

Planning and Controlling Raw Material of Balado Seasoning Using Material Requirements Planning (MRP) Method

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Abstract

The purpose of this research is to know the master production schedule, Bill of Materials (BOM), and lot sizing techniques for Balado seasoning products at PT. XYZ. The research method used is a quantitative method with the type of descriptive research, where research is done by collecting, preparing, and analyzing data to get a clear picture of the problem under study. Data collection is done through interviews and secondary data based on data provided by the company. Data analysis method uses the MRP (Material Requirement Planning) method, and in the MRP system, there are three techniques in determining the lot size or commonly called the Lot Sizing technique namely Lot for Lot, EOQ (Economic Order Quantity) and POQ (Order Quantity Period). Based on the calculation of Lot sizing it can be concluded that the lot-sizing technique for Component G, Component H and Component K that produces the optimal lot size is the Period Order Quantity (POQ) technique. While for other components that produce the optimal lot size is the Lot For Lot technique.

Keywords

Toknow, BOM, Balado, POQ and Planning.

1. Introduction

The increasingly fierce competition in the Manufacturing Industry requires companies to be more competitive so that they can win the existing market. Demand that is sometimes very uncertain is one of the causes of competition in the Manufacturing Industry to become increasingly fierce. This condition encourages companies to compete in meeting customer needs and providing services to customers. Based on data from the Central Statistics Agency (Badan Pusat Statistik Indonesia 2018), the growth of large and medium manufacturing industries can be seen in Figure 1.

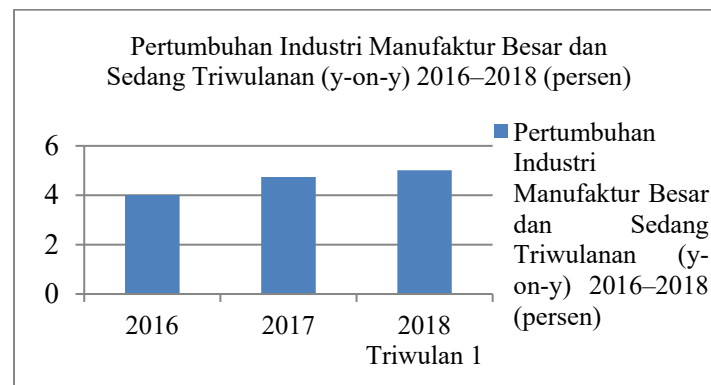


Figure 1. Growth of large and medium manufacturing industries quarterly (y-on-y) 2016-2018

PT XYZ is a manufacturing industry that produces spices, Dried Mixes (seasoning, herbs, and spices), Dried Products (shrimps, shrimps paste, tamarind, herbs, spices), chili paste, seasoning oil and sterilized chili and tomato sauce. The company, which was founded in 2001, provides added value to the food industry both domestically and abroad. The

concept of PT. This XYZ is to become an Intermediate Industry, namely as an intermediary industry between agro products and the Foods and Beverages Industry. So, the fresh ingredients obtained from suppliers are processed into spices in the form of powder or paste for later use in the manufacture of food by other companies. Of the many products at PT. XYZ, Balado Seasoning is a product whose quantity of demand is quite large and fluctuating. This can be seen in Table 1:

Table 1. Data of balado seasoning demand in 2016 and 2017

Period	Month	Demand	Unit
1	June '17	-	-
2	July '17	-	-
3	August '17	4,000	Kg
4	September '17	4,000	Kg
5	October '17	-	-
6	November '17	3,000	Kg
7	December '17	-	-
8	January '18	-	-
9	February '18	6,000	Kg
10	March '18	3,000	Kg
11	April '18	3,000	Kg

PT XYZ has not implemented or does not yet have a material requirements planning system using special methods. So sometimes companies experience excess or lack of raw materials where it has an impact on production activities and storage costs. Following are the data needs and availability of Balado Seasoning raw materials at PT. XYZ from June 2017 to April 2018 (table 2):

Table 2. Data needs and availability of balado seasoning raw materials in June 2017-April 2018

Komponen (KG)		Jun	Jul	Agst	Sept	Okt	Nov	Des	Jan	Feb	Mar	Apr
Komponen A	Kebutuhan	0	25	0	0	25	0	25	0	0	0	2,475
	Ketersediaan	0	25	25	25	0	25	0	0	0	0	25
Komponen B	Kebutuhan	0	146	40	260	707	725	1,445	780	171	694	741
	Ketersediaan	96	0	24	225	0	1,205	400	171	494	741	0
Komponen C	Kebutuhan	1,500	500	750	500	1,050	1,275	625	550	750	0	1,525
	Ketersediaan	2,750	875	800	750	6,450	517	455	400	325	0	1,375
Komponen D	Kebutuhan	6,725	9,000	15,500	5,575	20,675	5,800	5,800	6,350	5,575	9,350	0
	Ketersediaan	11,425	6,425	9,925	12,850	6,375	9,775	13,975	7,625	11,050	5,700	5,425
Komponen E	Kebutuhan	7,300	5,500	16,400	11,800	9,600	0	8,100	10,400	11,700	9,850	7,350
	Ketersediaan	8,750	5,750	6,300	1,250	11,600	0	0	2,600	5,850	1,000	6,200
Komponen F	Kebutuhan	7,025	7,750	16,325	11,600	18,975	7,500	11,200	12,175	13,850	13,175	10,900
	Ketersediaan	3,825	6,075	5,675	7,100	13,125	15,625	9,425	2,850	4,800	6,625	5,000
Komponen G	Kebutuhan	300	300	315	105	380	120	160	340	0	200	200
	Ketersediaan	60	100	482	400	20	200	40	0	440	240	40
Komponen H	Kebutuhan	3,650	4,415	8,295	595	12,935	3,360	1,215	790	510	3,630	6,450
	Ketersediaan	6,725	9,630	6,095	830	3,965	4,305	10,950	12,300	1,179	11,160	5,740
Komponen I	Kebutuhan	1,050	375	850	475	800	850	600	575	625	500	695
	Ketersediaan	525	1,650	800	825	1,025	1,675	1,075	1,500	1,175	675	680
Komponen J	Kebutuhan	1,825	1,525	1,975	2,175	4,300	375	2,175	575	2,400	2,475	750
	Ketersediaan	2,650	1,125	2,150	3,475	1,675	330	1,125	1,550	650	175	2,400
Komponen K	Kebutuhan	210	20	40	80	1,010	410	740	360	160	890	610
	Ketersediaan	0	0	960	88	1,870	1,710	1,220	860	1,500	610	0
Komponen L	Kebutuhan	1,500	2,000	4,200	350	7,025	1,175	625	825	400	1,875	0
	Ketersediaan	7,050	4,950	4,250	390	2,875	3,700	3,075	2,259	1,850	275	300

Based on table 2, there is a shortage or oversupply of Balado seasoning raw materials, so planning and controlling are needed so that the needs can be adjusted. For the planning, the Material Requirement Planning (MRP) method will regulate the plan through the forecasting process which will be the basis for the preparation of Material Requirement Planning which describes starting from the request, the amount of inventory, up to the number of items planned to be ordered. Materials Requirements Planning (MRP) is the best way to do production planning and determine net requirements. To determine net requirements requires a decision about how much and when to order, this is called Lot Sizing. There are three Lot Sizing techniques, namely Lot for Lot, Economic Order Quantity, and Order Quantity Period (Heizer et al. 2017).

The problem formulation in this study relates to the company's internal conditions, namely how many raw materials must be planned to make Balado Seasoning reduce the shortage or oversupply of raw materials at PT. XYZ; How the Material Requirement Planning (MRP) method provides a solution to the inventory cost at PT. XYZ; What control techniques in the Material Requirement Planning method are appropriate for controlling Balado Seasoning raw materials at PT XYZ.

The purpose of this research was to determine the amount of raw material that must be planned to make Balado Seasoning to reduce the shortage or oversupply of raw materials at PT XYZ, to find out how the Material Requirement Planning (MRP) method provides solutions to inventory costs at PT XYZ and to find out the control techniques in the appropriate Material Requirement Planning method for controlling Balado Seasoning raw materials at PT XYZ.

2. Research Method

The research method used is quantitative. There are two data sources for data collection, namely primary data and secondary data. Primary data obtained directly from interviewees through interviews. In this study, primary data sources were obtained from interviews with the General Manager of PT. XYZ Furthermore, secondary data is obtained from the internet, literature, and companies such as data needs and availability of Balado Seasoning raw materials, demand data, raw material requirements data, and cost data. In this study, the authors conducted a type of descriptive research, where research aims to find out the problems at PT XYZ. The research is collecting data based on the truth. Then, the data obtained is compiled, processed, and analyzed to provide an overview of the existing problems. The unit of analysis in this research is PT XYZ. This study was conducted to determine the amount of raw materials that must be planned to make Balado Seasoning in order to reduce the occurrence of excess or lack of raw materials at PT XYZ, to find out how the Material Requirement Planning (MRP) method provides a solution to the inventory costs at PT XYZ and to find out the techniques control in the appropriate Material Requirement Planning method for controlling Balado Seasoning raw materials at PT XYZ.

3. Results and Discussion

The following are the results of the research questions which are also the research objectives, starting from the first research question to the third research question regarding the number of raw materials that must be planned, MRP solutions to inventory costs, and the right MRP method for controlling Balado Seasoning raw materials at PT XYZ.

In solving the problem regarding the amount of raw material that must be planned in the first research question, the forecasting stage (Forecast), Master Production Schedule (MPS) input data, Exploding, Offsetting, Netting and Lotting stages are included in the calculation process for Materials Requirements Planning (MRP). Then, the stages are as follows:

3.1 Forecasting Result

In the forecast stage, the initial step taken is to determine whether the data pattern has a tendency or not.

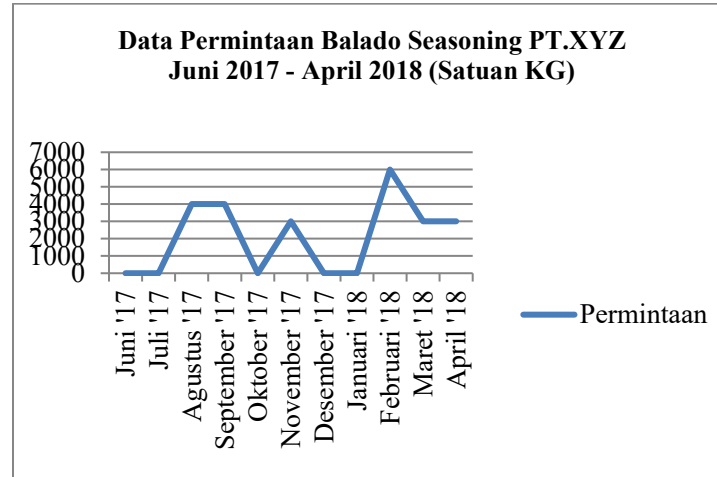


Figure 2. The pattern of balado seasoning request data in June 2017-April 2018

From the results of Figure 2, the pattern does not form a tendency so that the moving average or exponential smoothing method can be used in forecasting such as in Table 3:

Table 3. The comparison of MAD, MSE, and MAPE

Forecasting Method	MSE	MAD	MAPE
Moving Average n = 1	9500000	2300	40
Moving Average n = 2	8861111	2388,889	37,037
Moving Average n = 3	5847222	1875	24,306
Moving Average n = 4	6330357	2035,714	24,405
Moving Average n = 5	5766667	2033,333	30,556
Moving Average n = 6	5155556	1933,333	26,111
Exponential Smoothing a = 0.1	6950221	2096,581	46,457
Exponential Smoothing a = 0.2	6249759	2009,075	38,663
Exponential Smoothing a = 0.3	6199434	1964,286	33,796
Exponential Smoothing a = 0.4	6402388	1928,156	30,363
Exponential Smoothing a = 0.5	6724341	1973,438	30,479
Exponential Smoothing a = 0.6	7123412	2056,407	32,395
Exponential Smoothing a = 0.7	7592538	2133,061	34,48
Exponential Smoothing a = 0.8	8138036	2201,869	36,551
Exponential Smoothing a = 0.9	8770576	2259,318	38,444

Based on table 3, the two methods obtained the smallest standard error in the moving average method with $n = 3$. Furthermore, using this method can be obtained demand forecasting in June and July of 4,000.

3.2 Master Production Schedule

3.2.1 The Calculation of Master Production Schedule (MPS)

The forecasting data using the moving average method (3 months) are used as a reference in making the Master Production Schedule (MPS) or Production Master Schedule (JIP). Data from the forecasting needs of Balado Seasoning in June 2018 will be divided into a period of 1 month (4 Weeks). For more details can be seen in Table 4 and Table 5.

Table 4. Schedule of MPS in June 2018

Product	Sunday				Total
	1	2	3	4	
Balado Seasoning	1000	1000	1000	1000	4000

Table 5. Schedule of MPS in July 2018

Product	Sunday				Total
	1	2	3	4	
Balado Seasoning	1000	1000	1000	1000	4000

After calculating forecasting, the forecast results for June and July 2018 were 4000 kg of Balado Seasoning. Balado Seasoning products are produced in 1 month (4 weeks) and 1000 kg for each week.

3.3 Calculation Result of Material Requirement Planning (MRP)

In the MRP, it is necessary to carry out a step to find out when raw materials are ordered, how much is their net needs and when the product must be finished produced to meet customer needs.

3.3.1 Calculation of the Net Needs of Balado Seasoning Raw Materials

Based on the results of the forecasting calculation with $n = 3$, which produces the next period = 4,000, it can be seen the planning of raw material ordering. Balado Seasoning from the procurement of raw materials to finishing products is for three weeks, namely from the 1st week to the 4th week and the 4th week to the 7th week. So, on the 4th week of June, when the product is finished working, an order of raw materials is made to meet the product demand for July. Product requests for July can be completed in the 7th or third week of Jul.

Table 6. Net needs for per raw material

	Gross Requirements (1)	Inventory (2)	Net Supplies (1) - (2)
A	200	25 kg	175
B	20000	0 kg	20000
C	64600	1375 kg	63225
D	20000	5425 Kg	14575
E	100000	6200 Kg	93800
F	100000	5000 kg	95000
G.	16000	40 kg	15960
H	16000	5740 Kg	10260
I	40000	680 Kg	39320
J	8000	2400 Kg	5600
K	8000	0 kg	8000
L.	8000	300 kg	7700

Table 7. The compilation of MRP tables for balado seasoning raw materials, 2018

Lead Time (minggu)	On Hand	Persediaan Pengaman	Dialokasikan	Level	Identifikasi Barang	PD	Juni				Juli			
							1	2	3	4	5	6	7	8
3	0			0	Balado Seasoning	GR				4000			4000	
						SR				0				
						POH	0	0	0	0	0	0	0	
						N.R				4000			4000	
						P.O.R				4000			4000	
2	25			1	A	P.O.L		4000		4000				
						GR			200			200		
						SR						0		
						POH	25	25	25	25	0	0	0	
						N.R				175			200	
2	0			1	B	P.O.R							200	
						P.O.L		175		200				
						GR								
						SR			20000			20000		
						N.R			0			0		
1	1375			1	C	POH	0	0	0	0	0	0	0	
						N.R							20000	
						P.O.R				20000			20000	
						P.O.L		20000		20000				
						GR			64600			64600		
1	5425			1	D	SR			0			0		
						POH	5425	5425	5425	5425	0	0	0	
						N.R				14575			20000	
						P.O.R				14575			20000	
						P.O.L			14575		20000			
1	6200			1	E	GR				100000			100000	
						SR				0			0	
						POH	6200	6200	6200	6200	0	0	0	
						N.R				93800			100000	
						P.O.R				93800			100000	
1	5000			1	F	P.O.L			93800		100000			
						GR				100000			100000	
						SR				0			0	
						POH	5000	5000	5000	5000	0	0	0	
						N.R				95000			100000	
1	40			1	G	P.O.R				95000			100000	
						P.O.L			95000		100000			
						GR				16000			16000	
						SR				0			0	
						POH	40	40	40	40	0	0	0	
1	5740			1	H	N.R				15960			16000	
						P.O.R				15960			16000	
						P.O.L			15960				16000	
						GR								
						SR				16000			16000	
2	680			1	I	POH	5740	5740	5740	5740	0	0	0	
						N.R				10260			16000	
						P.O.R				10260			16000	
						P.O.L			10260				16000	
						GR								
2	2400			1	J	SR				40000			40000	
						POH	680	680	680	680	0	0	0	
						N.R				39320			40000	
						P.O.R				39320			40000	
						P.O.L			39320				40000	
3	0			1	K	GR				8000			8000	
						SR				0			0	
						POH	0	0	0	0	0	0	0	
						N.R				8000			8000	
						P.O.R				8000			8000	
3	300			1	L	P.O.L		8000		8000				
						GR				8000			8000	
						SR				0			0	
						POH	300	300	300	300	0	0	0	
						N.R				7700			8000	
						P.O.R				7700			8000	
						P.O.L		7700		8000				

3.3.2 The Comparison of Lot Technique

Table 8. The comparison of the cost of three lot sizing techniques (in rupiah)

Item	Biaya Pesan (Rp)			Biaya Simpan (Rp)			Biaya Total Bahan Baku (Rp)		
	LFL	EOQ	POQ	LFL	EOQ	POQ	LFL	EOQ	POQ
Komponen A	500,000	500,000	250,000	0	136,500	300,000	500,000	636,500	550,000
Komponen B	500,000	500,000	250,000	0	136,675	300,000	500,000	636,675	550,000
Komponen C	500,000	500,000	250,000	0	46,599	387,600	500,000	546,600	637,600
Komponen D	500,000	500,000	250,000	0	9,947	420,000	500,000	509,947	670,000
Komponen E	500,000	500,000	250,000	0	136,660	300,000	500,000	636,660	550,000
Komponen F	500,000	500,000	250,000	0	136,660	300,000	500,000	636,660	550,000
Komponen G	500,000	500,000	250,000	0	188,335	240,000	500,000	688,335	490,000
Komponen H	500,000	500,000	250,000	0	188,335	240,000	500,000	688,335	490,000
Komponen I	500,000	500,000	250,000	0	76,515	360,000	500,000	576,515	610,000
Komponen J	500,000	500,000	250,000	0	76,545	360,000	500,000	576,545	610,000
Komponen K	500,000	500,000	250,000	0	188,300	240,000	500,000	688,300	490,000
Komponen L	500,000	500,000	250,000	0	23,681	408,000	500,000	523,681	658,000

4. Conclusion

Based on the calculation at the forecasting stage, the forecasting results obtained 4,000 kg Balado Seasoning with the range of production time is 1000 kg every week. Then, from the calculation results at the explosion stage, the raw material needed to produce 4,000 kg of Balado seasoning is required 200 kg of raw materials A, 20,000 kg raw material B, 64,600 kg raw material C, 20,000 kg raw material D, 100,000 kg raw material E, 100,000 kg raw material F, 16,000 kg raw material G, 16,000 kg raw material H, 40,000 kg raw material I, 8,000 kg raw material J, 8,000 kg raw material K and 8,000 kg raw material L.

The total cost of Balado Seasoning raw material inventory for components G, H, and K is IDR 490,000 while for other components is IDR 500,000. Based on the calculation of the MRP method, techniques suitable for controlling raw materials G, H, and K are the Period Order Quantity (POQ) techniques. This technique is suitable because it has a smaller total inventory cost than Lot For Lot (LFL) and Economic Order Quantity (EOQ). Then, for controlling other raw materials, the Lot For Lot (LFL) technique can be used because it has a total inventory cost that is smaller than the Period Order Quantity (POQ) and Economic Order Quantity (EOQ).

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