MANAGEMENT INFORMATION SYSTEM OF PRODUCT DISTRIBUTION IN PT TAAWUN BERKAH BERSAMA

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ABSTRACT

Company PT Taawun Berkah Bersama is engaged in the distribution of women's beauty products that is Wardah. To distribute the product required the procurement process of the product to the supplier to meet the delivery needs in accordance with the order made by the customer, but the number of customers and the amount per product ordered every day is not the same. As a result the stock of products in the warehouse is often inadequate which makes the delivery process to be delayed and experienced daily buildup which makes it increasingly difficult to determine which vehicle will be used to deliver to every customer whose product is ready to be delivered. Therefore, this system is designed to facilitate PT TAAWUN BERKAH BERSAMA in distributing beauty products to its customers, especially to determine the amount of procurement to be made and the determination of route for product distribution that makes the product delay to the customer's hand. To overcome these problems use the method of Single Moving Average and Distribution Requirement Planning (DRP) for procurement process issues, while on route determination issues using the Google Distance Matrix API. The conclusion of this research is that the system created can assist in making decision on procurement process to keep stock of product in warehouse to fulfill requirement of distribution of product to customer and determination of order of delivery route to accelerate delivery process of product to some customer.

Keywords: management, distribution, drp, distance, matrix

1. INTRODUCTION

PT Taawun Berkah Bersama is a company engaged in the distribution of wardah cosmetics to several customers such as supermarkets, minimarkets, cooperatives, pharmacies and retail. Currently PT Taawun Berkah Bersama has a number of customers spread across several regions, but in this case customer data taken are customers who are in the area of Bekasi and Karawang.

Based on interviews conducted with Manager Warehouse at PT Taawun Berkah Bersama, He explained to do the distribution of product required procurement process to suppliers to meet the needs of delivery in accordance with the order made by the customer, the order is made by sales-sales who come to the store every day customers offering a product order or even a customer who contacted the sales to make an order to PT Taawun Berkah Bersama, therefore the number of subscribers and the number of products per customer ordered each day is not the same. It causes the stock of existing products in the warehouse is often insufficient for the delivery because the procurement that has been done previously not in accordance with the ordering from the customer, so that the process of procurement needed to meet the needs of product delivery but because the procurement process to suppliers that takes 3 day causes the frequent occurrence of delay in delivery of products to customers which will certainly impact on the number of customers who complain because the order is too long to be accepted by the customer.

Based on interviews with Supervisor Warehouse at PT Taawun Berkah Bersama also said the effect of delayed delivery process caused by lack of stock of products in the warehouse to make the distribution of products to customers experiencing a buildup every day which makes it increasingly difficult to determine which vehicle will be used to make delivery to each customers whose products are ready to ship. Until delivery becomes frequently hampered as it arrives at customer's premises too late until the driver has to wait until the customer store is open or back to the warehouse and will be brought back the next day. Currently the product distribution process at PT Taawun Berkah Bersama is done based on order order from customer and its product is available in warehouse and for delivery of product not yet fulfill order to customer hence will happen delay of delivery until product available again by using company vehicle that is 3 minibus car with the carrying capacity of 500 cartons per car, while for the problem of delivery route is determined by the driver in charge of distributing the product to the customer.

Based on some of the problems that have been described, then needed a system that can help solve the problem. Therefore the author tries to discuss it in the thesis with the title "Management Information System Of Distribution Product in PT Taawun Berkah Bersama"

The purpose of this research is as follows:

1. 1. Assisting Warehouse Manager of PT Taawun Berkah Bersama in determining procurement for stock of product in warehouse to fulfill distribution requirement of PT Taawun Berkah Bersama.
2. 2. Assisting the Warehouse Supervisor of PT Taawun Berkah Bersama in giving recommendation of distribution order and determining.

2. FORECASTING

The initial part of a decision-making process is to forecast, either forecasting demand or forecasting of production, where prior to forecasting must be known in advance the problems that occur in order to obtain an optimal decision in accordance with needs. Forecasting is the thinking of a quantity, eg demand for one or more products in the period to come. [1]

2.1 Forecasting Method

In forecasting systems, the use of forecasting methods greatly affects the results of forecasting obtained. The division of forecasting methods can be divided into several aspects depending on the point of view.

When viewed from the nature of its use, then the forecasting can be divided into two types, namely:

1. Forecasting is subjective, ie forecasting based on intuition or user feeling. Viewpoints, characteristics and characteristics of forecasting users strongly affect whether or not the forecasting results obtained.
2. Forecasting is objective, ie forecasting based on past data that can be collected. The use of this method is done by using certain calculation techniques followed by analysis of forecasting results.

When viewed based on the nature of prediction that has been compiled then generally forecasting methods are classified into two parts, namely the method of qualitative forecasting and quantitative forecasting methods. [1]

In this research the method of forecasting used is the method of quantitative forecasting because forecasting will be done based on past sales data obtained from PT Taawun Berkah Bersama.

1.1.1 Single Moving Average

Single Moving Average method is a forecasting method that is performed on the past data for a period that already has an average pattern. Forecasting is done to know the data of future demand, problems arising in the use of this method lies in the determination of time or period average data. The greater the value of time / period then the resulting forecast will increasingly deviate from the data pattern.

Mathematically the formula for forecasting this method is:

$Y'_{t+1} = T_{t-n+1} + ... + T_{t+1} + T_t / n$.....(1)

Where:

Tn = Data at period n

n = Number of time series used

Y'_{t+1} = Forecasting value of period t + 1

3. DISTRIBUTION REQUIREMENTS PLANNING (DRP)

Product inventory is one of the most important factors in the company, this supply is needed to overcome the fluctuation of demand. Therefore, it should be able to plan inventory control in the warehouse to anticipate excess demand.

The concept of DRP is a continuation of the concept of Material Requirements Planning (MRP) system applied to problems related to distribution. Based on the concept, the definition of DRP is a material handling aimed at the product distribution process.



Figure 1 DRP General Concept [1]

The success of this DRP system lies in the accurate forecasting ability of the product inventory, the exact timing of the lead from the distribution center, and the determination of the number of products ordered as future needs plans will ultimately reduce total product inventory and keep level service level of the distribution network as a whole. [1]

3.1 Stage Of Distribution Needs Planning

1. Sales forecasting stage
   The sales forecasting stage of the company tries to forecast the plan of selling and distributing the product at each retailer for some future period using methods on forecasting.
2. The stage of determining the master plan of sale
   This stage the company creates master plan sales for a certain period to find out how many products will be sold.
3. Stages of determining the plan to meet the needs

This stage of the company must determine how many items are needed and when the required product is ready to be marketed.

4. Stage of the booking plan
   This stage distributors will order the needs according to their needs to the manufacturer. [1]

3.2 DRP Steps

There are four main steps to DRP:

1. Netting, is the calculation process to determine the number of net needs whose value is the difference between the gross requirement and the state of the inventory. The data required in this process of net need is the gross requirement for each period, the inventory held at the start of the planning and the acceptance plan for each planning period.
2. Lotting, is a process to determine the amount of optimal order for each product individually based on the net needs that have been done.
3. Offsetting, is a process undertaken to determine the right time to do the order plan in order to meet the needs of the net.
4. Explosion, a process of calculating gross needs for a lower level of distribution network. [1]

3.3 DRP Basic Logic

1. From the forecasting result, calculate Time Phased Net Requirement. The Net Requirement identifies when the inventory level (Schedule Receipt plus the previous Projected on Hand period) is met by the Gross Requirement for a certain period.
   Where:
   Net Requirement = (Gross Requirement + Safety Stock) - (Schedule Receipts + Project on Hand before). The Net Requirement value recorded is a positive value.
2. Then generated Planned Order Receipts and Net Requirement (certain lot size) in certain period.
3. Determine the day of booking (Planned Order Release) by reducing the scheduled day of Planned Order Receipts by adding lead time.
4. Calculate Projected on Hand at certain period. Projected on Hand (Projected on Hand of previous period + Schedule Receipts + Planned Order Release) - (Gross Requirement)
5. The amount of Planned Order Release becomes Gross Requirement in the same period for the next level of the distribution network. [1]

4. GOOGLE DISTANCE MATRIX

The Google Maps Distance Matrix API is a service that provides travel time and distance to the matrix based on the latitude longitude of origin and destination, based on the recommended route between the start and end points.

For this study the route to be selected is based on the closest distance from the point of origin to the next destination point until the vehicle capacity has been fully charged.

5. DISCUSSION

In accordance with the problem of the product procurement process at PT Taawun Berkah Bersama, it is important to know the number of product suppliers that must be ordered to the supplier so as to meet the demand of the product in the coming period. At this stage the Distribution Requirement Planning (DRP) method is used.



Figure 2 Stage of Use of DRP Method

1. Gross Requirements

In this stage will be taken one example of products that will be made in the object for later in the analysis. Products to be made as an example of Wardah Make Up Remover. The data taken is the delivery of products that have been made to customers from January 2017 until June 2017 which can be seen in table 1:

Table 1 Data Delivery Wardah Make Up Remover Product

No	Periods	Number of Product Delivery Wardah Make Up Remover (Pcs)
1	January 2017	1825
2	February 2017	1603
3	March 2017	1472
4	April 2017	1600
5	May 2017	1796
6	June 2017	2240

Table 1 shows the product delivery data to be used as sample for product procurement forecast for July 2017. In this case Gross Requirement process is performed using Single Moving Average Forecasting method to predict product procurement at PT Taawun Berkah Bersama.

Based on the results of the forecasting that has been done, it can be concluded that with the data the previous six months generate the smallest error by using the method of Single Moving Average. From the results obtained in the Mean Squared Error (MSE) of the 2-month moving average is 89880 and the 3-month moving is 120691,83, the smallest error indicates that the accuracy of forecasting results is

high. Here is comparison of result calculation of Mean Squared Error (MSE) which can be seen in table 2 and table 3

Table 2 Single Moving Average Forecasting Results with MSE (2 Months)

No	Month	Shipping Amount/Month (Pcs)	MA 2 Month	Error	Absolute Error	Squared Error
1	January	1825	-	-	-	-
2	Febuary	1603	-	-	-	-
3	March	1472	1720	-248	248	61504
4	April	1920	1540	380	380	144400
5	May	1796	1700	96	96	9216
6	June	2240	1860	380	380	144400
Total				608	1104	359520
Mean Error			152			
Mean Absolut Error			276			
Mean Squared Error			89880			

Table 3 Single Moving Average Forecasting Results with MSE (3 Bulan)

No	Month	Shipping Amount/Month (Pcs)	MA 2 Month	Error	Absolute Error	Squared Error
1	January	1825	-	-	-	-
2	Febuary	1603	-	-	-	-
3	March	1472	1720	-248	248	61504
4	April	1920	1540	380	380	144400
5	May	1796	1700	96	96	9216
6	June	2240	1860	380	380	144400
Total				608	1104	359520
Mean Error			152			
Mean Absolut Error			276			
Mean Squared Error			89880			

Result of Wardah Make Up Remover product forecast for next period with 2 month moving, then PT Taawun Berkah Bersama is recommended to make Wardah Make Up Remover product in July 2017. Here is an example of calculation to determine gross requirement.

$$St_{Juli} = \frac{Xt_{Mei} + Xt_{Juni}}{n}$$

$$= \frac{1796 + 2240}{2}$$

$$= \frac{4036}{2}$$

$$= 2018 \text{ Pcs}$$

After calculation it is known that Wardah Make Up Remover demand forecast in July 2017 is 2018 Pcs. In the measurement of forecasting error using Mean Square Error (MSE) method. This method is a way to measure and evaluate errors in forecasting techniques.

Thus, the result of Gross Requirement by forecasting with Single Moving Average Method on Wardah Makeup Remover product is 2018 Pcs.

For the next step, it is necessary to calculate the safety of stock as a limiting material to overcome the fluctuation of demand (demand) and serves to protect the error in predicting demand during lead time. Where to calculate the safety stock needed service level, standard deviation, and lead time. Here is an explanation for the safety stock calculation:

a. *Service Level*
   In this case it is assumed that the desired service level for the distributor and retailer is the same that is 95%
b. Standard Deviation

$$= \sqrt{\frac{\sum_{i=1}^{n}(d-\bar{d})^2}{n}}$$

$$= \sqrt{\frac{(1796-2018)^2+(2240-2018)^2}{2}}$$

$$= \sqrt{\frac{49284+49284}{2}}$$

$$= \sqrt{\frac{98568}{2}}$$

$$= \sqrt{49.284}$$

$$= 222$$

c. *Lead Time*
   The period between the ordering of suppliers and receipt of products in the warehouse is 3 days as well as the period between the ordering of the customer until the delivery of the product is 3 days.
d. *Safety Stok* $= Z \; x \; s \; x \; \sqrt{L}$
   Explanation:
   Z = *Service Level*
   S = Standard Deviation
   L = *Lead Time*

Safety Stok $= 1{,}64 \; x \; 222 \; x \; \sqrt{3}$
= 630, 6
= 631 Pcs (Rounded)

So, based on the above calculation Safety Stock needed in the warehouse for Wardah Make Up Remover product is 631 Pcs.

2. Project On Hand

Project On Hand is the total supply held at the beginning of a certain period that will be used in the next period, in this case example, which will be calculated procurement process is July, then Project On Hand used in the previous period or June, contained in table 4.

Table 4 Beginning Supplies Wardah Make Up Remover

No	Periods	Project On Hand (Wardah Make Up Remover)
1	January 2017	1500
2	February 2017	1750
3	March 2017	1500
4	April 2017	2000
5	May 2017	1750
6	June 2017	1500

In the sample data, June has 1500 Pcs of Wardah Make Up Remover supplies. Then these results will be used for the next stage, ie to calculate the Net Requirement or net requirement.

3. Net Requirements

Net Requirements indicates the number of Wardah Make Up Remover products that a company needs to make a reservation to a supplier in order to be able to meet the demand in that period.

The data needed to calculate the net requirement (Net Requirements) is Gross Requirements data and Project on Hand data for the period 6 from the previous stage.

Net Requirement = (*Gross Requirement*+ *Safety Stock*) – (*Schedule Receipt* + *Project On Hand*)
= (2018 + 631) – (0 + 1500)
= 1149 Pcs

In the calculation of the net requirement (Net Requirements) for the case of Wardah Make Up Remover products obtained for 1149 pcs.

4. Planned Order Receipts

Planned Order Receipts are the number of refill orders (purchase orders) that have been planned to be received for a certain period to meet net requirements.

Planned Order Receipts = *Net Requirement* + *Safety Stock*
= 1149 + 631
= 1780 Pcs

In the calculation Determining the total quantity of the order receipt plan (Planned Order Receipt) for the case example Wardah Make Up Remover product obtained for 1780 Pcs.

5. Planner Order Release

Planned Order Release is the number of planning orders placed in a certain period so that products ordered will be available when needed. The Planned Order Release always has the same amount as the Planned Order Receipts, but is set backward by using the length of the lead time. So, the big Planned Order Release is 1780 Pcs.

6. Table Distribution Requirement Planning

The final step is to create a schedule of distribution needs based on the steps that have been done. The schedule of distribution needs for Wardah Make Up Remover products is in table 5 as follows:

Table 5 Distribution Requirement of Make Up Remover Products July 2017

Safety Stock : 694	Past Due	July
Gross Requirements		2018
Schedule Receipts		
Projected On Hand	1750	1500
Net Requirements		1149
Planned Order Receipt		1780
Planned Order Release		1780

So, it can be seen that the number of Wardah Make Up Remover products needed in July based on calculations that have been done using the DRP method of 1780 Pcs.

Delivery process is done the next day after product request from customer through Salesman which has been made invoice by Manager Accounting & Purchasing, demand always change every period make the stock of product in warehouse often not enough than request of customer hence Warehouse Manager will do procurement of product first before submitting an invoice and the absence of planning product delivery scheduling makes the process of sending products to customers often occur delays from the time specified.

Delivery stages will be done based on order order and customer area view from several customers up to the capacity of the box car transport that can accommodate 500 cartons of all kinds of products ordered. If the order exceeds the carrying capacity of all existing cars then delivery to the customer will be made after the previous delivery on the same day is completed and if the working time has been completed it will resume the next day. In Table 6 is a vehicle that will be used to distribute products to customers who order products at PT Taawun Berkah Bersama.

Table 6 Vehicle Of PT Taawun Berkah Bersama

No	Vehicle	License Plate	Capacity
1	Grandmax Box	B 8950 FDC	500 Box
2	Grandmax Box	B 8321 FDG	500 Box
3	Grandmax Box	B 8468 FDD	500 Box

Based on table 6, existing vehicles for the delivery of products to customers required scheduling to reduce delivery delays caused by the absence of scheduling arrangements for delivery of products to customers by supervisor warehouses whose current order of delivery is submitted to the driver entirely. Therefore, with data delivery destination that will be done on January 3 in accordance with table 3.6, the system will be made scheduling based on the shortest distance to

minimize the delay in product delivery in PT Taawun Berkah Bersama which can be seen in table 7.

Table 7 Warehouse Distance Matrix with Customers Ordering

Jarak (Km)	Gudang	Sucipto	Kopkar Pindodeli	Baru Teluk Jambe	Sederhana	MM Sinar	Gemah Ripah	Alina Mart	MM Prima
Gudang	0	79	78	78	82	86	67	64	85
Sucipto	79	0	9	11	17	22	36	34	27
Kopkar Pindodeli	78	9	0	3	16	20	30	28	21
Baru Teluk Jambe	80	11	3	0	18	22	32	30	23
Sederhana	82	17	16	18	0	4	30	29	22
MM Sinar	86	22	20	22	4	0	35	33	26
Gemah Ripah	67	36	30	32	30	35	0	8	13
Alina Mart	64	34	28	30	29	33	8	0	19
MM Prima	85	27	21	23	22	26	13	19	0

Here are the stages of choosing the shortest route for delivering the product to the customer

1. Determine the vehicles available in the warehouse to make delivery to customers, because for now all vehicles are still available then the selected vehicle is a vehicle 1 with plate No. B 8950 FDC.
2. Finding the closest customer distance to the last position of the vehicle, on the delivery will be done this time the customer closest distance with the warehouse is Alina Mart with 64 km that can be seen in table 8.

Table 8 Nearby Distance Warehouse with Customer

Distance (Km)	Warehouse
Warehouse	0
Sucipto	79
Kopkar Pindodeli	78
Baru Teluk Jambe	80
Sederhana	82
MM Sinar	86
Gemah Ripah	67
Alina Mart	64
MM Prima	85

3. Looking at the remaining capacity of the vehicle with the delivery of the product to be done, If the remaining capacity of the vehicle is more than the total number of shipments per carton from the customer then it will still use the same vehicle, but if the remaining vehicle capacity is less than the total number of shipments per carton from the customer it will use a vehicle whose capacity is still sufficient. The number of product shipments per carton to be made to Alina Mart's customers is 192 which can be seen in table 8. With this remaining capacity of the car 500 - 192 = 308.
4. Finding the closest customer distance to the last position of the vehicle, on the delivery to be made this time the customer who is the closest distance to Alina Mart is Gemah Ripah with 8 km which can be seen in table 9.

Table 9 Nearby Distance Alina Mart with Other Customers

Distance (Km)	Alina Mart
Warehouse	64
Sucipto	34
Kopkar Pindodeli	28
Baru Teluk Jambe	30
Sederhana	29
MM Sinar	33
Gemah Ripah	8
Alina Mart	0
MM Prima	19

5. Looking at the remaining capacity of the vehicle by delivering the product, If the remaining capacity of the vehicle is more than the total number of product shipments per carton from that customer will still use the same vehicle, but if the remaining capacity of the vehicle is less than the total number of products per carton from the customer then will use a vehicle whose capacity is still sufficient. The number of product shipments per carton to be made to Gemah Ripah customers is 149. With this remaining capacity of the car 308 - 149 = 159.
6. Finding the closest customer distance to the last position of the vehicle, the delivery will be done this time the customer is the closest distance to Gemah Ripah is MM Prima with 13 km which can be seen in table 10.

Table 10 Nearby Distance Gemah Ripah with Other Customers

Distance (Km)	Gemah Ripah
Warehouse	67
Sucipto	36
Kopkar Pindodeli	30
Baru Teluk Jambe	32
Sederhana	30
MM Sinar	35
Gemah Ripah	0
Alina Mart	8

Distance (Km)	Gemah Ripah
MM Prima	13

7. Looking at the remaining capacity of the vehicle by delivering the product, If the remaining capacity of the vehicle is more than the total number of product shipments per carton from that customer will still use the same vehicle, but if the remaining capacity of the vehicle is less than the total number of products per carton from the customer then will use a vehicle whose capacity is still sufficient. The number of product shipments per carton to be performed to MM Prima customers is 116. With this remaining capacity of the car 159 - 116 = 43.
8. Finding the closest customer distance to the last position of the vehicle, the delivery will be done this time the customer closest distance with MM Prima is Kopkar Pindodeli with 21 km which can be seen in table 11.

Table 11 Nearby Distance MM Prima With Other Customers

Distance (Km)	MM Prima
Warehouse	85
Sucipto	27
Kopkar Pindodeli	21
Baru Teluk Jambe	23
Sederhana	22
MM Sinar	26
Gemah Ripah	13
Alina Mart	19
MM Prima	0

9. Looking at the remaining capacity of the previous vehicle ie 43 cartons with the delivery of the product done, If the remaining capacity of the vehicle is more than the number of product shipments per carton from the customer it will still use the same vehicle, but if the remaining capacity of the vehicle is less than the amount of product delivery per carton of the customer will then use the vehicle whose capacity is still sufficient. The number of product shipments per carton to be made to Kopkar Pindodeli customers is 154. Due to insufficient vehicle capacity the next shipment will use other available vehicles, namely vehicle 2 with license plate B 8321 FDG and will make the second route for vehicle 2.
10. Repeat steps at points 1 through 9 until all vehicles are fully loaded and if any unfulfilled will be resumed later that day when the car returns if work time allows for delivery and otherwise it will resume next day.

Here the results of the selection of delivery routes to be made that can be seen in table 12.

Table 12 Results of Selection of Product Delivery Route to Customer on January 3rd

No	Vehicle	License Plate	Shipping Destination To Customers	Capacity Unfilled	Vehicle Capacity
1	Grandmax Box	B 8950 FDC	1. Sucipto (Klari, Karawang), 2. Kopkar Pindodeli (Teluk Jambe Timur, Karawang), 3. Baru Teluk Jambe (Teluk Jambe Timur, Karawang)	478 Box	500 Box
2	Grandmax Box	B 8321 FDG	1. Sederhana (Rengasdengklok, Karawang), 2. MM Sinar (Rengasdengklok, Karawang), 3. Gemah Ripah (Sukatani, Bekasi),	470 Box	500 Box
3	Grandmax Box	B 8468 FDD	1. Alina Mart (Sukatani, Bekasi) 2. MM Prima (Pebayuran, Bekasi).	308 Box	500 Box

6. CLOSING

6.1 Conclusion

After all the penultures are completed, it can be concluded as follows:

1. Distribution Management Information System This product can assist Warehouse Manager in estimating product procurement to maintain the safety of existing product stock in warehouse for next period, so as to minimize the risk of stock shortage that could happen and impact to distribution process of product to customer.
2. Distribution Management Information System This product can also assist Supervisor Warehouse in giving recommendation of distribution order and determining delivery route to customer according to vehicle capacity which will be used as transportation tool in product distribution process and minimize delay in product distribution to be done.

6.2 Suggestion

Based on the conclusions outlined above, the expected or forward-looking suggestion is as follows:

1. This system is enough to help PT Taawun Berkah Bersama in the procurement, ordering and delivery of products, but the system is expected to be developed so that the system can function better again in every existing process.

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