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Determination of Shipping Rates for Central Jakarta Route Based on Operational Costs of Battery-Based Vehicles with Chargeable Weight Pattern at PT. Dapensi Dwikarya

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Abstract: *The establishment of freight rates is an important component of the logistics sector, driven by a variety of factors such as vehicle running costs, weight computation methodologies, and transit efficiency. PT. Dapensi Dwikarya (DDK), a logistics service provider, is now implementing a distance-based tariff system (Rp/km) in partnership with PT. Pos Indonesia for commodities delivery along the Central Jakarta route. However, when the actual cargo weight is quite modest, this method is seen negatively by customers. As a result, the purpose of this study is to examine and determine a shipping rate based on the operational expenses of electric vehicles using the chargeable weight technique, which takes into account both actual and volumetric weight. This study takes a quantitative approach to investigating the operational expenses of battery-electric vehicles, including energy consumption, maintenance, and asset depreciation. The data show that driving an electric vehicle saves money, notably on fuel and maintenance costs. Furthermore, government subsidies for electric vehicles provide strategic potential to help sustain logistics operations. Based on these findings, the report suggests that PT. Dapensi Dwikarya implement a chargeable weight-based pricing structure and maximize the use of electric vehicles to create an efficient, competitive, and ecologically sustainable delivery system.*

Keywords: Shipping Rates, Electric Vehicles, Chargeable Weight, Operational Costs, Logistics Efficiency

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1. Introduction

One essential link in the logistics system is freight delivery, which aims to move items quickly and efficiently from one place to another. This procedure includes a number of components, including as inventory management, warehousing, packing, and transportation (Mandaku, 2022). The logistics sector encompasses all activities that facilitate the movement of commodities, both domestically and globally, using various modes of transportation such as land, sea, and air (Zhu & Xie, 2024).

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One of the most important components of freight delivery is determining shipping rates, which are determined by a variety of criteria including travel distance, kind of goods, weight and volume, and mode of transportation employed. Shipping prices are often computed using two methods: real weight and chargeable weight. Chargeable weight includes both the actual weight and the dimensions of the items, better representing space usage within the delivery vehicle. However, the method used in this study focuses entirely on determining shipping costs based on the actual weight of the items, without regard for volume or dimensions. The goal is to provide a more objective representation of the cost structure in relation to the operational and logistical efficiency adopted by the organization. Furthermore, shipping rates may vary based on operational costs, infrastructure conditions, government rules, and the level of demand for logistics services in a specific area (Rohman & Abdul, 2021).

PT Dapensi Dwikarya (DDK) is one of the logistics companies dealing with shipping tariff difficulties. This company offers vehicle rentals for both freight and passenger transportation. As a transportation service provider, DDK offers a diverse fleet of vehicles, including blind vans, L300, CDE, CDD, and Fuso trucks, establishing the company as a dependable distribution partner for a variety of industrial sectors. One of the key policies introduced by PT. Dapensi Dwikarya is a distance-based pricing system (Rp/km), which calculates car rental prices depending on distance traveled. Furthermore, DDK evaluates tariffs on a monthly basis to ensure that its pricing is in line with operational conditions and customer expectations.

Along the Central Jakarta route, PT. Pos Indonesia (Persero) and PT. Dapensi Dwikarya (DDK) work together to distribute commodities. For its distribution services, PT. Pos Indonesia leases Gran Max Blind Van vehicles from DDK. However, problems with operational performance and shipping tariffs have surfaced. The efficient distribution process has been hampered by frequent issues, such as car engines failing during deliveries. Long lines at gas stations are another operational issue that reduces time efficiency and causes delays.

On the other hand, the present tariff system is still distance-based (Rp/km), which has been a cause of dissatisfaction for PT Pos Indonesia. In other circumstances, the number of items sent is quite low, yet the corporation is nevertheless paid depending on distance, which is deemed economically inefficient. PT. Pos Indonesia believes that transportation prices are disproportionate to the number of goods delivered, particularly on routes with low shipment quantities.

Utilizing battery-powered Electric Vehicles (EVs), which have reduced operating costs and are more ecologically friendly, PT. Pos Indonesia suggested a modification in the operational structure in response to these issues. Additionally, it was suggested that a charged weight-based system—that is, price based on the tonnage of products transported—replace the formerly distance-based tariff system.

Moving from a distance-based pricing model to one based on chargeable weight is a strategic decision that aligns with operational efficiency and fairness in determining shipping prices. Chargeable weight is a pricing mechanism that takes into account both the actual weight of the items (referred to as actual weight) and their volume. This concept assures that shipping charges more properly reflect the real load usage within transport vehicles, thereby giving a more equitable system for both logistics providers and customers (Purtell et al., 2025).

A charged weight-based method takes into account the actual weight of the vehicle load in addition to travel distance for calculating tariffs. This strategy provides PT. Pos Indonesia with a way out of the distance-based pricing model that had previously made them feel burdened, especially when the shipping weight was low but the cost was still high. Both sides gain from the new system's increased flexibility in shipping charges, which are modified based on the vehicle capacity being used. Additionally, chargeable weight promotes load optimization, allowing logistics companies to increase productivity by packing vehicles according to their capacity (Muhamad Galih & Sukmadewi, 2024).

This choice to adopt Electric Vehicles (EVs) indicates an appropriate strategy for enhancing operating efficiency and reducing reliance on fossil fuels. Compared to conventional gasoline or diesel-powered vehicles, EVs have various advantages, the most notable of which is decreased operational costs (Hakam & Jumayla, 2024). PT. Dapensi Dwikarya (DDK) can cut fuel and maintenance costs by using electric vehicles (EVs), which have fewer mechanical components than internal combustion engines.

In addition to the financial advantages, using electric cars (EVs) helps the government implement laws aimed at reducing carbon emissions and promoting the use of green energy. The government of Indonesia has started an expedited initiative for the adoption of battery-electric vehicles as part of the country's national strategy to reduce greenhouse gas emissions and reach the Net Zero Emission (NZE) objective by 2060. According to Wahyudi et al. (2024), the use of EVs in the logistics industry is consistent with this policy and improves PT. Pos Indonesia's reputation as an environmentally conscious business.

Furthermore, electric vehicles can assist address various recurring logistics difficulties, such as long lines at gas stations, which cause delivery delays. Companies can refuel their EVs at authorized charging facilities, which can be scheduled based on operational demands to avoid delays (Shaumi & Cahyadi, 2022).

Battery-powered vehicles, often known as electric vehicles (EVs), use electricity as their primary energy source to power the motor. EVs have rechargeable electric batteries, which distinguishes them from traditional vehicles that run on fossil fuels like gasoline or diesel. In the logistics industry, electric vehicles provide an innovative approach for increasing delivery efficiency. Logistics companies that use electric vehicles can save money on gasoline, vehicle maintenance, and support sustainability objectives by implementing green logistics methods (Sudjoko, 2021).

However, the key problem in its execution is not only replacing fossil fuel-powered vehicles with electric vehicles, but also identifying the best tariff structure for PT. Dapensi Dwikarya (DDK). At the moment, DDK is unsure whether the usage of battery-powered cars in conjunction with a real weight-based pricing scheme will result in optimal profitability for the company.

Sulistiawati (2021) investigated the use of vehicle operational cost calculations at PT. Pia Prama Cargo to determine freight shipping costs. According to the study, the diesel-powered vehicle used had a capacity of 4.5 tons, and the rate was calculated in terms of cost per kilogram.

Burhanudzaky (2021) investigated the use of vehicle operational cost estimations at PT. XYZ to determine freight transportation costs. The vehicle utilized in his study was an ISUZU NLR71T that ran on diesel fuel, and the resulting rate was expressed as cost per kilometer.

Mandaku (2022) also reviewed the method of determining vehicle operational costs in Maluku Province to determine freight rates. The study utilized a Hino Dutro 110 LD LPG vehicle that also ran on diesel fuel. The rate obtained in this study was expressed per route.

To ensure the sustainability and profitability of PT. Dapensi Dwikarya (DDK)'s adoption of electric vehicles, the purpose of this study is to estimate shipping rates based on the operational costs of battery-powered vehicles. This method is critical because a chargeable weight-based rate system may not completely reflect operational costs—especially given that battery-electric vehicles have a cost structure that differs greatly from conventional fuel-powered vehicles.

2. Theory

Theory of Cost Structure

In economics and financial management, cost structure theory is a method that focuses on how company expenses are categorized, examined, and controlled in order to provide the best possible pricing or rate plans (Han et al., 2024). The cost structure in the logistics sector usually consists of variable costs like labor, fuel, and vehicle maintenance, as well as fixed costs like insurance, depreciation, and original fleet investment. Semi-variable expenses also exist, such as the electricity usage of battery-powered cars, which varies according to usage frequency. Understanding the cost structure of battery-electric vehicles is crucial for this study's purpose in order to establish effective shipping rates using the charged weight system and maintain market competitiveness.

Pricing Theory

Pricing Theory is an economic concept that describes how organizations set pricing for their services or products based on criteria such as cost structure, market demand, and business strategy (Faisal & Khan, 2021). In the logistics industry, shipping rates must strike a balance between operational expenses, price competitiveness, and perceived consumer value. Logistics firms must not only recover the costs of moving goods, but also keep their rates competitive in order to recruit consumers and preserve profitability. In this study, shipping charges are set using the chargeable weight technique. The goal of implementing this approach is to more accurately reflect truck space utilization and to avoid cross-subsidization between the shipment of large, lightweight goods and tiny, heavy ones. Thus, pricing theory helps businesses establish rate plans that not only cover operational costs but also maximize truck load capacity. Cost is an important component in pricing theory, especially when it comes to battery-electric vehicles, which have a different operational cost structure than fossil fuel-powered vehicles. While electric vehicles often have lower fuel costs, pricing plans must account for larger initial expenditures and additional infrastructure costs, such as charging stations. Furthermore, enterprises must consider route efficiency and load optimization to reduce cost per kilometer and offer more competitive rates without jeopardizing profit margins.

Shipping Rates

Shipping rates are the costs charged by logistics companies to consumers in exchange for the transportation of products from one point to another. These rates are set not just to recover the company's operational expenditures, but also to preserve competitiveness in the logistics business (Suliawati et al., 2021). Several important elements determine shipping charges, including the type of service chosen, the distance traveled, the chargeable weight, and operational costs, which include fuel, labor, vehicle maintenance, and supporting infrastructure. In freight distribution, transportation cost analysis is critical in determining rates that are consistent with the company's cost structure and the value of service offered to customers. These expenses are divided into fixed and variable components: fixed costs include initial vehicle and infrastructure investments, while variable costs include gasoline, maintenance, and driver wages (Abdurrahman & Susiladewi, 2023). As a result, rates must find a compromise between competitive market pricing and operational cost recovery. The method used to calculate the weight of items has a considerable impact on rate-setting regulations. Logistics companies typically use the real weight approach.

Freight Delivery

Freight delivery is a vital component of the supply chain, ensuring that products arrive on schedule and in acceptable condition (Arifin & Khairunnisa, 2019). This process consists of several stages, including pick-up from the sender, sorting by destination, packaging to preserve products during travel, transportation via the appropriate method, and final delivery to the receiver. The speed and accuracy of deliveries are significantly reliant on the logistics management system in place, which includes route optimization tactics, the selection of efficient transportation options, and supporting technologies such as real-time tracking. Modern logistics considers not just time and cost efficiency, but also environmental impact. Salsabilla et al. (2024) found that route optimization in multi-trip deliveries with diverse electric vehicle fleets can improve delivery efficiency while lowering carbon emissions. The study demonstrates that with good planning, businesses may cut energy usage, travel distances, and optimize truck load capacity, lowering operational expenses. Furthermore, the use of artificial intelligence (AI) and geographic information systems (GIS) is becoming more important for determining the most efficient routes, reducing traffic congestion, and improving delivery timeliness (GhinalIlmi et al., 2019).

Electric Vehicle (EV)

Electric vehicles (EVs), commonly known as EVs, are cars that run on one or more electric motors rather than internal combustion engines powered by fossil fuels (Veza et al., 2023). Unlike typical automobiles, EVs produce propulsion from electricity stored in batteries or hydrogen fuel cells. With technological breakthroughs, electric vehicles have arisen as an innovative alternative in the transportation and logistics industry, emphasizing efficiency and environmental sustainability (Mahmud et al., 2024). In the logistics industry, EVs provide numerous important benefits. One of the key benefits is a reduction in carbon emissions and air pollution. Compared to gasoline or diesel-powered vehicles, electric vehicles help to mitigate climate change by emitting no direct greenhouse gases. Furthermore, EVs use less energy than internal combustion engines because electric motors convert a greater amount of energy into motion. Because there are fewer moving parts that need to be serviced on a regular basis, this efficiency leads to cheaper long-term operational expenses, including fuel and maintenance savings. Despite these advantages, EV adoption in the logistics business confronts a number of hurdles. One of the most significant impediments is the scarcity of charging infrastructure, particularly in areas without a suitable network of public charging stations (Wahyudi et al., 2024). Furthermore, EVs typically have a shorter driving range than conventional vehicles, which may limit their use for long-distance freight transport. As a result, comprehensive operational planning—including route optimization tactics and charging management—is critical for effective EV implementation in logistics. Nurlailawati et al. (2023) investigate the problems of EV route design, namely battery constraints and infrastructural availability. The study underlines the necessity of combining technology-based route management systems, such as artificial intelligence (AI) and geographic information systems (GIS), to improve trip efficiency and ensure that electric cars can accomplish delivery responsibilities with minimal disruption. Furthermore, advances in high-capacity batteries and fast-charging technologies are critical in increasing EV competitiveness in the logistics sector.

Chargeable Weight

Chargeable weight is a mechanism used in the logistics business to calculate shipping costs based on the actual or volumetric weight of a package. This concept is critical since the available space within a delivery vehicle is limited not only by the weight of the goods, but also by its volume. As a result, shipping cost calculations must take into account both the physical weight and the amount of space the products take up in the vehicle (Arifin and Khairunnisa, 2019). In practice, chargeable weight is derived by comparing two important values: actual weight and volumetric weight. Actual weight is the physical mass of the items, measured in kilograms or tons. Volumetric weight, on the other hand, is calculated using a standardized formula developed by logistics corporations, frequently based on rules from international logistics organizations such as the International Air Transport Association (IATA) or global courier services.

The use of charged weight helps logistics companies prevent losses caused by improper space usage. Large but lightweight objects can take up a lot of vehicle space, and a volumetric rate more accurately reflects the actual capacity used than weight alone. Furthermore, firms can reduce costs by setting clear and consistent chargeable weight regulations. Shippers must also comprehend this process so that their goods can be packaged more effectively, potentially lowering transportation costs. For example, employing compact packaging and high-density packing techniques can assist reduce volumetric weight, resulting in lower costs. In the logistics sector, two broad ways to determining shipping costs are typically used: actual weight and chargeable weight, with the latter taking into account dimensional considerations. Although charged weight is becoming more popular for its fairness in depicting space consumption (Purtell et al., 2025), this study particularly uses the actual weight approach. This method is regarded as more suited for capturing actual operational expenses incurred during delivery, particularly in the context of electric vehicle (EV) use, since payload capacity is best defined by weight. As a result, this pricing plan prioritizes distribution efficiency and cost transparency based on the actual weight of the commodities transported.

3. Research Methodology

Using the chargeable weight scheme and the actual weight approach at PT. Dapensi Dwikarya (DDK), this study uses a descriptive quantitative method to assess freight shipping rates based on the operational costs of battery-powered cars. The company's financial reports, shipping rate documents, and earlier research on the operational costs and charging weight of electric vehicles are the sources of the secondary data used in this study. The analytical methodologies include assessing the operational costs of electric vehicles using energy consumption, maintenance costs, and asset depreciation. Subsequently, the chargeable weight calculation method is used to determine rates that are more equitable and efficient than the current distance system. A comparison of chargeable weight-based and distance-based charges is also performed to assess their impact on the company's profitability. The findings are expected to provide strategic recommendations for PT. Dapensi Dwikarya in terms of implementing a charged weight-based pricing system and improving operational cost efficiency in the logistics sector through the deployment of electric vehicles.

4. Conclusion

Table 1: Income Statement of PT. Dapensi Dwikarya (DDK)

A. 1. FIX COST	Monthly Cost	Annual Cost
a. Depreciation	2.990.038	35.880.456
b. Interest	1.364.111	16.369.332
c. Insurance	587.194	7.046.328
d. Vehicle Registration Certificate (STNK)	60.000	720.000
e. Vehicle Inspection Certificate (KIR)	125.000	1.500.000
TOTAL	5.126.343	61.516.116
A. 2. VARIABLE COSTS		
1. Human Resources (HR)	13.214.942	158.579.307
2. Maintenance	317.874	3.814.485
3. Direct Operational Costs		
a. Fuel	1.000.588	12.007.059
b. **Meal Allowance**	-	-
c. Loading and Unloading	-	-
d. Toll and Parking Fees	-	-
e**. Checker Fee**	-	-
TOTAL	14.533.404	174.400.851
A. 3. OVERHEAD 10.5% OF CAPITAL	778.024	9.336.285
TOTAL COSTS 1 + 2 + 3	20.437.771	245.253.252

Source: Internal Data of PT. Dapensi Dwikarya (DDK)

Calculation of Cost Per Kilogram (Rp/kg)

Given:

Total Monthly Cost = Rp. 20.437.771
Transport Capacity of EV Blind Van = 1.000 kg
Optimum Load Capacity (60%) = 1.000 kg x 60% = 600 kg
Number of Working Days = 30 days
Total Load per Month = 600 kg x 30 Hari = 18.000 kg/month

Cost per kg:

Rp. 20.437.771 ÷ 18.000 kg = Rp. 1.135 / kg

Calculation of Management Fee (Profit Margin)

In this calculation, a profit margin percentage is assumed. The assumed profit percentage is 15%, as follows:

Management Fee = Profit Margin (%) × Cost per kg
= 15% x Rp. 1.135/kg
= Rp. 170,-/kg.

Calculation of Chargeable Weight Rate (Rp/kg)

Given:

Operational Cost per kg = Rp.1.135,- /kg (from previous calculation)
Management Fee = Rp. 170,- /kg

Chargeable Weight Rate:

Operational Cost + Management Fee
= Rp. 1.135,-/kg + Rp. 170,-/kg
= Rp. 1.305,-/kg

Based on the Chargeable Weight Rate above, the total monthly revenue can be calculated as:

Chargeable Weight Rate × Total Monthly Load
= Rp. 1.305,-/Kg x 18.000 Kg
= Rp. 23.490.000,- / month

Based on the study's findings, shipping charges calculated using the chargeable weight approach provide a rate of Rp. 1,305 per kilogram for each unit of capacity conveyed. This implies that shipping prices are based on the volume of products, in compliance with Pos Indonesia's volumetric pricing policy. This research emphasizes the need of effective packaging in the logistics industry, as reducing package dimensions can ultimately lead to lower transportation costs.

From an operational standpoint, the cost of Rp. 1,135 per kilogram demonstrates the cost-effectiveness of logistics per unit weight when the charged weight system is used. Adopting electric vehicles (EVs) is one strategic alternative for increasing cost efficiency. Because fossil fuel-powered vehicles have more moving parts and require fuel at fluctuating costs, EVs are regarded as more energy-efficient and cost-effective in terms of maintenance. Furthermore, government subsidies and tax breaks for electric vehicles provide further reasons for logistics companies to engage in this technology.

Beyond monetary advantages, driving an electric vehicle has environmental benefits. Logistics firms that reduce carbon emissions can help national sustainability policies while also improving their brand image among more environmentally sensitive consumers. In the context of this study, which looks at a 42-kilometer route, EVs are particularly well-suited for short- to medium-distance deliveries, especially given the continual development of urban charging infrastructure that promotes EV mobility.

In addition to EV adoption, additional options for increasing efficiency include route optimization using GPS and artificial intelligence. These solutions enable businesses to choose the fastest and most energy-efficient routes, avoid traffic jams, and effectively arrange EV charging sessions. When combined with data-driven fleet management systems, these solutions can dramatically improve time and cost efficiency.

Finally, initiatives like delivery consolidation and dynamic pricing are critical for cost reduction. Consolidation maximizes truck capacity by consolidating many shipments into a single trip, whereas dynamic pricing enables businesses to modify rates based on demand and scheduling. Given EVs' more consistent running costs, dynamic pricing can be used more effectively, resulting in more flexible, efficient, and competitive delivery operations. The combination of these measures promotes long-term efficiency and accelerates the transition to environmentally sustainable logistics systems.

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Conflict of Interest Statement
The authors declare that there is no conflict of interest regarding the publication of this paper.

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