Study Of Material Requirement Planning Processes & Its Analysis And Implementation (A Case Study Of Automobile Industry)

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Abstract— The Material is the prime requirement of any final product, so that the Material Requirements Planning (MRP) systems are frequently used in any industry. In Material Requirements Planning (MRP) determining lot sizes, Lead time, scheduling in production areas is an essential task of production planning and control. Calculating economic lot size is becoming important in industries Due to the large number of parts and its varieties are available. Higher Lot Size increases the inventory level as well as increases the inventory carrying cost. This paper presents impact of Lot sizes on Material requirement planning (MRP), calculation of lot sizes of items, percentage of decreasing lot sizes & Collection plan, Receipts analysis & without collection plan material inward analysis & reduction in inventory level as well as inventory cost, transportation cost, storage cost by lower lot sizes, Collection plan, Receipts plan, coverage plan & reduces the without collection plan material inward, in order to increase Overall Profit of the organization, greater effectiveness in the production process and better information accuracy.

Index Terms— Just In Time (JIT), Lot Sizing, Material Requirements Planning (MRP), Production Planning and Control (PPC), Safety Stock, Scheduling, Coverage.

1 INTRODUCTION

In manufacturing system production planning, scheduling & inventory control is managed using Material requirements planning (MRP). MRP is a computer based information system in production process for managing dependent demand of inventory items and scheduling stock and replenishment orders. I.e., how much is needed, what is needed & when is it needed. Dependent Demand is a Demand for Parts or row material of assembly which becomes finished goods in production process. Material requirements planning (MRP) is a planning-and-control methodology for manufacturing products and inventory status in any every organization. MRP consists of Master production schedule (MPS), Bill-of-Material (BOM) & Inventory records (IR). (1)A master production schedule (MPS) is a plan for products to be produced in each time period such as production, staffing, inventory etc. It is linked to be manufacturing where the chart shows when and how much of each product will be required in a particular time period. (2)Bill of material contains the parts number of all components, quantity required in the manufacture of a final product and the unit of measure of the parts. (3) Inventory records Manual or computer-based record of the Inventory quantity at hand, work-in process, and on order, It is Also called stock record. From the Computerized MRP software we can plan order to release (i.e. order placed to its supplier for particular amount of quantity for particular items), changes in planned order, scheduling of planned order, planning report, performance control report, inventory reports analysis. MRP is basically suitable for the inventory reduction or lower the inventory level and maximum utilization of the parts in the end product is being assembled or manufactured from a lot of small variety of parts and components. In the MRP system the existing production system is examine first than operations are analyzed that need to be done, system is than arranged in such a way that the products and employees were made compatible with the system. In this Research work end products, its component & subassembly, and the raw material which are requirement during manufacturing, reduction inventory level (by decreasing lot sizes), maximum utilization of the items (increasing consumption of items as per received quantity) are all controlled by MRP system in Lower lot sizes & collection plan, shortage plan, receipts analysis, coverage reports.

2 LITERATURE REVIEW

There is valuable amount of literature available on materials requirement planning (MRP) in the form of research papers, books and articles in Journals. Some of the literature are as follows-

S. Chandraju[2012][6] in a sugar industry MRP is implemented using System Application Product (SAP) Materials Management (MM-Module). By executing SAP (MM-Module) in sugar industry for Material requirement planning, the product can be indented and received within safety period. On the basis of classification of material by ABC analysis, planning can also be done on priority basis by calling vendors for particular commodities online. **Karen Santin[2015][1]** Implemented MRP planning tool in furniture industry using MRP. In this paper improvements were seen in inventory cost reduction, greater effectiveness in the production & manufacturing processes, and better understanding in information accuracy. MRP is implemented, based on related Organizational Changes required and internal personnel allocation. **R. John Milne[2015][4]** In MRP system for determining optimum lead time that is to be used by the system, mixed integer programming model was proposed. The MIP contains a set of integrated constraints that determine planned orders similar to how an MRP system would be while executing these planned orders under capacity and component availability constraints. Experimental results—using data from a DRAM manufacturer—indicate that the

proposed method for determining planned lead time is superior to a commonly used ad hoc method for determining the planned lead time used by an MRP system. **George Ioannou[2012][5]** In a manufacturing system when a new order comes with unique processing requirements it directly enters into make to order manufacturing system for such products based on the current status of the system finishing time is estimated. In this case we focus on the multi machine and multi product manufacturing environment without the knowledge of configuration of resources. For lead time estimation of MRP system simple, iterative algorithms were used. **Vassiliki Manthou[1996][7]** this research work shows the use of MRP in a Greek manufacturing company. The implementation of MRP needs to be considered in a strategic context, since it will impact the whole company, its procedures, methods and culture, and its ability to compete in the market. In this case study it acted as indispensable information technology software. It was used as a data processing system, priority planning, but it was not linked with a capacity planning function.

3 RESEARCH OBJECTIVES

- To study and analyze the material requirement planning on daily, weekly & monthly basis.
- To study the actual Lot size and reducing Lot size based on the consumption value.
- To study the receipts material as per collection plan as well as shortage plan and to find out the shortage quantity of material so that over production will be continuing.
- To make a coverage plan for the Parts blocking & unblocking in order to control the Excess material & without collection plan material inward.
- To calculate percentage savings of the organization.

4 METHODOLOGY ADOPTED

4.1 Listing of data required

Based on the objectives of research work data required are collection plan, shortage plan and receipts plan on daily, weekly and monthly basis. In shortage plan we collect the data regarding the components which are in insufficient quantity and have to be received as early as possible. After framing shortage plan we move to collection plan where we order the required amount of various parts and components from selected vendors. In receipt plan items are received in different lot sizes depending on collection plan.

4.2 Data collection

This research work is based on an automobile assembling company. This company assembles many parts in a real time basis. As the number of parts enormous, I have selected specific and vital parts and the recorded data is logically arranged is presented in following table.

Table 1:

Parts	Description	Price	Lot size	shortage plan	Collection plan	Receipt plan
ID502976	FUEL INJECTION PUMP	17300	24	8	8	30
ID311702	REAR AXLE HOUSING	17088	28	6	7	28
ID351190	AXLE Hou. PRO3012	16398	10	2	4	20
ID203965	FUEL INJECT E483 TC	15687	35	12	17	70
ID801882	Propeller Shaft	14633	20	27	36	30

4.3 Data analysis and understanding outcome

Lot size calculation

For Example: - Part Name: - IC308615 Part Description: - SHOCK ABSORBER

Data Type	Description	Calculation
Last 5 Months Received	June+ July+ August+ September+ October	117
Last 5 Months Consumption	June+ July+ August+ September+ October	64
Map (Price)	Actual price of the parts	249.69
Actual Lot sizes	Quantity of an items ordered for delivery on a specific date	100
Calculated Lot Size	Sum of Consumption Quantity / 10 (i.e. fulfil the requirement of 2 Lots in every month)	64/10=6.4
Strategic/common	I.e. Parts are strategic/critical or common/regular part	common/regular
Mode	Maximum number of times on which we received Lot quantity	20
Lead time	Less than 2 Days	2 days

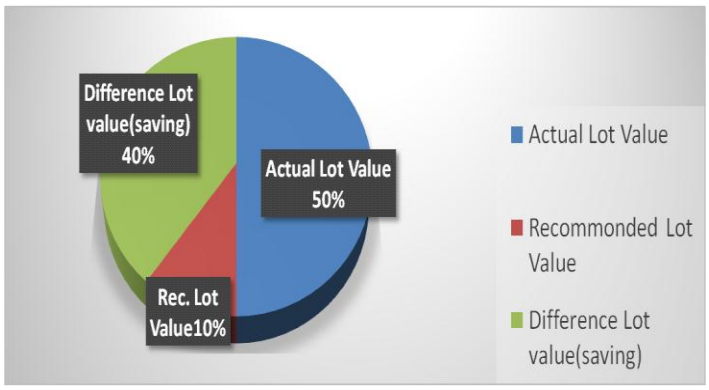
Packaging standard	As per mode quantity or equal to mode quantity	20 (1 Big box contains having 2 small box of 10-10 quantity)
Recommended Lot size	Based on the calculated lot sizes , mode, lead time & packaging standard	20

Actual Lot sizes Value	Lot quantity * Map	100*249.69 = 24969
Recommended Lot size value	Recommended Lot * Map	20*249.69 = 4993.8
Difference in lot value (saving)	Actual Lot sizes Value - Recommended Lot size value	24969-4993.8 = 19975.2

Lot Size Calculation

Lot Size Calculation Table

Part	Description	5Months Receipts	5Months Consumption	MAP	Lot Size	Cal. Lot Size	Rec. Lot Size	Mode	Packaging standard	Lot Value	Rec. lot Value	Diff. Lot value
IC308615	SHOCK ABSORBER	117	64	249.69	100	6.4	20	10	10	24969	4993.8	19975.2
ID336914	9 SPEED PTO	46	7	178781.7	15	0.7	8	8	8	2681725	1430253	1251472
ID802229	TRANSMISSION	132	41	176581.5	54	4.1	16	8	16	9535401	2825304	6710097
ID802230	TRANSMISSION	57	10	165828.4	260	1	10	10	10	43115392	1658284	41457108
ID801683	REAR AXLE	20	8	123031	20	0.8	10	10	10	2460621	1230310	1230310
ID802263	REAR REAR AXLE-5.24	20	9	79048.94	20	0.9	10	10	10	1580979	790489.4	790489.4
ID801760	TAG AXLE	16	3	73883.36	8	0.3	4	4	4	591066.9	295533.4	295533.4
ID338547	REAR AXLE HOUSING	101	83	34959.18	24	8.3	12	12	12	839020.3	419510.2	419510.2
ID353167	MUFFLER17L, HORI.	124	97	32405.81	27	9.7	14	14	14	874956.9	453681.3	421275.5
ID801501	HUB CASING	314	186	31376.51	200	18.6	50	50	50	6275302	1568826	4706477
ID800480	MUFFLER, VER BSIV	38	31	30797.9	16	3.1	10	5	10	492766.4	307979	184787.4
ID314230	REAR AXLE HOUSING	73	65	29424.78	18	6.5	12	12	12	529646	353097.4	176548.7
IF001454	20.15 AIR SUSP. KIT	10	6	28144	15	0.6	5	5	5	422160	140720	281440
IC802305	WHEEL PRESSED H185	21	17	25897.87	120	1.7	18	18	18	3107744	466161.7	2641583
ID501766	FIP, 101KW CEVIII ENGINE	64	38	19740.06	20	3.8	8	8	8	394801.2	157920.5	236880.7
ID334844	FUEL INJECTION PUMP	421	225	18651.9	46	22.5	30	10	10	857987.4	559557	298430.4



Lot Size Calculation Diagram

Calculation of without collection plan material & Collection v/s Receipts Analysis

- Download shortage plan from SAP software.
- To check the coverage plan, study of shortage plan, bill of material & calculate the actual need of items for Roll out vehicles & safety stocks.
- Based on the Coverage plan to be opening & blocking of the Parts for the material inward and control without collection plan material as well as excess material.
- **Calculation of short w/o norms for blocking / Unblocking part :-**

(CMS Qty + PLR Qty – No. of vehicle Coverage + Gate entry – Rejection Qty – CSPD plant – store Safety stock - Norms)
For Part ID801501 Short w/o norms = 1952+0-31+0-0-0-2-760 = 1159
Month End =IF (((Total Qty+ Gate entry –Rejection)-(store safety stock +Norms))>0,"Excess", "Short")

Part Code	Description	MAP	3106 Vehicle Cov.	Warehouse Norms	Gate Entry	Dispatch	In Warehouse	In Transit	Short w/o Norms	Days Covered	Month End	% of stock	Block/Unblock of Parts
ID801501	HUB CASING	32900	31	760	0	0	0	0	1159	>60 days	Excess	98 %	Block
ID333286C	CYLINDER BLOCK CASTING	10245	1263	1993	0	0	0	0	-531	08-10 days	Short	54 %	Open

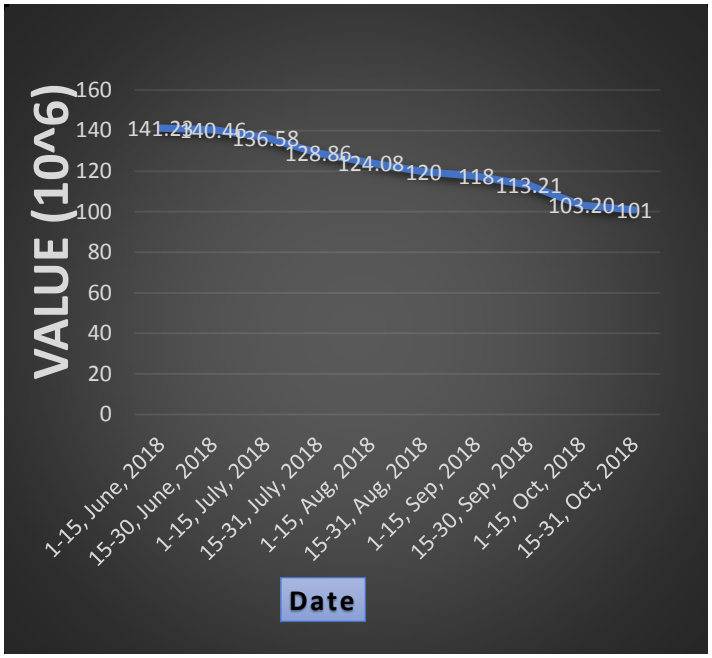
Coverage Plan Report

For Example

- Part ID801501 is Covered for >60days (Excess material for Month End) **-Block Part**
- Part ID333286C is not Covered for Month end (i.e. requirement of the part) **– Open Part**

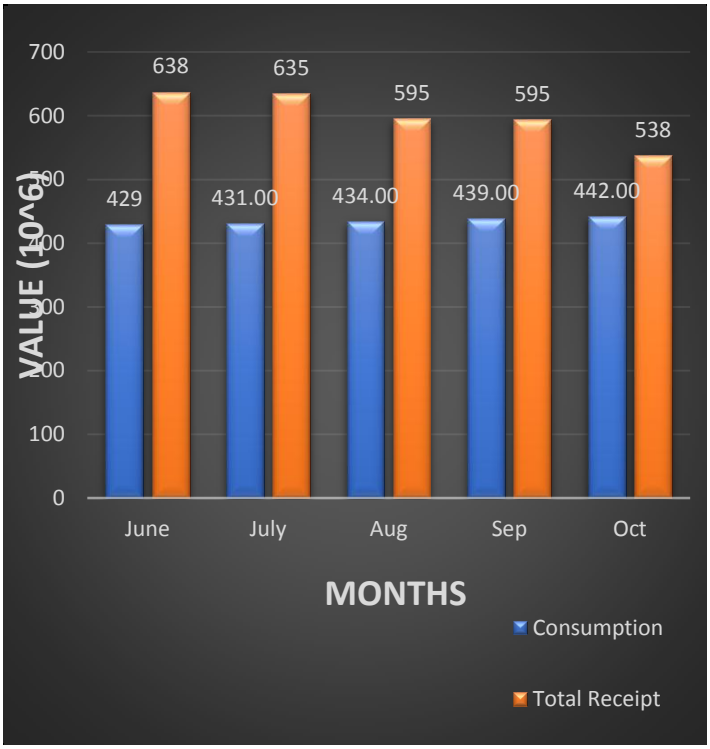
Date	Collection plan value	Count of no of parts in collection	Collection receipt value	Receipt Other Then collection plan(without collection value)	FA/FR/RA/SF/TM/RAH/Seat/Cowl	Others + Machine items
1-15, June, 2018	91.11	2783	121.26	141.23	34.78	32.14
15-30, June, 2018	85.12	2643	101.63	140.46	41.65	24.32
1-15, July, 2018	111.2	2521.00	135.76	136.58	32.73	30.92
15-31, July, 2018	83.90	2295.00	104.86	128.86	39.57	26.09
1-15, Aug, 2018	100.13	2218.00	124.95	124.08	37.87	22.54
15-31, Aug, 2018	92.30	2790.00	102.28	120	32.80	30.95
1-15, Sep, 2018	124.07	3692.00	129.91	118	46.14	29.14
15-30, Sep, 2018	101.66	2899.00	113.65	113.21	31.38	13.52
1-15, Oct, 2018	85.16	2012.00	97.80	103.20	31.28	29.12
15-31, Oct, 2018	104.04	2697.00	109.76	101	40.79	25.00

Receipts other than collection plan



Receipts other than collection plan

Month	Collection plan value	Collection receipt value	Receipt Other Then collection plan	FA/FR/RA/SE/TM/RAH/Seat/Cowl	Others + Machine	Consumption	Total Receipt	Percent Total Received Against Consumption
June	176.23	222.89	281.83	76.43	56.46	429.00	638	67%
July	195.11	240.62	265.44	72.30	57.01	431.00	635	68%
Aug	192.43	227.23	243.92	70.67	53.49	434.00	595	73%
Sep	225.73	243.56	230.77	77.52	42.66	439.00	595	74%
Oct	189.56	207.56	204.12	72.07	54.12	442.00	538	82%



Collection V/s Receipts Analysis

4 RESULTS

- By reducing the proper lot size of items/parts we are saving 40% Lot value of the total Lot size values and reduces the inventory as well as inventory carrying cost & Material handling cost.
- By Proper shortage, coverage plan, store report analysis we reduces material inward of without collection plan material from 141.23 to 101 value of MINR (10^6) of total material received in 5 months.
- From collection plan, receipts plan Analysis, we reduces the without collection plan material inward so that material inward as per collection plan & applied the Lot sizes working analysis, receiving of material is decreased (b/c of Excess material are not inward and Decreases Lot Sizes of items based on consumption) & Received Against Consumption percentage increase from 67% to 82.

5 CONCLUSION

Minimum Lot sizes of all items based on Economic order quantity, Lead time, packaging standard, effectiveconsumption of material, material receiving. Safety stock reduces the inventory cost, transportation cost, packaging cost etc as well as increases the overall profit of the company. By checking the proper shortage plan & find out shortage quantity of items that should be in next day collection plan, so that it Reduces the without Collection plan material (i.e. higher authority approval) & Reduces shortage of

critical parts during manufacturing. By making Daily coverage reports reduces the without collection plan material, basis on parts blocking/unblocking & Scheduling, so that proper material inward, Consumption & avoid unnecessary material handling problem as well as material handling cost. It can be concluded from the results that the food quality provided by the system is good enough to attract most of the students of the area, and rates of the food items are also cheaper than other nearby food services. But the problem arises due to space and number of workers. The load on staff is more than they can handle. Survey showed that many students, who find it frustrating to wait for so long at the system, still prefer to go there instead of any other place due to quality and hygiene of food. Many students want to join the system but they don't because of the high waiting time. Hence, space and number of staff must be increased in the system.

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