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Implementation Distribution Requirements Planning for Bajigur Powder Demand to Minimize Costs Using LFL and EOQ Methods in PT. XYZ Plant Cibitung

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ABSTRACT

PT. XYZ is a healthy food and beverage producer that produces a wide range of products distributed domestically and internationally. The distribution process is one of the most critical stages in supply chain management; therefore, the distribution process must be carried out properly, starting from the number of orders, delivery time, and quality assurance. This is very important because by keeping the distribution process reasonable, customer satisfaction will also be maintained—the problems faced by PT. XYZ currently is in the absence of an adequate Distribution Requirement Planning system, thus increasing the potential for excess or shortage of inventory in the warehouse. One of the locally produced products is Bajigur Powder, which is distributed by the four branch locations of the warehouse owned by PT. BSP including warehouses in Bandung, Karawang, Cirebon, and Bekasi. This study uses historical demand data from PT. BSP to PT. XYZ, to forecast future demand after forecasting, a good Distribution Requirement Planning system is also carried out so that PT. XYZ knows how many product units must be provided to meet the demand from PT. BSP at a specific time. The results showed that to meet the demand for Bajigur powder drink to 4 warehouse branches of PT. BSP distribution strategy using a combination of EOQ and LFL methods can reduce costs by Rp. 1,442,000 / year or about 8,23% of the existing conditions using only the LFL method. This method can control the availability of Bajigur Powder Drink products as well as distribution scheduling to optimize distribution activities.

Keywords
Distribution requirement planning, forecasting, supply chain, scheduling

Introduction

Food is the primary basic need for humans that must be fulfilled at all times. In addition to three complete menus in the main diet to meet the body's calorie needs, a snack that is less in number than the main meal and can take the form of food or drinks is significant because it can provide extra energy. Businesses in the food and beverage sector will never become numerous and develop from time to time with increasingly diverse human needs.

Today, the increasingly competitive competition in the soft drink industry demands services in fast and precise product availability according to quantity and quality and avoid missing business opportunities. The limited ability of a company to handle consumer demands for product availability can cause various losses. Therefore, it is necessary to have external parties who can support the success of a company. One of the external parties that plays a significant role in handling this matter is the party that can carry out part of the product distribution activities, namely the distributor.

Companies use various ways to win the competition, including increasing customer satisfaction through quality products, on-time delivery, and cost-efficiency (Bushuev et al., 2013). The policy to control product inventory at a specific location must be accompanied by the ability of management to coordinate distribution planning from the marketing department, as well as in the production section, which results in product inventory levels to produce the right amount so that who can maintain the level of customer satisfaction and company profits.

PT. XYZ is a national private company that is engaged in the health food and beverage industry. The company was founded in February 1979. Its head office is in Jakarta, with a distribution network that reaches more than thirty countries globally. Currently PT. XYZ Indonesia, which already has 933 outlets and distributors spread across Indonesia, has two factories, namely in Ciawi and Bekasi, and has four supporting factories in Malang, Gresik, Surabaya, and Jakarta. Apart from making local Indonesian shipments, the company also sends products to several other countries.

One of the products of PT. XYZ is Bajigur Powder Drink. Bajigur Powder Drink in 2018 won an award from the Ministry of Tourism of the Republic of Indonesia as 'Wonderful Indonesia Co-Branding Champions 2018: The Best Product for Promoting Local Heritage'. Therefore, one way to improve this product's performance is by carrying out a structured distribution plan for the Sebuk Bajigur beverage product throughout Indonesia and even abroad.

Currently at PT. XYZ to meet the needs of consumers or distributors relies on the number of previous requests. This can cause PT. XYZ faces two risks: lost sales because the demand for goods is more significant than inventory or excess inventory because the quantity demanded is smaller than stock.

Based on the problems that occurred at PT. XYZ things that can be done are planning and scheduling replenishment of supplies for distribution needs. One method that can be used is Distribution Requirements Planning (DRP). Distribution Resource Planning is a system for forecasting or projecting requirements for finished products at the point of demand (Farrington & Lyson, 2006). Thus, this research aims to implement Distribution Requirements Planning (DRP) at PT. XYZ to control the availability of Bajigur Powder Drink products and distribution scheduling to optimize distribution activities. With good planning, excess or shortage of inventory will not occur at every level of distribution activities that costs incurred for shipping can be minimized.

Literature Review

Supply Chain Management

Supply Chain Management (SCM) is a method or approach to managing the flow of products, information, and money in an integrated manner that involves parties, from upstream to downstream, consisting of suppliers, factories, distribution activities players, and logistics services (Pujawan & Mahendrawati, 2017). The implementation of supply chain management can directly benefit companies in increasing profits, reducing costs, and creating customer satisfaction. Along with the times, the manufacturing industry also continues to develop in applying control of the raw material supply system and the fabrication planning process. The supply chain system has created a network that is interrelated to form a supply chain. In addition to improving process efficiency, supply chain management can also guarantee product quality (Maddeppungeng et al., 2015).

Forecasting

According to Heizer and Render (2014), forecasting is a combination of art and science to predict future events. Historical data is used to be processed as projections in forecasting the future. The quantitative method is the method most often used in forecasting problems. Time series is a series or set of data recorded in a certain period such as daily, weekly, monthly, or yearly. An important part that needs to be considered in the time series method is determining the data pattern type (Maricar, 2019). The technique required to use the time series method includes:

1. Double Moving Average method this method is quite suitable for short-term and medium-term forecasting. The double Moving Average technique is done by calculating the average twice then followed by forecasting using absolute equations. (Sinaga & Irawati, 2018).
2. Double Exponential Smoothing the parameter used in Brown's double exponential smoothing method is α, which has a value between 0 and 1. If more data is used in calculating the forecast, the forecast error of the estimates will be smaller, and vice versa. (Sinaga & Irawati, 2018).
3. Linear regression this method is a suitable solution for use by multi-product companies. By estimating various product combinations, the company can maximize profits and evaluate the right production amount (Indarwati et al., 2019). This method is used to determine the statistical relationship between the causal factor variable and the consequent variable. The symbol x is expressed as a causative factor while the resulting variable is denoted by Y (Marbun et al., 2018).

Calculation of Error Level

The number of forecast errors is not an appropriate measure to determine how effective the forecasting method is used, but only a measurement or the resulting difference. To avoid problems where positive forecasting error values neutralize negative forecasting error values, several alternative forecasting error methods that are widely used are as follows (Singgih, 2009):

1. Mean Square Error (MSE)
2. Mean Absolute Error (MAE)
3. Mean Absolute Percentage Error (MAPE)

Distribution Requirement Planning (DRP)

DRP method is a method for handling inventory procurement in a multi-level distribution network. DRP systems are designed to take demand forecasts and reflect them through a distribution system based on gradual needs (Baily et al., 2008). Distribution Requirements Planning functions to determine the need for replenishing inventory at branch warehouses based on the demand phase for each item in the distribution channel (Wahyuningsih et al., 2018). Good planning and scheduling in distribution activities are expected to optimize consumer demand fulfillment and improve performance in terms of quantity and time accuracy. Distribution costs can be kept to a minimum (Herdiani & Kustiawan, 2015). DRP systems work to eliminate inventory and combine the need for lower inventory investment with improved customer service (Rushton & Phil, 2011). The development of an effective inventory model will determine the number of order sizes with a minimum total inventory cost (Magdalena & Suli, 2019). In compiling DRP, there are essential components that need to be known (Anistya, 2019):

1. Gross Requirements is the amount of demand for product needs, where (GR) is obtained from the results of forecasting that have been done previously.
2. Schedule Receipt is the number of products to be received in a certain period based on the order made
3. Net requirements show the actual amount required by each shop in each period. Net Requirements is the number of goods needed to meet the existing shortages in demand.
4. Inventory On Hand is the number of items in stock. The number of things is the number of each product in each store at the end of each month. Then by knowing the projected on hand, the net requirements can be calculated by reducing the gross requirements.
5. Lot Size is the lot size when ordering goods. This measure of order is carried out from store to warehouse.
6. Planned Order Receipt and Planned Order Release
   Planned order receipts are a calculation of the order quantity required in a given period. While the planned order release determines when an order must be made by each store so that the goods are available when a request occurs, according to the order lead time.
7. Lead Time order lead time is the time it takes from the initial order until the receipt of the goods. This determination is carried out based on the company's policy, where the lead time is the time from the order to pass from the warehouse to each store.

Lot for Lot (LFL) Method

The LFL method is the most straightforward lot-sizing technique. The saving cost to zero is one of the advantages of this technique. The purpose of this LFL is to minimize the saving costs that occur in planning material requirements. The implementation of meeting the net needs of the LFL is carried out in each required period. The ordering cost in the LFL is the amount of price to order or prepare the required raw materials. For the quantity measure or the quantity's size, the order is the same as the number of net needs for each period concerned that must be met (Heizer & Render, 2014).

Economic Order Quantity (EOQ) Method

One of the right methods in minimizing total inventory costs is EOQ. The EOQ method in determining the optimal order size and minimum stock level can use query data (Ngatilah et al., 2020). The EOQ method is a standard formula used to balance storing too much or too little inventory (Moon & Lee, 2000). A company will be able to minimize out-of-stock occurrence to not interfere with the company's production process

and save on the cost of raw material inventory in the company. The EOQ method strives to achieve the minimum possible inventory level, lower prices, and better quality. On the other hand, Economic Order Quantity identifies optimal order quantity by minimizing a certain annual quantity costs vary with the size of the order (Kamanfrand, 2012).

Methodology

The following is a research method used by the author in this study is presented in Figure 1:

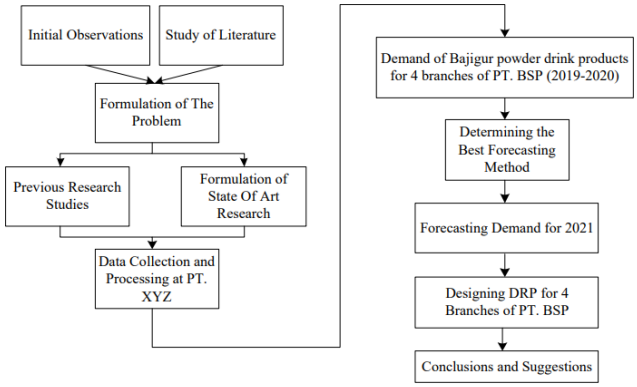

Figure 1. Research methodology chart

1. Initial Observation and Literature Study
   A literature study is a way to solve problems by tracing pre-made sources related to issues obtained from initial observations.
2. Data Collection and Data Processing
   The data collected and processed is obtained from the purchase history of Bajigur Powder Drinks by PT. BSP at PT. XYZ collected from 2019 to 2020.
3. Determine the Best Method
   The best forecasting method is chosen as a reference for estimating the amount of demand for Bajigur powder drink products. Therefore, the method selected must be done as well as possible.
4. Forecasting Demand in 2021
   The method used to predict the amount of demand in 2021 is the best method that has been chosen. This forecasting is carried out to 4 retailer branches
5. Doing DRP Planning
   Distribution Requirement Planning is done by using EOQ and LFL methods for four branches of PT. BSP already has the respective quantity forecasts for its demand in 2021.
6. Conclusion
   The conclusions in this journal are made to meet the expectations of existing goals. The decisions made are based on the evidence obtained from the results of data processing that has been carried out. Suggestions made into the opinion of the author to be implemented. Recommendations from the author can be a way to find out existing problems or weaknesses.

Results and Discussion

Data processing was carried out by collecting requests for Bajigur Powder Drink products in a master box containing 24 small boxes and a minimum order of 1 master box PT. BSP in 4 regional branches to PT. XYZ from January 2019 to December 2020. A total of 96 data were taken from the purchase history recorded in the company's historical data. The following are 96 data presented in Table 1 and Table 2:

Table 1. Demand of 2019

Year	Months	Branch of PT. BSP				Total
		Bandung	Karawang	Cirebon	Bekasi	
2019	Jan	40	66	15	0	121
	Feb	79	75	55	2	211
	Mar	50	75	48	4	177
	Apr	85	20	35	13	153
	May	83	78	104	11	276
	Jun	66	45	15	0	126
	Jul	35	20	20	5	80
	Aug	26	12	9	3	50
	Sep	10	5	10	2	27
	Oct	29	6	2	1	38

	Nov	23	9	11	5	48
	Dec	10	11	4	2	27

Table 2. Demand of 2020

Year	Months	Branch of PT. BSP				Total
		Bandung	Karawang	Cirebon	Bekasi	
	Jan	63	18	18	3	63
	Feb	14	21	19	10	14
	Mar	28	6	18	0	28
	Apr	24	15	16	2	24
	May	37	18	33	7	37
2020	Jun	8	0	0	0	8
	Jul	10	19	4	6	10
	Aug	16	8	12	2	16
	Sep	19	12	6	4	19
	Oct	28	18	7	5	28
	Nov	15	20	4	2	15
	Dec	0	0	7	6	13

The following is a description of the Distribution Requirements Planning between PT. BSP and PT. XYZ so it can be seen as shown in Figure 2.

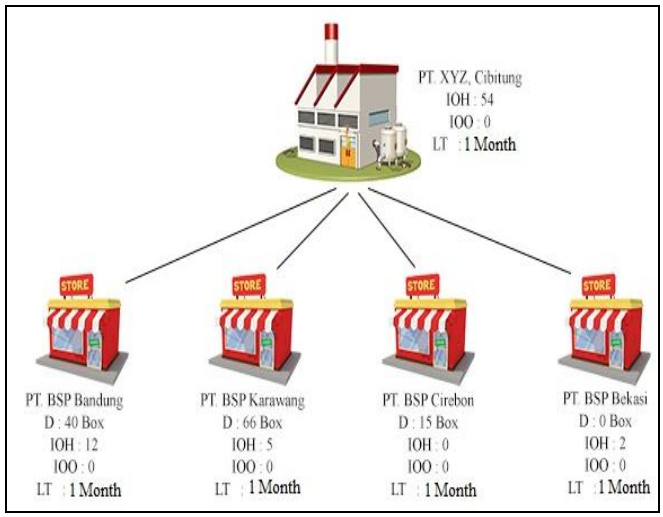

Figure 2. Network map PT. XYZ to PT. BSP

Each branch of PT. BSP has different demand sizes from one another because this demand is influenced by the absorption of Bajigur Powder Drink products in different regions.

The following is the assumption data used to describe the amount of inventory on Hand (IOH) and lead time at each branch of PT. BSP, which will influence the calculation of the purchase plan to PT. XYZ is presented in Table 3:

Table 3. Parameter DRP

Branch of PT. BSP	IOH	Lead Time
Bandung	12	1
Karawang	5	1
Cirebon	0	1
Bekasi	2	1

Data from Table 1 and Table 2 are used as a reference for determining the best forecasting method to determine the approximate amount of Bajigur powdered beverage product demand by PT. BSP in 2021. There are 3 methods used to forecast the magnitude of this demand, namely Double Moving Average, Double Exponential Smoothing (Brown), and Linear Regression. The following Table 4 summarizes the results of the forecast for 2021:

Table 4. Forecasting demand of 2021

Period (2021)	DMA	DES (Brown)	Linear Regression
1	62	42	85
2	55	19	85
3	58	14	85
4	61	10	86

5	64	6	86
6	67	2	86
7	69	-2	86
8	72	-6	87
9	75	-10	87
10	78	-14	87
11	80	-18	87
12	83	-22	88
MSE	1772	2794	2951

The MSE (Mean Squared Error) value is a method used to measure the accuracy of a forecasting model. MSE represents the average error absolute between the forecast results and the actual value. The MSE value of the DMA forecasting method is the smallest with 1772 units, and this indicates that among the three methods used, the DMA method is the method with the most significant similarity to the actual data. Therefore, the DMA method will be used to predict the quantity of demand in 2021 for Bajigur Powder Drink products from four branches of PT. BSP towards PT. XYZ. Table 5 is the result of demand forecasting in 2021 from each branch of PT. BSP using the Double Moving Average method.

Table 5. Demand forecasting results

Period	PT. BSP			
	Bandung	Karawang	Cirebon	Bekasi
Jan-21	32	15	11	5
Feb-21	26	25	2	4
Mar-21	28	27	1	4
Apr-21	30	30	2	4
May-21	32	32	3	3
Jun-21	34	35	5	3
Jul-21	35	38	6	3
Aug-21	37	40	8	3
Sep-21	39	43	9	3
Oct-21	41	45	11	3
Nov-21	42	48	12	3
Dec-21	44	50	14	3

Based on Table 5, it is known that the amount of demand for Bajigur Powder Drink in each branch of PT. BSP, the next step is to design a Distribution Requirement Planning for the year 2021 at each branch of PT. BSP from available data. The following is an assumption of the number of costs that are parameters in the DRP design which is presented in the Table 6:

Table 6. DRP parameter calculation

Cost Parameter	Branch of PT. BSP	Unit	Cost
Delivery	Bandung	/order	Rp. 500.000
	Karawang		Rp. 300.000
	Cirebon		Rp. 600.000
	Bekasi		Rp. 200.000
Carrying	All	/month/box	Rp. 2.000
Product	All	/box	Rp. 600.000

In the distribution design using the DRP method at PT. XYZ, 2 lot sizing methods are carried out, namely Economic Order Quantity (EOQ) and Lot for Lot (LFL). The LFL method is an existing condition in the product distribution process, and later these two methods will be compared to see the method with the lowest cost and the shipping scenario that will be carried out. The following is the calculation result of the EOQ value for each branch of PT. BSP based on demand projections in 2021 which is presented in the Table 7:

Table 7. EOQ calculation results

Branch of PT. BSP	EOQ
Bandung	502
Karawang	507
Cirebon	225
Bekasi	157

The EOQ value, according to Table 6 is the optimal amount of demand for each branch by minimizing the total cost. This EOQ value will be

used as the amount of the request every time an order is made. The following is the DRP design of the EOQ method for PT. BSP Bandung branch with Inventory on Hand 12 Boxes and 1-month lead time as presented in Table 8.

Table 8. DRP PT. BSP Bandung branch with EOQ methods

Item Name		Bajigur Powder Drink			Description		Bandung							Total
unit		box			On Hand		12							
Lead Time		1			Lot Size		EOQ	502						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		32	26	28	30	32	34	35	37	39	41	42	44	420
SR		502												
IOH	12	482	456	428	398	366	332	297	260	221	180	138	94	3652
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	0	0	0	0	0	0	0	0	0	0	0	0
PORL		0	0	0	0	0	0	0	0	0	0	0	0	0
Carrying Cost		Rp 964.000	Rp 912.000	Rp 856.000	Rp 796.000	Rp 732.000	Rp 664.000	Rp 594.000	Rp 520.000	Rp 442.000	Rp 360.000	Rp 276.000	Rp 188.000	Rp 7.304.000
Delivery Cost	Rp -	Rp 500.000	0	0	0	0	0	0	0	0	0	0	0	Rp 500.000
Total Cost														Rp 7.804.000

The following is the DRP design of the EOQ method for PT. BSP Karawang branch with 5 Box on Hand Inventory and 1-month lead time as presented in Table 9.

Table 9. DRP PT. BSP Karawang branch with EOQ methods

Item Name		Bajigur Powder Drink			Description		Karawang							Total
unit		box			On Hand		5							
Lead Time		1			Lot Size		EOQ	507						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		15	25	27	30	32	35	38	40	43	45	48	50	428
SR		507												
IOH	5	497	472	445	415	383	348	310	270	227	182	134	84	3767
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	0	0	0	0	0	0	0	0	0	0	0	0
PORL		0	0	0	0	0	0	0	0	0	0	0	0	0
Carrying Cost		Rp 994.000	Rp 944.000	Rp 890.000	Rp 830.000	Rp 766.000	Rp 696.000	Rp 620.000	Rp 540.000	Rp 454.000	Rp 364.000	Rp 268.000	Rp 168.000	Rp 7.534.000
Delivery Cost	Rp -	Rp 300.000	0	0	0	0	0	0	0	0	0	0	0	Rp 300.000
Total Cost														Rp 7.834.000

The following is the DRP design of the EOQ method for PT. BSP Cirebon branch without Inventory on Hand with 1-month lead time as shown in Table 10.

Table 10. DRP PT. BSP Cirebon branch with EOQ methods

Item Name		Bajigur Powder Drink			Description		Cirebon							Total
unit		box			On Hand		0							
Lead Time		1			Lot Size		EOQ	225						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		11	2	1	2	3	5	6	8	9	11	12	14	84
SR		225												
IOH	0	214	212	211	209	206	201	195	187	178	167	155	141	2276
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	0	0	0	0		0	0	0	0	0	0	0
PORL		0	0	0	0	0	0	0	0	0	0	0	0	0
Carrying Cost		Rp 428.000	Rp 424.000	Rp 422.000	Rp 418.000	Rp 412.000	Rp 402.000	Rp 390.000	Rp 374.000	Rp 356.000	Rp 334.000	Rp 310.000	Rp 282.000	Rp 4.552.000
Delivery Cost	Rp -	Rp 600.000	0	0	0	0	0	0	0	0	0	0	0	Rp 600.000
Total Cost														Rp 5.152.000

The following is the DRP design of the EOQ method for PT. BSP Bekasi branch with two boxes on Hand Inventory and 1-month lead time as presented in Table 11.

Table 11. DRP PT. BSP Bekasi branch with EOQ methods

Item Name		Bajigur Powder Drink			Description		Bekasi							Total
unit		box			On Hand		2							
Lead Time		1			Lot Size		EOQ	157						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		5	4	4	4	3	3	3	3	3	3	3	3	41
SR		157												
IOH	2	154	150	146	142	139	136	133	130	127	124	121	118	1620
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	0	0	0	0	0	0	0	0	0	0	0	0
PORL		0	0	0	0	0	0	0	0	0	0	0	0	0
Carrying Cost		Rp 308.000	Rp 300.000	Rp 292.000	Rp 284.000	Rp 278.000	Rp 272.000	Rp 266.000	Rp 260.000	Rp 254.000	Rp 248.000	Rp 242.000	Rp 236.000	Rp 3.240.000
Delivery Cost	Rp -	Rp 200.000	0	0	0	0	0	0	0	0	0	0	0	Rp 200.000
Total Cost														Rp 3.440.000

The Lot for Lot (LFL) method is used to ignore storage costs, where PT. XYZ will deliver the goods according to the request from PT. BSP without the need to store it in the warehouse as inventory first. The following is the DRP design of the LFL method for PT. BSP Bandung branch with Inventory on Hand 12 Boxes and 1-month lead time as presented in Table 12.

Table 12. DRP PT. BSP Bandung branch with LFL methods

Item Name		Bajigur Powder Drink			Description		Bandung							Total
unit		box			On Hand		12							
Lead Time		1			Lot Size		LFL	1						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		32	26	28	30	32	34	35	37	39	41	42	44	420
SR		20												
IOH	12	0	0	0	0	0	0	0	0	0	0	0	0	0
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	26	28	30	32	34	35	37	39	41	42	44	388
PORL		26	28	30	32	34	35	37	39	41	42	44	0	388
Carrying Cost		Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -
Delivery Cost		Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000	Rp 500.000		Rp 5.500.000
Total Cost														Rp 5.500.000

The following is a DRP design for the LFL method for PT. BSP Karawang branch with 5 Box on Hand Inventory and 1-month lead time as presented in Table 13.

Table 13. DRP PT. BSP Karawang branch with LFL methods

Item Name		Bajigur Powder Drink			Description		Karawang							Total
unit		box			On Hand		5							
Lead Time		1			Lot Size		LFL	1						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		15	25	27	30	32	35	38	40	43	45	48	50	428
SR		10												
IOH	5	0	0	0	0	0	0	0	0	0	0	0	0	0
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	25	27	30	32	35	38	40	43	45	48	50	413
PORL		25	27	30	32	35	38	40	43	45	48	50	0	413
Carrying Cost		Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -
Delivery Cost		Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000	Rp 300.000		Rp 3.300.000
Total Cost														Rp 3.300.000

The following is the DRP design of the LFL method for PT. BSP Cirebon branch without Inventory on Hand with 1-month lead time as presented in Table 14.

Table 14. DRP PT. BSP Cirebon branch with LFL methods

Item Name		Bajigur Powder Drink			Description		Cirebon							Total
unit		box			On Hand		0							
Lead Time		1			Lot Size		LFL	1						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		11	2	1	2	3	5	6	8	9	11	12	14	84
SR		11												
IOH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	2	1	2	3	5	6	8	9	11	12	14	73
PORL		2	1	2	3	5	6	8	9	11	12	14	0	73
Carrying Cost		Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -
Delivery Cost		Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000		Rp 6.600.000
Total Cost														Rp 6.600.000

The following is the DRP design of the LFL method for PT. BSP Bekasi branch with 2 boxes on Hand Inventory and 1-month lead time as presented in Table 15.

Table 15. DRP PT. BSP Bekasi branch with LFL methods

Item Name		Bajigur Powder Drink			Description		Bekasi							Total
unit		box			On Hand		2							
Lead Time		1			Lot Size		LFL	1						
Periode	0	1	2	3	4	5	6	7	8	9	10	11	12	
GR		5	4	4	4	3	3	3	3	3	3	3	3	41
SR		3	0	0	0	0	0	0	0	0	0	0	0	
IOH	2	0	0	0	0	0	0	0	0	0	0	0	0	0
NR		0	0	0	0	0	0	0	0	0	0	0	0	0
PORC		0	4	4	4	3	3	3	3	3	3	3	3	36
PORL		4	4	4	3	3	3	3	3	3	3	3	0	36
Carrying Cost		Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -	Rp -
Delivery Cost		Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000	Rp 200.000		Rp 2.200.000
Total Cost														Rp 2.200.000

Based on the DRP design of the four branches of PT. BSP by using two different lot sizing methods, the following is a comparison of distribution costs and storage costs arising from these activities are presented in Table 16:

Table 16. Comparison of DRP methods

Branch of PT. BSP	Methods	Parameter		Cost		Total Cost
		Delivery Frequency	Stored Goods	Delivery	Carrying	
Bandung	LFL	12	0	Rp. 13.200.000	0	Rp. 5.500.000
	EOQ	1	3652	Rp. 500.000	Rp. 7.304.000	Rp. 7.804.000
Karawang	LFL	12	0	Rp. 5.500.000	0	Rp. 3.300.000
	EOQ	1	3767	Rp. 300.000	Rp. 7.534.000	Rp. 7.834.000
Cirebon	LFL	12	0	Rp. 19.800.000	0	Rp. 6.600.000
	EOQ	1	2276	Rp. 600.000	Rp. 4.552.000	Rp. 5.152.000
Bekasi	LFL	12	0	Rp. 3.600.000	0	Rp. 2.200.000
	EOQ	1	1620	Rp. 200.000	Rp. 3.240.000	Rp. 3.440.000

Looking at the data presented in Table 16, each branch of PT. BSP has different optimal methods, where distribution to Bandung, Karawang, and Bekasi branches has a lower cost when using the LFL method. In comparison, distribution to Cirebon has a lower cost when using the EOQ method. After knowing the distribution design from PT. XYZ to PT. BSP through the LFL and EOQ methods, the projected time and number of orders for each period can be used as a reference for decision making in the distribution system between PT. XYZ and PT. BSP.

Conclusion

Based on the analysis of the application of the Distribution Requirement Planning (DRP), the planning of the distribution requirements for the Bajigur powder beverage products produced by PT. XYZ to fulfill requests from 4 branches of PT. BSP. This planning is used to optimize the

distribution of goods from producers to consumers, which is carried out in several stages. The existence of a history of the magnitude of demand in the past makes future requests predictable. The forecasting method used is Double Moving Average (DMA) because it has the smallest Mean Square Error (MSE) value when compared to other methods. The forecast obtained from forecasting the demand for Bajigur powder drink products is the number of Gross Requirements that will be used in the calculation of the application of DRP.

This Gross Requirements value is the amount of demand required by each branch of PT. BSP. However, the order size in each period depends on what DRP method is used. If you use the EOQ method, the order size in the past-due period will be greater than the first period request, whereas if you use the LFL method, the order size in the past-due period will be the same with requests in the first period. The difference in ordering time and order quantity causes a difference in the total distribution costs in Table 17. The application of DRP for the period of 2021 using the EOQ method costs Rp. 24,230,000, if using the LFL method, the cost required is Rp. 17,600,000, whereas if using the combination method of LFL and EOQ, it will cost Rp. 16,152,000. There is a difference of around Rp. 1,148,000 or about 8.23% between the methods that have been used (LFL) and the combination method (LFL and EOQ), therefore the LFL method is more recommended to be applied to the distribution network of PT. XYZ to the branch of PT. BSP in Bandung, Karawang, and Bekasi, while distribution to Cirebon branches is recommended to use the EOQ method which is presented in the Table 17.

Table 17. Comparison of Costs

Branch of PT. BSP	Total Cost		Optimal Methods
	EOQ	LFL	
Bandung	Rp. 7.804.000	Rp. 5.500.000	LFL
Karawang	Rp. 7.834.000	Rp. 3.300.000	LFL
Cirebon	Rp. 5.152.000	Rp. 6.600.000	EOQ
Bekasi	Rp. 3.440.000	Rp. 2.400.000	LFL
Total	Rp. 24.230.000	Rp. 17.600.000	Rp. 16.152.000

The planning of the distribution of Bajigur powder drink products to 4 branches of PT. BSP from PT. XYZ by using the Distribution Requirements Planning (DRP) aims to determine the size and time of orders that will be received by PT. XYZ every month of the year and provides the best choice of methods with the lowest cost projections. With the right size and order time, PT. XYZ can control inventory and manage distribution scheduling properly so that it can reduce potential lost sales because the demand for goods is greater than inventory and experience excess inventory because the amount of demand is smaller than inventory. The application of DRP can also be continued by integrating the selection of transportation modes to be used when shipping with adjustments to the number of requests from customers so that it allows more optimal costs to arise from the comparison of several types of transportation modes. Therefore, the authors suggest conducting further research with these parameters.

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