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IMPLEMENTATION OF TRANSPORTATION METHODS IN IMPROVING SUPPLY CHAIN MANAGEMENT AT PT. X

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Abstract

The process of delivering goods from producers to consumers uses transportation. This means of transportation requires spare parts. Companies often experience shortages of spare parts, which slightly disrupts the distribution process and company operations. This study aims to analyze data on motorcycle spare parts inventory as a means of transportation in the company's distribution process. The research method used is descriptive analysis by taking a sample of PT X's consumers, amounting to four stores. The data analysis technique used is the northwest transportation method (NWCR). The results of this study indicate that the company has a total transportation cost of Rp. 49,060.

Keywords: supply chain management, transportation methods

Introduction

In an era of globalization and increasingly competitive competition, both service and manufacturing industries face significant challenges in meeting dynamic market demand, improving product quality, and reducing production costs. Supply Chain Management (SCM) is a strategic element that helps companies achieve their operational and business goals. Supply Chain Management (SCM) is a series of integrated activities to manage the flow of products, information, and finances from upstream to downstream, playing a crucial role in creating efficiency and competitive advantage (Permana & Hasibuan, 2025).

Competition today is not just between manufacturers but has expanded to include supply chain competition. The role of Supply Chain Management encompasses the relationships between internal and external stakeholders (Suhardi, 2025).

PT. X is a multinational consumer goods company. The company has a diverse portfolio of well-known brands across various categories, including personal care products, household care products, food and beverages. PT. X wants to analyze the inventory data of consumable motorcycle spare parts which are supporting products for motorcycle repair activities at PT. X. This will be proposed as a method for planning and controlling motorcycle spare parts to prevent stockouts.

Supply Chain Management is the integrated process or utilization of suppliers, manufacturers, warehouses, and retailers to produce and deliver good products at the right time and quantity, according to consumer needs at a minimum cost. Supply chain management is an approach used to efficiently integrate various organizations from suppliers, manufacturers, distributors, retailers, and customers. This means that goods are produced in the right quantity, at the right time, and in the right place with the aim of achieving minimum overall system costs and also achieving the desired service level (Suhardi, 2024).

Supply chain management in a company is a method implemented by companies to organize all production activities to be more effective and efficient by collaborating to produce products oriented towards customer satisfaction. Developing an integrated SCM model is a strategic solution to create competitive advantage, especially for companies operating in a dynamic business environment. There are two benefits of implementing supply chain management: first, to meet the need to fulfill the inventory of merchandise that has a fast-moving nature, and second, to meet customer needs for merchandise choices according to what customers want, and where they want it (Anisa et al., 2025).

The transportation model is a linear program that can be divided using the conventional simplex method. Its distinct structure allows for the development of more effective solution methods in calculations known as transportation engineering. Transportation problems involve how goods are shipped from multiple purchasing locations, called sources, to locations called destinations. Optimization means finding the best

value of various functions in a given situation, improving performance, resulting in superior quality and results, within constraints. The decision to solve a problem that maximizes value is distribution optimization. Distribution optimization is the process of finding the best way to deliver a product or service with the least amount of time, resources, and cost. Distribution optimization is crucial for improving supply chain efficiency. To find more effective distribution patterns, optimization strategies typically involve a combination of technology and analytical methods (Innana et al., 2025).

A transportation model is a method used to manage the distribution of sources that provide the same product to places that need it optimally at the lowest cost. This product allocation must be arranged accordingly because there are differences in allocation costs from one source or several sources to another destination. The transportation model relates to a situation where a commodity is to be sent from a number of sources to a number of destinations. The objective of this problem is to determine the quantity of the commodity that must be sent from each source to each destination so that the total shipping cost can be minimized, while at the same time the constraints in the form of limited supply and demand needs are not violated. The transportation model assumes that the cost of shipping a commodity on a certain route is proportional to the number of units of the commodity shipped on that route. The transportation problem is a problem that addresses the problem of distributing a commodity or product from a number of sources (supply) to a number of destinations (demand), with the aim of minimizing the transportation costs incurred (Amelia et al., 2024).

Transportation methods relate to the distribution of a single product from multiple sources with limited supply to multiple destinations with specific demand to minimize distribution costs. Because there is only one type of product, a destination can meet demand from one or more sources [5]. Transportation problems have several characteristics, namely:

1. There are a number of sources and a specific number of destinations.
2. The quantity of goods distributed from each source and the demand at each destination is specific.
3. The quantity of goods shipped from a source to a destination is based on the demand or capacity of the source.
4. The cost of transportation from a source to a destination is specific.

Transportation problems can be represented in a special table called a transportation table. Sources are listed in rows and destinations in columns. The transportation table contains m × n boxes. The transportation cost per unit of goods Cij is recorded in the small box at the top right of each box. The demand from each destination is in the rightmost column. The bottom left corner box indicates the fact that supply (S) is equal to demand (D). The variable Xij in each box indicates the quantity of goods transported from source i to destination j. The first step in solving a transportation problem is to determine the initial feasible solution using the Vogels approximation method. There are three methods for determining the initial feasible solution:

1. Northwest Corner Method
2. Least Cost Method
3. Vogel's Approximation Method (VAM)

After determining the initial feasible solution, the method is optimized using the Stepping Stone method or MODI (Modified Distribution Method) to achieve the desired results (Azizah & Suryawinata, 2018).

Methods

This study uses a quantitative descriptive approach. This research method aims to determine the optimization of transportation cost calculations for PT. X using the NWCR method. PT. X determines that there are three stores and three warehouses used in this study. The specified warehouses are Warehouse A, Warehouse B, and Warehouse C. While the specified stores are Simple Store, Happy Store, and Ceria Store. The data used includes demand data for each store and the capacity of each warehouse. This data will later be analyzed using the NWCR method and then decisions will be made.

Results and Discussions

Data collection was conducted from three customers and three warehouses of PT. X. The selected customers were Toko Sederhana, Toko Bahagia, and Toko Ceria. The three warehouses from which data was collected were Warehouse A, Warehouse B, and Warehouse C. The demand for Toko Sederhana was 150 units, Toko Bahagia 190 units, and Toko Ceria 360 units. Warehouse A had a capacity of 123 units, Warehouse B 164 units, and Warehouse C 413 units. The following are the transportation costs per unit from each source to the specified customers:

1. Warehouse A to Toko Sederhana Rp. 100
2. Warehouse A to Toko Bahagia Rp. 150

3. Warehouse A to Toko Ceria Rp. 150
4. Warehouse B to Toko Sederhana Rp. 100
5. Warehouse B to Toko Bahagia Rp. 60
6. Warehouse B to Toko Ceria Rp. 100
7. Warehouse C to Toko Sederhana Rp. 70
8. Warehouse C to Happy Store Rp. 80
9. Warehouse C to Ceria Store Rp. 60

Table 1 Northwest Method Calculation (NWCR)

Sumber	Toko Sederhana	Toko Bahagia	Toko Ceria	Supply
Gudang A	123 100 X_{11}	150 X_{12}	150 X_{13}	123
Gudang B	27 100 X_{21}	137 60 X_{22}	100 X_{23}	164
Gudang C	70 X_{31}	53 80 X_{32}	360 60 X_{33}	413
Demand	150	190	360	700

Sumber : Hasil Pengolahan Data, 2025

In the Northwest method, filling starts from the northwest side with the maximum quantity until all sources are used up by looking at the warehouse capacity with market demand. The Northwest Corner position is located on the top left or column X11, Warehouse A has a stock of 100 pcs, so Warehouse A fills the request from the Simple Shop as much as 100 pcs so that the stock in Warehouse A has run out. To overcome the remaining demand from the Simple Shop from Warehouse B with a remaining demand of 20 pcs. The next step is to fill in column X21. In fulfilling the delivery request to the Happy Shop with the remaining stock from Warehouse B. Because the capacity of Warehouse B cannot fully fulfill the demand for the Happy Shop's needs, the remaining demand is fulfilled by Warehouse C. Next, the Northwest Corner is X33, this cell is filled with the maximum possible goods (according to the demand, namely 230 pcs), with this the delivery to the Ceria Shop has been fulfilled. So the total shipping cost = 123(100) + 27(100) + 137(60) + 53(80) + 360(60) = IDR 49,060,-

Research conducted by Innana et al. found that the minimum transportation cost for a sample of rice agents at UD. Kurnia Jaya was IDR 1,480,000 per shipment. According to research conducted by Azizah and Suryawinata, the transportation method is one solution for cases involving multiple sources to multiple destinations. This study focused on optimizing RASTRA distribution costs in the case study of the Sidoarjo Sub-Divre of the State Logistics Agency (Bulog), with the distribution points being the regional or sub-district areas. Azizah and Suryawinata's research used the MODI and VAM methods and minimized RASTRA distribution costs. The company's calculations revealed that the lowest cost method reduced the cost from IDR 87,209,690,750 to IDR 85,186,035,750, resulting in a savings of IDR 2,023,655.

Meanwhile, research conducted by Amelia et al., stated that the transportation cost for sand distribution at Tangkahan Pasir Syawal in November 2023 using the Vogel's Approximation method was IDR 6,310,000 and the Stepping Stone method obtained an optimal transportation cost of IDR 9,425,000 per month. In this case, Tangkahan Pasir Syawal can optimize transportation costs for sand distribution in November 2023, with cost savings of IDR 3,115,000 per month or 4%.

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