Jurnal Riset Manajemen Sains Indonesia, 15 (2) 2024, 01-08

Jurnal Riset Manajemen Sains Indonesia

http://journal.unj.ac.id/unj/index.php/jrmsi

Feasibility Analysis of Organic Waste Management Program at IPB University, Indonesia.

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Article Info

Article history:
Received: December 21, 2023;
Accepted: August 11, 2024;
Published: September 1, 2024.

Keywords:
economic value, financial analysis, IPB university, management, organic waste.

Abstract

More than half of waste produced at IPB University are organic waste and routinely generated every day. The waste could have economic value if it has a proper management. On the other side, waste management costs money for the investment and operational. Therefore, the proper project plan is needed so the management could generate profits. This research is aims to (1) estimate the potential of organic waste from IPB University that can be used optimally to produce economic value and (2) to analyze the economic feasibility of organic waste at IPB University. The result of this research shows that the number of potential organic waste from IPB University that can give economic value is 506,496 kg each year. Economic value and feasibility were analyzed using three criteria which are Net Present Value (NPV), Internal Rate of Return (IRR), and Net Benefit Cost Ratio (Net B/C). In economic analysis with a project life cycle of 20 years, the organic waste management obtained NPV value by 915,056,415 rupiahs, 1.29 for Net B/C, and 10.35% for IRR. In financial analysis with a project life cycle of 20 years, the organic waste management obtained NPV value by -695,114,013 rupiahs, 0.78 for Net B/C, and 0.12%for IRR. Based on the description above, it can be concluded that the project IPB campus organic waste management is economically feasible but not feasible financially.

INTRODUCTION

In Indonesia, waste management is regulated by Law no. 18 of 2008. The law on waste defines that waste is the residue of everyday human life that is formed from natural processes (Effendy, et, al, 2020). According to this law, waste management is a systematic, comprehensive and sustainable activity that includes waste reduction and handling. Waste management has a complex and lengthy process, not only considered as an engineering problem but also as a management paradigm. The solution is not limited to the end-pipe system but includes management systems such as reducing waste from the source (reduce), segregating reusable waste, and recycling processes. Before processing, waste must be sorted first (Zakiatunnia, 2021).

Reuse, reduce, and recycle (3R) system is carried out as an effort to reduce the amount of waste that must be transported and stored in the landfills. By reducing the amount of waste transported to landfills, it is hoped that the negative impact of waste collection activities at landfills can be reduced (Wijayanti and Suryani, 2015). In carrying out one part of the 3R system, namely the recycling process, waste must be sorted by type. Types of waste are divided into two, namely organic waste and inorganic waste. This sorting of waste types can be useful for determining the recycling process, because different types of waste mean different recycling treatments. Organic waste such as litter, food waste, and livestock manure can be processed into organic fertilizer and biogas. Inorganic waste such as plastic and paper can be recycled back into the same form or recycled into new goods such as handicrafts. Waste that has been recycled and turned into useful goods can return to provide economic value.

On the other hand, waste management and processing also requires production equipment as an investment with a large enough cost. Good planning both financially and economically is needed in making a waste management system. The economic value provided by waste after processing can be used to cover its production costs. To get economic value from processed waste products, these products can be traded in a business. It is hoped that the processed waste products that have been traded will not only be able to cover production costs but also be able to provide benefits for the managers.

ISSN
2301-8313 (online) DOI:
doi.org/10.21009/JRMSI.015.2.01

In 2019, IPB University Campus in Dramaga had a population of 1,220 lecturers and 22,770 students (PPDIKTI 2019). The data does not include the number of other populations in the campus area such as the population of employees and other campus communities such as traders in the canteen. With this population, the Dramaga IPB campus has the potential to produce quite a lot of waste. In 2018, the waste generated by the IPB campus was 940.16 kilograms (kg) per day or 343.159.52 kg per year. The waste consists of organic, inorganic, and hazardous and toxic waste (B3). The amount of waste generated by the Dramaga IPB campus can be seen in Table 1.

Table 1. The amount and type of waste generated by the IPB campus

Type of Waste	Quantity			
	Kg/Day	**Kg/Year**	**Tons/Year**	**Percentage**
Organic	517.59	188,923.52	188.92	55.037
Inorganic	401.92	146,700.00	146.70	42.765
Hazardous Waste	20.65	7,536.50	7.53	2.198
total	940.16	343,159.52	343.15	100

Source: ESL Department, 2018

Until now, the waste management that has been carried out by the IPB campus is the transportation of waste from several Temporary Disposal Sites in the IPB campus area. Then waste management is continued by transporting waste to landfills Cikabayan. Landfills Cikabayan has a land area of 5,000 m^2. Every year, landfills Cikabayan experiences an increase in the amount of waste accumulated. This is due to the fact that garbage continues to arrive every day while the landfill at that location has not been managed properly.

Disposal of waste into the Cikabayan landfills creates negative externalities that must be borne by the environment around the landfills. The accumulation of garbage disposal that has not been managed optimally causes an accumulation of garbage which has an unpleasant odor and spoils the scenery in the surrounding area. To minimize this impact, a good waste management system is needed. Waste management costs a lot of money. The cost of waste management as responsibility for the externalities generated in the Cikabayan landfills should be borne by the IPB campus as a waste contributor. Therefore, currently the IPB campus is planning a waste management program to be implemented in the next period.

Table 1 shows that more than half of the waste generated by the Dramaga campus is organic waste. The organic waste comes from food scraps, leaf litter, litter, twigs, and livestock manure. Organic waste is waste that is easily decomposed due to the activity of microorganisms. Organic waste if left for a long time can cause a foul odor such as ammonia and other volatile acids.

Good planning is needed in order to create sustainable waste management. Financial and economic feasibility analysis is needed to determine the feasibility of organic waste management. Therefore, this research aims to estimating the potential for organic waste generation from the IPB campus which can be utilized optimally to generate economic value and analyzing the financial and economic feasibility of organic waste management on the IPB campus. This research is the first research conducted at IPB. This is a novelty in this research.

LITERATURE REVIEW

Some research related to waste management that has been carried out includes analysis of economic benefits and strategies for developing Organic Waste Management Units (UPS) in Depok City. This research was conducted by Razak (2016). This research estimates the economic benefit value of UPS as seen from the economic benefit value of processing organic waste, the cost of citizen levies, and the absorption of local labor. Researchers analyze UPS feasibility and analyze UPS development strategies using SWOT analysis. Researchers also calculated the total net benefit, NPV, IRR, and Net B/C. The results showed that the total net economic benefits of the UPS received from the value of compost fertilizer, levy costs, and labor absorption were greater than the construction value of the UPS and the value of its operational costs. The net benefit value received by the UPS project is IDR 472,959,990. The UPS project run by the private sector was declared feasible because it met all the criteria for NPV, IRR, and Net B/C.

Furthermore, Waddin (2015) conducted research entitled Management of Organic Waste from Slaughterhouses, Tofu Industries, Livestock and Markets in Krian District, Sidoarjo Regency. The aim of this research is to analyze organic waste produced from four activity processes, namely organic waste produced from slaughterhouse activities, tofu industry activities, organic waste from livestock, and from market waste. Obtain data related to the generation and composition of organic waste in Krian District, Sidoarjo Regency. This research was carried out using SNI 19-3964-1995 concerning methods for collecting and measuring samples of urban waste generation and composition. The amount of solid waste generated by the tofu industry center is 5,018.33 kg/day for high production capacity, 2,412.92 kg/day for medium production capacity, and 524 kg/day for low production capacity. Analysis of the processing potential used in terms of financial aspects is compost, RDF, and biogas. The investment cost for processing compost and RDF is IDR 445,675,000.00. The investment costs for biogas are IDR 684,650,000.00 and IDR 293,150,000.00, while the profits obtained from processing compost and RDF are IDR

253,938,445.00 per year. The biogas profit is IDR 131,613,525.00 and IDR 34,437,203.00 per year.

Ramadhania's research (2018) entitled Estimation of Economic Value and Alternatives for Utilization of Community Waste Generation in RW 05 Pesarean Village, Bogor Regency. Researchers estimate the amount of waste generated by the community, Estimate the economic value of waste generated by the community, and Formulate policy implications that can be implemented by the community regarding waste utilization. The analysis carried out is quantitative descriptive analysis, income analysis, WTP estimation, benefit transfer, and waste generation calculations according to SNI 19-3964-1994. As much as 66.13% of the household waste produced is organic waste. With the total waste generation of RW 05 Pasarean Village for one year amounting to 86,400,907 kg per year, the total economic value of waste generation is IDR 14,752,109.17 per year. Waste can be utilized by being managed by the Cahaya Bersinar Waste Bank located in RW 05. Organic waste can be processed into compost, and if farmers in RW 05 apply organic farming, 40.8% of the need for organic fertilizer can be met by utilizing the waste in RW 05. When waste utilization is implemented, 75.2% of the waste in RW 05 is utilized and not thrown into the environment.

Jamasb and Nepal (2010) conducted research entitled Issues and Options in Waste Management: A Social Cost-Benefit Analysis of Waste-to-Energy in the UK. This research assesses the economic and environmental aspects of waste management, focusing on waste-to-energy (WtE) as a renewable resource. Cost-benefit analysis (CBA) The results of the research show that fulfilling the waste management targets of the EU Directive at this time is socially more effective in terms of costs. Cost-effectiveness increases substantially with higher carbon prices. Other results show that WtE can be an important part of waste management and renewable energy policy strategies, although reaching its full potential requires the development of heat delivery networks.

RESEARCH METHODS

This research was conducted at the Dramaga Bogor Agricultural University campus, Bogor Regency, West Java Province. The location selection was carried out purposively (*purposive sampling*) with the consideration that the location has a large waste generation. The data collection process was carried out from May to June 2019.

The data used in this study are primary and secondary data. The primary data was obtained through interviews with the management of livestock pens on the IPB campus, the general directorate, facilities and infrastructure of the IPB campus, and the company has carried out organic waste processing. The primary data in this study were obtained through direct field observations and interviews using a questionnaire. Direct observation in the field is intended to determine the situation and conditions in the field. Interviews using a list of questions or questionnaires are used to obtain information related to the research topic. Interviews were conducted with the Directorate General, Facilities and Infrastructure regarding waste management at IPB and PT. wen Innovation Transfer as a company that has implemented waste processing into biogas and integrated agriculture. The secondary data used are references from the internet, books, and related agencies such as the Directorate General, Facilities and Infrastructure of IPB and the Department of Resource and Environmental Economics.

Secondary data is a complement to primary data, which includes the amount of livestock manure production, the amount of IPB's waste generation in 2018, the 2019 market price, a study on the production of biogas produced from organic waste, and the cost of waste management equipment. The secondary data comes from the 2018 IPB waste generation study report and previous research reports related to the research topic.

Researchers conducted a quantitative analysis to determine the estimated generation of manure from livestock pens on the IPB campus. The final result obtained is an estimate of organic waste heaps that can be used optimally as output to obtain economic value.

$$TSK = \sum(Qh \times Qk)$$

Information:

TSK = Total manure generated by livestock pens per day.
Qh = Number of each type of livestock in the stables of the IPB campus.
Qk = Manure production for each type of livestock per day.

This research is a feasibility study, namely a systematic plan and analysis of the sustainability of a project or business by considering various factors (Masanja, 2020). A feasibility study can not only be carried out for a business idea that has not been implemented, but also for businesses that are already running but have plans for development. (Istiyani, 2022). The purpose of having a feasibility study is to avoid mistakes that end in losses, simplify design and planning, make work execution easier, facilitate supervision, and simplify control (Santa et al., 2020). Business feasibility analysis is carried out to determine the feasibility of a business from a financial perspective by taking into account the time value of money (Gandhi, 2021).

In this study to analyze the feasibility of waste management the organic campus of IPB used the method of cost and benefit analysis. Therefore calculations are carried out using criteria including Net Present Value (NPV), Net Benefit Cost Ratio (Net B/C), and Internal Rate of Return (IRR). According to Nurmalina et al. (2014), NPV is the difference between the total present value of benefits and the total present value of costs over the life of the business. A business is declared feasible if the NPV is greater than 0 (NPV> 0) because it means the business is profitable or provides benefits. Calculation of NPV systematically can be formulated as follows:

$$NPV = \sum_{t=0/1}^{n} \frac{Bt}{(1+i)^t} - \sum_{t=\frac{0}{1}}^{n} \frac{Ct}{(1+i)^t} = \sum_{t=0/1}^{n} \frac{Bt-Ct}{(1+i)^t}$$

Keterangan:
Information:
Bt = Benefits in year t (Rp).
Ct = Cost in year t (Rp).
T = Year of business activity (t=0, 1, 2, 3, …, n), the initial year can be year 0 or year 1 depending on the characteristics of the business (year).
i = DR rate (%).

$\frac{1}{(1+i)^t}$ = discount factor (DF) in year t (%).

Net B/C ratio is the ratio between positive net benefits and negative net benefits. A business can be said to be feasible if the Net B/C ratio is greater than one (Net B/C > 1) and is said to be feasible if the Net B/C is less than one (Nurmalina et al., 2014). Mathematically it can be written by the formula:

$$\frac{(Bt-Ct)>0}{(Bt-Ct)<0} Net \frac{B}{C} = \frac{\sum_{t=0}^{n} \frac{Bt-Ct}{(1+i)^t}}{\sum_{t=0}^{n} \frac{Bt-Ct}{(1+i)^t}}$$

Information :
Bt = Benefit in year t (Rp)
Ct = Cost in year t (Rp)
t = Time Period or t-th year
i = prevailing interest rate (%)
n = Length of time period

A business is said to be feasible if the IRR value is greater than the opportunity cost of capital (DR). Here's the IRR formula:

$$IRR = i_1 \frac{NPV_1}{NPV_1 - NPV_2} x\,(i_2 - i_1)$$

Information:
i_1 = Discount rate that produces a positive NPV
i_2 = Discount rate that produces a negative NPV.
NPV_1 = NPV positif.
NPV_2 = NPV negative.

RESULTS AND DISCUSSION

IPB Campus Organic Waste

IPB University Campus, Dramaga, produces 520.66 kilograms (kg) of organic waste per day or 190.041 kg per year. The organic waste was collected from 44 points of temporary waste storage and leaf litter and litter scattered throughout the IPB campus area. The organic waste consists of food waste, leaf litter and litter, and animal waste. The amount of each type of organic waste on the IPB campus can be seen in Table 2.

Table 2. The amount of each type of organic waste on the IPB campus

Type of Waste	Kg/year
Leftovers	108,957.90
Leaf litter, litter, twigs	75,248.10
Animal dung	5,835.00
Total	190,041.00

Source: ESL Department, 2018

In Table 2 it is stated that the calculated animal waste is 5.835 kg per year. The animal waste comes from animal waste left over from student practicum materials in the laboratory, cat feces, or feces from baby diapers. The amount of animal waste does not describe the entire animal waste produced by the campus. This is because the manure from the cattle pens on campus has not been included. In fact, these cages have the potential to contribute large amounts of organic waste. Therefore, the author conducted a survey to the location of the cages to record what livestock animals were there. As a result, there are four types of animals that routinely produce dung, namely cows, sheep, goats, and chickens. However, in this study, the authors only included animals that produce the most feces, namely animals from the ruminant group, namely cows, goats, and sheep

Table 3. Potential waste of livestock manure on the IPB campus

Type of animal	Livestock weight /tail (kg)	Productiondirt/day/ tail (kg)	Amount animal	Total shit /year (kg)
Dairy cows	450	25	15	136,875
Sheep and goats	40	2	246	179,580
Total livestock manure				316,455

Source: Sarah, 2019

Based on the data that has been processed above, the livestock pens located on the IPB campus have the potential to produce 316,455 kg of livestock manure per year. These results are then added up by the secondary data contained in Table 3 to obtain a total of 506,496 kg of organic waste per year. This amount represents the potential for organic waste generation from the IPB campus which can be utilized optimally to generate economic value. The economic value is obtained after the waste is processed and produces output in the form of biogas, solid fertilizer, and liquid fertilizer.

Feasibility Analysis of Organic Waste Management at IPB Campus, Dramaga.

The entire amount of organic waste that has been calculated above has the potential to provide economic value after being processed. In calculating the estimated value of organic waste on the IPB campus, the author uses a feasibility analysis both financially and economically. However, in this section the author only pays attention to the components of costs and benefits of organic waste management only.

To get the benefits of processing organic waste on the IPB campus, processing components are needed. To obtain these processing components, costs are needed, either in the form of investment costs from fixed assets or in the form of operational costs for production tools and materials as well as labor. Investment costs are costs incurred at the beginning of the period when starting the project. The tools that are included in the investment costs are fixed assets that have a high value and a fairly long technical and economic life, while operational costs are costs associated with running and managing a business. Investment costs and operational costs in this calculation were obtained from the Directorate General, Facilities and Infrastructure of the IPB campus, previous research, related literature, and interviews with related parties. In Table 4, the investment costs for the management of organic waste at the IPB campus are described which have been processed according to research interests.

Table 4 Investment costs for organic waste management at IPB campus

No	Investment Cost Component	Total	Unit	Amount (Rp)	Economical Age
1	20000 liter biogas reactor	2	unit	120,000,000	20
2	Gensets 5000 watts	2	unit	48,000,000	8
3	New hydraulic trucks	2	unit	780,000,000	10
4	Fertilizer material chopperorganic	1	unit	29,736,000	8
5	Compost sieve	1	unit	32,676,600	8
6	Compost mixer machine	1	unit	8,400,000	8
7	Compost drying machine	1	unit	54,000,000	8
8	Junk containers	1	package	700,000,000	5
9	Garbage collection building	1	unit	243,101,250	20
10	Water installations	1	unit	30,000,000	20
11	Scope	4	unit	360,000	4
12	Plant sprinklers	2	unit	288,000	4
13	Garbage rake fork 8 threaded teeth	20	unit	4,800,000	4
14	Garbage rake 8 rows	10	unit	264000,000	4
15	Digital sitting scale	1	unit	2,157,600	4
16	Sack sewing tools	1	unit	3,000,000	4

Total investment cost				2,056,783,450	

Source: General Directorate of Facilities and Infrastructure (DUSP), 2019

Apart from investment costs, waste management also has operational and maintenance costs. Component maintenance tools can be seen in Table 5.

Table 5. Cost of maintenance tools for IPB campus organic waste management

No	Description	Total	Unit	Amount (Rp)	Economical Age
1	Boots	13	pairs	3,416,400	2
2	Waste officer orange shirt	13	units	3,744,000	2
3	Special gloves waste	13	units	3,884,400	1
4	Waste Officer Masks	13	units	1,404,000	1
5	Safety raincoats	13	units	3,026,400	2
6	Headlights	13	units	4,929,600	3
7	Garbage officer vest	13	units	624,000	2
8	Field work hats	13	units	546,000	2
9	Tarpaulins	4	units	1,032,000	1
	Total cost of maintenance tools			22,606,800	

Source: DUSP, 2019

In addition to costs for equipment maintenance, there are operational costs that must be incurred every year. Operational costs can be seen in Table 6. The operational cost components listed in Table 6 are the cost components in the financial feasibility analysis.

Table 6. Operational costs of IPB campus organic waste management

No	Description	Total	Unit	Amount (Rp)
1	Diesel for 2 Truck	30	litres	28,782,000
2	Driver	2	people	84,000,000
3	Garbage hauler	6	people	131,040,000
4	Biogas processor	5	people	109,200,000
5	Plastic baskets for trash	20	units	3,326,400
6	Sacks	2104	units	2,827,690
7	Maintenance of biogas	1	package	18,000,000
8	Truck tax	1	unit	15,926,000
	Total operating costs per year			393,102,090

Source: Sarah, 2019

The economic analysis does not include a truck tax of Rp. 15,926,000 which is issued annually. Another difference, in the analysis of the economic feasibility of managing waste at the IPB campus, includes the cost of land rent that must be paid annually, which is Rp. 56,700,000. This is because the land used for waste management belongs to the IPB campus which is subsidized by the government, so it does not need to be taken into account in financial analysis.

However, the cost of the subsidy is borne by the community as a tax, therefore it is necessary to include the land rental price. In addition, in the economic analysis, the opportunity cost of labor is used if the workforce works in other fields according to their qualifications. In the observation, it was found that the driver's workforce has a high school education level/equivalent, therefore the salaries of minimarket employees whose educational qualifications are also high school/equivalent are used.

The minimarket cashier's salary is the UMR of Bogor Regency, which is IDR 3,700,000 per month. Meanwhile, cleaning workers have a similar skill level, so they use an office boy's salary in minimarkets around the IPB campus, which is Rp. 1,500,000 per month. The total benefits of processed organic waste from the IPB campus can be seen in Table 7.

Table 7. Benefits of processed organic waste from IPB campus

Processed	Unit	Production quantity /year	Unit price (Rp)	Production value /year (Rp)
Liquid fertilizer	liter	258,930.99	2500	647,324,976
Solid fertilizer	kg	202,598.40	500	101,299,200
Biogas (equivalent with gasoline)	m^3	8,103.94	7650	61,995,110
Total benefits of processed organic waste/year				810,619,286

Source: Sarah, 2019

The processed organic waste products contained in Table 7 are not entirely sold. One of the benefits of solid fertilizer or compost is to increase soil fertility. Therefore, some of the solid fertilizer produced will be allocated to increase the fertility of the land located on the IPB campus.

Benefits of the Residual Value of Depreciation of Fixed Assets of IPB Campus Waste Management Project

In the feasibility analysis, there are goods that have a long period of use, are not sold in the normal activities of the project, and have a fairly large price. These items are called fixed assets. The value of fixed assets needs to be taken into account in the cashflow feasibility analysis and is referred to as investment costs.

Table 8. Depreciation Value And Residual Value Of Fixed Assets In Organic Waste Management IPB

Fixed assets	Mark investment (Rp)	Age economical (year)	Shrinkage every year (Rp)	Residual value in end of project (Rp)
Genset 5000 watts	48,000,000	8	6,000,000	24,000,000
Fertilizer chopper organic	29,736,000	8	3,717,000	14,868,000
Compost sieve	32,676,600	8	4,084,575	16,338,300
Compost mixer machine .	8,400,000	8	1,050,000	4,200,000
Fertilizer drying machine compost	54,000,000	8	6,750,000	27,000,000
Flashlight	4,929,600	3	1,643,200	1,390,400
Total salvage value				87,796,700

Source: Sarah, 2019

Feasibility Analysis of Organic Waste Management IPB Campus

Based on the benefits and costs of managing IPB campus organic waste which have been described in the previous sub-chapter, a feasibility analysis is then calculated using a cost and benefit analysis. For the project life of 20 years (assuming the project starts in 2019), the economic and financial value of campus organic waste management IPB can be seen in Table 9.

Table 9. Financial And Economic Feasibility Of Campus Organic Waste Management IPB

Eligibility Criteria	Economy	Financial
NPV (Rp)	915,056,415	-695,114,013
Net B/C	1.29	0.78
IRR	10.35%	0.12%
Payback period	8 years 1 month	-

Source: Sarah, 2019

Table 9 shows that the results of the cost and benefit analysis for the IPB campus organic waste management project with a deposit interest rate of 5% meet all the analysis criteria. Based on the calculation results, the results of the economic analysis are as follows; (1). The NPV value obtained has a value of more than one, meaning that the total net benefit received by the IPB campus organic waste management project for 20 years has a value of IDR

915,056,415 so it can be said that it is feasible to run. (2). The Net B/C value obtained is 1.29 (more than 1). This value defines that for every IDR 1 of the costs incurred in an organic waste management project during the project period of 20 years, it can generate a net benefit of IDR 1.29 so that the project is feasible to run.(3). In the IRR criteria, the value obtained is 10.35% for the project life of 20 years. This figure shows that the internal rate of return on investment in organic waste management projects is greater than the deposit rate of 5%. (4). The payback period obtained from the economic feasibility analysis is 8 years and 1 month. That is, the payback period for investment in economic analysis is 8 years and 1 month.

In the financial analysis, the following results were obtained;(1). The NPV value obtained has a value of less than one, meaning that waste management on the IPB campus can be said to be financially unfeasible.(2). The Net B/C value obtained is 0.78 (less than 1). This value defines that for every IDR 1 the cost incurred in managing organic waste during the project period of 20 years can generate a net benefit of IDR 0.78 so it is not feasible to run.(3). In the IRR criteria, the value obtained is 0.12% for the project life of 20 years. This shows that the internal rate of return on investment in organic waste management projects is smaller than the prevailing interest rate of 5%. (4). Payback period cannot be estimated.

Based on the description above, it can be concluded that the IPB campus organic waste management project is economically feasible but not financially feasible. If viewed from the perspective of the project, it would be better if the management of organic waste in IPB Dramaga campus was not carried out. However, if you see this waste management as an effort to reduce waste and its benefits to society, then this program is good to run.

CONCLUSIONS AND SUGGESTION

The current organic waste produced by the IPB campus is 506.496 kg per year and the majority is obtained from livestock manure produced by cages on the IPB campus. All of this waste has the potential to generate economic value when processed. Processed organic waste can produce 258,930 liters of liquid fertilizer, 202,598 kg of solid fertilizer, and 8,103.94 m3 of biogas per year. Not all of the processed organic waste products from campus have financial benefits. Biogas and some solid fertilizers are not sold but are used for on-campus needs such as electricity and land fertility. Even so, the benefits are still felt by campus residents so that it has benefits that can be calculated in economic analysis.

Financial and economic feasibility analysis are used to analyze organic waste management only. In analyzing the feasibility, three criteria are used, Net Present Value (NPV), Internal Rate of Return (IRR), and Net Benefit Cost Ratio (Net B/C). The result is that waste management is not financially feasible but economically feasible.

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