Bakery Product Distribution Efficiency: A Case Study of Danisy Bakery Delivery with Transportation Methods

[1]Aditya Dwi Pamungkas, [2]Ara Danisy, [3]Saidah Qurrota Ayun, [4]Risma Hanifatin Amamah

[1,2,3,4] UIN Sunan Kalijaga Yogyakarta

[1]23108010052@student.uin-suka.ac.id, [2]23108010056@student.uin-suka.ac.id, [3]23108010063@student.uin-suka.ac.id, [4]23108010066@student.uin-suka.ac.id

Abstract: Distribution efficiency is very important in reducing business operational costs, especially in the food industry such as Danisy Bakery. This study uses a quantitative approach with a case study of Danisy Bakery's distribution. The data collected includes the amount of production, the destination of delivery, and the cost of transportation per unit. The calculation is carried out by applying the NWC and Least Cost methods, then compared to determine the most economical method. The results of the study show that the Least Cost method is more effective in reducing costs than NWC because it prioritizes the cheapest route, so that the allocation is more optimal. This method is recommended to improve the distribution efficiency of Danisy Bakery. This research is expected to help business actors choose a more cost-efficient distribution strategy and become an academic reference in the application of transportation methods.

Keywords: Distribution efficiency, operational costs, transportation methods, Least Cost, Northwest Corner Method (NWC), Danisy Bakery, optimal allocation.

Introduction

The distribution and delivery of goods is one of the crucial aspects in the business world, especially for companies engaged in food production such as bakeries. Efficiency in distribution not only affects customer satisfaction, but also on the company's operational costs. In the context of the food industry, the speed and accuracy of delivery greatly determine the quality of the products that consumers receive, considering the perishable nature of food products. Therefore, choosing the right transportation method is very important in optimizing shipping costs and maintaining service quality.

Based on data from the Indonesian Logistics Association (ALI), logistics costs in Indonesia are still relatively high, reaching 23.5% of the Gross Domestic Product (GDP), higher than other ASEAN countries such as Malaysia and Thailand which berada di kisaran

13–15%. This high logistics cost has a direct impact on the price of the final product and the competitiveness of business actors, especially MSMEs engaged in the food and beverage sector.

On the other hand, the consumption of bread and bakery products in Indonesia continues to increase. Data from the Indonesian Bakery Entrepreneurs Association (APEBI) shows the growth of the bakery industry by 10% per year in line with the increasing urban lifestyle and the demand for practical food. However, this growth potential can only be maximized if the product distribution system runs efficiently, quickly, and cost-effectively. Danisy Bakery, as one of the growing bakeries in Surabaya, faces challenges in determining an efficient delivery strategy to ensure that distribution costs remain low without sacrificing service quality. This bakery deserves to be used as a case study because it faces first-hand the challenges of distribution efficiency, has a fairly wide delivery range, and is willing to provide the necessary data access. This characteristic makes it representative to describe the logistics problems faced by food MSMEs.

In this case, transportation methods such as North-West Corner (NWC) and Least Cost can be used to determine the minimum cost in the distribution process. These two methods have different approaches to determining the optimal initial solution to the transportation problem. The North-West Corner (NWC) method provides an initial solution based on the position of the upper left corner of the transportation cost table, while the Least Cost method provides an initial solution by choosing the route with the lowest cost first. By comparing these two methods, this study aims to find the most effective method in reducing shipping costs for Danisy Bakery, while contributing to food MSMEs in improving logistics efficiency and competitiveness amid the challenges of national distribution costs.

Literature Review

An important component of supply chain management that can affect a company's performance and competitiveness is distribution efficiency. Businesses must not only quickly meet client demands, but also do so at a low cost in an increasingly global and competitive business environment (Hulu et al., 2025). The application of transportation methods is a

strategy used to distribute goods as best as possible from the source of the goods to the intended location, with the aim of obtaining the lowest transportation costs. The transport model is basically a linear program that can be solved with the usual simplex method. But its special structure allowed the development of a solving procedure called Transport Engineering that was more efficient in its calculations. In the use of transportation methods must have the following (Shidiqi et al., 2024):

1. Supply and capacity in a short period.

2. Place of delivery and number of requests per period.

3. The amount of cost of distributing goods per unit from the place of origin to the destination.

Food products such as Danisy Bakery cookies are included in the category of perishable goods, which are perishable goods and have a short shelf life, which requires a fast and consistent distribution system to maintain product quality and avoid losses due to spoilage or loss of selling value. In this study, the researcher used the North-West Corner (NWC) Method and the Least Cost Method which will then be optimized with the Stepping Stone Method to obtain the minimum distribution cost.

The North West Corner (NWR) method is one of the easiest methods of transportation, the source and location of the destination are sorted from left to right side and from top to bottom in a matrix data map (Safari et al., 2020). Meanwhile, the Least Cost Method is a method that has a working principle, namely giving priority in the allocation that has the smallest unit cost per unit, where the initial allocation is carried out in the box in the table that has the lowest cost (Lestari et al., 2021)

Stepping stones are methods to help find the optimal solution from the selected basic feasible solution. This tool has a function to evaluate costs based on transporting goods through transportation routes that are not included in the solution. This method is used by calculating empty boxes by determining the loop trajectory and calculating the value of the transportation cost. Allocate as much as possible to boxes that have negative loop values to reduce transportation costs until there are no negative values, which means that the table is optimal (Ilahy Rosihan et al., 2022).

Methodology

This research is an applied type of research or included in field research, namely the researcher himself comes directly to the company and collects data by conducting observations and interviews with business owners who will be processed in this research. The data used are primary data with a type of quantitative data (Shidiqi et al., 2024). The object taken by the researcher is the Danisy Bakery company, which is engaged in the production of pastries which has 2 cake making factories in Besuki and Boyolangu districts with the aim of distributing them to five stores, namely Amanah Besuki, Amanah Bandung, Amanah Ngrance, Ria, and Central. The main focus of the research is to optimize distribution efficiency using transportation methods in operational research. components of transportation costs, shipping distribution of goods. The population in this study is all data on the delivery of bread products from Danisy Bakery to various outlets or regular customers (Nurhayana, 2023). The sample used is shipping data within one month which represents the route and volume in general, while for wages supir juga berbeda-beda untuk sekali pengantaran dari Rp.1.000,- sampai dengan Rp.2.000,-/Pcs. The stages in the study are as follows (Sembiring et al., 2023):
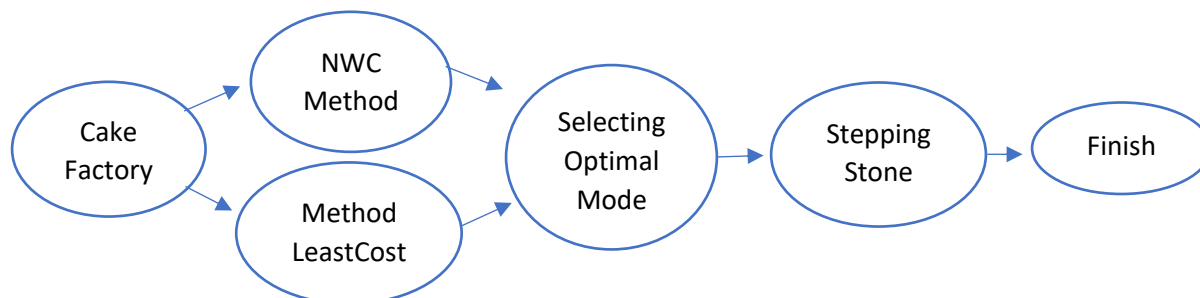

Figure 1. Methodology

Discussion

In this study, data collection was carried out directly through primary data sourced from Danisy Bakery. The data used in this study are :

1. **Number and Location of Source (factory)**

Danisy Bakery has two factories in the Tulungagung Regency area, namely factory 1 located in Besuki District and factory 2 in Boyolangu District. Both factories produce

pastries. The production capacity of the two Danisy Bakery factories in Tulungagung Regency is shown in Table 1.

Table 1. Number of feed products distributed in March 2025

Factory Location		Production Quantity (pcs)
Besuki	P1	250
Boyolangu	P2	50
TOTAL		300

Factory 1 (P1) in Besuki District produces 250 pcs of pastries, and P2 in Boyolangu District produces 50 pcs. Overall, the production reached 300 pcs, which met the total demand (Table 2). Factory 1 in Besuki District is the factory with the most production capacity because the main factory is Danisy Bakery, while Factory 2 has a smaller production capacity as a production branch to meet local demand in Boyolangu District.

2. **Number and Location of Destinations (Marketing)**

Danisy Bakery distributes pastry products to five stores, namely Amanah Besuki, Amanah Bandung, Amanah Ngrance, Ria, and Central. Table 2 shows the number of demand and marketing destination stores in March 2025.

Table 2. Total demand for pastry products in March 2025

Destination Store		Number of Requests (pcs)
Amanah Besuki	T1	50
Amanah Bandung	T2	100
Amanah Ngrance	T3	50
Ria	T4	50
Central	T5	50
TOTAL		300

The demand for pastries from the five destination stores is illustrated in Table 2. Toko Amanah Bandung (T2) has the highest demand with 100 items, followed by four other stores with a demand of 50 items each. Amanah Bandung is the store with the highest demand because it is the largest store with the most visitors among the other four stores.

3. Distribution and Transportation Costs

The cost of distribution and transportation from the source (factory) to the destination (marketing) can be seen in Table 3.

Table 3. Transportation costs (in hundreds of rupiah)

Factory	Shop				
	Amanah Besuki	Amanah Bandung	Amanah Ngrance	Ria	Central
Factory 1	12	15	18	10	13
Factory 2	17	14	11	20	15

Table 3 shows the comparison of transportation costs per unit from two factories to five stores. From factory 1 (P1) to Ria (T4) has the lowest cost of Rp1,000/pcs, showing that the route from Besuki District to Toko Ria is quite efficient because of the short distance. Meanwhile, from factory 2 (P2) to Ria (T4) has the highest cost of Rp2,000/pcs, because the distance is quite far from Boyolangu District to Toko Ria. Due to this difference in costs, the implementation of transportation methods is necessary to optimize Danisy Bakery's distribution costs.

Table 4. Calculation Results with NWC Method

| Factory | Shop | | | | | |
	Amanah Besuki	Amanah Bandung	Amanah Ngrance	Ria	Central	SUPPLY
Factory 1	12	15	18	10	13	250
Factory 2	17	14	11	20	15	50
Demand	50	100	50	50	50	300

| Factory | Shop | | | | | |
	Amanah Besuki	Amanah Bandung	Amanah Ngrance	Ria	Central	SUPPLY
Factory 1	50	50	50		50	250
Factory 2		50		50		50
Demand	50	100	50	50	50	300

Total NWC Cost

$= (12\times50) + (15\times100) + (18\times50) + (10\times50) + (13\times50) + (15\times50)$

$= 600 + 1500 + 900 + 500 + 650 + 750$

$= 4900$

The NWC method production allocation starts in the upper left corner of the table. The results of the initial allocation resulted in a total cost of IDR 490,000,-. The cost of shipping/distributing cookies from factory 1 (P1) to 4 stores, namely Amanah Besuki (T1) amounted to IDR 60,000,- , Amanah Bandung (T2) store amounted to IDR 150,000,- , Amanah Ngrance store (T3) amounted to IDR 90,000,- , and Central store (T5) amounted to IDR 65,000,- . The cost of shipping / distributing cookies from factory 2 (P2) to T4, namely the Ria store, is IDR 100,000,-.

Table 5. Optimization test with the stepping stone method

Factory	Shop					
	T1	T2	T3	T4	T5	Supply
P1	50	50	50	50	50	250
P2		50				50
Demand	50	100	50	50	50	300

Loop 1 : P2T1 = P2T1-P2T2+P1T2-P1T1 = 17-14+15-12 = 6

Loop 2 : P2T3 = P2T3-P1T3+P1T2-P2T2 = 11-18+15-14 = -6 (not optimized)

Loop 3 : P2T4 = P2T4-P1T4+P1T2-P2T2 = 20-10+15-14 = 11

Loop 4 : P2T5 = P2T5-P1T5+P1T2-P2T2 = 15-13+15-14 = 3

The results of the optimization test with the stepping stone method above are not optimal, so improvements need to be made as follows:

Table 6. Repair

Factory	Shop					
	Amanah Besuki	Amanah Bandung	Amanah Ngrance	Ria	Central	Supply
Factory 1	50	50+50	50-50	50	50	250
Factory 2		50-50	+50			50
Demand	50	100	50	50	50	300

Table 7. Improvement Results

Factory	Shop					
	Amanah Besuki	Amanah Bandung	Amanah Ngrance	Ria	Central	Supply
Factory 1	50	100		50	50	250
Factory 2			50			50
Demand	50	100	50	50	50	300

Total Cost :

= (12×50) + (15×100) + (11×50) + (10×50) + (13×50)

= 600 + 1500 + 550 + 500 + 650

= 3800

The Stepping Stone Method is based on the table of the upper left corner of the bottom right corner (North West Corner Method), the most optimal cost result is IDR 380,000.

APLNPOM software. QM is an application used to calculate the minimum optimization of product shipping costs. This application is required to validate the calculation of the manual transport method that has been calculated above, and can It is used to determine the minimum shipping cost in a method of transportation by starting with the data input, calculating the loop, and calculating the optimal output.

Figure 2. The results of the calculation using the NWC (North West Corner) method in the APLNPOM software. QM.

Objective				Starting method	
○ Maximize				Northwest Corner Method	∨
● Minimize					

Shipping list
Danisy Bakery Solution

From	To	Shipment	Cost per unit	Shipment cost
P1	T1	50	12	600
P1	T2	100	15	1500
P1	T3	0	18	0
P1	T4	50	10	500
P1	T5	50	13	650
P2	T3	50	11	550

Based on the above output, the calculation of the transportation model using the NWC method and the analysis using the Stepping Stone method using APLNPOM software. QM produces results comparable to manual calculations, which is IDR 380,000,-. These results show that the cost efficiency of allocating cookies to multiple destination stores is the optimal outcome.

Table 8. Calculation Results with the Least Cost Method

Factory	Shop					
	Amanah Besuki	Amanah Bandung	Amanah Ngrance	Ria	Central	Supply
Factory 1	50	100		50	50	250
Factory 2			50			50
Demand	50	100	50	50	50	300

Total Least Cost

$= (12×50) + (15×100) + (11×50) + (10×50) + (13×50)$

$= 600 + 1500 + 550 + 500 + 650$

$= 3800$

The Least Cost method directly allocates based on the lowest cost. The cost of shipping/distributing cookies at factory 1 (P1) to 4 stores, namely the Amanah Besuki store (T1) is IDR 60,000,- , the Amanah Bandung (T2) store is IDR 150,000,- , the Ria store (T4) is IDR 50,000,- , and the Central store (T5) is IDR 65,000,-. Meanwhile, the cost of shipping / distributing cookies from factory 2 (P2) to the Amanah Ngrance (T3) store is IDR 55,000,. The Least Cost Method, the result is IDR 380,000,-. The total cost of the Least Cost is equal to the NWC result after optimization. This method is more efficient because it does not require any additional steps.

Figure 3. Calculation Results with the Least Cost Method in APLNPOM software. QM.

Based on the above output, the calculation of the transportation model using the Least Cost method uses   APLNPOM software. QM produces results comparable to manual calculations, which is IDR 380,000,-. This result is an optimal result after prioritizing the cheapest route.

Conclusion

Based on the research conducted, the application of the Northwest Corner (NWC) and Least Cost transportation methods has succeeded in optimizing the efficiency of Danisy Bakery's product distribution. Both methods produce the same minimum cost, which is **IDR 380,000**, after optimizing with the Stepping Stone method for NWC. Nonetheless, the Least Cost method is   more recommended because it does not require additional steps for optimization, making it more efficient in time and resources. These results were also validated using   APLNPOM software. QM, which shows consistency between manual and computational calculations.

This research proves that the selection of the right transportation method is able to significantly reduce distribution operational costs, especially for MSMEs such as Danisy Bakery. The implication is that the application of this method can increase business competitiveness through logistics cost savings, while ensuring timely delivery to maintain perishable product quality. For further development, it is recommended to use a combination of transportation methods with supply chain management technology to achieve holistic efficiency.

Reference

Hulu, N., Harahap, L. M., Marbun, S., Putri, D. A., & Kunci, K. (2025). Efisiensi Distribusi melalui Optimasi Biaya dan Jarak dengan Pendekatan Metode Transportasi. *Journal of Economics, Business and Management*, *1*(1), 1–5.

Ika Widya Ardhyani. (2017). MENGOPTIMALKAN BIAYA DISTRIBUSI PAKAN TERNAK DENGAN MENGGUNAKAN METODE TRANSPORTASI (Studi Kasus di PT. X Krian). *Teknika : Engineering and Sains Journal*, *1*(No. 2), 95–101.

Ilahy Rosihan, R., rizky, M. ferdiansyah dwi, Paduloh, P., Saputra, Y., Kumalasari, R.,

Spalanzani, W., & Sitorus, H. (2022). Optimasi Biaya Transportasi Rantai Roda Tipe-428 dengan Metode Stepping Stone dan Modified Distribution. *Jurnal Rekayasa Sistem Industri*, *7*(2), 40–47. https://doi.org/10.33884/jrsi.v7i2.5481

Lestari, R., Romadhon, T., & Fauzi, M. (2021). Implementasi Model Transportasi Distribusi Produk Vaksin Hepatitis B Menggunakan Metode Least Cost Dan Modified Distribution. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, *2*(2), 180–193. https://doi.org/10.46306/lb.v2i2.69

Nurhayana, C. (2023). Penerapan Metode Transportasi untuk Mengoptimalkan Waktu Pengiriman Produk pada PT. Sera Banyu Urip. *El-Mujtama: Jurnal Pengabdian Masyarakat*, *4*(1), 556–571. https://doi.org/10.47467/elmujtama.v4i1.5338

Sembiring, H. A. Z., Perangin Angin, D. P. P. A., & Tanjung, A. A. (2023). Minimasi Biaya Pengiriman Perusahaan Jasa J&T Menggunakan Metode Transportasi. *Competitive*, *17*(2), 77–78. https://doi.org/10.36618/competitive.v17i2.2580

Shidiqi, A. F. A., Fahris, A., Lathifatul Mufidah, M. A. H., Fadhlillah, M. M., & Wulandari, R. (2024). Optimasi Biaya Distribusi Tahu pada Pabrik Tahu Dompyong Wetan Menggunakan Metode North West Corner (NWC) dan Stepping Stone. *Sunan Kalijaga Islamic Economics Journal*, *3*(1), 41–52.

Hulu, N., Harahap, L. M., Marbun, S., Putri, D. A., & Kunci, K. (2025). Efisiensi Distribusi melalui Optimasi Biaya dan Jarak dengan Pendekatan Metode Transportasi. *Journal of Economics, Business and Management*, *1*(1), 1–5.

Ika Widya Ardhyani. (2017). MENGOPTIMALKAN BIAYA DISTRIBUSI PAKAN TERNAK DENGAN MENGGUNAKAN METODE TRANSPORTASI (Studi Kasus di PT. X Krian). *Teknika : Engineering and Sains Journal*, *1*(No. 2), 95–101.

Ilahy Rosihan, R., rizky, M. ferdiansyah dwi, Paduloh, P., Saputra, Y., Kumalasari, R., Spalanzani, W., & Sitorus, H. (2022). Optimasi Biaya Transportasi Rantai Roda Tipe-428 dengan Metode Stepping Stone dan Modified Distribution. *Jurnal Rekayasa Sistem Industri*, *7*(2), 40–47. https://doi.org/10.33884/jrsi.v7i2.5481

Lestari, R., Romadhon, T., & Fauzi, M. (2021). Implementasi Model Transportasi Distribusi Produk Vaksin Hepatitis B Menggunakan Metode Least Cost Dan Modified Distribution. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, *2*(2), 180–193. https://doi.org/10.46306/lb.v2i2.69

Nurhayana, C. (2023). Penerapan Metode Transportasi untuk Mengoptimalkan Waktu Pengiriman Produk pada PT. Sera Banyu Urip. *El-Mujtama: Jurnal Pengabdian Masyarakat*, *4*(1), 556–571. https://doi.org/10.47467/elmujtama.v4i1.5338

Sembiring, H. A. Z., Perangin Angin, D. P. P. A., & Tanjung, A. A. (2023). Minimasi Biaya Pengiriman Perusahaan Jasa J&T Menggunakan Metode Transportasi. *Competitive*, *17*(2), 77–78. https://doi.org/10.36618/competitive.v17i2.2580

Shidiqi, A. F. A., Fahris, A., Lathifatul Mufidah, M. A. H., Fadhlillah, M. M., & Wulandari, R. (2024). Optimasi Biaya Distribusi Tahu pada Pabrik Tahu Dompyong Wetan Menggunakan Metode North West Corner (NWC) dan Stepping Stone. *Sunan Kalijaga Islamic Economics Journal*, *3*(1), 41–52.