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Effect of Distribution Resources Planning (DRP) Method on Supply Chain Management (SCM)

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Abstract

PT. Growth Asia is an industrial company in the iron and steel foundry sector. It is well known for its export orientation as a supplier of wear-resistant parts to the international market, especially in gold and copper mining. This steel product will be used for planning distribution activities in mining, with the primary raw material, namely scrap (old iron or scrap iron) obtained from domestic suppliers, which is then processed into finished products, namely selections (mining tools) and distributed to the distribution centre. namely Gorontalo, Maluku, Papua, and South Kalimantan. Fulfilment of consumer demand for the product is not timely; this occurs due to problems in the distribution schedule at the distribution centre to each city that is a consumer of PT. Growth Asia. Based on these problems, the purpose of this study is to determine the factors that cause non-smooth distribution, determine distribution scheduling planning using the Distribution Resources Planning (DRP) method and its effect on supply chain management method that can be proposed to deal with this problem is Distribution Resources Planning (DRP). With DRP, companies can initiate distribution scheduling more accurately and, at the same time, achieve production stability. The results of distribution planning and scheduling with the DRP method can reduce the total frequency of orders from 20 orders to 13 demands, and distribution costs have decreased by 13%, from IDR 39,610,000 to IDR 26,159,000.

Keywords: *Distribution resources planning, Distribution centre, Scheduling, Supply Chain Management.*

1. Introduction

Improvements and improvements need to be made in all industrial sectors, including distribution management. This distribution activity is essential because it involves meeting customer needs. In such a competitive business environment, various ways are used by companies to compete to be the best in the global market to increase customer satisfaction. For this reason, the company must also pay attention to the materials offered to meet consumer demand, which is focused on quality, durability, affordable (economical) prices, and perhaps even the ease of consumers obtaining these materials.

PT. Growth Asia is an industrial company engaged in casting iron and steel, which is very well known with export orientation as a supplier of wear-resistant spare parts to the international market, especially in gold and copper mining. This steel product will be used for planning distribution activities in mining, with the primary raw material being scrap (scrap or scrap metal) obtained from domestic suppliers, which are then processed into finished products, namely selections (mining equipment) and distributed to distribution centres. namely Gorontalo, Maluku, Papua, and South Kalimantan.

The demand for selection steel materials in Gorontalo, Maluku, Papua and South Kalimantan is increasing to facilitate consumer service; distribution centres are made in each city. Table 1 shows the stock and demand data for Selecton steel material in 2020.

Table I. Total Demand and Stock of Selecton Steel Materials in 2020

Period	Number of Requests (Units)	Stock	Difference
January – March	228	191	-37
April – June	354	342	-12

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Period	Number of Requests (Units)	Stock	Difference
July - September	243	285	44
October -December	407	330	-77

Table 1 shows the amount of production and the number of asynchronous requests, so that customer requests are not fulfilled. Another problem is fulfilling consumer demand for products that are not on time. This occurs due to issues with distribution scheduling at the distribution centre to each city that is a consumer of PT—Asian Growth. With the problems that arise, the purpose of this research is to find out the factors that cause non-current distribution, to know the distribution scheduling plan using the Distribution Resources Planning (DRP) method and its influence on supply chain management.

One method that can be proposed to deal with this problem is Distribution Resources Planning (DRP), a distribution schedule planning method. With DRP, companies can start distribution scheduling more accurately and, at the same time, achieve production stability. DRP has expanded from the distribution of manufacturing processes to even the concept of DRP, enabling the integration of supply chain processes. Besides, DRP can improve customer service, inventory management, purchasing, manufacturing effectiveness, and profit maximization [1]. By designing a directed DRP concept, it is hoped that it can support the Supply Chain Management (SCM) system to run and integrate properly, solving unfulfilled demand problems which impact non-smooth distribution.

2. Research Methodology

2.1. Research Stages

This research was conducted at PT—Growth Asia, KIM I Mabar, Medan. The data in this study were obtained from interviews, company documentation, and literature studies related to distribution activities. The research data consists of supply chain lines in the company, product demand from customers, shipping capacity/stock from the company, and customer destination areas.

From the existing data, data processing is then carried out using the basic approach of the DRP method, such as demand forecasting, safety stock calculations, and order quantity calculations. The data processing results become the basis for analyzing the factors that influence non-current distribution and scheduling planning, as well as the influence of the DRP method on the effectiveness of the company's supply chain management.

2.2. Metode Distribution Resources Planning (DRP)

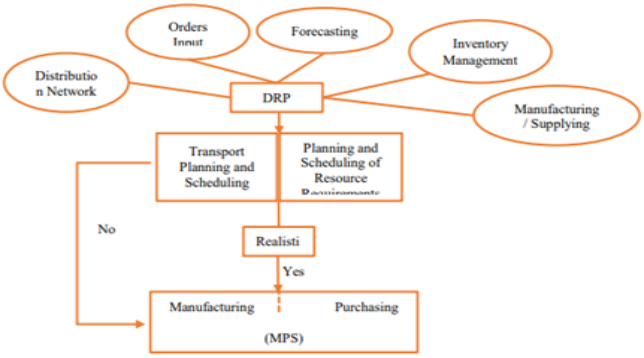
Distribution Resource planning is the application of material requirement planning rational numbers based on demand forecasting at the lowest level in the network to be able to determine inventory requirements at a higher level [2]. DRP has been an effective method of inventory control in multi-product, multi-echelon physical distribution environments since 1970. The goal is to gain complete visibility of inventory levels at every supply chain node [3].

DRP is driven by sales forecasting, so small changes downstream can lead to significant changes upstream. Dependencies between network nodes also create too long a delay to respond to actual requests and cause signal distortion and many more bullwhip effects (small fluctuations in demand at the downstream level will increase dramatically as we move towards the upstream level).

Distribution Resource planning (DRP) is a management process for determining needs at supply locations and ensuring supply sources can meet demand. Some of the input data needed in DRP consists of:

1. Customer Orders
2. Inventory for sale

3. Purchasing and/or making orders for products purchased and/or produced
4. Delivery time and production
5. Securities stock policy
6. Minimum purchase, production, and distribution quantities.



Source : [3]

Figure 1. Diagram Proses DRP

In Figure 1, it can be seen that after all input data is integrated, DRP produces a simulation of resource requirements from time to time to support a logistics strategy which includes what products will be needed, how much and when, transport capacity requirements by type of vehicle and deposit, labour requirements, surface and equipment with deposits, and stock investment needs.

3. Results and Discussion

3.1. Research Results

The demand data for steel material products is the basis of historical data for demand forecasting for the next 12 months. After forecasting the number of requests, this number of proposals will be used for the initial scheduling of production and scheduling and scheduling of production activities using the DRP worksheet [4]. Data on the number of steel material shipments to each distribution centre can be seen in table 2 below.

Table 2. Demand Data for Selecton Products for January-December 2021

Month	Gorontalo	Maluku	Papua	South Kalimantan	Total (Ton)
January	18	17	18	20	73
February	17	15	16	17	65
March	20	20	30	20	90
April	36	25	24	30	115
May	26	35	25	35	121
June	22	26	30	40	118
July	18	17	18	25	78
August	20	20	16	17	73
September	20	22	30	20	92
Oktober	26	35	25	43	129
November	22	26	28	40	116
December	45	36	36	45	162
Total					1232

Inventory status at each distribution centre can be seen in table 3

Table 3. Initial Inventory Status Data

No	*Distribution Centre*	Amount of stockpile (Ton)
1	Gorontalo	150
2	South Kalimantan	250
3	Maluku	155
4	Papua	162

To support product delivery activities in the form of administrative costs, telephone costs, and loading and unloading costs. The cost of ordering at each distribution center can be seen in table 4 below.

Table 4. Order Cost Data

Distribution Centre	**Administrative costs (Rp/Order)**	**Phone Fee (Rp/Order)**	**Shipping Fee (Rp/Send)**	Total Cost (Rp)
Gorontalo	8.000	10.000	1.550.000	1.568.000
South Kalimantan	8.000	10.000	1.835.000	1.853.000
Maluku	8.000	10.000	2.195.000	2.213.000
Papua	8.000	10.000	2.450.000	2.468.000

In addition to ordering costs, the company has also set inventory holding costs. Inventory storage costs are costs incurred by the company as a form of product inventory in the warehouse. These costs include costs estimated due to capital held in stock, costs used for maintaining goods, and moving products. The company's inventory storage cost is Rp—130,000/ton for one year.

3.2. Discussion

From the data obtained, further data processing and analysis are carried out as follows:

a) Determination of order quantity for each distribution centre

Calculate the order quantity for each distribution centre using the economic order quantity method. The EOQ calculation uses the following equation (1) [5].

$$Q\ optimal = \sqrt{\frac{2DA}{h}} \quad (1)$$

Description:

D : Total demand for goods during one period (year)
A : Ordering cost every time you order
H : Holding cost per 1-ton unit for one period (year)

Table 5 is the result of calculating the order quantity using the EOQ method at each distribution centre.

Table 5. Recapitulation of Order Quantity Calculations

No	***Distribution Centre***	***Order Quantity* (Ton/Order)**
1	Gorontalo	84
2	South Kalimantan	100
3	Maluku	100
4	Papua	106

From the calculation results shown in table V, the total order quantity for several distribution areas, such as Gorontalo, South Kalimantan, Maluku and Papua, has a reasonably high number of order quantities for each order, namely 100 tons and 106 tons due to the high number of requests and distribution costs. Inversely proportional to the product storage costs (holding costs) that underlie the number of order quantities to be higher. In other words, applying the order quantity will save on distribution costs.

b) Determination of the frequency of orders

Based on the calculation of the frequency of orders, it can be seen in table 6 as a comparison of the frequency of orders without the DRP method with those who have used the DRP method.

Table 6. Comparison of Order Frequency

No	***Distribution Centre***	**Order Frequency (Without DRP)**	**Order Frequency (DRP)**
1	Gorontalo	6	3
2	South Kalimantan	5	4
3	Maluku	5	3
4	Papua	4	3
Total		20	13

By calculating using DRP, it can minimize distribution costs by reducing the total frequency of orders from 20 orders to 13 charges.

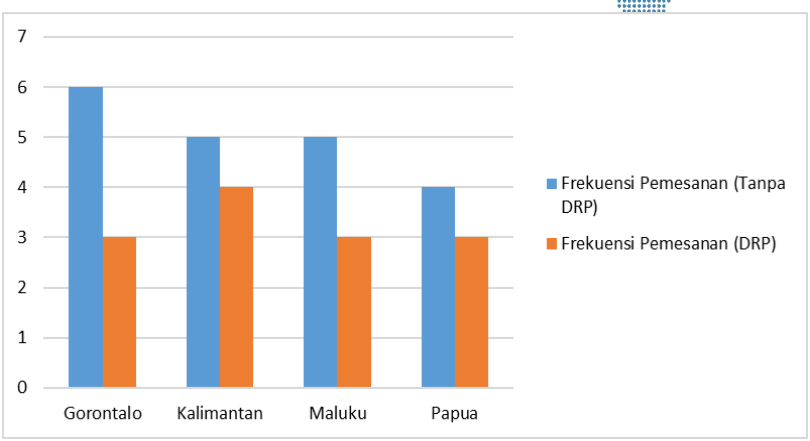


Figure 2. Order Frequency Comparison

In Figure 2, it can be seen that there is a decrease in the frequency of orders for each distribution centre after using the DRP method. Using the DRP method, we can reduce the frequency of orders from 20 orders to 13 rankings with a percentage decrease of 35%. This decrease in orders can reduce the cost of ordering for the company.

c) Determination of safety stock

In planning with DRP, it is estimated that safety stock is carried out simply by assuming average demand and the level of service the company desires is 95% [6]. Equation (2) is used in the calculation of safety stock.

Safety Stock = s x Z (2)

Description :

s : Standard deviation of requests at the distribution centre

Z : The Z value obtained is 95% or 1.65. This value is obtained from the table's normal distribution

From the results of the safety stock calculations carried out to find out the safety stock in each DC's warehouse, the recapitulation of the safety stock calculations for each DC can be seen in table 7 below:

Table 7. Recapitulation of Safety Stock Calculations

Bulan	Gorontalo	South Kalimantan	Maluku	Papua
January	18	20	17	18
February	17	17	15	16
March	20	20	20	30
April	36	30	25	24
May	26	35	35	25
June	22	40	26	30
July	18	25	17	18
August	20	17	20	16
September	20	20	22	30
October	26	43	35	25
November	22	40	26	28
December	45	45	36	36
Total	**290**	**352**	**294**	**296**
Average	24,17	29,33	24,50	24,67
Standard Deviation	8	10	7	6
Z (95%)	1,65	1,65	1,65	1,65
Safety Stock	13	17	12	10

d) Distribution costs

In DRP processing, distribution costs are needed to see the structure of the product distribution network. These costs describe the structure of a particular product distribution network. Bills from distribution show the number of storage locations based on distributors needed to meet customer demands [7]. The reduction in distribution costs before and after the DRP can be seen in table 8 below.

Table 8. Comparison of Distribution Costs Before and After DRP

No	*Distribution Centre*	Distribution Cost Without DRP (Rp)	Distribution Cost After DRP (Rp)
1	Gorontalo	9.408.000	4.704.000
2	South Kalimantan	9.265.000	7.412.000
3	Maluku	11.065.000	6.639.000
4	Papua	9.872.000	7.404.000
Total		39.610.000	26.159.000

Table 8 shows that the percentage reduction in costs, namely from IDR 39,610,000, decreased to IDR 26,159,000, which fell by 13%, which was very helpful in increasing profits.

e) Supply Chain Effectiveness

Supply chain capability shows the flow of product distribution from CFS to each Distribution Center (DC) at an integrated time and quantity to create a distribution system that can meet needs and improve service to consumers. The DRP system can also reduce one of the problems in DC through stockouts by planning a distribution schedule that can project the following needs.

f) Distribution design

In the supply chain, three things must be managed to be able to design distribution based on supply chain management, namely:

1) Material flow from downstream to upstream, namely the products needed by the distribution centre according to the customer orders of each city.
2) The flow of money from upstream to downstream, where consumers pay for products ordered through the distribution centre, and DC will channel these funds to PT. Asian Growth.
3) Information flow that can occur from upstream to downstream or vice versa. The information referred to in this case is the number of requests, capacity, and supply status

Distribution activities designed based on supply chain management can be seen in Figure 3 below.

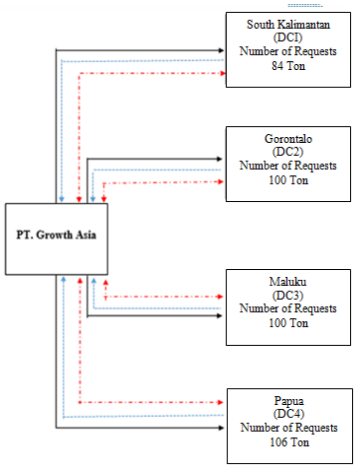


Figure 3. Distribution Design Based on Supply Chain Management

Figure caption 3:

4. Conclusion

Based on the results of this study, the factors that cause non-current distribution are production scheduling, poor delivery, inadequate inventory, and a less competent and disciplined workforce in carrying out their work. The results of distribution planning and scheduling using the DRP method can reduce the number of order frequencies from 20 orders to 13 orders, and distribution costs decrease by 13%, from IDR 39,610,000 to IDR 26,159,000. The role of DRP in distribution centres in supply chain management is to reduce losses arising from unsystematic planning and scheduling, such as not delivering goods on time to each distribution centre.

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