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Assessing Investment Feasibility in Tegal City: A Strategic Perspective on Infectious Waste Handling

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Abstract

Based on simulation data from recapitulation of Health Facilities waste or medical B3 waste in Tegal City in 2022, it was recorded as 454 kg of medical B3 waste per day. Recap of data for Health Facilities in areas around Tegal City (Slawi, Brebes, Pekalongan, Pemalang and Batang) recorded 3,336 kg of B3 medical waste per day. This condition has the potential to cause environmental problems if not addressed. This research aims to provide an analysis of the feasibility of investment for handling medical waste. The study used secondary data sourced from the Tegal District Government Health Service and primary data collected through field observations. The research results show that the condition is suitable to continue. Investment funds required are IDR. 28 billion more. The financial feasibility results show an Internal Rate of Return (IRR) using a discount rate of 7.042%. Net Present Value (NPV), for considering the time value of money of 7.042% produces a positive value. The Investment Payback Period does not exceed the loan term. The feasibility results from economic and social environmental aspects also show that this waste management investment can be recommended for regional government implementation.

Key words : Infectious waste materials, Internal rate of return, Net present value, Payback period

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INTRODUCTION

The problem of B3 waste in the environmental context in Indonesia is currently the focus of the Ministry of the Environment. The definition of B3 waste according to Government Regulation Number 101 of 2014 concerning Management of Hazardous and Toxic Waste (B3) is a substance, energy, and/ or other component which, due to its nature, concentration, and/ or amount, either directly or indirectly, can pollute and/ or damage the environment, and/ or endanger the environment, health and survival of humans and other living creatures, so that B3 waste must be treated and managed specifically, not using conventional methods such as domestic waste. B3 waste that is not managed properly can threaten human health and the environment. The impact caused by B3 waste that is dumped directly into the environment is very large and can be accumulative, so that the impact will chain following the waste transmission process.

Referring to Law no. 32/2009 concerning Environmental Protection and Management and Government Regulation Number 101 of 2014, it is stated that "Every person and/ or business activity that produces B3 Waste is obliged to manage the B3 Waste they produce. "If each person is unable to manage B3 waste themselves, the management is handed over to another party and must obtain permission from the minister, governor or regent/ mayor in accordance with their authority." The regulation also regulates criminal provisions in the form of imprisonment and fines if B3 waste management is not carried out properly.

Most B3 waste is produced by industry, but B3 waste is also generated from health service activities. The health service facilities referred to here are hospitals, community health centers, and health service clinics or similar. Health service facilities produce waste in the form of liquid waste, gas waste and solid waste. The solid waste produced is non-medical and medical in nature. The medical waste produced is also B3 waste. Medical B3 waste is categorized into: (1) Infectious waste is waste contaminated with pathogenic organisms that are not routinely present in the environment and these organisms are in sufficient quantity and virulence to transmit disease to susceptible humans; (2) Pathology waste is waste in the form of waste during operations, autopsies and/ or other medical procedures including tissue, organs, body parts, body fluids, and/ or specimens and their packaging; (3) Sharps waste, is waste that can stab and/ or cause wounds and has been in contact with agents that cause infection, including hypodermic needles; (4) Pharmaceutical waste, is waste produced from pharmaceutical installations, for example expired medicines, contaminated medicines; (5) Cytotoxic waste, is waste from contaminated materials from the preparation and administration of cytotoxic drugs for cancer chemotherapy which have the ability to kill and/ or inhibit the growth of living cells. Included in the cytotoxic waste group is genotoxic waste, which is waste that is very dangerous, mutagenic (causing genetic mutations), teratogenic (causing damage to the embryo or fetus), and/ or carcinogenic (causing cancer); (6) Chemical waste, is B3 waste that is chemical in nature, for example fixer solution, expired chemical waste; (7) Radioactive waste, is radioactive waste which is usually produced from the x-ray process; (8) Pressure container waste, is waste from activities that use pressurized cylinders, for example gas cylinder waste; (9) Waste with a high heavy metal content is B3 waste that has or contains heavy metals, for example mercury thermometers and mercury sphygmomanometers.

Infectious waste management in healthcare facilities holds substantial implications for public health and the environment. Understanding the generation rates of infectious healthcare waste is crucial for policy development (Maalouf & Maalouf, 2021). Assessing personnel attitudes and practices regarding infectious waste in clinics is vital to gauge the current situation (Romin & Akkajit, 2018). Similarly, evaluating infectious waste handling in well-accredited hospitals offers insights into existing protocols (Fitria et al., 2018).

During crises like the COVID-19 pandemic, effective medical waste management becomes paramount (Kalantary et al., 2021). Research emphasizes the need for efficient waste management to control health risks and prevent disease transmission (Kalantary et al., 2021). However, data scarcity on pandemic-related medical waste sources underscores the importance of assessing COVID-19 waste flows (Mihai, 2020).

Managing infectious waste involves various treatment methods and disposal techniques (Thakur & Ramesh, 2015). These include autoclaving, microwave treatment, chemical disinfection, combustion, and different landfill approaches. Strategic waste management, especially during natural disasters, warrants comprehensive studies to address associated challenges (Kazemi et al., 2022).

Comprehensive knowledge of waste generation rates, current practices, and external factors like pandemics and disasters is essential for effective infectious waste management in healthcare settings. Synthesizing research findings enables facilities to develop strategic approaches to mitigate risks and ensure proper handling and disposal of infectious waste.

As a form of support for the green economy which is also in accordance with the vision of the City of Tegal, namely "The realization of a government that is dedicated towards a clean, democratic, disciplined and innovative Tegal City", an investment project plan was prepared in this study, namely building a B3 medical waste processing industry. This sector has great potential for Tegal City, especially the prospective and sustainable market opportunities seen from the amount of B3 medical waste produced by Tegal City and its surroundings.

Based on simulation data, recapitulation data for health facilities or medical B3 waste in Tegal City recorded 454 kg of medical B3 waste per day, while recap data for health facilities in areas around Tegal City (Slawi, Brebes, Pekalongan, Pemalang and Batang) recorded 3,336 kg of waste. B3 medical per day. Therefore, in accordance with the mission of the City of Tegal "Improving infrastructure, public transportation, a clean and healthy living environment and sustainable development oriented towards renewable energy" it is necessary to carry out efforts to process B3 medical waste in the City of Tegal and its surroundings, which has currently been processing waste. The medical B3 is carried out outside Tegal City.

Current direct competitors in waste services in Tegal City and their derivative services are summarized in Table 1.

Table 1. Competitors in the Waste Processing Industry

No	Company Name	Location	Type of Activity	Facility	Number of Units	Capacity	Capacity/Unit
1	PT. Andhika Makmur Persadha	Jakarta	Processing		1	700	kg/hour
2	PT. Primanru Jaya	Tanjung Priok, Banten, Lampung	Processing		3	45	Ton/day
3	PT. Wastec International	Cilegon	Processing		3	108	Ton/day
4	PT. Teknotama Lingkungan Internusa	Banten	Processing		N/A	N/A	Ton/day
5	PT. PPLI		Processing, Stockpiling	IPAL, TPS	N/A	N/A	Ton/day

Source: DPMPTSP Kota Tegal

The price of waste processing services for each company is different. PT. Wastec International charges a tariff of IDR 30,000,000/ton while PT. PPLI charges a tariff of IDR 22,000,000/ton. To compete in the medical B3 waste processing market in Tegal City, a tariff of IDR 20,000,000/ton.

The construction of B3 medical waste processing has several advantages, including reducing transportation costs because the location is close, easier, and faster to reach, improving thorough handling of increasingly increasing medical waste, is a step in providing solutions for managing B3 medical waste in the Tegal City area and surroundings. Therefore, marketing analysis in the form of segmentation, targeting and positioning of the B3 medical waste processing industry covers all health facilities in the Tegal City area and its surroundings. The Tegal City Government will provide incentives in the form of policies to recommend all Tegal City Health Service Facilities to use B3 Medical Waste Processing services in Tegal City.

Considering the large risks posed by medical waste, it is necessary to create a B3 medical waste processing facility in Tegal City for the western part of Central Java as mandated by Minister of Health Regulation No. 18/2020 concerning Regional-Based Health Facilities Medical Waste Management.

METHOD

The data analysis method used in this research is qualitative and quantitative analysis. Qualitative analysis was carried out to analyze the feasibility of B3 waste utilization projects based on non-financial aspects including legal, technical, management, environmental and social aspects. Meanwhile, quantitative analysis is carried out to analyze the feasibility of the project from a financial aspect.

The financial analysis methods used in this research include Benefit Cost Ratio (BCR) and Net Present value (NPV). In the BCR calculation, a comparison of the benefit value and cost value of the project will be analyzed. Meanwhile, in NPV calculations, the net present value will be analyzed, which is a comparison between the present value of net cash and the present value of investment or costs over the life of the project. The data sources used in this research come from secondary data, namely documents from the field and data from interviews.

Financial Feasibility in the construction of a project basically aims to find out estimates in terms of funding and cash flow, so that it can be known whether the project is feasible or not. To assess whether the project is feasible to implement and can provide financial benefits for the company, it is necessary to assess financial feasibility through financial analysis using 3 (three) methods: (1) Internal Rate of Return (IRR) using a discount rate of 7.042%; (2) Net Present Value (NPV), to consider the time value of money so that the cash flow used is cash flow that has been discounted by 7.042% to produce a positive value; and (3) Investment Payback Period does not exceed the loan term.

RESULTS AND DISCUSSION

The results of the feasibility analysis for the B3 Medical Waste Processing business project can be seen in the table below:

Table 2. Project Feasibility Analysis

Project Feasibility Analysis		
NPV	IDR 20,952,829,248	Feasible
IRR	13.6%	Feasible
Payback Period	9 years 5 months	Feasible

Based on the table 2, the NPV value is > 0, the business investment proposal is declared feasible, the IRR value is > 0.742%, the investment is acceptable, the payback period is < the maximum payback period, the investment proposal is acceptable.

Information, If NPV > 0 then the business investment proposal is declared feasible; If NPV < 0 then the business investment proposal is declared unfeasible; and if NPV = 0 then the company value remains whether the business investment proposal is accepted or rejected.

Net present value (NPV) is a fundamental metric in feasibility studies, particularly in assessing the financial viability of investments. NPV is used to compare the present value of cash inflows with the initial investment and ongoing costs. It is a widely accepted method for evaluating the profitability of a project or investment (Ardhana et al., 2023).

In the context of financial feasibility studies, NPV serves as an indicator for assessing investment feasibility by comparing net cash inflows with their costs at present value (Ardhana et al., 2023). This method involves considering the entire costs and benefits over the project's lifespan and discounting them to their present value (Sarker et al., 2020).

In the literature, NPV has been applied in various feasibility studies across different industries, including agriculture, energy, and infrastructure. For instance, in the context of agribusiness, NPV has been utilized to evaluate the financial feasibility of poultry farming enterprises (Abadi et al., 2017). Similarly, in the energy sector, NPV has been employed to assess the economic viability of solar home systems for rural electrification (Sarker et al., 2020). Moreover, in the context of infrastructure projects, such as railway construction and intermodal transportation, NPV has been utilized to determine the profitability and feasibility of such ventures (Arga et al., 2020).

The NPV is considered positive when the present value of cash inflows exceeds the present value of cash outflows, indicating a potentially profitable investment (Yanto et al., 2019). Furthermore, NPV is often used in conjunction with other financial metrics such as the internal rate of return (IRR), payback period, and benefit-cost ratio to provide a comprehensive assessment of the financial feasibility of a project (Cahyati et al., 2022). According to Zativita et al (2019) and Abdelhady (2021), the inclusion of NPV analysis in feasibility projects significantly impacts investments. A positive NPV or one that exceeds 0 indicates the feasibility of a project.

The assessment criteria are if the IRR obtained is greater than the specified rate of return then the investment can be accepted. Besides NPV, the Internal Rate of Return (IRR) is another technique utilized to evaluate the company's viability.

The internal rate of return (IRR) is a widely used indicator in feasibility studies to assess the viability of various projects and investments across different sectors such as agriculture, energy, and business (Liu et al., 2021). For instance, in the context of solar collector systems, the maximum IRR for residential and industrial applications was found to be 22% and 17.2%, respectively (Liu et al., 2021). Similarly, in the analysis of healthy food restaurant and catering business, the IRR method was utilized alongside the net present value (NPV) method to assess the feasibility of long-term project investment (Aprilia et al., 2018). Moreover, in the context of poultry farming, the IRR was found to be higher than the discount rate for all sizes of farms, indicating the feasibility of the investment (Soumya & Reddy, 2021).

Furthermore, the IRR is often used in conjunction with other financial metrics such as NPV, payback period, and profitability index to comprehensively evaluate the financial feasibility of projects. In a study on the potential of chicken in supporting poultry, the financial feasibility analysis included IRR, net present value, net benefit-cost ratio, and break-even point (Sani et al., 2022). Additionally, in the context of the utilization of eucalyptus leaves for producing essential oils, the IRR value of 33.01% indicated the feasibility and profitability of the business (Purwoko, 2023).

It is important to note that while the IRR is widely used, there are debates regarding its superiority compared to other metrics such as NPV. Some studies have suggested that the IRR is considered inferior to NPV for evaluating and ranking projects, despite its comparability to the cost of capital and the return of other investment opportunities (Weber, 2011). However, the IRR remains a valuable tool in assessing the potential returns of investments and projects across various sectors.

According to Zativita et al (2019) when the Internal Rate of Return (IRR) in a feasibility study exceeds the Minimum Attractive Rate of Return (MARR), the project is considered feasible. In this case, the feasibility study's IRR yielded 13.6%, which is greater than the discount rate of 7.042%. Therefore, the infectious waste handling project in Tegal City is deemed feasible.

To assess whether a business is worthy of acceptance or not from a PP perspective, the assessment criteria are if the payback period is shorter than the maximum payback period, then the investment proposal can be accepted. The maximum payback period is the economic life of a business investment determined by the company.

In the context of various feasibility studies, the payback period has been utilized as a key indicator for financial analysis. For instance, in the assessment of economic viability for off-grid rural electrification in Bangladesh, the payback period was one of the indicators considered, alongside NPV and IRR (Sarker et al., 2020). Similarly, in the feasibility study of forest plantation in Indonesia, the payback period was assessed along with NPV, B/C ratio, and IRR to determine the project's financial feasibility (Setiawan et al., 2019). Furthermore, in the context of swiftlet farming in Indonesia, the payback period was used as a method for quantitative analysis of the financial performance of the farming venture (Mursidah et al., 2020).

It is important to note that the payback period should be interpreted in conjunction with other financial metrics to provide a comprehensive assessment of the feasibility of an investment. For example, in the study on the construction of the Jakarta International Stadium, the payback period was found to be more than 14 years, indicating a longer time for the initial investment to be recovered, which was supported by the negative NPV (Abdullah & Shalihati, 2020). This highlights the significance of considering multiple financial indicators to make informed decisions regarding the feasibility of projects.

Sensitivity analysis is an analysis carried out to determine the impact of changes in production parameters on changes in the performance of the production system in generating profits. By carrying out a sensitivity analysis, the possible consequences of these changes can be known and anticipated in advance.

Sensitivity analysis is a crucial component of feasibility studies, particularly in assessing the viability of various business ventures. It involves evaluating the impact of changes in different variables on the overall feasibility of a project or business. This analysis is essential due to the inherent uncertainty in future conditions, which can significantly affect the success of a business endeavor (Mutmainnah et al., 2022). For instance, in the context of establishing a dairy milk business, sensitivity analysis was performed based on assumptions such as increased feed costs, operational costs, and decreased milk production of dairy cows (Novitawati et al., 2023). Similarly, in the financial feasibility assessment of a pepper order business, sensitivity analysis was employed to gauge the impact of changes in investment criteria such as the Net Benefit-Cost Ratio, Net Present Value, Internal Rate of Return, and Payback Period (Cahyati et al., 2022).

Moreover, sensitivity analysis is not limited to traditional businesses but extends to various sectors such as renewable energy systems. In the assessment of hybrid renewable energy systems, sensitivity analysis was utilized to optimize system configurations, highlighting its applicability across diverse domains (Sawle et al., 2021). Additionally, in the context of agricultural initiatives, such as hybrid corn farming and orange plantation, sensitivity analysis played a pivotal role in determining the feasibility of these ventures under varying scenarios (Dharmawan et al., 2022; Suswadi et al., 2022). Furthermore, the importance of sensitivity analysis is underscored by its ability to reveal the susceptibility of enterprises to changes in revenue and costs, as evidenced in a study on small-scale tempe production enterprises (Susilowati & Kurniati, 2018).

The significance of sensitivity analysis is further emphasized by its ability to provide insights into the financial feasibility and potential risks associated with business ventures. It allows decision-makers to assess the robustness of their plans and make informed choices based on the potential impact of changing variables. Additionally, the application of sensitivity analysis extends beyond business feasibility studies, as demonstrated in the context of process control and rare-event analysis models, where it is utilized to ensure appropriate method sensitivity and efficiency in monitoring procedures (Conte et al., 1997; Wenz et al., 1991).

The aim of sensitivity analysis is to see what will happen to the results of the project analysis, if there is an error or change in the basis for calculating costs or benefits. Sensitivity analysis is an analysis to be able to see the effects that will occur due to changing circumstances (Gittinger, 1986). In the agricultural sector, changes that occur in business activities can be caused by four main factors, namely changes in product selling prices, delays in business implementation, increased costs and changes in production volume. Sensitivity analysis is carried out by looking for several replacement values for the cost and benefit components that still meet the minimum investment feasibility criteria or the maximum NPV value is equal to zero, the IRR value is equal to the interest rate and the Net B/C ratio is equal to 1 (cateris paribus) (Gittinger, 1986).

The parameters of product selling price, number of sales and costs in financial analysis are assumed to be constant each year (cateris paribus). However, in real situations the three parameters can change over time. For this reason, a sensitivity analysis needs to be carried out to see to what percentage a price reduction or cost increase that occurs can result in a change in the investment feasibility criteria from feasible to unfeasible. (Gittinger, 1986).

Sarker et al. (2020) conducted a study evaluating the economic viability and socio-environmental impacts of solar home systems for off-grid rural electrification in Bangladesh. The results indicated positive NPV, low payback periods, and varying IRR values, signifying a high rate of investment exchange. Similarly, Stec & Zeleňáková (2019) analyzed the effectiveness of rainwater harvesting systems, assessing their profitability using NPV and discounted payback period. The study revealed the profitability of these systems based on financial ratios.

Additionally, Sunardiyo & Winarsih (2022) focused on the evaluation of a solar power plant's investment feasibility. The study employed NPV, probability index (PI), and discounted payback period (DPP) for economic analysis, along with an assessment of CO_2 emission reduction for environmental analysis. The results provided insights into the financial and environmental aspects of the investment.

Moreover, Aprilia et al. (2018) examined the investment feasibility of establishing a healthy food restaurant and catering business, utilizing NPV, payback period, IRR, return on investment (ROI), and investment sensitivity analysis for financial evaluation. This comprehensive approach allowed for a thorough assessment of the investment's financial viability.

The results of the sensitivity analysis calculations that occurred show that the Medical B3 Waste Management Industry is still feasible to develop, this is supported by financial analysis which shows that the ROI, Payback Period and B/C Ratio are still above standard.

CONCLUSION

Based on the feasibility analysis, the B3 Medical Waste Processing business project is suitable for implementation with the criteria as shown in the table below:

Table 3. Project Feasibilty Analysis with BCR

Project Feasibility Analysis		
NPV	IDR 20,952,829,248	Feasible
IRR	13.6%	Feasible
Payback Period	9 years 5 months	Feasible
BCR	1.82%	Feasible

A positive NPV (net present value) value will indicate that the income from the investment is greater than the costs incurred. The NPV value for this project is IDR 20,952, 829,248, which means that this project is worthy of investment.

If the IRR is greater than the cost of capital, it shows that the investment made will produce a return greater than the target, so the company is advised to accept or carry out the investment project. The IRR value of this project is 37.7%, which is greater than the target of 12% and less than 100%, therefore this project is worthy of investment.

If the payback period is faster than the specified time, then it is appropriate/ acceptable to invest. The payback period for this project is 9 years 10 months, this period is faster than the specified time of 20 years, therefore this project is worthy of investment.

If BCR ≥ 1, it can be said that the benefits of the project are greater than the sacrifices incurred. So that the project can be accepted or feasible. On the other hand, if BCR < 1, it is said that the benefits of the project are smaller than the sacrifices or the project is not feasible. The BCR value for this project is 6.0391 ≥ 1, which means this project is worthy of investment.

However, it is necessary to consider the potential risks of the B3 Medical Waste Processing business project, which is quite large, which can be seen in the table below.

Table 4. Potential Risks of the B3 Medical Waste Processing Business Project

Financial Impact	Safety	Delays	Performance	Legal	Politics
20%-30% variance to budget Interpretation: The financial risk of this business is quite large	The safety risk is quite large due to processing hazardous and infectious waste	The delay can be quite long considering that finding the right location as mandated by laws and regulations is quite difficult to find in the city of Tegal	Moderate performance risk because there is not much disruption to the core business except Environmental Issues	The risk is considered large because the fines and sanctions will be large if you fail to comply with the applicable regulations	Moderate Political Risk due to political changes having a moderate impact on business

Several critical issues that need to be resolved at the investment finalization stage are as follows: (1) Reduce the room for error in estimated income and project costs by conducting an in-depth survey; (2) Increase the speed of coordination between stakeholders; (3) Compliance with regulations and land in accordance with the regulations will greatly determine the success of establishing this business.

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