ANALYSIS OF DETERMINING RAW MATERIAL REQUIREMENTS EFFECTIVELY AND EFFICIENTLY BY APPLYING THE MRP METHOD

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Received: July, 2022; Accepted: August, 2022; Published: September, 2022

ABSTRACT

This research aims to analyze the effective and efficient lot sizing method for determining raw material requirements in implementing MRP. The research stages are through testing 3 lot sizing methods namely LFL, EOQ, and POQ. The initial stage of data processing is in the form of a MPS obtained from demand recap data and BOM which are components of the product as input. The next step is the MRP process, namely the netting process, the lotting process, the offsetting process, and the explosion process. This stage is in the form of a MRP matrix in tabular form. The next step is to enter the inventory cost calculation process for each method consisting of the storage cost of each component per period and the ordering cost per message. Calculations are carried out for each method to determine the amount of absorption of inventory costs from each method. The results show that the LFL method absorbs inventory costs of Rp.240,000,000, the EOQ method absorbs inventory costs of Rp.251,503,100 and the POQ method absorbs inventory costs of Rp.261,027,683. In this case, LFL has the lowest absorption of inventory costs, according to the current state of the company, does not leave inventory, and is easy to implement for the company. The study results concluded that the most effective and efficient method is LFL according to the current state of the company, does not leave inventory, and is easy to implement for the company. The study results concluded that the most effective and efficient method is LFL according to the current state of the company, does not leave inventory, and is easy to implement for the company. The study results concluded that the most effective and efficient method is LFL

Keywords: raw materials, lot sizing, Material Requirement Planning (MRP)

INTRODUCTION

High quality products through the production process with precise accuracy effectively and efficiently. According to Windarti and Ibrahim (2017) the consistency of needs and desires for each product into product quality and specifications is a condition related to products, human and natural services to meet buyer expectations. In fulfilling the need for orders, companies often carry out the production process several times to maintain the quality of their products. This is due to a decrease

in product quality which was originally classified as a grade A product to a grade B product each time it is produced. The following is a table of grade reduction data in January-October 2021.

The company sets a tolerance limit for grade A grade reduction of 8.5% each time it is produced. Table 1 shows that in January, May, July, September and October the company's tolerance limit was exceeded. The problem faced by companies related to the decline in product quality is that raw materials are often damaged so that they do not meet the standard of raw materials.

Table1. Pallet Production

Month	Production Grade A	Production Grade B	Percentage
January	1025	100	9.76%
February	965	80	8.29%
March	898	65	7.24%
April	2025	125	6.17%
May	1200	124	10.33%
June	984	80	8.13%
July	919	95	10.34%
August	800	60	7.50%
September	780	70	8.97%
October	820	80	9.76%

Source: Rafansa (2021)

This happens because the company does not implement ordering scheduling, the amount of raw material needed, the time needed for raw materials and production time so that it has an impact on product quality because the production process is less effective and efficient. With the existing problems, the researcher proposes to apply MRP in controlling raw material inventory. According to Heizer and Render (2015; 642) Material Requirements Planning (MRP) has benefits as a better response to customer orders as the result of improved adherence to schedules, faster response to market changes, improved utilization of facilities and labor, and reduced inventory level. According to Eddy Herjanto (2010:276) the purpose of Material Requirements Planning (MRP) is to minimize inventory, reduce risk due to production or delivery delays, realistic commitments, and increase efficiency.

LITERATURE REVIEW

Definition of Supply

According to Jacobs and Chase (2016) the supply of goods and resources used by the company for the course of the production or operational process. Inventory will become a large asset at a certain time so that the statement of financial position and inventory is difficult to cash back so the company suppresses inventory in the company

called inventory.

According to Karongkong et al (2018) an item that is stored for a certain period depends on the demand period or which will be resold in the next period for the use of a separate company called inventory.

MRP

Heizer and Render (2016) a suspended demand technique that utilizes material inventory expected receipts and material requirements planning. Diana (2013) the concept that analyzes related to the right way in planning the needs of goods in the production process so that the goods that are needed can be available according to expectations and when needed.

Lot sizing on MRP

Lot For Lot (LFL) is one of the lot size determination techniques that produces exactly as needed. The decision is consistent with the MRP objective, which is to meet the needs of the dependent request. The Lot For Lot (LFL) technique orders materials only when they are needed. If the company already has the cost of ordering (preparation), the cost of holding each unit for a certain period of time, and a production schedule, the company can enter the order into the company's net needs plan.

EOQ is the value of the amount of material needed during each purchase using the most economical cost. The formula used in calculating EOQ according to Sugiono (2009) is:

$$EOQ = \sqrt{\frac{2SD}{H}}$$

The technique of determining the lot size for meeting material needs based on the number of demand periods that must be fulfilled (excluding zero requests) for each order is called POQ. The formula used in the POQ technique according to Martono (2018) is as follows:

$$POQ = \frac{EOQ}{Rata - rata\ permintaan\ tiap\ periode}$$

METHOD

The researcher conducted interviews with the owner of the company as well as the leader of the company to find out the main problems at this time, the product that was having problems, the production process and the company's business flow. Researchers also conducted direct field observations to find out the causes of the problems that occurred and the production process

DIE: Jurnal Ilmu Ekonomi dan Manajemen
ISSN. 0216-6488 (Print), 2775-7935 (Online)

directly. The initial step in implementing MRP is input in the form of MPS data, BOM and Inventory Costs. MPS is an arrangement of finished product requirements consisting of a schedule of needs and the number of needs in the short term. BOM is the structure of the product that composes the final product on the pallet product which is divided into 3 levels starting from finished or final products, semi-finished products and raw materials as listed in Figure 1.

RESULT AND DISCUSSION

Table2. Master Production Schedule (MPS)

Year	January-December 2021											
	Needs plan											
Month	1	2	3	4	5	6	7	8	9	10	11	12
Master Production Schedule(MPS) TOTAL	1085	1040	963	2140	1300	1089	1014	900	860	940	1210	1320
Grade A . Pallets	1025	965	898	2025	1200	984	919	800	780	820	1065	1260
Grade B . Pallets	60	75	65	115	100	105	95	100	80	120	145	60

Source: Rafansa (2021)

The next stage of MRP is the MRP process which consists of the netting process, the lotting process. offsetting process and explosion process. The MRP process is summarized in the form of an MRP matrix which directly applies 3 lot sizing methods.

Figure1.Bill of Materials(BOM) ProductPallet

Table3. Storage Fee

No	Items	Nominal
1	Grade A . Pallets	1,667
2	Board Assemblies	833
3	Beam 1000mm	167
4	Beam 1000mm	167
5	Foot	125
6	Beam 1200mm	250
7	1030mm . spindle	1,250
8	1030 spindle	1,250
9	1030 spindle	1,250
10	1300 spindle	1,250

Source: Rafansa (2021)

Table4. Ordering Fee

Information	Nominal	Time	Unit
Shipping costs	2,000,000	1	One time delivery

Source: Rafansa (2021)

LFL

The MRP stage uses the LFL lot sizing method. Figure 2 lists the MRP matrix using the LFL method at level 0. At level 0 there are only finished products in the form of pallets.

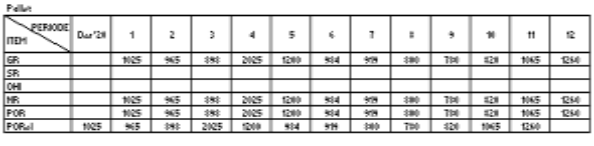


Figure 1. MRP Matrix Level 0 LFL

Figure 2. LFL Level 1 MRP Matrix

Figure 3 lists the MRP matrix using the LFL method at level 1. At level 1 there are 2 items in the form of semi-finished goods and 1000mm beams.

Figure 4 lists the MRP Matrix using the LFL method at level 2. At level 2 there are 4 items in the form of 1000mm beams, legs, 1200mm beams and 1030mm logs.\

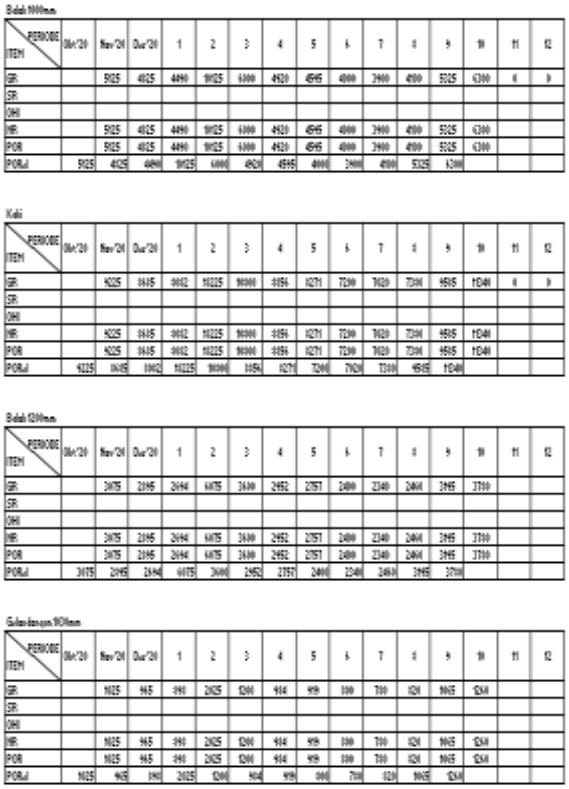


Figure 3. MRP Level 2 LFL Matrix

Figure 5 lists the MRP Matrix using the LFL method at level 3. At level 3 there are 3 items in the form of 1030mm logs, 1030mm logs and 13000mm logs.

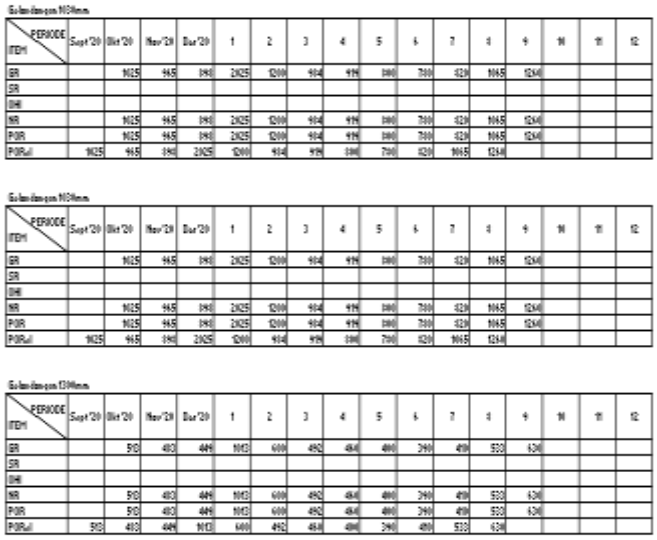


Figure 4. MRP Level 3 LFL Matrix

EOQ

The MRP stage using the EOQ lot sizing method in Figure 6 lists the MRP matrix using the EOQ method at level 0. At level 0 there are only finished products in the form of pallets. Figure 7 lists the MRP matrix using the EOQ method at level 1. At level 1 there are 2 items in the form of semi-finished goods and 1000mm beams.

Pallet

PERIODE / ITEM	Des'20	1	2	3	4	5	6	7	8	9	10	11	12
GR		1025	965	898	2025	1200	984	919	800	780	820	1065	1260
SR													
OHI		571	1202	304	1471	271	883	1560	760	1576	756	1287	27
NR		1025	394		1721		713	36		20		309	
POR		1596	1596		3192		1596	1596		1596		1596	
PORel	1596	1596		3192		1596	1596		1596		1596		

Figure 5. MRP Matrix Level 0 EOQ

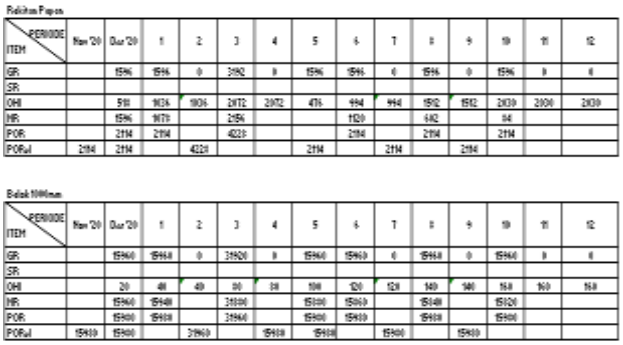


Figure 6. Matrix MRP Level 1 EOQ

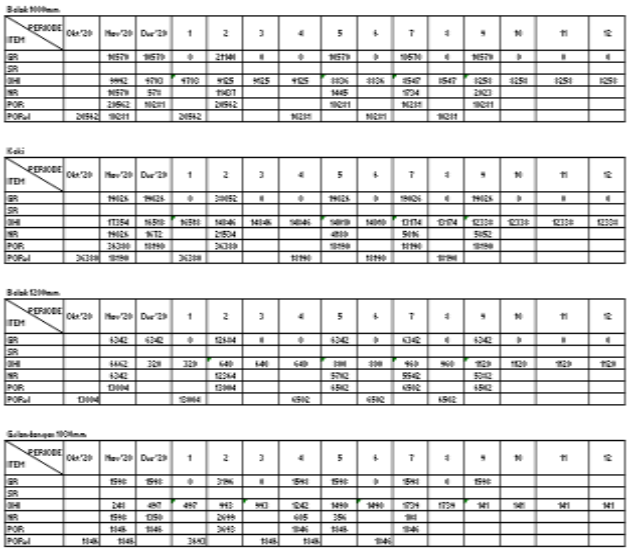


Figure 7. MRP LEVEL 2 EOQ MATRIX

Figure 8 lists the MRP Matrix using the EOQ method at level 2. At level 2 there are 4 items in the form of 1000mm beams, feet, 1200mm beams and 1030mm logs.

Figure 9 lists the MRP Matrix using the EOQ method at level 3. at level 3 there are 3 items in the form of 1030mm logs, 1030mm logs and 13000mm logs.

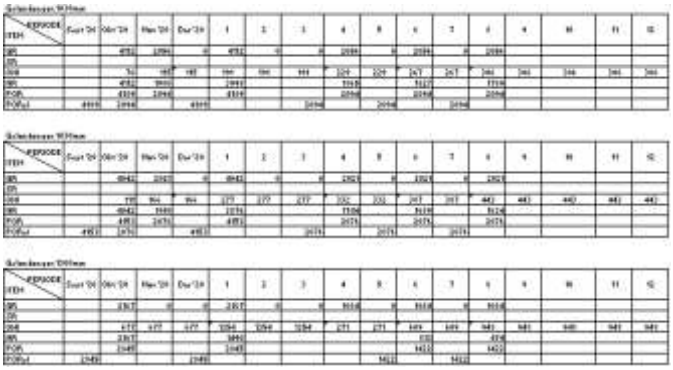


Figure 8. MRP Level 3 EOQ Matrix

POQ

The MRP stage using the POQ lot sizing method in Figure 10 lists the MRP matrix using the POQ method at level 0. At level 0 it is only a finished product in the form of a pallet. Figure 11 lists the MRP Matrix using the EOQ method at level 1. At level 1 there are 2 items in the form of semi-finished goods and 1000mm beams.

Pallet

PERIODE / ITEM	Dec'20	1	2	3	4	5	6	7	8	9	10	11	12
GR		1025	965	898	2025	1200	984	919	800	780	820	1065	1260
SR													
OHI		965	0	2025	0	984	0	800	0	820	0	1260	0
NR		1025		898		1200		919		780		1065	
POR		1990		2923		2184		1719		1600		2325	
PORel	1990		2923		2184		1719		1600		2325		

Picture9. Matrix MRP Level 0 POQ

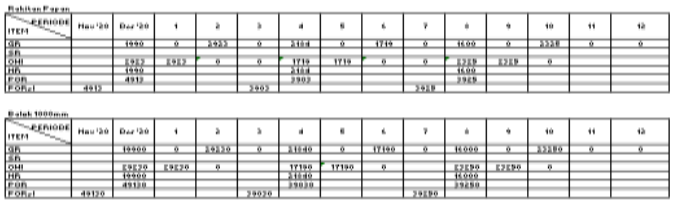


Figure 10. MRP Level 1 POQ . Matrix

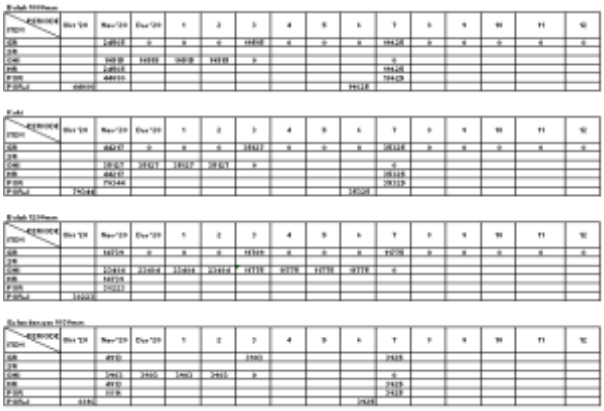
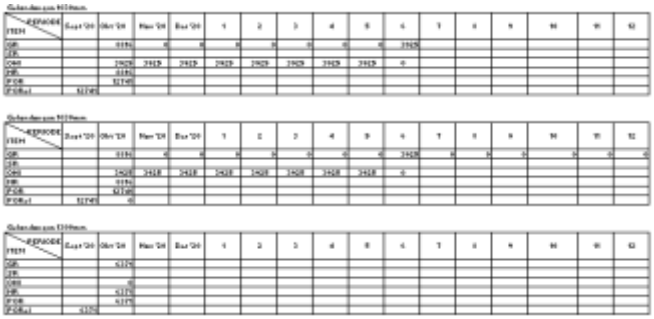


Figure 11. MRP Level 2 POQ Matrix

Figure 12 lists the MRP Matrix using the POQ method at level 2. At level 2 there are 4 items in the form of 1000mm beams, legs, 1200mm beams and 1030mm logs.

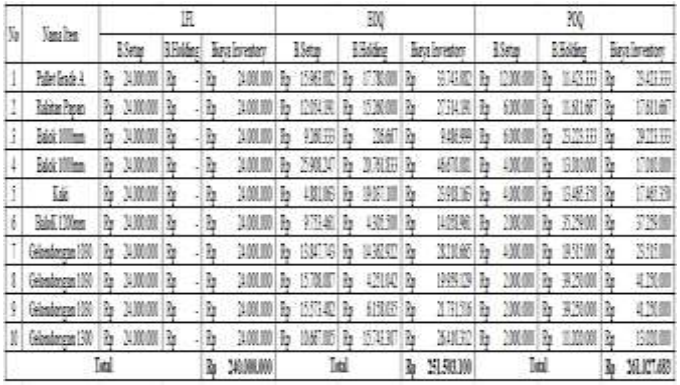


Picture12. Matrix MRP Level 3 POQ

Figure 13 lists the MRP Matrix using the EOQ method at level 3. At level 3 there are 3 items in the form of 1030mm logs, 1030mm logs and 13000mm logs.

Discussion

The results of this study include the MRP calculation process using 3 (three) methods, namely LFL, EOQ and POQ. The LFL method minimizes inventory by emphasizing ordering according to needs in a certain period and not leaving inventory so that the costs absorbed by the LFL method are lower than the EOQ and POQ methods. In accordance with the expectations of companies and researchers to minimize costs and minimize ordering excess needs that lead to storage of raw materials and finished products where the company is less competent in this regard. With these results it can be seen that the lfl method is a suggestion for calculating the future mrp matrix for the company



Picture13. Result of Cost Evaluation Method*Lot Sizing*

Table 5 lists the output of the MRP in the form of a monthly pallet raw material requirement report where the company will find it easier to read the results of the MRP. In looking for and calculating table 5, the researchers carried out stages in the form of recapitulation per order and per month so as to produce reports on raw material needs.

Table5. 2021 Raw Material Needs Report

Month Items	1030 mm . spindle	1030mm . spindle	1030mm . spindle	1300mm . spindle
January	0	1148	1148	1148
February	1148	1265	1265	1265
March	1265	950	950	950
April	950	734	734	734
May	734	919	919	919
June	919	1150	1150	1150
July	1150	780	780	780
August	780	920	920	920
September	920	1170	1170	1170
October	1170	0	0	0
November	0	0	0	0
December	0	0	0	0

Source: Rafansa (2021)

In planning the raw material requirements using the MRP method, the researcher tested 3 (three) lot sizing methods using 2021 data. The 2021 LFL method did not cause storage on pallet products so that the costs incurred due to storage were Rp. 0 and the results of calculating the total cost inventory of rp 240,000,000. The EOQ method causes storage on pallet products so that the costs incurred due to storage are Rp. 117,886,406 and the result of calculating the total cost of inventory is rp. 251,503,100. In the POQ method in 2021, it causes storage of pallet products so that the costs incurred due to storage are Rp. 217,027,683 and the result of calculating the total cost of inventory is rp 261,027,683.

CONCLUSION

Testing with 3 lot sizing methods on the application of MRP in companies shows that the LFL method is better than the EOQ and POQ methods. The LFL method does not cause inventory which has been a source of problems for the company due to lack of competence in storage, the LFL method is in accordance with the current state of the company, the LFL method is much easier to implement into the company and the inventory costs incurred are much less than the EOQ method. and the POQ is in line with the company's expectations regarding reduced storage costs. So it can be concluded that the most effective and efficient method for companies today is the LFL method.

Suggestion

Researchers provide suggestions

to further researchers to be able to apply to other companies with different cases and different types of products. So that it will add insight to the reader that the results of research using the same lot sizing method are not necessarily the same results.

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