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Feasibility Analysis of Using Electronic Vehicles at Grab Indonesia with the IRR Method

Muhammad Alif Furqan[1], Aulia Idharizqi Widayani Sahbandar[2], Barandika[3], Yizri Ievana Febrianty Rumalutur[4], Rasyid Abid[5], Fazar Sutisna[6], Yelita Anggiane Iskandar[7*], and Resista Vikaliana[8]

[12345678] Department of Logistics Engineering, Faculty of Industrial Technology, Universitas Pertamina

**Email korespondensi: yelita.ai@universitaspertamina.ac.id*

Abstrak

Indonesia merupakan negara dengan jumlah penduduk terbesar keempat di dunia, mencapai 275,77 juta jiwa pada tahun 2022. Hal ini menyebabkan kebutuhan akan transportasi turut terus meningkat sehingga menciptakan peluang bisnis baru bagi perusahaan angkutan umum, termasuk perusahaan ojek *online* seperti Grab yang menyediakan layanan *door-to-door* dan pesan antar makanan. Namun, peningkatan kebutuhan transportasi juga menyebabkan naiknya konsumsi bahan bakar yang menjadi salah satu faktor penyebab pencemaran udara. Penelitian ini bertujuan untuk menghitung dan mengetahui kelayakan penggunaan sepeda motor listrik oleh pengemudi Grab untuk mengangkut penumpang, barang, atau makanan sekaligus menghitung emisi karbon yang tercipta akibat berbagai aktivitas tersebut. Analisis kelayakan didasarkan pada *Internal Rate of Return* (IRR) masing-masing tipe kendaraan pengangkut yang digunakan, dengan metode *Sum of Years Digits* (SOYD), yang mempertimbangkan penyusutan, penggunaan bahan bakar, dan jumlah emisi karbon yang dihasilkan. Hasil penelitian menunjukkan bahwa penggunaan kendaraan listrik merupakan investasi yang layak dalam jangka panjang, baik secara teknis maupun finansial.

Kata Kunci: Motor Listrik, Transportasi, IRR, Emisi Karbon, dan Analisis Kelayakan

Abstract

Indonesia is a country with the fourth largest population in the world, reaching 275.77 million people in 2022. This has caused the need for transportation to increase, thereby creating new business opportunities for public transportation companies, including online motorcycle taxi companies such as Grab which provide service gates - to-door and order food delivery. However, the increase in transportation needs also causes an increase in fuel consumption, one of the factors causing air pollution. This study aims to calculate and determine the feasibility of using electric vehicles by Grab drivers to transport passengers, goods, or food while calculating the carbon emissions created as a result of these various activities. The feasibility analysis is based on the Internal Rate of Return (IRR) of each type of transport vehicle used, using the Sum of Years Digits (SOYD) method, which takes into account depreciation, fuel use, and the carbon emissions produced. The results of the study show that the use of electric vehicles is a viable investment in the long term, both technically and financially.

Keywords: *Electric Vehicles, Transportation, IRR, Carbon Emission, Feasibility Analysis*

1. Introduction

1.1. Background

According to a report from the World Population Review, Indonesia is the 4th most populous country in the world after the United States, where the population reaches 275.5 million people (Annur, 2022). The development of the population civilization in Indonesia, which is quite high, has had an impact on increasing transportation needs, which will continue to grow from year to year. The total number of vehicles in Indonesia is estimated to be 136,1137,451 (Badan Pusat Statistik,

2020). in 2020. As time passed, the number of vehicles also increased. Within 2 years, the number of vehicles increased to 150,786,747 units (Sari, 2022). Most Indonesians depend on public transportation to meet their mobility needs. As is well known, most Indonesians have a relatively low economic level. The development of transportation has an important role along with the influence of globalization in human life, especially transportation, which considers timeliness, safety, environmental friendliness, and comfort, which will have an impact on the conception of social and economic development in Indonesia (Supit & dkk, 2019).

The higher level of mobility needed by the community creates new business opportunities for public transportation service companies. Currently, public transportation service companies are competing with each other to create and develop new business innovations to meet the needs of the community. The existence of technological developments is the main factor behind the emergence of transportation business ideas in the online field. Pick-up services that were originally carried out conventionally are now being changed on a technology-based basis that utilizes the internet network. Online motorcycle taxis are a means of transportation that can be summoned quickly and easily using a smartphone. The services provided by online motorcycle taxis currently not only serve customer pick-ups but also provide convenient services for users in ordering or buying food or goods; besides that, the emergence of the idea of online motorcycle taxis has had a positive impact on people who need jobs (Fahrurrozi & dkk, 2020). Currently, online motorcycle taxi services in Indonesia are in great demand by the public, one of which is Grab. Grab is a public transportation service company that utilizes technology by combining transportation and technological developments. Grab is a pioneer in the creative economy business that utilizes Information and Communication Technology (ICT). As a provider of online transportation services, Grab has the characteristics of customers aged 15–30 years because they are considered to understand and adapt more quickly to the emergence of new things (Syahrul & arisah, 2020). Apart from providing passenger pick-up services, Grab also provides the Grab Food service, where people can order food anytime and anywhere via their respective smartphones without having to leave the house.

However, the increasing need for transportation in the community and the high level of mobility will have a negative impact on the environment because the need for fuel will continue to increase. In addition, the transportation sector is a major contributor because it consumes fossil fuels and produces greenhouse gas emissions. In 2015 there was an increase in the concentration of CO2 in the atmosphere, which was initially stable, increasing to 400.26 ppm due to the use of fossil fuels (Abas, Kalair, & Khan, 2015). In 2013, the energy consumed by the transportation sector comprised 27.6% of the total energy consumption in the world. The resulting CO2 emissions are 22.9% of the total CO2 emissions in the world (Woo, Choi, & Ahn, 2017). Reducing the scarcity of fuel in the world finally motivated researchers to find the use of new renewable energy such as the use of electric powered vehicles or what is currently known as Electric Vehicles (EV).
The use of electric vehicles is an example of implementing green logistics. EV is a solution in the future in handling related to reducing greenhouse gas emissions. inversely proportional to the TV, which uses non-renewable resources as fuel. When viewed from the advantages and disadvantages, EVs have a positive impact on the sustainability of a healthy environment, while difficulties will be found in the cost of maintaining the EV (Feng, 2021). This is inversely proportional to TV, which plays a smaller role in reducing greenhouse gas emissions, but the advantage lies in the costs incurred in operating the mode of transportation. The price is, of course, more affordable because of the technological advancements used, which are of a lower level than EVs. According to the latest data obtained in 2022, it is known that the number of EVs for motorcycles is 21,668 units, while cars are 3,317 units (Ibrahim, 2022).

Investment in EVs is believed to be one of the methods to reduce carbon emissions in the air. Because it does not produce exhaust gases like those produced by petrol or diesel engines, it can

help in efforts to reduce air pollution levels and climate change. EVs can also lower operating costs as they have lower fuel costs and require less maintenance compared to gasoline or diesel engines. Investment in charging infrastructure is also needed to support the increased use of electric vehicles. In addition, the investment was made considering the vision of the Grab company, which pays attention to the environment, so based on the above considerations related to EV and TV, it can be concluded that proposals related to investment for Grab in order to deliver passengers, food, or goods to their destination can be submitted. With the EV investment, it is hoped that it will have a positive impact on the development of Grab. Investment feasibility can be determined through the IRR (internal rate of return) method, which then becomes the investment criteria (Wulan & Astuti, 2023). Feasibility can be seen based on the value generated by this method. In addition to using reasoning as a step towards realizing the vision, the company also wants to get more profit from the results of its investment so the IRR method is considered the most suitable method for solving problems in research.

1.2. Formulation of The Problem

Based on the background research explained above, the following are three problem formulations we consider here:

1. How do the depreciation values of EV and TV compare?
2. What is the IRR on EV and TV?
3. How much pollution do EVs and TV produce?

1.3. Purpose

Regarding the problem formulation, we define these several research objectives:

1. Calculate the depreciation value of EV and TV.
2. Calculate the IRR value on EV and TV.
3. Calculate the total emissions issued by EVs and TVs.

The calculations are then utilized to analyze the managerial implication of the recommendation for the company.

2. Method

In this study, a comparison will be made between the use of gasoline and electric drive motors (EVs). This study aims to calculate and determine the feasibility of the investment in using electric motors as passenger vehicles and between goods. Besides that, the purpose of this study is also to calculate the depreciation value of EVs and TVs and the resulting carbon emissions. Depreciation is a reduction in the value or cost of fixed assets owned by the company. The types of assets that exist in the depreciation process itself consist of buildings, machinery, equipment, and money. This study conducted a trial using the SOYD depreciation method and IRR investment feasibility.

SOYD (Sum of Years Digits) is a method of calculating the depreciation in the value of an item or tool within a certain period of time. Another term for this method is the "number of years' digits" depreciation method. This is useful for determining how much the value of a tool or machine used in a company's industry will decrease each year so that companies can make the right decisions for the continuity of their industrial system. The sum of year-digit (SOYD) method is a method used to calculate the present value or future value of an amount of money to be received or paid at some point in the future. The SOYD method makes it possible to calculate the present value of future payments by multiplying the number of years that will pass before the payment is received by the appropriate discount rate. This discount rate is the rate of return expected by investors if the money is kept in a safe place for that period of time.

$$Dt = \frac{Sisa\ masa\ aset}{SOYD} = \frac{(N-t)+t}{SOYD}\ (P-S)$$

(1)

$$SOYD = Jumlah\ digit\ tahun\ dari\ 1\ sampai\ N \quad (2)$$

$$SOYD = 1 + 2 + 3 + \cdots + (N-1) + N = \frac{N(N-1)}{2} \quad (3)$$

IRR is the expected rate of return on an investment or project, which is calculated by finding the interest rate that causes the present value of the expected cash inflows to be equal to the present value of the cash outflows required to finance the investment or project. IRR stands for Internal Rate of Return and is a technique used to calculate the rate of return. Basically, the internal rate of return (IRR) is a method used to calculate the interest rate that equates the present value of all cash inflows with cash outflows from an investment project. Thus, this method is used to calculate the actual rate of return. In principle, the IRR should be found by trying various interest rates until the present value of cash inflows equals the present value of cash outflows. According to the eligibility criteria for receiving investment using the internal rate of return (IRR) method, an investment is considered feasible if the IRR is greater than the desired profit level. Conversely, if the IRR of an investment is less than the expected rate of return, then the investment is considered inappropriate.

$$\sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t} = 0 \quad (4)$$

NPV is a way to evaluate a project or investment by calculating the difference between the present value of cash inflows and outflows. If the NPV is positive, then the investment is profitable, whereas if it is negative, it is a loss. The higher the NPV value, the better the potential profit from the investment. The NPV is obtained using a predetermined discount rate. To determine the feasibility of an investment using the NPV method, data is needed regarding the initial cash outflow, net cash inflows in the future, and the expected minimum rate of return. NPV can be used to evaluate emissions-related projects, such as those to reduce or address emissions. In emission reduction projects, NPV is used to calculate the present value of the cash flows generated from the project, which is calculated from the costs incurred to reduce emissions and the costs incurred to keep emissions the same. If the NPV is positive, the project is considered profitable because it reduces emissions at a lower cost than it would cost to keep emissions the same. In an emissions management project, the NPV is used to calculate the present value of the cash flows generated from the project, which is calculated from the costs incurred to deal with the emissions and the costs incurred to allow the emissions to remain the same. If the NPV is positive, the project is considered profitable because it deals with emissions at a lower cost than it would cost to keep emissions the same.

$$\sum_{t=0}^{n} \frac{CF_t}{(1+R)^t} = NPV \quad (5)$$

3. Result

3.1. Fuel Usage Between EV And TV

The widespread use of motorcycles results in the sale of numerous motorcycle variants. This study limits the comparison of the use of motorbikes to types of motorbikes for traditional vehicles (TV), 110cc motorbike types, and similar AV motorbikes. In the data below, you can see a comparison of the two vehicles with the same mileage restrictions. The costs incurred for operations are as follows (Kementerian ESDM, 2020):

Table 1. EV Motorcycles

Name	Value	Unit
The price of an electric motorcycle + battery	IDR18,950,000	Unit
Battery price	IDR6,500,000	Unit
Battery capacity (A)	2	kWh

Mileage when the battery is full (B)	60	Km
PLN electricity tariff (C)	1,467	Rp/KWH
Battery charging fee per month (D=A*C*30)	IDR88,020	Month

The table above shows the purchase price of the vehicle, its equipment, and the total operating cost of the vehicle. The results of a simple calculation show that the total costs incurred per month for TV-type vehicles are higher with a total cost of IDR300,000/month compared to AV vehicles with a cost of IDR88,020/month.

Table 2. TV Motorcycles

Name	Value	Unit
Fuel motorbike prices	IDR17,150,000	Unit (Cash)
Mileage	60	km
Fuel Cost (Pertalite) (A)	IDR10,000	Liter
Fuel costs (B=A*30)	IDR300,000	Km
Total cost	IDR300,000	Month

3.2. Carbon Emission Analysis

In the annual data on the amount of carbon produced, there are several types of emission gases that are released during the combustion process on TV vehicle types, whereas AV does not experience combustion when used, so the results obtained for TV emission values are much different from EV, as shown in Table 3 (Asri dkk., 2022).

Table 3. Comparison of Carbon Emissions

Transportation Type	CO (kg/km)	NOx (dag/km)	PM_{10} (dag/km)	$C0_2$ (kg/dam)	SO_2 (dg/km)
TV Motor	0.014	0.029	0.024	0.0318	0.08
EV Motor	-	-	-	-	-

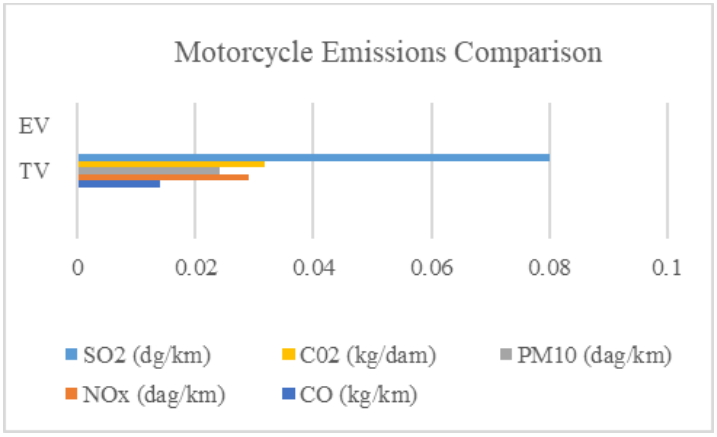

Figure 1. Emissions Comparison Chart

The comparison of emissions emitted by TVs and EVs is significantly different. This is because traditional vehicles have a fuel combustion process that is used, causing a polluting effect. Meanwhile, an EV does not experience the combustion process when it is used. Meanwhile, an EV does not experience the combustion process when it is used. After analyzing the carbon emissions produced by vehicles, the total depreciation is calculated using the SOYD (sum of years depreciation) method for both types of vehicles to obtain the annual depreciation amount with a large accumulation of payments at the beginning of the year, as shown in Table 4 and 5.

Table 4. Calculation of Depreciation using SOYD on EV

EV (in IDR)		
Year	Year End Depreciation	Book Value (EV)
0	-	17,150,000.00
1	4,416,666.67	12,733,333.33
2	3,533,333.33	9,200,000.00
3	2,650,000.00	6,550,000.00
4	1,766,666.67	4,783,333.33
5	883,333.33	3,900,000.00

The calculation of the annual depreciation on both vehicles has been accumulated so that the depreciation value generated each year has decreased. The decrease in the number that is getting smaller at the end of the year shows that the depreciation of the SOYD method applied at the beginning of the year will be large, but with each additional year, the resulting book value gets smaller.

Table 5. Calculation of Depreciation using SOYD on TV

TV (in IDR)		
Year	Year End Depreciation	Book Value (EV)
0	-	17,150,000.00
1	5,050,000.00	12,100,000.00
2	4,040,000.00	8,060,000.00
3	3,030,000.00	5,030,000.00
4	2,020,000.00	3,010,000.00
5	1,010,000.00	2,000,000.00

Based on Figure 2, it can be interpreted that the gradient of decline due to depreciation imposed on TV is greater than EV. The final book value (TV) or scrap value has a value of IDR2,000,000, while the final book value (EV) is IDR3,900,000.

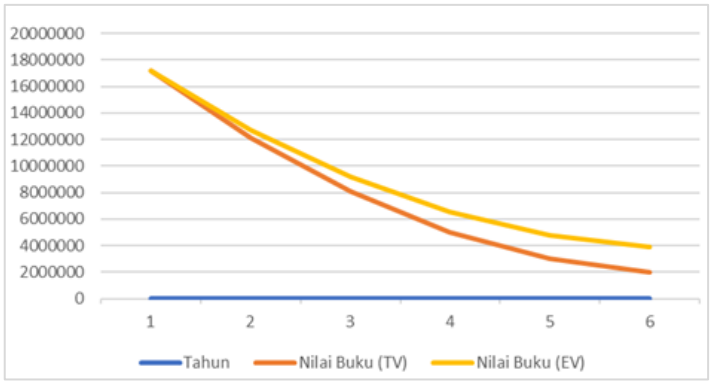

Figure 2. Graph of SOYD AV & TV Depreciation Rate

3.3. Net Present Value Analysis on EV And TV Vehicle Investments

The NPV analysis calculates the percentage of BRI's current interest rate for corporate loan processes in Tables 6 and 7.

Table 6. Calculation of NPV on EV

EV				
Year	Charge Fee	Depreciation	Expenditure	Revenue
1	IDR1,056,240	IDR4,416,667	- IDR5,472,907	IDR12,960,000
2	IDR1,056,240	IDR3,533,333	- IDR4,589,573	IDR12,960,000
3	IDR1,056,240	IDR2,650,000	- IDR3,706,240	IDR12,960,000

EV				
Year	Charge Fee	Depreciation	Expenditure	Revenue
4	IDR1,056,240	IDR1,766,667	- IDR2,822,907	IDR12,960,000
5	IDR1,056,240	IDR883,333	- IDR1,939,573	IDR12,960,000
			NPV	IDR27,958,298

Based on NPV analysis using an interest rate of 8.00% (BRI's interest rate for corporate loans) and within a period of 0–5 years, the NPV for EV and TV is more than zero, making it feasible to invest. The NPV value of EV is greater than TV, with a difference of IDR10,321,097. As a result, investing in EVs is preferable to TV.

Table 7. Calculation of NPV on TV

TV				
Year	Fuel	Depreciation	Expenditure	Revenue
1	IDR3,600,000	IDR5,050,000	- IDR8,650,000	IDR12,960,000
2	IDR3,600,000	IDR4,040,000	- IDR7,640,000	IDR12,960,000
3	IDR3,600,000	IDR3,030,000	- IDR6,630,000	IDR12,960,000
4	IDR3,600,000	IDR2,020,000	- IDR5,620,000	IDR12,960,000
5	IDR3,600,000	IDR1,010,000	- IDR4,610,000	IDR12,960,000
			NPV	IDR17,637,200

3.4 Calculation of Vehicle Emission IRR Feasibility in EV And TV

The IRR analysis of carbon emissions is determined to show that the vehicle has an adequate amount of return per year that is worth investing in. The IRR for carbon emissions in the table below shows that the IRR for EV use is a larger percentage than for TV use.

Table 8. Calculation of IRR on EV

EV (in IDR)				
Year	Charge Fee	Depreciation	Expenditure	Revenue
1	1,056,240	4,416,667	5,472,907	12,960,000
2	1,056,240	3,533,333	4,589,573	12,960,000
3	1,056,240	2,650,000	3,706,240	12,960,000
4	1,056,240	1,766,667	2,822,907	12,960,000
5	1,056,240	883,333	1,939,573	12,960,000
			IRR	145%

Table 9. Calculation of IRR on TV

TV (in IDR)				
Year	Fuel	Depreciation	Expenditure	Revenue
1	3,600,000	5,050,000	8,650,000	12,960,000
2	3,600,000	4,040,000	7,640,000	12,960,000
3	3,600,000	3,030,000	6,630,000	12,960,000
4	3,600,000	2,020,000	5,620,000	12,960,000
5	3,600,000	1,010,000	4,610,000	12,960,000
			IRR	61%

Based on the table above, fuel expenditure and battery charging for both types of vehicles, taking into account depreciation, show that the IRR for an EV is considered feasible compared to the IRR for a conventional vehicle.

IRR describes the level of efficiency of an investment, the higher the percentage, the better the efficiency of the investment. As shown in Figure 3, the EV IRR value is 145%, while the TV value is only 61%. It can be concluded that investing in EVs is more efficient than investing in TV.

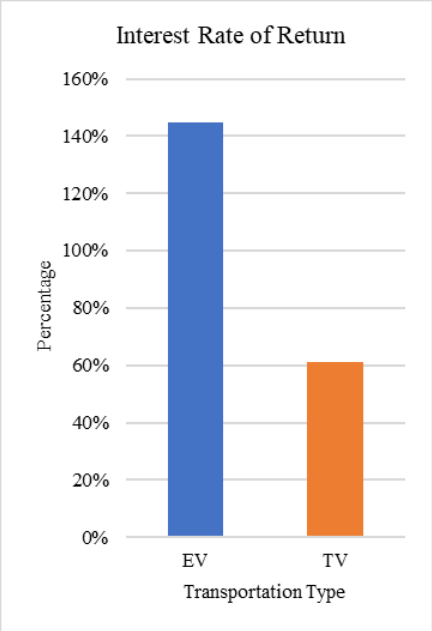

Figure 3. IRR Percentage Value on AV and TV

4. Discussion

Fuel Usage Between EV And TV

Energy Efficiency: Studies and research show that EVs have higher energy efficiency compared to traditional vehicles. Energy efficiency can be measured by comparing the percentage of energy used to propel the vehicle compared to the energy lost as heat or waste. In Electric Vehicles (EVs), an electric motor converts electrical energy from the battery into wheel motion. This conversion process is highly efficient, typically from 85% to 95%. Therefore, most of the energy used in EVs is effectively used to propel the vehicle. Traditional Vehicles: In traditional vehicles with internal combustion engines, energy generated from the combustion of fossil fuels is used to propel the vehicle through a series of mechanical transfers. Internal combustion engines have lower efficiency compared to electric motors in EVs, usually ranging from 20% to 40%. A significant amount of energy is lost in the form of heat through the exhaust system and cooling system. Numerous studies and research have compared the energy efficiency between EVs and traditional vehicles. One relevant study is "Comparative analysis of energy consumption and emissions of conventional and electric vehicles: A review" by Shah et al. (2017). This study analyzed previous research and concludes that electric vehicles have higher energy efficiency than traditional ones.

Carbon Emission Analysis

Indonesia is one of the countries with a transportation sector that is a major contributor to greenhouse gas emissions. The growth of motorized vehicles and high dependence on fossil fuels has increased emissions in this sector. By adopting EVs in Grab Indonesia's operations, a significant reduction in emissions can be expected. According to data from the Indonesian Ministry of Energy and Mineral Resources in 2020, the transportation sector contributed approximately 32% to the total greenhouse gas emissions in the country. By replacing traditional vehicles with EVs, especially in transportation services like Grab, the emissions contribution from the transportation sector can be significantly reduced. Here is a comparison of the carbon emissions generated:

a. Emission Sources of TV: Vehicles that use fossil fuels such as gasoline or diesel produce major greenhouse gas emissions, including carbon dioxide (CO2), methane (CH4), and nitrogen oxides (NOx). These emissions contribute to climate change and global warming.
b. EV Emissions: Electric vehicles, such as EVs, do not produce direct emissions during use because they don't have exhaust systems and do not burn fossil fuels. Emissions associated with EVs depend on the source of electricity used. If the electricity is obtained from renewable energy sources such as solar, wind, or hydro, then the greenhouse gas emissions produced by EVs will be very low or even zero.

The use of EVs also has the potential to reduce air pollution in densely populated areas. Motor vehicles with internal combustion engines produce air pollutants such as fine particles (PM), nitrogen dioxide (NO2), and carbon monoxide (CO), which have negative impacts on air quality and human health. By replacing conventional vehicles with EVs, air pollution can be reduced, providing significant health benefits to the community. A study by Clean Air Coalition Indonesia (2018) concluded that if the entire taxi fleet in Jakarta switched to EVs, greenhouse gas emissions could be reduced by up to 45% and air pollution could be significantly reduced.

Net Present Value Analysis of TV And EV Vehicle Investments

Future Cash Flows for traditional vehicle investment, NPV will consider the expected cash flows from the operational use of TV. This includes higher fuel costs and higher operational expenses compared to electric vehicles. In traditional vehicles, operational costs amount to IDR300,000. From Initial Investment Costs consideration, NPV will also take into account the initial costs associated with the traditional vehicle investment, including the price of the TV itself, fuel costs, and vehicle maintenance expenses. The cost of purchasing a used traditional vehicle is IDR17,150,000.
Future Cash Flows for NPV analysis in an EV investment will take into account the expected cash flows from the operational use of EVs. This includes savings from lower fuel costs and lower operational expenses compared to traditional vehicles. These savings can be achieved through cheaper electricity costs and reduced dependence on fossil fuels. The required operational costs for an electric vehicle are IDR80,020.

From Initial Investment Costs consideration, NPV will also consider the initial costs associated with the EV investment, including the price of the EV itself, charging infrastructure costs, and vehicle maintenance expenses. The cost of purchasing an electric vehicle is higher, amounting to IDR18,950,000.

The calculation results indicate that both the NPV for EV (Electric Vehicle) and TV (Traditional Vehicle) yield positive values. A positive NPV signifies that the investment is expected to generate profits after considering the initial costs and operational expenses. In this study, both the NPV calculations for TV and EV are positive. However, when considering the magnitude of the values, the use of EV yields a larger NPV of IDR27,958,298. Therefore, it can be implemented that the use of EVs is more economically advantageous compared to the use of TV.

The positive NPV for EV and TV indicate that both investment options are expected to generate higher returns than the initial investment and operational costs. However, when comparing the magnitudes of the NPV values, it is evident that the use of EV yields a significantly higher NPV of IDR27,958,298. This higher NPV for EVs suggests that the investment in electric vehicles offers greater potential for long-term profitability. It indicates that the returns generated by EV usage are expected to exceed the costs and generate a substantial positive net gain. There could be several factors contributing to the higher NPV for EVs. One significant factor is the lower operating costs associated with EVs compared to traditional vehicles. Electric vehicles generally require less maintenance, have lower fuel costs (or electricity costs), and may qualify for incentives or tax

benefits, all of which can contribute to reduced operational expenses. Furthermore, the growing trend towards sustainable and environmentally friendly practices may enhance the economic benefits of EV adoption. This includes potential savings from reduced carbon emissions and access to government subsidies or grants to promote clean energy initiatives.

Considering these factors, the higher NPV for EV suggests that it is a financially sound investment and aligns with broader sustainability goals. Therefore, implementing the use of EVs can be seen as a more economically advantageous and environmentally responsible choice compared to traditional vehicles.

5. Conclusion and Suggestion

Based on the calculation results using the Sum of Year Digit (SOYD) method, the depreciation values of the electric vehicle (TV) and traditional vehicle (TV) can be determined. In addition, the final book value (EV) or scrap value (SV) has a different value, greater than the TV, namely IDR3,900,000 to IDR2,000,000. Then, based on the IRR calculation, it can be concluded that the investment made in the procurement of electric motorbikes as a passenger and inter-goods transportation service vehicles is declared feasible. The feasibility of this investment is determined by the IRR (EV) value, which is greater than the IRR (TV) value (145% versus 61%). Using an electric vehicle (EV) can reduce emissions resulting from logistics activities, namely in this study, the transportation activities of the Grab company in which EV does not produce the slightest emission compared to TV, which produces emissions in the form of SO2, CO2, NOx, and CO. We can conclude that the investments made by Grab, taking into account all the factors, proved that EV is worth investing in in the long term compared to TV.

References

Abas, N., Kalair, A., & Khan, N. (2015). Review of Fossil Fuels and Future Energy Technologies. *Futures, 69(May 2015)*, 31–49.

Annur, C. M. (2022, November 1). *Indonesia Masuk 5 Besar Jumlah Penduduk Terbanyak di G20*. Diambil kembali dari Databoks: https://databoks.katadata.co.id/datapublish/2022/11/01/indonesia-masuk-5-besar-jumlah-penduduk-terbanyak-di-g20#

Asri, L. N., Sari, K. E., & Meidiana, C. (2022). Emisi CO Kendaraan Bermotor pada Ruas Jalan dengan Tingkat Pelayanan Rendah di Kota Malang. *2*, 36.

Badan Pusat Statistik. (2020). Perkembangan Jumlah Kendaraan Bermotor Menurut Jenis (Unit), 2018-2020. *Transportasi*, hal. 1.

Fahrurrozi, & dkk. (2020, Januari). Analisis Layanan Ojek Online PT. Grab Indonesia Wilayah Surabaya dalam Perspektif Bisnis Islam. *Jurnal Ekonomi & Ekonomi Syariah, Vol.3 No.1*.

Feng, X. (2021). Economic and Ecological Optimization of The London Urban Logistics System Considering Infection Risk during Pandemic Periods. *International Journal of Supply and Operations Management*, 114-133.

Ibrahim, M. A. (2022). *Berapa Populasi Kendaraan Listrik di Indonesia Saat Ini?* Jakarta: CNN Indonesia.

Kementerian ESDM. (2020). *Dashboard Percepatan Program KBLBB (Kendaraan Bermotor Listrik Berbasis Baterai)*. Dipetik Januari 3, 2022, dari https://www.esdm.go.id/kblbb/

Sari, J. P. (2022). *Jumlah Kendaraan Bermotor di Indonesia Tembus 150,7 Juta Unit.* Jakarta: Kompas.

Supit, R. M., & dkk. (2019, Januari). Model Pemilihan Moda Transportasi Online di Kota Manado. *Jurnal Sipil Statik, Vol.7 No.1*, 35-48.

Syahrul, M., & arisah, n. (2020). Persepsi Pengguna Jasa Transportasi Online Grab Ditinjau dari. *Journal of Education and Entrepreneur Studies, vol 1(2)*, 88-100.

Woo, J., Choi, H., & Ahn, J. (2017). Well-to-Wheel Analysis of Greenhouse Gas Emissions for Electric Vehicles Based on Electricity Generation Mix: A Global Perspective. *Transportation Research Part D: Transport and Environment, 51*, 340–350.

Wulan, S., & Astuti, T. M. (2023). Analisis Kelayakan Bisnis Rencana Pendirian usaha Butik Busana Lady

Center di Pringsewu. *JUrnal FEB Univesitas Bandar Lampung*, 1-20.