Available online at http://iorajournal.org/indx.php/orics /index

Operations Research: International Conference Series

e-ISSN: 2722-0974
p-ISSN: 2723-1739

Vol. 5, No. 4, pp. 125-133, 2024

Analysis of the Influence of Fixed Asset Depreciation Methods on Profitability: A Case Study of the Tirta Arcamanik Endah Association

Salwa Nur Fitria[1*], Alifiah Khotimah[2]

[1.2]*Mathematics Study Program, Faculty of Mathematics and Natural Sciences, Padjadjaran University, Bandung, Indonesia*

**Corresponding author email: salwa23007@mail.unpad.ac.id*

Abstract

Fixed assets are a significant long-term investment for a company. For Paguyuban Tirta Arcamanik Endah, a company providing artesian water services, fixed assets such as water distribution infrastructure are the backbone of operations. Choosing the right fixed asset depreciation method is crucial, because it will affect the company's cost recognition, net income, and cash flow. This study aims to test the hypothesis that the use of the declining balance method will increase the company's cash flow in the short term, but can reduce the long-term profitability of water service providers. This study will analyze the financial report data of Paguyuban Tirta Arcamanik Endah for 2 years, focusing on the effect of the depreciation method on variables such as net income, operating cash flow, and financial ratios. This study is expected to fill the gap in research related to the impact of depreciation methods on medium-scale water service providers. The results of this study can provide recommendations for company management in choosing the optimal depreciation method, as well as contributing to the development of accounting literature.

Keywords: Fixed assets, depreciation, profitability, depreciation method, profitability stability

1. Introduction

Fixed asset management is a crucial aspect of business continuity, especially amidst global economic uncertainty. Economic fluctuations, high inflation, and the impact of the COVID-19 pandemic have forced companies to optimize the use of their assets. One of the important decisions that companies must make is the choice of fixed asset depreciation method. The depreciation method not only affects financial statements but also has implications for cash flow and investment decisions.

This study focuses on the effect of depreciation methods on company profitability, by taking the case of Paguyuban Tirta Arcamanik Endah as the object of research. This water service provider company, with fixed assets that have varying useful lives, faces challenges in managing its fixed assets, most of which are water distribution infrastructure. This study aims to evaluate whether the use of the declining balance method, which is popular among companies because of its potential to reduce tax burdens at the beginning of an asset's useful life, has a positive impact on the company's profitability in the long term.

There are several research gaps that need to be filled on this topic. Previous studies tend to focus more on large manufacturing companies, while this study will analyze a medium-sized water service provider company. In addition, this study will also consider factors specific to the water service industry, such as government regulations and fluctuations in water demand.

The results of this study are expected to contribute to water service providers in making better decisions regarding the selection of depreciation methods. In addition, this study is also expected to provide input for policy makers regarding fixed asset accounting regulations.

2. Literature review

According to Financial Accounting Standards (SAK), fixed assets need to be depreciated because their value will decrease over time and use (PSAK 16). Effective management of fixed assets is very important because these assets are one of the company's significant investments that contribute to long-term financial performance.

Fixed Asset Depreciation Methods

Straight-line Method: Depreciation expense is allocated evenly over the economic life of the asset. Declining Balance Method: Depreciation expense is greater at the beginning of the asset's use and decreases over time. Units of Production Method: Depreciation is calculated based on the amount of production or use of the asset.

According to research by Lyla and Djoko (2011), the selected depreciation method can have an impact on financial performance, especially in cost management. The declining balance method, which recognizes greater depreciation at the beginning of the asset's useful life, can reduce net income in the early stages, but provides benefits in the form of tax savings. Meanwhile, the straight-line method provides a constant depreciation burden, so that profits tend to be more stable from year to year.

According to Yuliani's research (2015), the depreciation method has an impact on the size of the net profit reported by the company. The declining balance method, which is more aggressive, is often used to reduce taxable income in the early years.

According to research by Rahayu (2018), a study was conducted on manufacturing companies and found that the straight-line method was more often chosen because it provided stability in recording annual profits.

According to research by Sari and Hidayat (2017), there was a relationship between the depreciation method used and earnings management, where companies often choose certain depreciation methods for financial management and tax reporting purposes.

According to Anthony & Govindarajan (2007) the depreciation method is considered as a way to allocate the cost of fixed assets over their useful life.

Profitability is measured through indicators such as Return on Assets (ROA) and Net Profit Margin (NPM). Research by Suwardi (2019) shows that companies that use the accelerated depreciation method tend to have lower ROA in the early years of asset use, due to high depreciation expenses. However, net income tends to increase in subsequent years as depreciation expenses decrease. In contrast, the straight-line method creates profit stability, which makes the profitability ratio more consistent.

3. Materials and Methods

3.1. Material

3.1.1. Tirta Arcamanik Endah Community

Tirta Arcamanik Endah Association is a company that provides water distribution services to various homes in the Arcamanik area. Tirta Arcamanik Endah Association is located at Jl.

3.1.2. Definition of Fixed Assets

According to Hery (2016:148), fixed assets are assets that have a physical form, are relatively permanent, and have a long period of use. These assets are different from intangible assets, which do not have a physical form and arise as a result of legal, economic, or social contracts. The acquisition cost of fixed assets includes all expenses incurred to acquire the asset. In the balance sheet, fixed assets are not only reported at their purchase price, but also include all costs until the asset is ready for use.

3.1.3. Definition of Depreciation of Fixed Assets

Depreciation is the process of allocating the cost of a depreciable fixed asset over its estimated useful life. Based on PSAK No. 16 (2015), there are various depreciation methods that can be used to systematically allocate the depreciable amount over the useful life of the asset.

3.1.4. Fixed Asset Depreciation Methods

The fixed asset depreciation method is a method used to charge the acquisition cost of fixed assets periodically. There are three main variables in this cost allocation, namely the acquisition price of the asset, the residual value, and the estimated useful life.

a) Straight-line Method.

This method is considered simple because it allocates costs evenly throughout the life of the asset, assuming that the asset provides the same benefits each period. The economic life of the asset is estimated in months or years. In the straight-line method, the asset's residual value is divided by its useful life to produce a constant periodic depreciation charge. The assumption used is that repair and maintenance costs remain stable throughout the life of the asset, and its operational efficiency also does not change. This asset is expected to provide the same benefits each year during its useful life. The calculation of depreciation charges in this method is calculated using a simple formula, namely by subtracting the estimated residual value from the acquisition price of the asset, then dividing it by the useful life of the asset.

b) Sum of the Years' Digits Method.

This method produces a decreasing depreciation expense each year. The calculation is done by breaking down the acquisition value of the depreciable asset into several parts that are adjusted according to the age of the asset. A larger portion of the asset's value is allocated to the early years of its useful life. The formula used in this method involves the sum of the digits of the years of the asset's useful life, and the depreciation expense is set higher at the beginning of the asset's use.

c) The Declining Balance Method

The Declining Balance Method is a depreciation method that charges higher depreciation costs in the early years of an asset's use and decreases in subsequent years. Depreciation calculations are carried out using a fixed percentage of the asset's book value at the beginning of the period. Unlike the straight-line method, this method does not take into account the residual value at the beginning of the calculation. This method is suitable for assets that provide greater benefits at the beginning of their use, such as vehicles, production machines, or technological equipment. Over time, the book value of the asset will decrease, so that the depreciation burden in subsequent years will also be smaller.

d) Double Declining Balance Method.

This method accelerates depreciation charges at the beginning of the asset's useful life, so that depreciation charges are greater at the beginning of the year and decrease in subsequent years. Depreciation charges are calculated based on a fixed percentage of the asset's book value that decreases each year, without considering the residual value at the beginning of the calculation. This method is used for assets that lose their productivity or efficiency more quickly at the beginning of their useful life.

e) The Units of Production method

Calculates depreciation based on the number of units produced or specific activities related to the use of the asset. This method is most suitable for assets whose performance is affected by the amount of production, such as factory machinery or operational vehicles. Depreciation expense is calculated by dividing the total acquisition cost of the asset (less residual value) by the total number of units expected to be produced over the life of the asset. Depreciation expense for a particular period is then adjusted for the number of units produced in that period. With this approach, the amount of depreciation expense will vary depending on the level of production or use of the asset.

3.1.5. Profitability

Profitability is the ability of a company to generate profits from its assets over a certain period. The measure of profitability is often used as an indicator of a company's financial performance and efficiency in managing its resources.

3.2. Method

This study uses a quantitative approach with a case study at Paguyuban Tirta Arcamanik Endah. This study will analyze the financial statements of the organization in 2019 to 2020. The focus of the study is to see how calculating depreciation of fixed assets (such as buildings or equipment) affects an organization's profits. This study will compare two depreciation methods, namely, the straight-line method, the declining balance method, and the sum of the figures method.one. To measure profit, we will use the Return on Assets (ROA) calculation. The data will be analyzed using simple statistical methods, namely descriptive statistics for the calculation results and correlation analysis to see the relationship between the depreciation method and the organization's profit.

3.2.1. Formula

The notations used in the calculations are:

C : acquisition cost
S : residual value
n : economic life
W: depreciation basis
R_k : depreciation expense in year k

B_k : book value at the end of year k
D_k : accumulated depreciation at the end of year k

The equation used to calculate depreciation **straight line method** is:

- Calculate the amount of depreciation costs R_k using the following formula

$$R_k = \frac{C-S}{n} \text{ or } R_k = \frac{W}{n} \quad (1)$$

- Calculate the accumulated depreciation value using the following formula:

$$D_k = kR_k \quad (2)$$

- Calculate the book value using the following formula:

$$D_k = C - kR_k \quad (3)$$

The equation used to calculate **declining balance depreciation** is:

- In calculating depreciation costs using the declining balance method, a depreciation rate d is required, the amount of which can be calculated using the equation:

$$d = 1 - \sqrt[n]{\frac{S}{C}} \quad (4)$$

- The amount of depreciation expense in year k is R_k calculated using the equation:

:

$$R_k = dB_{k-1} \quad (5)$$

- The book value in year k is B_k calculated using the equation:

$$B_k = (1-d)^k C \quad (6)$$

- The amount of accumulated depreciation at the end of year k is D_k calculated using the equation:

$$D_k = C - B_k = C - (1-d)^k C \quad (7)$$

The equation used to calculate depreciation using the sum of the years' digits method is:

- If for example the year number then the number of year numbers is k = 1,2,..,n then the number of year numbers T is:

$$T = \sum_{k=1}^{n} \quad k = 1 + 2 + \ldots + n \quad (8)$$

- The amount of depreciation expense in year k is R_k calculated using the equation:

$$R_k = \frac{n-k+1}{T}(C-S) \quad (9)$$

To calculate **Return on Assets (ROA)** use the following formula:

$$ROA = \frac{net\ profit\ before\ tax}{total\ assets} \times 100\% \quad (10)$$

4. Results and Discussion

This study analyzes the effect of fixed asset depreciation methods on the profitability of Paguyuban Tirta Arcamanik Endah by comparing three depreciation methods: the straight-line method, the declining balance method, and the sum of the years' digits method. The results of the Return on Assets (ROA) analysis show that each method affects the company's financial performance in different ways, according to the characteristics of each method.

Table 1: Asset Data

Asset	Economic Life (Year)	Acquisition cost (IDR)	Residual Value (residue) (5%)
Sibel Size 10hp	8	25,000,000.00	1,250,000.00
Torn Air Size 35,000 Liters	10	95,450,000.00	4,772,500.00
12 Meter Iron Tower	10	5,750,000.00	287,500.00
1000 PVC Pipes Size 2"	8	140,000,000.00	7,000,000.00
140 pcs Water Meter Size ½"	1	18,900,000.00	945,000.00
140 pcs Stop Valve Size ½"	3	1,610,000.00	80,500.00

Table 2: Results of Depreciation Expense Calculation Using Straight Line Method

Asset	Economic Life (Year)	Acquisition cost (IDR)	Residual Value (residue) (5%)	Depreciation Expense per Year (IDR)
Sibel Size 10hp	8	25,000,000.00	1,250,000.00	2,968,750.00
Torn Air Size 35,000 Liters	10	95,450,000.00	4,772,500.00	9,067,750.00
12 Meter Iron Tower	10	5,750,000.00	287,500.00	546,250.00
1000 PVC Pipes Size 2"	8	140,000,000.00	7,000,000.00	16,625,000.00
140 pcs Water Meter Size ½"	1	18,900,000.00	945,000.00	17,955,000.00
140 pcs Stop Valve Size ½"	3	1,610,000.00	80,500.00	509,833.33
Total Depreciation Expense				**47,672,583.33**

Based on the asset data listed in Table 4.2, depreciation calculations have been carried out using the straight-line method. The calculation results show that the depreciation expense for the Sibel Size 10hp asset in 2020 is Rp2,968,750.00. This figure is obtained by dividing the acquisition price minus the residual value by the economic life of the asset.

Table 3: Results of Depreciation Expense Calculation for Year 1 Declining Balance Method

Asset	Beginning Book Value of Year 1 (IDR)	Depreciation Rate (%)	Depreciation Expense Year 1 (IDR)
Sibel Size 10hp	25,000,000.00	31.23%	7,807,500.00
Torn Air Size 35,000 Liters	95,450,000.00	25.80%	24,626,100.00
12 Meter Iron Tower	5,750,000.00	25.88%	1,488,100.00
1000 PVC Pipes Size 2"	140,000,000.00	31.23%	43,722,000.00
140 pcs Water Meter Size ½"	18,900,000.00	95%	17,955,000.00
140 pcs Stop Valve Size ½"	1,610,000.00	62.78%	1,010,758.00
Total Depreciation Expense			**96,609,458**

Table 4: Results of Depreciation Expense Calculation for Years 16 to 17 Using the Declining Balance Method

Asset	Year End Book Value 15 (IDR)	Depreciation Expense Year 16 (IDR)	Year-end Book Value 16 (IDR)	Depreciation Expense Year 17 (IDR)
Sibel Size 10hp	90,975,692	28,411,708	62,563,985	19,538,732
Torn Air Size 35,000 Liters	1,086,011,716	280,191,022	805,820,694	207,901,739
12 Meter Iron Tower	64,372,296	16,659,550	47,712,746	12,348,059
1000 PVC Pipes Size 2"	509,463,878	159,105,569	350,358,316	109,416,902
140 pcs Water Meter Size ½"	5.76782226	5.47943115	2.88391114	2.739715583
140 pcs Stop Valve Size ½"	0.586774738	0.36837718	0.2183975578	0.1371099868
Total Depreciation Expense		**484,373,697**		**349,208,309**

There is a significant decline in book value for all assets in years 16 and 17. This is a typical characteristic of the declining balance method, where depreciation expense is greater at the beginning of an asset's useful life and decreases over time. Although the book value continues to decline, the depreciation expense in year 17 is still quite large. This indicates that these assets still make a significant contribution to the company's activities, but their economic value continues to decrease.

Table 5: Results of Depreciation Expense Calculation Using Sum of Years' Digits Method

Asset	Economic Life (Year)	Acquisition cost (IDR)	Residual Value (residue) (5%)	Year to-	Depreciation Expense (IDR)
Sibel Size 10hp	8	25,000,000.00	1,250,000.00	1	5,277,777.78
				2	4,618,055.56
				3	3,958,333.33
				4	3,298,611.11
				5	2,638,888.89
				6	1,979,166.67
				7	1,319,444.44
				8	659,722,222
Torn Air Size 35,000 Liters	10	95,450,000.00	4,772,500.00	1	16,486,818,181
				2	14,838,136,363
				3	13,189,454,545
				4	11,540,772,727
				5	9,892,090.909
				6	8,243,409,090
				7	6,594,727,272
				8	4,946,045,454
				9	3,297,363,636
				10	1,648,681,818
12 Meter Iron Tower	10	5,750,000.00	287,500.00	1	993,181,818
				2	893,863,636
				3	794,545,455
				4	695,227,273
				5	595,909,091
				6	496,590,909
				7	397,272,727
				8	297,954,545
				9	198,636,364

				10	99,318,181
1000 PVC Pipes Size 2"	8	140,000,000.00	7,000,000.00	1	29,555,555,556
				2	25,861,111,111
				3	22,166,666,667
				4	18,472,222,222
				5	14,777,777,778
				6	11,083,333,333
				7	7,388,888,889
				8	3,694,444,444
140 pcs Water Meter Size ½"	1	18,900,000.00	945,000.00	1	17,955,000.00
140 pcs Stop Valve Size ½"	3	1,610,000.00	80,500.00	1	764,750.00
				2	509,833,333
				3	254,916,667

The sum of the years' digits method results in greater depreciation in the early economic life of the asset, reflecting more intensive use or higher economic benefits in the early years of the asset's use. With this method, depreciation of the asset will be greater in the early years and smaller in the later years. The accumulation of depreciation costs each year will vary depending on the useful life of the asset.

Table 6: Financial Data 2019-2020

Cost Burden	2019	2020
Salary Cost	22,200,000.00	22,200,000.00
THR Costs	1,850,000.00	1,850,000.00
Routine Maintenance Costs	3,000,000	3,000,000.00
Electricity cost	50,981,283	51,689,372.00
RW Contribution Fee	1,500,000.00	1,500,000.00
Maintenance Fee	30,720,000.00	8,220,000.00
Internet Costs	2,760,000.00	2,760,000.00
ATK Cost	1,200,000.00	1,200,000.00
Total Cost Burden	114,211,283.00	92,419,372.00
Income	192,314,975.00	181,548,132.00
Total Assets	679,900,000.00	679,900,000.00

Table 7: Return on Assets (ROA) Calculation Results

Method	Year	Depreciation Expense (IDR)	Net profit (IDR)	ROA (%)
Straight Line Method	2019	47,672,583.33	30,431,108.7	4.48%
	2020	47,672,583.33	41,456,176.7	6.10%
Declining Balance Method	2019	484,373,697	77,619,318,303	11.42%
	2020	349,208,309	88,779,551,691	13.06%
Sum of Year Digits Method	2019	31,813,916,665	46,289,775,335	6.81%
	2020	60,290,166,668	28,838,593,332	4.24%

The results of the study indicate that the straight-line method provides stability in net income due to the even allocation of depreciation each year. This method is suitable for companies with stable income, such as Paguyuban Tirta Arcamanik Endah, which prioritizes consistency in income statements. In this study, the straight-line method showed an increase in ROA from 4.48% in 2019 to 6.10% in 2020, reflecting increased efficiency in the use of fixed assets.

In contrast, the declining balance method charges higher depreciation at the beginning of the asset's useful life, allowing for significant tax savings. The highest ROA was achieved with this method, which was 11J.42% in 2019

and increased to 13.06% in 2020. Although the initial profit appears lower, this method is effective in increasing overall profitability and is suitable for companies looking to take advantage of tax savings in the early years of an asset.

The sum of the years' digits method, on the other hand, provides a high depreciation expense at the beginning of the asset's useful life, reflecting intensive use in the early period. However, this method shows a decline in performance, with ROA dropping from 6.81% in 2019 to 4.24% in 2020, making it less than optimal in supporting long-term profitability. Group 7_Analysis of the Influence of Fixed Asset Depreciation Methods on Profitability Case Study .id.en

The discussion of the results shows that each depreciation method has different strategic implications for the company. The straight-line method can be used to maintain long-term profit stability and provide a consistent financial image to stakeholders. On the other hand, the declining balance method provides significant tax savings at the beginning, which can increase the company's free cash flow in the short term. The sum of the years' digits method, although providing a high depreciation allocation at the beginning, needs to be re-evaluated considering the downward trend in profitability seen in this study.

The strategic recommendation for Paguyuban Tirta Arcamanik Endah is to choose a depreciation method that is in accordance with the company's financial goals. The straight-line method is recommended to maintain long-term profitability stability, while the declining balance method can be considered if the main focus is short-term tax savings. In addition, accounting policies need to be evaluated periodically to adjust to changes in economic conditions and business needs. Choosing a strategic depreciation method will help the company in more effective financial management, in accordance with accounting standards, and increase competitiveness in the long term.

5. Conclusion

This study examines the effect of fixed asset depreciation methods on the profitability of Paguyuban Tirta Arcamanik Endah by comparing three methods: straight line, declining balance, and sum of the years' digits. The results of the Return on Assets (ROA) analysis show that each depreciation method in fluence company's financial performance differently. The straight-line method produces stable net income because of consistent depreciation allocation each year, which is suitable for companies with stable income. The declining balance method, with a larger depreciation charge at the beginning of the asset's useful life, can provide tax savings benefits even though the company's profit is lower at the beginning. Meanwhile, the sum-of-the-years'-digits method also provides large depreciation at the beginning, but is not as optimal as other methods in increasing long-term profitability. Based on these findings, it is recommended that Paguyuban Tirta Arcamanik Endah choose the straight-line method to maintain profitability stability in the long term, considering that the company needs profit stability. However, if the company's goals are more focused on short-term tax savings, then the declining balance method can be considered. The choice of depreciation method must be in accordance with the company's financial strategy and the long-term goals to be achieved. This study emphasizes that selecting the right depreciation method is very important to maximize profitability and maintain the company's financial sustainability, by paying attention to operational conditions and applicable accounting policies.

Reference

Adyani, LR, & Sampurno, RD (2011). Analysis of factors influencing profitability (ROA). Journal of Economic Development Dynamics, 7(1), 46–54.

Alligood, K. T., Sauer, T. D., & Yorke, J. A. (1996). Chaos: An introduction to dynamical systems. Springer-Verlag.

Anishchenko, V.S., & Strelkova, G.I. (1997, August). Attractors of dynamical systems. In 1997 1st International Conference, Control of Oscillations and Chaos Proceedings (Cat. No. 97TH8329, Vol. 3, pp. 498–503). IEEE.

Anthony, R.N., & Govindarajan, V. (2007). Management control systems. McGraw-Hill.

Hery. (2016). Financial report analysis. Gramedia Pustaka Utama.

Indonesian Institute of Accountants. (2015). Statement of Financial Accounting Standards (PSAK) No. 16: Fixed Assets. Indonesian Institute of Accountants.

Lyla, T., & Djoko, S. (2011). The effect of non-performing financing and operating costs on profitability. Indonesian Journal of Accounting and Finance, 8(3), 21–35.

Rahayu, S. (2018). Study on the use of straight-line depreciation method in manufacturing companies. Indonesian Accounting Journal, 12(4), 45–67.

Sari, D., & Hidayat, T. (2017). The relationship between depreciation methods and earnings management. Journal of Finance and Business, 10(2), 32–48.

Yuliani, E. (2015). The impact of depreciation methods on corporate financial statements. Journal of Economics and Accounting, 7(2), 15–28.