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Integrated Methods in Managing Increase of Logistic Cost

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ABSTRACT

Logistics professionals are under tremendous pressure to remain competitive as retail firms are experiencing a logistic cost increase. This research has been carried on agriculture machinery and industrial equipment, a Trader Company.Enterprise has been found an increase in logistics costs by 4% above the target, where the target of increasing sales in 2014 should still be achieved. An integrated methods was conducted to handle a long-term impact ofthe increase logistics cost. With improving the accuracy of demand forecast as one of inventory control tool, combines withoptimize distribution cost and Purchasing control by develop decision-making system for selecting suppliers in shipping services. Demand forecasting for retail found a level of forecasting accuracy with single exponential smoothing method, optimized the distribution systemwith linear programming, and AHP method for selecting suppliers in shipping services.

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INTRODUCTION

In enterprise of many economic sector, operational cost of the complete product supply chain e.g. procurement and material management, production, distribution, (including warehousing, forwarding and transport), make up a considerable (above 70%) share of total running cost (Wajszczuk, K., *et al*., 2011). Logistic cost is a part of operational cost. Logistic cost component are transport cost, warehousing cost, inventory and financial cost, administrative cost, licences and procedure cost. Recently Logistic are one of the five key pillars of competitiveness (Guasch, J.L., 2010). Logistics is considered to have a great effect to the competitiveness of the enterprise. Large trading enterprises report that in average as much as 43% of the enterprise competitiveness originates from logistics. In addition, some 40-50 % of enterprise competiveness can be affected by enterprise's own actions and decisions (Solakivi, T., *et al*., 2012).

The experts define logistics management is the discipline that studies the functional activity that determines the flow of materials within a company, from the initial suppliers through to delivery of finished products to the customer and post-sales services (Giani, G., *et al*., 2013). Logistics management includes planning, organize, and control of logistics processes (procurement, recording, storage, and distribution) to support the achievement of organizational goals effectively and efficiently. Each logistic process at an industrial goods or services has a cost incurred by the company for every process performed on logistics elements must be done effectively and efficiently.

In order to reduce the impact of increase logistic cost and increase the enterprise competitiveness, an integrated supply chain model was developed to handle a long-term impact of the increase logistics cost. Inventory control accounted 37% of the variance in supply-chain management (Aiyedun, A., 2012). In order to reduce inventory cost, the retail company improve the accuracy of demand forecast. The enterprise is agriculture machinery and industrial equipment, the main activity is selling units and spare parts, rental, and Services, coverage Indonesia market. High forecast accuracy provide right inventory to serve customer on time delivery.

The object of research is quantitative forecasting methods of time series, based on last two years historical data. In determining the time series forecasting methods, required consideration based on the pattern of the data, so it can determine the appropriate method in accordance with the pattern of demand (Render, B., J. Heizer, 2001).

To determine accurately the pattern of the above data is done by determining the pattern of historical data. The method used in the test data patterns are as follows: Single exponential smoothing for stationary data pattern; Double exponential smoothing for trend

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data pattern; adjusted exponential smoothing for Trend and Seasonal Variation: Winters seasonal models for the data pattern

In order to reduce logistic cost, distribution system shall be optimize by minimize cost and optimize type and amount of transport modes. Distribution costs are determined based on the delivery process carried out internally or use third party transporter. If distribution using third party transporter, costs calculated based on the rate delivered by the shipping company (Giani, G., *et al*., 2013). With Linier programming optimize type and number transport modes result distribution cost more lower. Linear Programming is one of the Operations Research techniques most widely used and well known.

In order to get reliable third party transporter and minizime rate distribution cost, it is important to improve purchasing system on supplier selection with Analytical Hierarchy Process (AHP), to make a choice from two or more alternatives, to reduce uncertainty and doubt about alternatives to allow reason can be made in the choice between these options (Madan, A.K., M.S, Ranganth, 2014).

Methodology:

The literature review and previous research conducted by Panayotova (Panayotova, G., S.L. Slavova, 2010) have been used to observe the logistic area. Survey research by interview with stake holder was also used to get more information for this research. The survey was done at the agriculture machinery and industrial equipment to get information on the demand history, third party transporter data and supplier criteria. Data for this research were collected by doing some interviews with those involved on Logistic area such as the Logistic Manager, Logistic supervisor, Logistic staff, and others at the agriculture machinery and industrial equipment enterprise.

Last two years customer demand data on East Java used to determine demand forecasting model for 2015 to achieve first objective. Rate delivery and type distribution modes are used to construct linear programming to optimize distribution system. Then, further interview was taken to determine supplier assessment criteria.

RESULTS AND DISCUSSION

(i) Determine Demand forecasting 2015 as Inventory Control Tool:

The customer demand history last two years, shows that customer demand increase 13 unit in 2013, increase trend used as enterprise decision to increase the sales target in next future (April 2014 to March 2015). Test data pattern conducted to determine the appropiate demand forecasting pattern on the data, whether a horizontal pattern (single exponential smoothing for stationary data pattern), inclination/trend(double exponential smoothing for trend data), or seasonal (eksponential smoothing adjusted) for trend and seasonal variation. Then, test conducted by taking the results of the smallest error value (MSE, MAD, and MAPE) of the 3 pattern demand forecasting by Minitab 17 software, as can be seen in Table 1.

Table 1: Comparison of Error value

Method	MAPE	MAD	MSD
Single Exponential Smoothing	32.879	3.533	19.415
Double Exponential Smoothing	37.134	4.047	26.215
Winters Model	32.852	4.031	21.083

The comparison table of error value show that the single exponential smoothing method has the smallest error rate compared to others. This is shown by the value of MSD = 19.4147 and MAD = 3.533. Based on the results of the test data patterns in customer demand is stationary. Stationary data patterns shall use exponential smoothing method. Further experiment, need to determine the smallest error value (alpha) by tests alpha value of 0.1 to 0.9.The smallest error value of the MSDis on the alpha value of 0.1. It will use in forecasting calculation with single exponential smoothing method, found demand forecasting for April 2014 is 14 units, as shown on Fig.1.

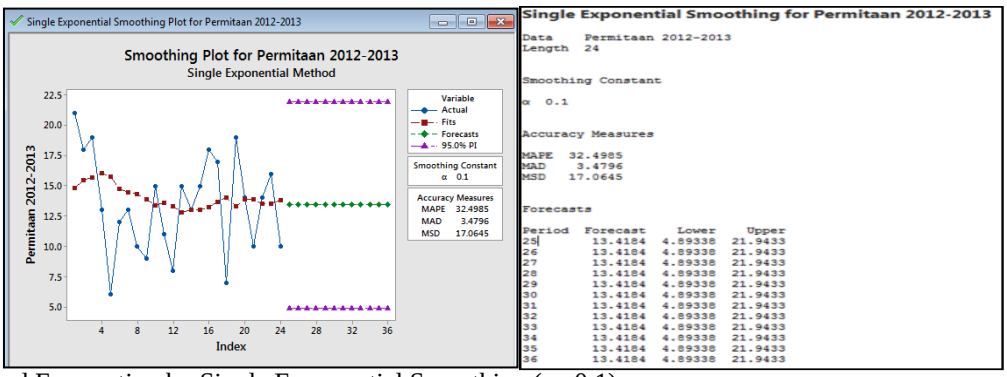

Fig. 1: Demand Forecasting by Single Exponential Smoothing (α=0.1)

(ii)Optimized Distribution system by Formulated Multi Objective Linear Programming:

It is necessary to optimize distribution system, in achieving minimum cost. The enterprise constraints arethe transport capacity per unit, delivery time, and customer demand. There are several types of transportation modes, Colt Diesel Truck, Tronton Truck, and Fuso Truck. These three trucks have different capacity, different cost, and different time to delivery for the same destination. Linear programming is used to find the type and number of transportation modes, which has the minimum cost, formulated as follows:

Decision variables : X1 = Colt Diesel Truck
X2 = Fuso Truck
X3 = TrontonTruck
Objective function : Z = 3000000X1 + 5000000X2 + 7000000X3 = 0 (Minimize)
Function Constraints :
(i) X1 + 2X2 + 3X3 ≤168
(ii) 3X1 + 4X2 + 5x3 ≤360
(iii) X1 + X2 + X3 = 14
Non-negativity:
(iv) X1≥ 0, X2 ≥ 0, X3≥ 0
Where:
Constraint (i) = Carrying capacity per unit trucks
Constraint (ii) = Time to delivery (specific to East Java Area)
Constraint (iii) = Forkliftdem and on April 2014
Constraint (iv) = Number of truck needs to be more than equal to 0

In this research, Microsoft Excel Solver is used to help calculation process, for the linear programming formula. The Calculation result in Microsoft Excel Answer Report shows that using 14 Colt Diesel Truck is the best solution, to get the minimum cost for distribution (IDR 14,000,000).

(ii)Delivery Service Company Selection with the Analytical Hierarchy Process:

In the last years, this company was using 11 Delivery Service Company, with various type of transportation modes, for various reason, with one significant reason was lack of planning process. For distribution process improvement, this company decided to select only from 3 companies to distribute product to East Java Area. Analytical Hierarchy Process (AHP) is used to assist the decision making process, which one should selected, to get the best advantage, based on company's important criteria. There were 4 criterions to consider the best-value company, as it shows in the hierarchy structure, as can be seen in Fig. 2. The accuracy of the results of this method depends on the assessment made by the respondents. That is why only expert respondents and also verified (regarding to related problem) could be involved in this assessment. Responses from respondents for importance rating for each criterion and level, and also their assessment for each Delivery Service Company, to result in weight for each criterion, level, and given alternative, as can be seen in Fig. 2.

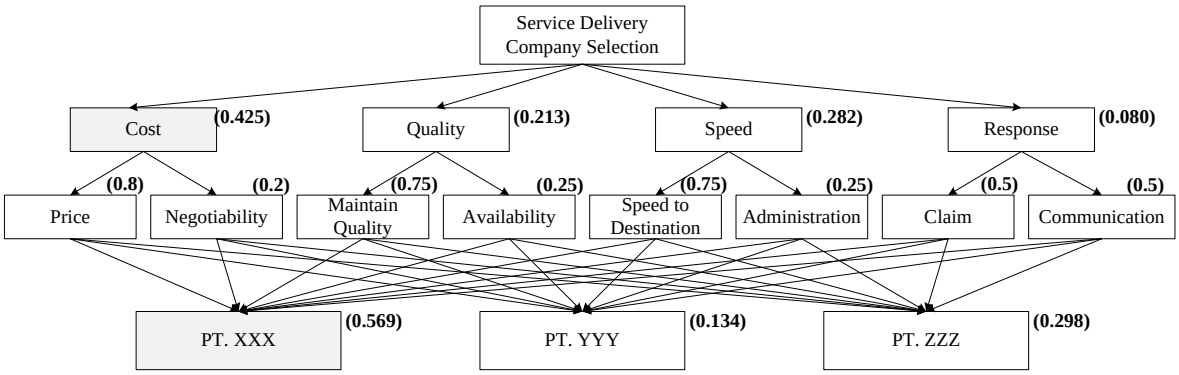

Fig. 2: Hierarchical Structure and Weight Results for Delivery Service Company Selection

Cost criteria was the most important to consider in selection process, with the highest weight importance, 42.5%, compare to the three others. And PT. XXX are the most valuable company with the highest weight, 56.9%, compare to PT. YYY and PT. ZZZ.

Summary:

Tore duce the cost of logistics, for agriculture machinery and industrial equipment company, then the project was implementing3 methods, to determine the optimal amount of inventory, the type and amount of transport that should be used, and the supplier or delivery company must be selected. Demand forecasting for retail found a level of forecasting accuracy with single exponential smoothing method, with forecast demand was 14 units. Linear programming methodleads to the conclusion that the use of Fuso trucks for delivery of14units of forklifts to East Java is the most require

minimum distribution cost. AHP shows that cost is the most importance variable in decision making process on company selection (who's going to distribute the products), compare to variable quality, speed, and response, and 1 from 3 company is selected as the most valuable company.

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