. (Kuo-Jung yuvan, Sheng-hung chang and Rong-kwei Li 2003).

Methodology:



ABC Categorization:

ABC analysis is a popular technique to understand and categories inventories. If you have handling inventory at a plant that manufactures Power Tillers, Each Power Tiller requires several parts (700 nearly) to assemble a machine some of those parts are costly, while some parts are cheap. So, we are categorized parts on the bases of cost by ABC category are as follow

Class	Value	Units
A	70-80%	105
B	15-20%	130
C	5-10%	463

After categorization of parts into ABC category, we are taking 25 parts of A category parts on the bases of commodities such as, Casting, Forging, Proprietary, Sheet metal, Rubber.

Steps in Implementing TOC:

1. Identifying the system constraint: In implementation of TOC, first step is to identify the constraint in the system. Each gadget has at least one constraint that limits its growth. Identifying the constraint in system is necessary, which can be physical, such as a material or managerial weakness such as an inefficient procedure.
2. Determines how to exploit the constraint: Once the constraint is identified, the next step for the organization is to "exploit". You need to plan your

process so as to exploit the constraint. The constraint utilizing every part of the constraining component without committing possibility of valuable changes and/or improves. Effort may be taken sure that the concentration is focused on the constrained process or resource and it is fully utilized.

- Subordinate everything else to the constraint: The next step is subordinate all other activities of your set to the constrained process or resource or in other words, organizations should handle the rest of the system to allow the constraint to operate at most effectiveness.
- Elevate the production of the constraint: The next step is to eliminate the system constraint if above steps were not able to make that process/resources a non-constraint.
- If in any of the above steps the constraint has shifted, go back to step: Last step is to go back to first step and identifying new constraint, as the earlier constraint has been eliminated and go through the cycle of implementation once again.

important which may show the colour coding on the bases of Coverage of parts (In days). Manager can be easily operating it by using this excel sheet for daily buffer management of parts. Only update the daily stock of parts and take the action on the colour coding.

The colour coding is as follows;

White - White colour coding shows that we have excessive stock of the parts. It is applicable when coverage in days is greater than 8 days.

Green - Green colour coding shows that we have healthy stock of parts. It is applicable when coverage in days is 7-8 days.

Yellow -Yellow colour coding shows that we have comfortable stock of parts. It is applicable when coverage in days is 4-6 days.

Red- Red colour coding shows that we are near stock out. It is applicable when coverage in days is 2-3 days.

Black- Black colour coding shows that we are out of stock. It is applicable when coverage in days is 0-1 day.

Buffer Penetration Sheet (Excel Sheet):

Sr.No.	Part Name	Commodity	Monthly plan June	Stock (On Hand)	Under Inspection	In Transit	Total Stock level	Lead Time in Day	One day Requirement	Coverage (In day)	Colour Cod
1	CRANKCASE FOR POWER TILLER	Casting	250	40	0	0	40	15	8	5	White
2	RADIATOR (4R) WITH COOLANT E	Proprietary	594	502	0	0	502	45	20	26	White
3	FLYWHEEL	Casting	625	100	5	0	105	15	21	6	Green
4	CRANK SHAFT FOR POWER TILLER	Casting	666	271	0	0	271	15	22	13	Green
5	MAIN GEAR BOX HOUSING, EXCL	Casting	175	15	0	0	15	15	6	3	Yellow
6	FUEL TANK FOR POWER TILLER	Sheet Metal	573	156	0	0	156	15	19	9	Yellow
7	SHAFT ASSLY ROTARY EXCLUSIVELY	Sheet Metal	150	30	0	0	30	10	5	6	Yellow
8	CAMSHAFT FOR POWER TILLER	Forging	709	50	20	0	70	20	24	3	Yellow
9	INT. GEAR SUPPORT	Forging	1288	70	0	0	70	20	43	2	Yellow
10	INT. GEAR WITH BUSH FOR POWE	Forging	725	20	0	0	20	20	24	1	Yellow
11	GOVERNOR WEIGHT	Forging	1450	300	20	0	320	20	48	7	Yellow
12	SILENCER WITH HEAT SHIELD	Sheet Metal	725	107	0	0	107	10	24	5	Yellow
13	BONNET TOP ASSLY EXCLUSIVELY	Sheet Metal	625	25	2	0	27	5	21	2	Yellow
14	BLADE TILLING LH EXCLUSIVELY F	Proprietary	6500	1728	0	0	1728	30	217	8	Green
15	BLADE TILLING RH EXCLUSIVELY F	Proprietary	6500	1728	0	0	1728	30	217	8	Green
16	MAIN BEARING HOUSING FOR PC	Casting	725	92	0	0	92	15	24	4	Green
17	DECOMP LEVER ASSEMBLY	Sheet Metal	594	40	15	0	55	5	20	3	Green
18	FLYWHEEL COVER EXCLUSIVELY F	Sheet Metal	525	147	56	0	203	5	18	12	Green
19	STARTING GEAR WITH BUSH FOR	Forging	638	125	0	10	135	20	21	7	Green
20	FAN ASSEMBLY	Proprietary	599	318	0	0	318	70	20	16	Green
21	BALL BEARING (6410/3, NBC) FOR	Proprietary	549	10	0	5	15	45	18	1	Green
22	TYRE 612 EXCLUSIVELY FOR POWE	Proprietary	1224	332	0	0	332	45	41	9	Green
23	ANTI VIBRATION PAD FOR DEXKXC	Rubber	702	100	0	0	100	10	23	5	Green
24	TUBE 612 EXCLUSIVELY FOR POWE	Proprietary	1260	296	0	0	296	30	42	8	Green
25	RUBBER FENDER PLATE ASSLY EXI	Rubber	86	273	0	0	273	10	3	96	Green

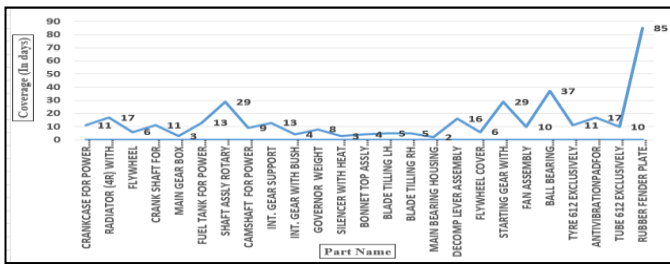
Figure 1- Excel Sheet

The Excel sheet represents, one day status of 25 parts in that there are columns such as Part name which represents part name, commodity which represents the part is which Commodities, Month plan which represents the monthly requirement of each part, taken from MRP, next column is Stock (on hand), Under inspection (UI), In transit those are taken from the ERP software and after that making total of those three columns which is Total stock level. Lead time is different for parts, the next column is One day requirement of part that is calculated from, in one month the days are 30 (Working days) so, we can calculate by Monthly plan to working days. After that the second last column is coverage of parts (In days), which is calculated from, Total stock level to One day requirement. The last one column is very

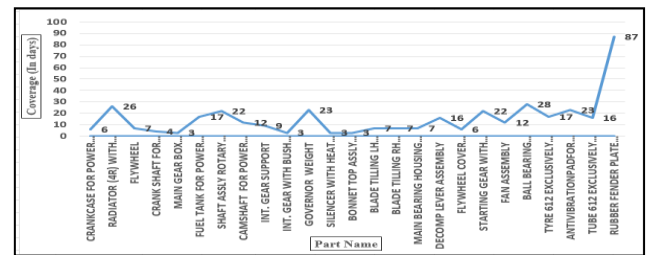
Coverage in Days	Colour code	Colour	Status
>8	White	White	Excessive Stock
7-8	Green	Green	Health Stock
4-6	Yellow	Yellow	Comfortable stock
3-2	Red	Red	Near Stockout
0-1	Black	Black	Stockout

Figure 2- Colour Code

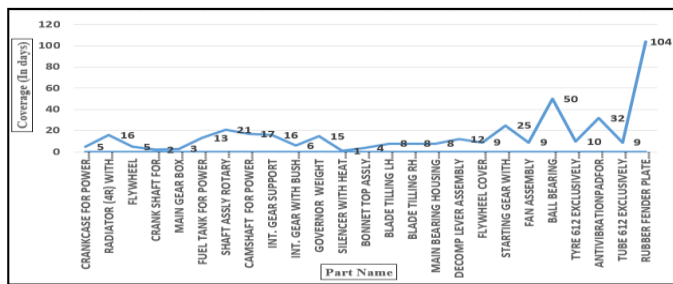
Results:



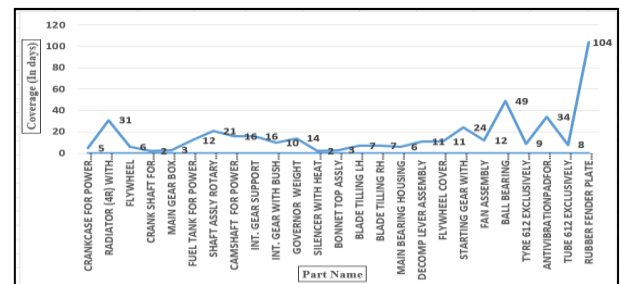
Day One



Day Two



Day Three



Day Four

Conclusion:

This study demonstrates the Inventory Management of Power Tiller plant, in that inventory buffer management planning concept is identified, studied and implemented the main advantage is significantly reduction in the stockouts of parts was observed. Daily data of inventory buffer management to predict and avoid the potential excessive stock of parts or stock outs of the part.

Future Scope:

Demand of the Theory of Constraints for the inventory management is going to be high in the few years. As the demand increases there will be need of proper inventory planning on which the companies revenue depends. If this sheet is workable for these parts, we can use this for other parts which are nearly 3000. We can also automate the sheet by programming in that the daily stock is updated from ERP automatically and the mail will go to the supplier if, he didn't respond then the mail goes to suppliers manager.

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