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Heavy equipment business model based on lifetime value and cost of ownership for financial decisions

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Abstract

The purpose of this paper is to develop a model for analyzing the heavy equipment business to support investment decisions through a new perspective of lifetime value and ownership cost. The research design of this study utilizes SEM-PLS (Structural Equation Modeling – Partial Least Squares) and develops a new model for heavy equipment investment analysis using mathematical modeling. This model is formed by combining several theoretical factors validated by practitioners in the heavy equipment field. The findings of this study indicate that all variables have a significant relationship with lifetime value and ownership cost. All variables also have a significant relationship with the feasibility study of the heavy equipment business. The practical implications of this research show a return on investment value of 93%, with a maximum profit value of 4,177 achieved at 8 years of age or 16,000 working hours. This model provides an illustration that heavy equipment reaches its most optimal value at a specific age when the predetermined variables are applied. The heavy equipment analysis model can serve as an assessment tool for the heavy equipment business.

Keywords: Financial decision, Heavy equipment, Lifecycle of business, Lifetime value, Ownership Cost, SEM – PLS, Feasibility Study, Investment.

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1. Introduction

The heavy equipment industry plays a pivotal role in supporting key economic sectors such as mining, construction, forestry, and agriculture. In Indonesia, the 2021 annual report of PT United Tractors noted that heavy equipment sales reached 3,088 units, exceeding the target of 1,700 units, with mining dominating the sectoral distribution at 53% [1]. Despite this growth, a pre-research survey revealed that 24% of heavy equipment owners lack clarity on the revenue potential of their businesses. Furthermore, 14,706 units of heavy equipment were sold in Indonesia in 2021, with approximately 3,530 units failing to optimize their business performance. Previous research has indeed addressed the aspects of ownership and value gained during the life cycle of a machine. However, approaches that comprehensively integrate both aspects are still rare [2]. Therefore, this research aims to fill the gap by offering a machine business model based on lifetime value and ownership cost as a tool for financial decision-making.

Many studies have reviewed financial decision-making in the heavy equipment industry, highlighting its pivotal role in ensuring business profitability and sustainability Kirchherr, et al. [3]. Kargul, et al. [4] note that inappropriate financial strategies often lead to poor performance in this sector, leading to investment losses and operational inefficiencies [5]. On the other hand, Onat, et al. [6] found that financial mismanagement, especially in projecting revenues and expenses, is the main cause of the premature failure of many businesses [7]. This demonstrates how important accurate and strategic financial decision-making is Castro, et al. [8]. Therefore, this research seeks to address the need for a more holistic approach to financial decision-making in the heavy equipment sector.

One other important aspect that has received less attention in the literature is the cost of ownership and lifetime value [9]. Ownership costs include purchase, maintenance, and operational costs, while lifetime value reflects the potential revenue generated over the operational life of the machine [10]. For example, some studies discuss the cost of ownership without linking it to the revenue cycle, while others focus solely on lifetime value without considering the cost structure [11]. This fragmented perspective makes it challenging for stakeholders to make informed decisions [12]. Therefore, this research aims to bridge the gap by integrating the cost of ownership and lifetime value into an overarching analytical framework.

This study aims to explore two key questions to fill the existing gap in the literature.

RQ1: What factors influence the cost of ownership and lifetime value in the heavy equipment business?

RQ2: How can the cost of ownership and lifetime value be applied in practical financial decision-making?

This research aims to provide a solid framework to bridge the theoretical gap while offering applicable insights. By answering these questions, this study seeks to contribute to the development of a comprehensive business model for the heavy equipment sector, based on the cost of ownership and lifetime value.

The paper is structured as follows. The introduction outlines the background, research gaps, and objectives. The literature review delves into existing studies on financial decision-making, ownership cost, and lifetime value, highlighting their limitations. The methodology section describes the research design, data collection, and analytical techniques employed. The findings and discussion present the results of the study, offering insights into the integration of ownership cost and lifetime value in financial decision-making. Finally, the conclusion summarizes the key contributions, implications for stakeholders, and recommendations for future research.

2. Literature Review

2.1. Lifetime Value

The theory of "*customer lifetime value*" and "*technical lifetime value*" [13] reflects the word "*Lifetime*" [14]. Customer lifetime value [15] and technical lifetime [16] are more detailed forms of "lifetime value" because there is an object that is measured/valued [17]. In general, Lifetime Value consists of 2 syllables, namely "*Lifetime*" and "*Value*" Where "*Lifetime*" is the time assessed from the beginning to the specified age point [18]. Lifetime is data in the form of time that is time series in nature [19]. Meanwhile, "*Value*" is a value that is measured due to a comparison of the assessment of a particular object [10]. Then "*Lifetime Value*" (LV) is a method for assessing the income of a particular object over its lifetime. Equation of lifetime value showed that Figure 1.

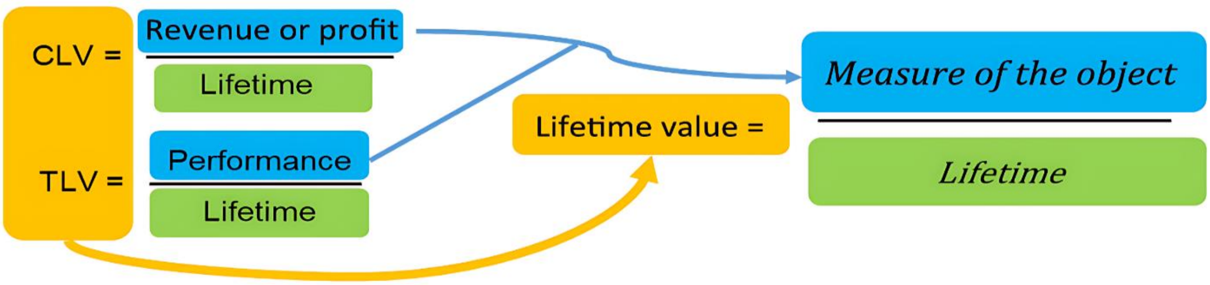

Figure 1.
Determine the lifetime value equation.

Figure 1 showed how determined lifetime value equation [20]. Lifetime value can measure any desired object and compare it with its lifetime. The concept of "lifetime value" encompasses multiple dimensions, including customer lifetime value and technical lifetime value. These terms emphasize the temporal and monetary aspects of value assessment for specific objects or systems [21]. Lifetime value, as a composite metric, integrates "lifetime" — defined as the time span from an initial point to a defined endpoint — and "value," which represents the quantifiable benefit or return over that time. Lifetime value methodologies assess revenue generation over an asset's operational lifespan and provide critical insights into profitability and sustainability [22].

In addition, research on the lifetime value of heavy equipment is still minimal. In fact, the lifetime value of heavy equipment, which is influenced by the age and performance of the equipment, is very important to understand in order to maximize the value and income from the use of heavy equipment. Assessments of machine lifetime value often focus only on internal factors such as age and performance, while external factors such as income levels by type of work sector and work area are less frequently considered. As a result, machine lifetime value estimates do not reflect the actual conditions on the ground, which can negatively impact business decision-making [23].

Lifetime value has a close relationship with revenue levels and production planning [24]. The level of revenue generated by the machine is the main factor that determines its lifetime value [25] as higher revenue can increase the return on investment over time [26]. In addition, production planning plays an important role in managing the machine's utilisation and workload, which ultimately affects its capacity to generate revenue and its lifetime value [27].

For example, an optimised production schedule can improve efficiency, reduce idle time, and maintain a steady revenue stream, so that the lifetime value of the machine can be maximised [28]. Conversely, poor production planning can lead to low utilisation or excessive wear and tear, ultimately hurting revenue potential and asset life [29]. Based on this, this study hypothesises that income level and production planning have a significant influence on machine lifetime value.

2.2. Total Cost of Ownership Framework

Total Cost of Ownership (TCO) is a model used to calculate overall costs, including capital costs, financial costs, and operating costs [30]. This model also allows for the consideration of changes in book value from year to year due to fluctuations in costs. In Onat's article, the process of identifying the Total Cost of Ownership is described [6]. However, one of the major problems in strategic management and business planning is the lack of understanding of the factors that drive value [31]. While Value Driver Analysis is a very useful tool, management often lacks deep insight into the key factors that influence value and performance. As a result, decision-making and resource allocation are less effective, which ultimately hinders the optimization of enterprise value [10].

The use of the TCO model also has limitations. The model often does not account for possible changes in book value from year to year due to fluctuations in costs [11]. Without this adjustment, the cost of ownership calculation becomes less accurate and can mislead long-term financial planning. In addition, most machine owners do not know exactly how much revenue they can achieve if the business is optimized. This leads to underutilization of heavy equipment, resulting in unrealized revenue potential. There is also limited research on the comprehensive cost of ownership of heavy equipment. Without adequate research, equipment owners do not have enough information to make informed decisions regarding the purchase, maintenance, and operation of their machines [32].

This research is particularly important and urgent, given that the heavy equipment sector plays a crucial role in infrastructure development in Indonesia [33]. However, understanding and managing the cost of ownership and lifetime value of heavy equipment is still very limited [34]. With a high degree of uncertainty in forecasting revenue and machine performance, many machine owners struggle to optimise their revenue potential. In addition, existing models often do not consider external factors, such as variations in work sectors and operational locations, which can affect the lifetime value of machines. This results in inaccurate estimates and sub-optimal business decisions.

Therefore, the findings of this research are expected to provide a solution to the problem by offering a more comprehensive and accurate approach in assessing the lifetime value and cost of ownership of machinery. As such, this research not only solves the problem at its root, but also makes a significant contribution to improving operational efficiency and effectiveness in the heavy equipment sector [35].

This research aims to explore and develop a more comprehensive and accurate machine business analysis model. The model will consider internal factors, such as machine age and performance, as well as external factors, such as income levels by type of employment sector and operational location [36]. By integrating these approaches, this research is expected to provide a better evaluation tool for stakeholders to make decisions regarding the purchase, maintenance and operation of heavy equipment. In addition, the developed model will also assist in long-term financial planning and increase the economic value of machine utilisation [37].

The Total Cost of Ownership (TCO) framework covers all costs associated with an asset, including acquisition, maintenance, and operational costs [38]. This comprehensive approach allows businesses to evaluate long-term financial commitments and optimise resource allocation. Onat, et al. [6] describe an iterative process of identifying and projecting TCO, and highlight its benefits in dynamic cost management.

However, although widely used, the TCO framework often ignores year-to-year cost fluctuations, such as inflation-adjusted maintenance costs or unexpected operational downtime [39]. In addition, the strategic mismatch between cost considerations and revenue projections often results in suboptimal decision-making, especially in capital-intensive sectors such as heavy equipment [40]. The lack of TCO-related research in the heavy equipment industry further exacerbates the challenge [41]. Internal factors, such as initial costs, maintenance schedules, and operational reliability, have been analysed, but external influences, such as market conditions and sector-specific demand, are rarely explored.

Therefore, this study hypothesises that start-up costs, maintenance costs, and operational costs have a significant influence on the total cost of ownership. By exploring these factors, this research is expected to provide deeper insights and assist machine owners in making better decisions to improve the efficiency and effectiveness of their asset usage.

2.3. Conceptual Framework

Lifetime value is the value/income of a product which is influenced by the age of the product [4]. The output of lifetime value includes performance and durability which are converted into predictions of working time [20, 21]. The first step is to define the age of the heavy equipment used [22]. The second step is the performance of the heavy equipment is measured to obtain the performance percentage of the equipment [23]. The performance measured is the main component consisting of the engine, swing, travel motor, and final drive equipment such as Boom cylinder, Arm cylinder and Bucket cylinder [24]. The third step is taking measurements and getting work ability units in percent, then convert performance into working time ability [32]. The last step after getting the working time ability, the number of working ability abilities is used to calculate the Heavy equipment lifetime value in the form of revenue [35]. The factors that form lifetime value are the business unit rate factors based on area and based on job type clusters, reliability/performance factors, ability to work overtime factors. Meanwhile, the factors that form ownership costs are initial cost factors, maintenance cost factors, and operating cost factors.

The investment decision making method in heavy equipment feasibility analysis has stages. The process of analyzing the value of heavy equipment is always oriented towards the profit that will be obtained. The value tree is divided into 3 parts, namely revenue, cost and capital change [42]. The following are details on obtaining value or profit from investing in heavy equipment. The first thing you need to know is how the heavy equipment generates income, namely by multiplying the rental price by the production plan in units of time. where the rate can be determined based on the business cluster or business area. Meanwhile, plan production is a reduction of the total available time minus unproductive time. After knowing the revenue or income, you then need to know the costs that arise from the business or investment in heavy equipment or what is often called ownership costs. In ownership costs there are many cost factors that will be taken into account, one of which is initial costs, then maintenance costs and operating costs. The costs contained in ownership costs will of course continue to change according to the age of the unit and according to the situation and conditions over time. so, all costs must be calculated based on the lifetime value of the unit at each time. Factors are arranged hierarchically as in Figure 2.

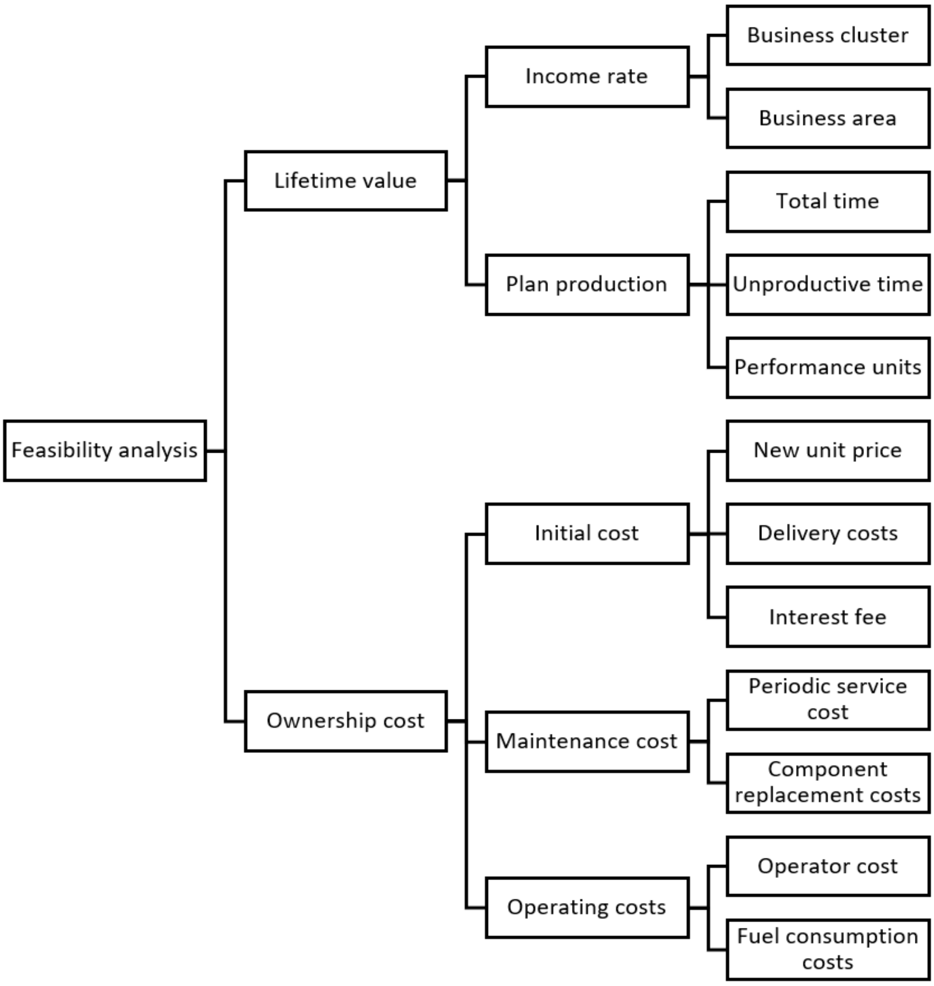

Figure 2.
Model development.

Furthermore, the factors that have been studied will be validated by heavy equipment practitioners using questionnaire methods and statistical analysis.

3. Materials and Methods

3.1. Research Design

This study employed a quantitative approach using a survey distributed via Google Forms. The survey was conducted from March 5, 2024, to April 1, 2024, targeting practitioners in the heavy equipment sector. The survey was distributed through WhatsApp groups to reach individuals with relevant expertise. A total of 62 respondents with experience in the heavy equipment field participated in this survey. These respondents provided valuable input for identifying and analyzing factors affecting the feasibility of heavy equipment income and expenses.

The survey in this study consisted of 11 questions designed using a five-point Likert scale, with response options ranging from "Very Unimportant" to "Very Important." The questions were developed based on an in-depth literature review and aimed to capture respondents' perceptions of the key factors affecting financial viability in the heavy equipment sector. Full details of the questionnaire are available in the appendix.

The factors analysed in this study were drawn from previous literature and refined through input from industry practitioners to ensure relevance and accuracy. The questionnaire measured respondents' responses on a Likert scale, ranging from 1 (lowest perception) to 5 (highest perception). The response rate and input from practitioners revealed important elements needed to analyse the feasibility of revenues and expenses in this industry.

To validate the findings, this study used Structural Equation Modelling-Partial Least Squares (SEM-PLS) analysis [43]. The SEM-PLS methodology was conducted through the following steps: 1) Develop a model represented through a path diagram. 2) Conducting Outer Model tests to evaluate the validity and reliability of indicators. 3) Assessing the goodness-of-fit of the model to ensure the fit of the data with the theoretical framework. 4) Conduct Inner Model testing to analyse the proposed research hypothesis [30]. This research ensures robust validation of the model and provides a comprehensive analysis of the factors affecting revenue and expenditure eligibility in the heavy equipment sector.

3.2. Mathematical Model

To answer the question "How can ownership cost and lifetime value be implemented in practical financial decision-making?" this study utilizes a mathematical model. In the mathematical model, the analysis of the heavy equipment business is illustrated as the result of dividing revenue against costs. However, these two parameters are influenced by lifetime value and ownership cost, as shown in Figure 3.

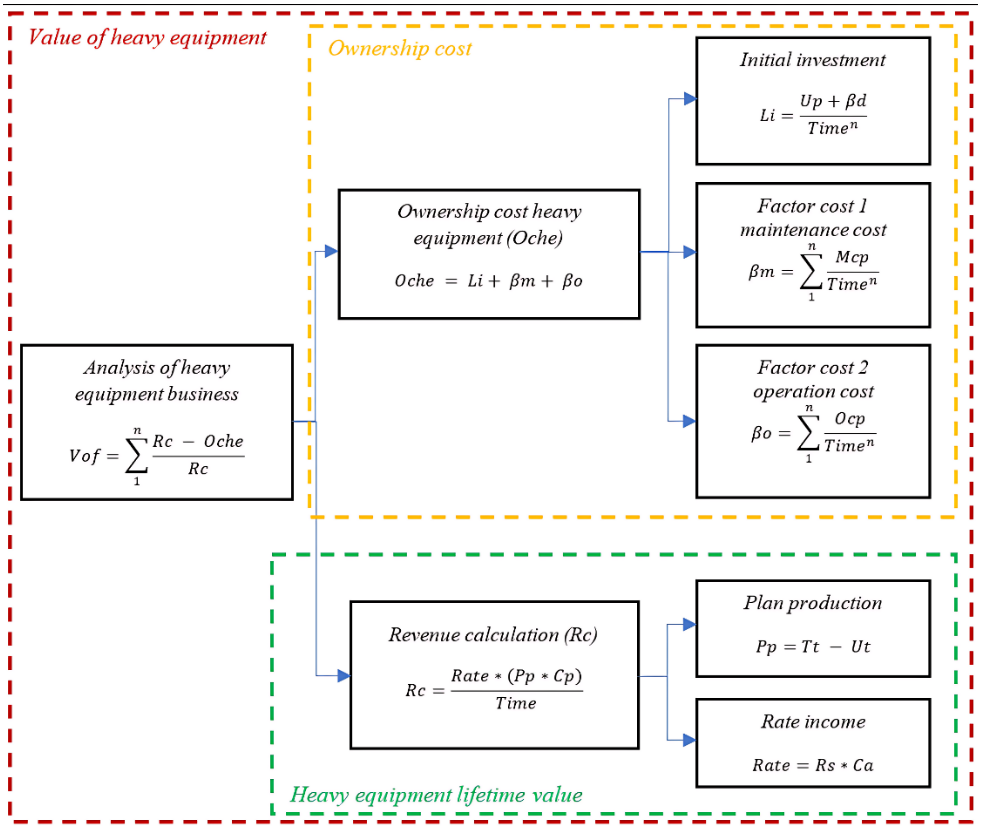

Figure 3.
Mathematical model of analysis heavy equipment business.

Legend
Ii: Initial investment.
Up : Unit price.
βd: Budget delivery.
βm: Maintenance budget.

βo: Budget operations.
Time: in years.
Mcp: Maintenance cost planning.
Csm: Cost schedule maintenance.
Cum : Cost of unscheduled maintenance.
O cp: Operating cost planning.
fm: Coefficient maintenance.
fΔt: Coefficient time of maintenance.
Co: Operator costs.
Cc: Consumable costs.
Pph: Plan production in hours.
Oche: Ownership cost heavy equipment.
Rate: Price per hour.
Pp: Plan productivity.
Rs: Sector rate.
Cp: Coefficient productivity.
Ca: Area coefficient.
Tt: Total time.
Ut: Unproductive time.
Rc: Revenue calculation.
Vof: Value of Feasibility Investment.
PV: Prediction Value.

4. Results and Discussion

4.1. Respondent Profile

This study involved respondents with various levels of work experience, positions within the company, and from the heavy equipment industry sector. Based on work experience, most respondents have experience between 10 to 15 years, with a total of 12 people. A total of 30 respondents had experience between 16 to 20 years, while 20 respondents had experience under 10 years. In terms of position in the company, respondents consisted of various positions. The majority of respondents, 7 people, are in the Supervisor position. A total of 28 people were Staff, followed by 20 people who served as Managers, and 7 people were in the Director position. This shows that this research involves respondents with managerial positions up to the operational level in the company. Furthermore, all respondents in this study came from companies engaged in the heavy equipment sector. This research used a Google Form survey which was distributed directly to practitioners from March 5 2024 to April 1 2024, distributed via WhatsApp group in the form of a Google Form to practitioners in the heavy equipment sector. Respondents, with experience in the heavy equipment field, filled out the survey and provided input for determining factors to analyze the feasibility of heavy equipment income and expenses. A total of 62 respondents from various circles participated. The survey contained 11 questions using a five-choice Likert scale, ranging from "Very unimportant" to "Very important."

Factors used to analyze the feasibility of heavy equipment income and expenditure were identified from literature studies and developed in a questionnaire, available in the appendix. This questionnaire uses a Likert Scale from 1 (lowest perception) to 5 (highest perception). Response rate from respondents, who are practitioners in the heavy equipment sector.

4.2. Smart PLS Analysis

This research analyzes the influence of 7 latent variables on income and expenses using SEM analysis with SmartPLS. The SEM PLS analysis steps include: 1) Developing modeling with path diagrams; 2) Outer Model test for indicator validity and reliability; 3) Assessing the goodness of fit of the model to ensure the suitability of the data to the model; 4) Inner Model Testing to test research hypotheses [44]. The modeling in this research contains the relationships between variables latent and variable endogenous Which can depicted as following Figure 4:

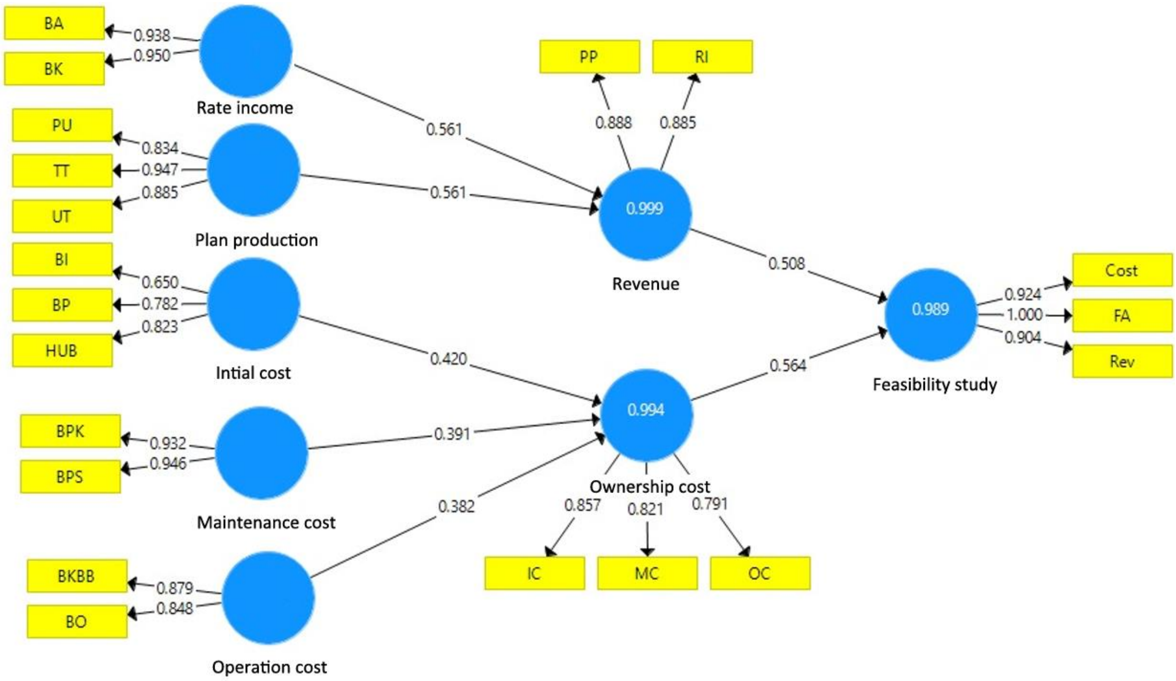

Figure 4.
Result smart PLS.

Latent variables are: 1) Production Plan (PP); 2) Rate Income (RI); 3) Lifetime Value/Revenue (R); 4) Feasibility Analysis (FA); 5) Ownership Cost (OC); 6) Initial Cost (IC); 7) Maintenance Cost (MC); and 8) Operation Cost (OC) and the dependent variable is Determinants of Feasibility Analysis on heavy equipment

4.3. Testing the Influence Between Variables

In PLS analysis, after the model is fit, the influence between variables is tested using bootstrapping, which includes testing the model created on the influence of the factors being tested. The estimation results of the SEM PLS model using the bootstrapping method are as follows. Direct effects or often referred to as direct effects or total effects are the influence of exogenous variables directly on endogenous variables. In SEM PLS analysis, the significance and direction of direct influence can be seen from the p value, T-statistic and path coefficient that shown as Table 1.

Table 1.
Hypotheses testing.

Path coefficients	Original sample (O)	T statistics	P values	Hypotheses
Initial cost -> Ownership cost	0.418	12.269	0.000	Accepted
Maintenance cost -> Ownership Cost	0.391	11.289	0.000	Accepted
Operation cost -> Ownership cost	0.383	16.169	0.000	Accepted
Ownership cost -> Feasibility analysis	0.537	21.458	0.000	Accepted
Plan production -> Revenue	0.563	28.786	0.000	Accepted
Rate income -> Revenue	0.559	24.093	0.000	Accepted
Revenue -> Feasibility analysis	0.534	26.114	0.000	Accepted

The results of this study indicate a significant relationship between the cost, revenue, and feasibility analysis factors in the tested model. Start-up costs, maintenance costs, and operating costs each have a positive influence on the cost of ownership. Of the three factors, start-up costs contributed the most with a path coefficient of 0.418, followed by maintenance costs (0.391) and operating costs (0.383). This finding supports the Total Cost of Ownership (TCO) theory, which states that the cost of ownership includes all direct and indirect cost components that arise during the life cycle of an asset or project. The high value of T-Statistics in this relationship indicates a very high level of confidence in the contribution of each cost in determining the cost of ownership.

Ownership costs also have a significant influence on feasibility analysis, with a path coefficient of 0.537. This suggests that good cost management can increase the chances of project success in the context of feasibility. This finding is relevant to the theory of investment feasibility analysis, which emphasises that cost control is an important element to ensure projects stay within budget and deliver expected economic value. Thus, the more efficient the management of start-up, maintenance, and operational costs, the greater the chances of the project being judged economically viable.

In addition to the cost factor, this study also highlights the importance of the revenue factor in determining the feasibility of a project. Production planning was shown to have the greatest influence on revenue with a path coefficient of 0.563. This finding is in line with operations management theory, which asserts that effective planning can improve process efficiency, optimise resources, and increase output. Income levels also had a significant influence on revenue, with a path coefficient of 0.559, reflecting the importance of revenue stability and management strategies in supporting project sustainability. The high T-Statistics values of these two relationships confirm that revenue is a key variable in ensuring project success.

Revenue ultimately influenced the feasibility analysis with a path coefficient of 0.534. This finding supports the revenue-based approach in feasibility studies, where revenue is used as a key indicator of project profitability and viability. The theory states that stable and significant revenue can increase the attractiveness of a project in the eyes of investors while ensuring the project's ability to fulfil its financial obligations [45]. In this context, the positive relationship between revenue and feasibility analysis highlights the importance of integration between operations management, revenue strategy, and cost analysis in supporting better decision-making.

Overall, this study reinforces the relevance of Total Cost of Ownership (TCO) theory and operations management theory in the context of project feasibility analysis. The findings suggest that effective management of costs and revenues not only improves efficiency, but also increases the chances of overall project success. In addition to contributing to the development of theoretical understanding, the results of this study also offer practical guidance for decision-makers to strategically manage projects by considering the integral influence between costs, revenues, and feasibility analysis.

4.4. Analysis of Heavy Equipment Business

Heavy equipment value is an assessment from a business perspective by looking at the profitability of heavy equipment business factors. The value of heavy equipment is a combination of the elements of income / lifetime value and costs / ownership costs. The explanation in Ownership cost and Heavy equipment lifetime value provides a new perspective in presenting the value of heavy equipment by placing it in a certain area and calculating costs carefully. This can be used by heavy equipment owners to analyze the value of their heavy equipment in order to get more optimal profitability.

The value of heavy equipment model will be implemented on the C15678 unit. Where currently working at a rate of 260,000 in the construction sector. Then it will be compared with the average rate in the Jawa area of 545,562, the average rate in the Sumatra area of 899,273 and the average rate in the Kalimantan area of 1,103,571 shown as Figure 5. The results of using the analysis of heavy equipment model are the profits cumulative trend.

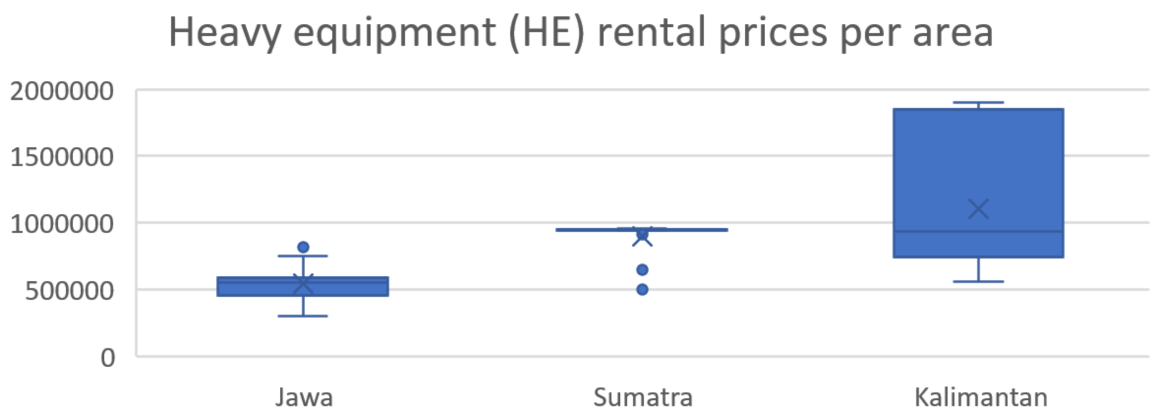

Figure 5.
HE rental prices per sector.

4.5. Heavy Equipment Business

Investing in heavy equipment, the owner must get an analysis of the costs and income of the heavy equipment. And get an idea of when the unit needs to be replaced with a new unit. And choose a heavy equipment business model that has better value when viewed from the work sector or work area. In Figure 6 we will discuss the selling price of used units which will be accumulated into additional profits.

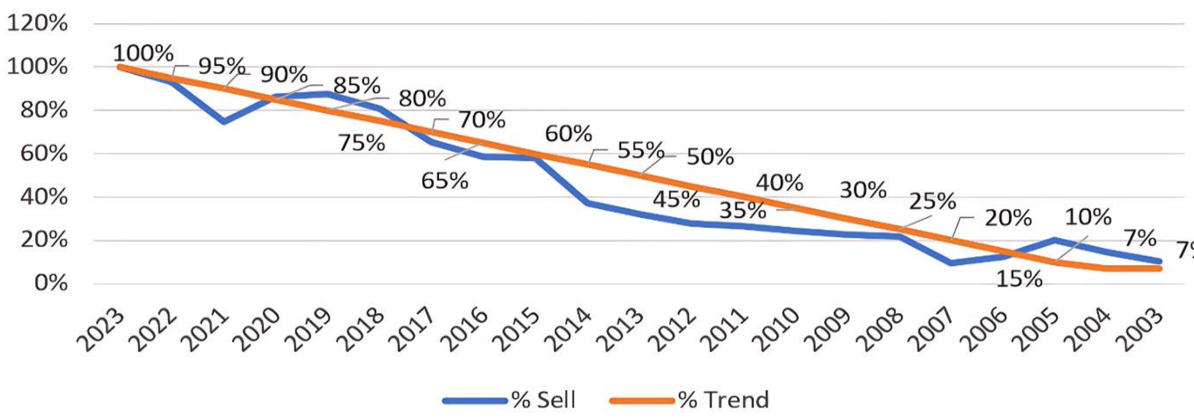

Figure 6.
Selling price unit used.

Sustainable investment in heavy equipment in this discussion is the final topic of discussion in getting a picture of the heavy equipment business cycle. The highest cumulative profit is the reference for decision making in determining the sustainability of the heavy equipment business. HE analysis in the Jawa region will be one of the objects that will analyze its business patterns as stated in Table 2.

Table 2.
HE Analysis of rate Jawa.

Year	Working hours	Cumulative profit	Price of used units	Total profit
0.5	1000	314	1450	1764
1	2000	623	1450	2073
1.5	3000	927	1377.5	2304.5
2	4000	1210.1	1377.5	2587.6
2.5	5000	1472.3	1305	2777.3
3	6000	1703.6	1305	3008.6
3.5	7000	1904	1232.5	3136.5
4	8000	2068.5	1232.5	3301
4.5	9000	2197.1	1160	3357.1
5	10000	2289.8	1160	3449.8
5.5	11000	2539.6	1087.5	3627.1
6	12000	2753.5	1087.5	3841
6.5	13000	2931.5	1015	3946.5
7	14000	3068.6	1015	4083.6
7.5	15000	3169.8	942.5	4112.3
8	16000	3235.1	942.5	4177.6
8.5	17000	3264.5	870	4134.5
9	18000	3258	870	4128
9.5	19000	3215.6	797.5	4013.1
10	20000	3137.3	797.5	3934.8
10.5	21000	3023.1	725	3748.1
11	22000	2873	725	3598
11.5	23000	2687	652.5	3339.5
12	24000	2465.1	652.5	3117.6
12.5	25000	2207.3	580	2787.3
13	26000	1913.6	580	2493.6
13.5	27000	1584	507.5	2091.5
14	28000	1218.5	507.5	1726
14.5	29000	817.1	435	1252.1
15	30000	379.8	435	814.8

In Table 2, Total heavy equipment profit in the Jawa area, as an example of a heavy equipment business calculation, the highest cumulative profit is 17,000 working hours or 8.5 years. Then the used price in 8.5 years is 870 million, so if you add the unit price to the profit you get a figure of 4.134 billion. However, it turns out that the highest total profit was at 16,000 working hours or exactly 8 years with a total profit figure of 4.177 billion. This gives an idea that the maximum point in the Heavy Equipment business is at 16000 or in the 8th year. This is the right decision to sell heavy equipment and buy new heavy equipment in the 8th year or at 16000 working hours.

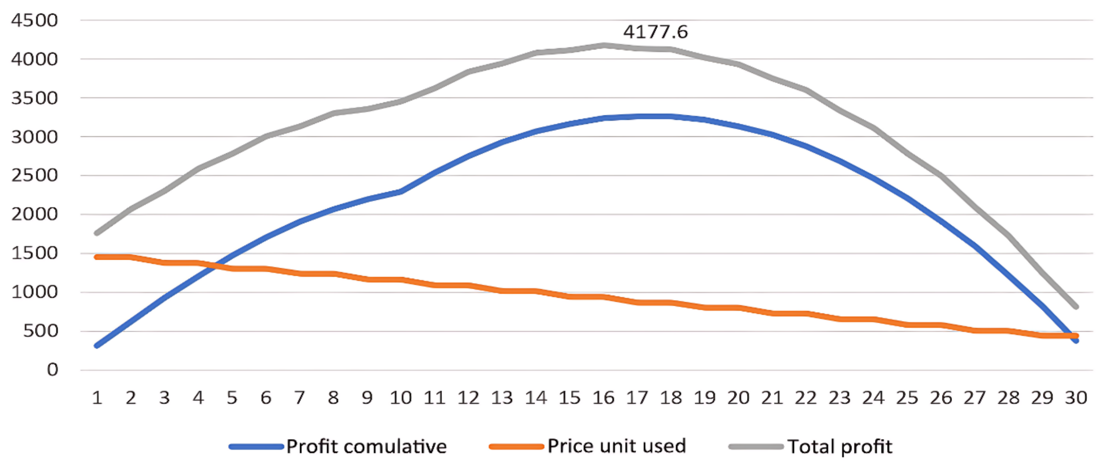

Figure 7.
Total profit in the jawa area.

It can be seen in Figure 7. The peak profit in the Jawa area was 4.177 billion. This illustrates that it was the right decision to sell the unit because the price was still relatively high, namely 870 million. Plus profits have reached their peak so that in 16,000 working hours the owner can sell the unit so he gets a total profit of 4.177 billion. Then these profits can be reinvested to buy new units with initial costs as of 193 million, meaning the total profit in the first heavy equipment business is 3.984 billion.

4.6. Heavy Equipment Business Cycle

The heavy equipment business cycle will provide an overview of business work patterns in the heavy equipment world. Starting with the first business then the second business then the third business and so on. Using the value of heavy equipment calculation model discussed previously and calculating the peak point of profit on heavy equipment, the heavy equipment business cycle can be depicted as in Figure 8.

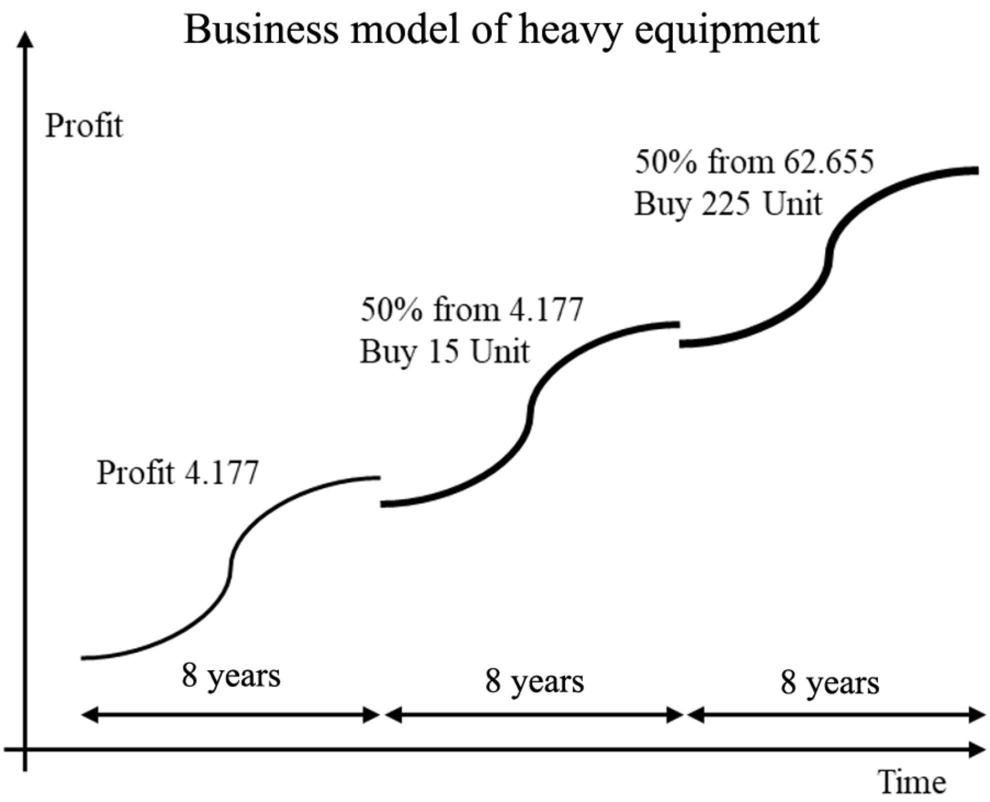

Figure 8.
Sustainability business model of HE.

In Figure 8, it can be seen that the first cycle, which is 8 years long with a number of units of 1, will get a profit of 4.177 billion rupiah. These profits can be reinvested. If 50% is invested in new unit investment or 2.088 billion. Where 1 new unit only costs 139 million, then from the 50% profit invested the number of units that can be used for the next heavy equipment business is 15 units with a duration of the next 8 years. Then the 15 units will generate a profit of 62 billion rupiah. In the next cycle, if 50% of the 62 billion is used as the initial investment cost for the next unit, the investment for the next unit will be 225 units. This means that within 24 years, with 1 unit of capital, it can grow to 225 units. This is because tariffs in the Jawa area are able to make profits from this heavy equipment business model better so that the tariff rate has a big influence on the sustainability of the heavy equipment business model, especially the PC200.

4.7. Return of Investment / ROI

Return on investment (ROI) is a performance measure used to evaluate the efficiency or profitability of an investment or compare the efficiency of a number of different investments. ROI attempts to directly measure the amount of return on a particular investment, relative to the cost of the investment. The formula used to calculate ROI is as follows:

$$ROI = \frac{Nilai\ investasi\ saat\ ini - Biaya\ investasi}{Biaya\ Investasi} \quad (1)$$

Where, the current investment value is the total income from the heavy equipment business from the start to the present. Meanwhile, investment costs are the total costs during the heavy equipment business from the start to the present. The heavy equipment business in the Jawa area with peak profits in 8 years or 16,000 hours can be calculated. So the ROI / Return on investment value is 93% with a maximum profit value of 4,177,000,000 at the age of 8 years or 16,000 working hours.

5. Conclusion

The results of this study show that start-up costs, maintenance costs, and operating costs have a significant influence on machine ownership costs, with the largest contribution coming from start-up costs. These ownership costs also have a direct impact on the project feasibility analysis, emphasising the importance of efficient cost management to increase the chances of project success. In addition, production planning and revenue stability are shown to play an important role in increasing revenue, which in turn affects the feasibility analysis.

The study also identified that the maximum profit point in the business cycle of heavy equipment in the Java region occurs at 16,000 man-hours or equivalent to 8 years, with a total profit of 4.177 billion rupiah. The decision to sell the machine at this point resulted in a Return on Investment (ROI) of 93%, which is an important indicator of investment efficiency. In addition, the business cycle model developed showed potential growth from 1 unit to 225 units in 24 years, reflecting significant opportunities for long-term machine investment development.

Further research could expand the scope of the analysis by comparing heavy equipment business models in different regions, such as Java, Sumatra and Kalimantan, to identify differences in factors affecting profitability. In addition, the impact of implementing new technologies such as IoT and AI on machine cost efficiency and revenue should also be further investigated. Additional research could explore the influence of external factors, such as government policies or tariff fluctuations, and develop dynamic ROI models that include risk scenarios. Finally, studies related to the integration of environmental and social sustainability aspects in machine business feasibility analyses will make an important contribution in supporting more holistic strategic decision-making.

This conclusion provides guidance for heavy equipment industry players to manage projects strategically and sustainably, while capitalising on the long-term growth opportunities that exist.

6. Implication

From the results, several managerial implications can be drawn. Efficient cost management, particularly on start-up, operational, and maintenance costs, is essential to reduce the total cost of ownership and improve project feasibility. In addition, attention to the machine's life cycle, by selling the unit at peak profitability in year 8, is an effective strategy to maximise profitability. It is also important for companies to improve production planning that contributes directly to revenue optimisation. The implementation of Return on Investment (ROI) as a key performance indicator can assist managers in evaluating investment efficiency. Finally, the implementation of a sustainable cyclical business model allows for exponential expansion of operations, providing huge profits in the long run.

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