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THE ROLE OF MANUFACTURING SUPPLY CHAIN ANALYSIS IN MEETING CUSTOMER NEEDS OF *BATIK* SHIRT

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ABSTRACT

The main problems in this study consists, (1) how many products should be produced, so that company is ready to distribute to customers, (2) what are the type of material is to be availed by the company and how much material must be ordered, (3) which suppliers are eligable to be a partner.Using the approach with DRP,MRP and MCDM , the research problem can be solved, by obtaining the MPS, the type and amount of materials needed as well as the time of ordering to be able to support production, as information for material procurement process from the supplier

***Keywords**: Ditribution Requirement Planning, Material Requirement Planning, Multi Criteria Decision Making*

1. INTRODUCTION

Business competition is getting tighter in the globalization era , its pushing the company to perform new design and tactical stratategy, when viewed in detail, the essence of competition lies in how companies can implement the process of the creation of products with cheaper, better, and faster than competitors (Indrajit & Djokopranoto). Therefore, planning and controlling the movement of materials from upstream to downstream in the supply chain system is indispensable.

Supply chain is a series of events that are intended to meet consumer demand a series of events that includes procurement, manufacturing, distribution and elimination of wasteful activities, together intertwined with the transport, storage and IT (Amin Widjaja, 2012). Supply chain is a network of organizations (supplier, manufacturer, distributor, etc.) are interrelated and work together to deliver products to consumers, the management nodes through efficient distribution.The management efficient in order to avoid loss of sales or the bullwhip effect.

Management is aimed so that the flow of goods manufactured can be delivered to consumers on time and the amount targeted. With good management of the flow of goods, is expected to avoid loss of sales or the bullwhip effect, because both phenomena such inventory is undesirable because it would have an impact on the increase in costs.

The “X” Company Limited is the corporate brand of clothing *batik* garment holder "Arjuna Weda"and "Adi Kusuma", the product is marketed in Jakarta, Bogor, Depok, Tangerang, Bekasi and some areas of Indonesia country. The fundamental difference of the two brands just from the quality of the material, where "Arjuna Weda" using raw materials better than "Adi Kusuma", because the intended target market of the two brands is different, and Arjuna Weda consumers preferred than others. Consumer demand for "Arjuna Weda" which often can not be met due to frequent delays raw materials, which affect the smoothness and distribution of consumer products to retailers and end customers. Due to the poor distribution planning, inventory at each retailer conditions often occur out of stock and over stock, these phenomena lead to loss of sales and high carying cost.(see tabel-1).

Tabel -1: Production and demand "Arjuna Weda" Batik Clothing 2013

MONTH	PROD	DEMAND	DEV
January	13.050	6.804	6.246
February	13.050	6.428	6.622
March	17.250	8.865	8.385
April	19.400	9.643	9.757
May	12.718	9.243	3.475
June	21.782	9.669	12.113
July	8.151	10.101	(1.950)
August	9.751	11.790	(2.039)
Sept	9.947	3.818	6.129
October	20.262	7.073	13.189
Nov	11.614	6.743	4.871
Dec	9.565	15.460	(5.895)
Total	166.540	105.637	60.903

Based on these data seem clear that during the year 2013 there were the large gaps (more and less) between amount of production with demand. In 2013, there were 9 months of production is not absorbed by the market, and for 3 months, market is shortaged, then within a year had as many as 60.903 units over stock (36.6%).
This research problem can be formulated as follows: (1) how to plan the distribution requirement to be a guide to determine the amount of production that must be produced, (2) how to plan material requirements needed for production planning, (3) how to choose a supplier that is able to support the activities of material requirements planning.

2. THEORETICAL BACKGROUND

The supply chain is a relatively new concept in view of logistical problems. While based on the concept of past time, is seen as a matter of internal logistics respective companies and solutions focused on solving internally anyway. In this new concept, logistical problems viewed as a wider problem, which lies very long since the base/raw material to finished goods that used by end consumers, and a series of supply chain of goods. Because of the breadth of the supply chain issues, then Indrajit & Djokopranoto (2007) stated that the supply chain is a logistics network built from some major players and have the same interests, namely suppliers, manufacturer, distributor, retail outlets, and customers. All of the parties to function as a chain of mutually support a smooth move and store activities from the upstream to the end.

2.1 The concept of DRP

Distribution Requirement Planning is the application of logic figures Material Requirement Planning (MRP), Inventory Bill of Materials (BOM) on MRP replaced with a Bill of Distribution (BOD) on the DRP function to determine the need to replenish inventory at distribution center (Vincent Gaspersz, 2012:488). Distribution Requirement Planning developed by Martin (1980,1983), and Alan J.Stenger uses similar terms, namely, Distribution Resource Planning (DRP) which although not exactly the same meaning, but talking about the same thing. Multi-level or multiechelon distribution network can be described as Figure 1.

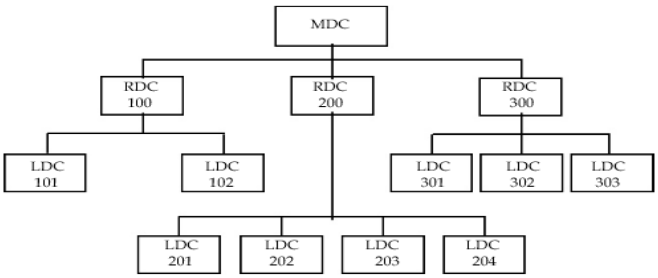

Figure-1:. Multiechelon chart in Distribution Network (source : Indrajit & Djokopranoto, 2007 : 84)

MDC is the highest level of the distribution system is directly related to the supplier/factory, while the LDC is the lowest level of the distribution system is directly related to the customer or user of goods.

2.2. Basic steps DRP

As a basis for calculation starts from a local distribution center level, as follows:

1. Calculate the gross requirements at the level of product demand forecast local distribution center for the future.
2. Calculate the net requirements at the local distribution center, based on the schedule future (time-phased requirement). Net requirement is the gross requirement minus with existing inventory and orders that have been done, plus the safety stock, if any, and

only positive net requirement that recorded and counted.
3. Calculate how much less at any given time schedule and this deficiency is planned arrival orders . Keep in mind that this issue depends on the number of minimum orders orr lot size dtermined by the supplier.
4. Ordering time can be calculated backwards , when and how much the order to be done and planned.
5. From the above steps the amount of inventory acquired at each end of a certain time frame.
6. The amount and timing of an order made at the local distribution center is the gross amount and timing needs of one level above it.

2.3. Demand Forecasting

Implementation of the above steps starting from the activities of forecasting demand at the local distribution center, and obtained gross requirement. The forecasting method used is primarily a group of time series methods: (1) Winter Additive Holt and (2) Holt-Winters Algorithm Multiplicative Algorithm

1. Holt-Winters Additive Algorithm, is used for data that is constantly varied seasonally , where the value of c in the formula is a point which shows seasonal fluctuations regular / permanent (steady seasonal fluctuations) . The formula that is used by Holt and Winters are :

$$F(t)=\alpha[x(t)-S(t-c)]+(1-\alpha)[F(t-1)+T(t-1)] \quad (1)$$

$$T(t)=\beta[F(t)-F(t-1)]+(1-\beta)T(t-1) \quad (2)$$

$$S(t)=\gamma[x(t)-F(t)]+(1-\gamma)S(t-c) \quad (3)$$

$$f(t+h)=[F(t)+hT(t)]+S(t+h-c) \quad (4)$$

$$f(t+h)=[F(t)+hT(t)]+S(t+h-2c) \quad (5)$$

For h = c+1, c +2, ... 2c

$$f(t+h)=[F(t)+hT(t)]+S(t+h-3c) \quad (6)$$

For h = 2c +1, 2c + 2,...3c

where :

F (t) = value of single smoothing
T (t) = smoothing trend
S (t) = smoothing seasonal
c = Length Seasonal
α, β, γ = constant with a value of 0 to 1
F (t+h) = Value forecast

2. Hoht-Winters Multiplicative Algorithm, is used for the data varied seasonally up/ down, where the value of c in the formula is a point that showed varying seasonal fluctuations . The formula that is used by Holt and Winters are as follows :

$$F(t)=\alpha x(t)/S(t-c)+(1-\alpha)[F(t-1)+T(t-1)] \quad (7)$$

$$T(t)=\beta[F(t)-F(t-1)]+(1-\beta)T(t-1) \quad (8)$$

$$S(t)=\gamma x(t)/F(t)+(1-\gamma)S(t-c) \quad (9)$$

$$f(t+h)=[F(t)+hT(t)]S(t+h-c) \quad (10)$$

for h = 1,2,.....c

For h=c+1, c+2, ...2c

$$f(t+h)=[F(t)+hT(t)]S(t+h-3c) \quad (11)$$

for h=2c+1, 2c+2,...3c

Where:

F(t) = Single smoothing value
T(t) = Smoothing trend
S(t) = Smoothing seasonal
c = Length of seasonal
α,β,γ = constant with a value of 0 to 1
F(t+h) = Nilai ramalan

2.4. Material Requiement Planning

Vincent Gaspersz (2012: 266) states that the MRP is a method of scheduling planned orders for purchased and manufactured planned orders. Purchased planned order is a ordering plan while manufactured planned orders a production plan . While the procedure is composed of 4 steps: (1) explotion, (2) netting, (3) lotting and (4) offsetting. Explotion is the process of calculating gross requirements for item level/lower components, netting is the process of calculation to determine the net requirements, which amount represents the difference between gross requirements by the state (which is in stock and which are ordered), lotting is is a process to determine the size of the individual orders are "optimal" based on the results of the calculation of net demand and offsetting is aimed to determine the right time to make a reservation plans in order to meet the net requirements by subtracting the initial time of availability of the desired lot size with the amount of lead time.

2.5. Selection of Suppliers.

The output of the DRP is the company earned master production schedule, while the output of the MRP process is generating

information about how the amount of materials needed and when to place an order. Because the material used comes from supplier, then the problem that arises is which supplier should be selected in order to obtain a high-performing suppliers, that is capable of supplying the material with the right quality, right quantity, right time and with reasonable prices. On the basis of these issues required multicriteria decision-making process, using analytical hierarchy process (AHP) method. In AHP performed the following steps (Suryadi, Ramdhani, 1998) consists:(a) defining the problem and determine the desired solution, (b) creating a hierarchical structure that begins with the main goal, (c) make pairwise comparison matrix that describes the relative contribution or influence of each element on the goals or criteria level above it, (d) defining pairwise comparisons to obtain a whole number of assessment as n x (n-1)/2 pieces, where n is the number of elements being compared.

3. RESULT AND DISCUSSION

This study summarizes the issues resolved through 3 stages: (1) determines the plan of distribution needs, (2) determine the material requirements plan, and (3) selecting appropriate suppliers into partners. Three phases are described as follows:

1. The results of product demand forecasting "Arjuna Weda" cotton on MDS distribution centers, and WS are based on the following data" in Figure 2. Based on the analysis of two methods of forecasting the above, and measured the size of the forecast error and the tracking signal, and through the help of the software Win QSB, for the MDS distribution center, we recommend using the Holt-Winters Additive Algorithm forecasting method, while the WS distribution centers should use methods of forecasting Holt-Winters Mutiplicative Algorithm, because it has the smallest error rate and signal tracking is at the specified intervals. Forecasting results are taken as gross requirements as shown in Table-2.

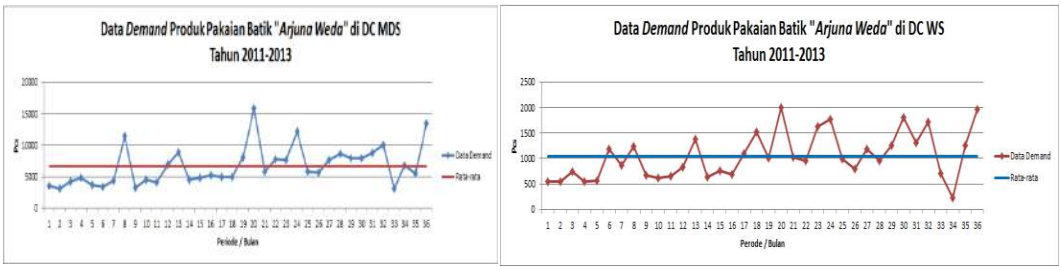

Figure 2. Graph the data demand "Arjuna Weda at MDS and WS istribution center

Tabel 2. Gross requirement “Arjuna Weda” for distribution center MDS and WS

DC	Distribution Planning											
	1	2	3	4	5	6	7	8	9	10	11	12
MDS	7768	6653	8111	8925	8169	7961	9409	15150	7592	10020	9323	13882
WS	1095	857	1215	978	1152	1932	1426	2185	1110	804	1547	1741

The gross requirement data s preliminary data to obtain a Master Production Schedule, through the stages of explotion, netting, lotting, and offsetting, at WS and MDS distribution center, then obtained a master production schedule which is an aggregate of the both DCs, see table 3.

Tabel 3. Master Production Schedule for batik shirt “Arjuna Weda”

Year	MPS											
	1	2	3	4	5	6	7	8	9	10	11	12
Q	8388	7512	9324	9900	9324	9900	10836	17328	8700	10824	10872	15624

2. Master production schedule, is one of the inputs to calculate the material requirements planning, while the other input are the product structure and inventory status. Materials needed for batik shirt “Arjuna Weda” consists of 13 types of material, to calculate the amount of material needs, we use material requirement planning method. Using Lot For Lot lotting method is based on the mater production planning, product structure, and status of inventory, the amount of data obtained material needs 13 orders for each month, as presented in table- 4.

Tabel-4. Quantity and ordering time for 13 materials that must be order to suppliers

No	Jenis Material	Satuan	Past Due		Jumlah Rencana Pemesanan												Sumber
			Periode (-2)	Periode (-1)	Periode 1	Periode 2	Periode 3	Periode 4	Periode 5	Periode 6	Periode 7	Periode 8	Periode 9	Periode 10	Periode 11	Periode 12	
1	Assembling 1 (Pakaian Batik Kemeja Hem)	Unit			8388	7512	9324	9900	9324	9900	10836	17328	8700	10824	10872	15624	Dibuat (Manufactured)
2	Kain Katun	Roll	5	4	5	5	5	5	6	9	5	5	6	8			Dibeli (Purchased)
3	Benang Obras	Cones			228	132	168	180	168	180	204	312	156	192	204	276	Dibeli (Purchased)
4	Benang Jahit	Kelos			2724	2508	3108	3300	3108	3300	3612	5772	2904	3606	3624	5208	Dibeli (Purchased)
5	Kancing	Pieces			158400	79200	108000	108000	100800	108000	122400	187200	93600	122400	122400	165600	Dibeli (Purchased)
6	Hang Tag	Pieces			0	0	5400	9900	9400	9900	10800	17300	8700	10900	10800	15700	Dibeli (Purchased)
7	Kain Keras	$Yard^2$			22	19	24	25	24	25	28	44	22	28	28	40	Dibeli (Purchased)
8	Size Label	Pieces			8500	7500	9500	10000	9000	10000	11000	17500	8500	11000	10500	16000	Dibeli (Purchased)
9	Care Label	Pieces			8500	7500	9500	10000	9000	10000	11000	17500	8500	11000	10500	16000	Dibeli (Purchased)
10	Brand Label	Pieces			0	0	6000	12000	6000	12000	12000	18000	6000	12000	12000	12000	Dibeli (Purchased)
11	Price Label	Sticker			8500	7500	9500	10000	9000	10000	11000	17500	8500	11000	10500	16000	Dibeli (Purchased)
12	Plastik Pembungkus	Lembar			12000	7800	9000	10200	9000	10200	10800	17400	8400	10800	10800	15600	Dibeli (Purchased)
13	Mika Leher	Pieces			14400	7200	9600	9600	9600	9600	10800	17400	9000	10800	10800	15600	Dibeli (Purchased)
14	Karton Penyangga	Lembar			0	0	0	3168	9360	9936	10800	17280	8784	10800	10800	15696	Dibeli (Purchased)

In the table above it clear that 13 types of material can be determined the quantity and time ordering. This is important, because all the materials that used for manufacture comes from purchased activities.

3. In respect of all materials derived from the result of the purchase, then the costs incurred by the company is very large, therefore need to plan well in order to effisient procurement. To accomplish that, the supplier selection is very important, because the company must obtain a supplier that has a good performance. AHP is a method used to solve the problem, and this issue is structured into a hierarchical structured that consists of 3 levels, the first lefvel is called the focus, the second level called set of criteria, conssisting: model, condition, accuracy, and response. This criteria are poured into the pairwise comparison matrix with order (5x5), then filled by experts become the raw data matrix. After that is data normalization and we obtained the weighted priority of each criteria. While the third level is an alternative, consisting DPT, SF, ABS and EA. The measure of the matrix is 4x4, and the quantity between the alternative and set criteria are 5 matrices. Thus, in this issue there are 6 matrices that must be tested for consistency, that are the matrix size of 5x5 is one piece, and 4x4 are 5 matrices. Through the steps set out in the AHP method from start to trips, as well as through the consistency test for 6 matrices, then obtained the sequence of priority for all alternatives, (see Figure-3).

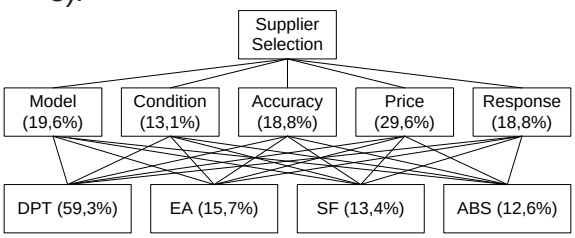

Figure-3: The priority weihgt for each supplier

4. According to Fgture-3 at above, is very clear that the sequence of priority from 4 alternatives area: the first is DPT (59,3%), the 2nd is EA (15,7%), the 3rd is SF(13,4%) and the last is ABS(12,6%).

4. CONCLUSION

From the results of research and analysis has been done, it can be concluded that:

1. With method of Distribution Requirement Planning (DRP) companies can know the exact amount and time in distributing their products, DRP calculation results can also be used as a guideline to determine the number or size of production that must be produced by the company.
2. The method of material requirements planning (MRP) has been able to calculate the exact amount and when the raw materials must be ordered so that the company can produce according to the production plan.
3. DPT Company Limited is the most reliable supplier capable of supporting material requirements planning activities compared to the others.
4. Efforts to satisfy customers, not just the responsibility of the production function, but must be integrated begin the process of procurement, production, marketing and distribution. In other words, the system must arrange the supply chain system from upstream to downstream in the enterprise business process.

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