ADPEBI
International Journal of Business and Social Science

https://journal.adpebi.com/index.php/IJBS

Vol.2, No.1, (2022)
e-ISSN: 2808-0939

Feasibility Study For The Development of TPS3R Waste Bank

Prama Widayat[1], Sri Maryanti[2], Nurhayani Lubis[3], Safrul Rajab[4]
[1,2,3,4]Univeritas Lancang Kuning
Email: pramawidayat@unilak.ac.id[1], sri_maryanti@unilak.ac.id[2],
nurhayanilubis@unilak.ac.id[3], safrulrajab@unilak.ac.id[4]

ARTICLE INFO

Research Paper

Article history:
Received: April 02, 2022
Revised: April 24, 2022
Accepted: April 28, 2022
Available online: April 30, 2022

doi.org/10.54099/aijbs.v2i1.112

ABSTRACT

The existence of a waste processing site is very urgent because what is currently happening is a landfill that accumulates waste. Then there was the waste bank as one of the waste processing sites in Pematang Pudu Village, Mandau District, Bengkalis Regency. But it has not been able to optimally manage waste, where the population of Mandau District is 150,806 people while Pematang Pudu Village is 29,986 people and the potential for waste is 15 tons per day. So far, only 0.5 tons of waste banks can manage per day. So it is necessary to make a breakthrough by building TPS3R which has a larger capacity, at least 2 tons per day. This capacity can continue to be developed and be able to create job opportunities for the community.

Keywords: waste, employment and TPS3R

INTRODUCTION

The waste problem has become a global issue and its handling cannot be done only with one side but must prioritize collaboration, meaning that waste management must be viewed from various sides. Indonesia is currently the number 2 (two) waste-producing country in the world with a total of 3.2 million tons of waste per year. Riau Province produces more than 1000 tons of waste per day, while Bengkalis Regency is in the 4th (fourth) largest waste producer in Riau Province, namely 27 tons per day, with an area divided into 2, namely mainland and islands. Here we see the distribution of the population of Bengkalis Regency by District:

Table 1. Bengkalis Regency Population per District in 2019

No	District	Gender		Total (Soul)
		Men	Women	
		2019	2019	
1	Mandau	77.297	73.509	150.806
2	Pinggir	45.776	43.177	88.953
3	Bengkalis	41.694	40.417	82.111
4	Bathin Solapan	31.443	29.493	60.936
5	Bantan	21.331	20.141	41.472
6	Rupat	17.005	16.111	33.116

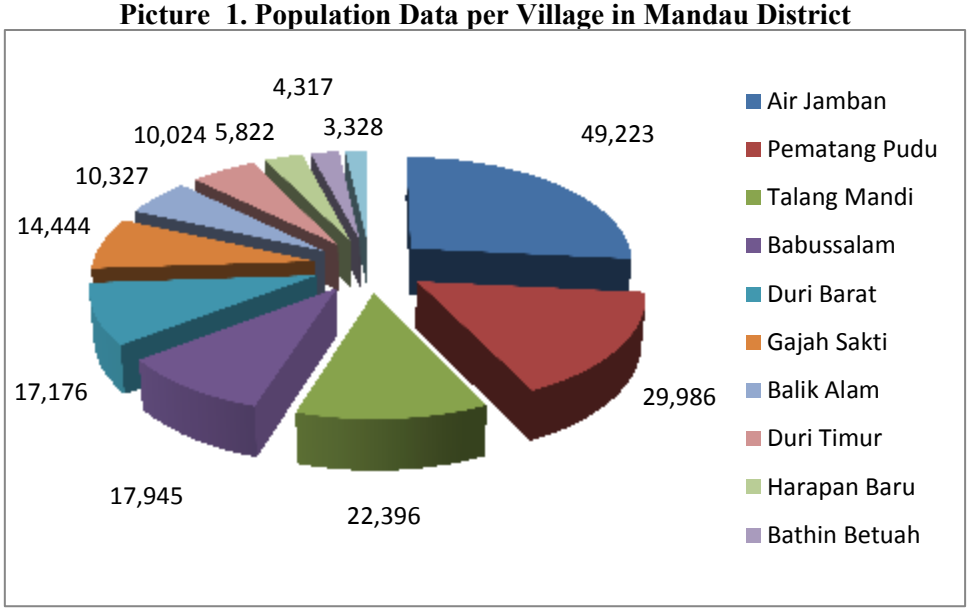
7	Bandar Laksamana	12.358	11.761	24.119
8	Talang Muandau	11.884	10.856	22.740
9	Bukit Batu	10.666	10.279	20.945
10	Siak Kecil	7.738	7.219	14.957
11	Rupat Utara	7.070	6.713	13.783
Total		**284.262**	**269.676**	**553.938**

Source: BPS Bengkalis Regency in 2019

From table 1 above, it can be seen that the mainland Bengkalis area which consists of Mandau District, Pinggir District and Bathin Solapan District is in the 4th largest population in Bengkalis Regency. Bengkalis Regency. If it is related to the amount of waste produced by Bengkalis Regency of 27 tons per day, then the 3 sub-districts produce 13.5 tons per day.

This is only a count of the waste that goes to the Final Disposal Site (TPA) and does not include the waste that is scattered on the side of the road, burned and piled up by the community and thrown into an illegal TPA. On average, the waste that enters the TPA is around 70%-75% of the total waste generated by the community. With a large number of residents in these 3 sub-districts, of course, more waste is produced than other sub-districts, for that waste management and management must go through an integrated concept by involving various parties, one of which is through the concept of a waste bank. Mandau Subdistrict with the largest population in Bengkalis Regency has 11 villages, namely :

Picture 1. Population Data per Village in Mandau District



Source : Mandau District 2021

Picture 1 shows population data in the Mandau sub-district, where Pematang Pudu Village ranks second in terms of population, which is 29,986 people and here there is 1 (one) Garbage Bank that has existed and experienced enough since 2015, namely the Pematang Pudu Clean Waste Bank (BSPPB).) which is located in Pematang Pudu Village, Mandau District, in the last 3 years the progress of BSPPB has made significant progress in managing waste, it can be seen in table 2 below :

Table 2. Amount of Waste managed

No	Year	Total (Kg)	Total (Ton)
1	2019	18.482	18
2	2020	55.850	55
3	2021	150.000	150

Source : BS PPB 2021

From table 2 above, we see that for 2021 BSPPB has managed 150 tons of waste, meaning an average of 12.5 tons (12,500 kg) per month, 0.416 tons (417 kg) per day, for more details can be seen in table 3 below this.

Table 3. Average waste management of BSPPB

Year	Per Year (Kg)	Per Mont (Kg)	Per Day (Kg)
2021	150.000	12.500	417

Source : BS PPB 2021

Of course, this is still not optimal because if you look at the waste generated by Pematang Pudu Village, and with a population of 29,986 people in Pematang Pudu Village, with an estimate per person producing 0.1 kg of waste every day, the waste generated is approximately 2,900 kg or equivalent to 2, 9 tons per day. When compared with the waste that can be managed by BSPPB, which is 417 kg per day, while the waste produced by one kelurahan is 2,900 kg, it is equivalent to only 1.4% that can be managed through BSPPB. For this reason, strategic steps are needed if you want to manage more waste in Pematang Pudu Village because from the waste there is economic potential that can be utilized in a circular economy. In addition, the main problem regarding waste is waste segregation, where people are not all educated in waste sorting, so that the waste processing process becomes more difficult and takes longer. The community really needs to get education in sorting organic and non-organic waste. where the process of sorting waste is not an easy thing, because it requires a high effort and a long time and requires great support from various parties.

The government is the regulator in supporting the handling of waste problems, in fact, has issued regulations regarding waste management, but the implementation in the field is not going well. Through the Circular of the Minister of the Environment (LHK) Number: SE.5/MENLHK/PSLB3/PLB.0/10/2019 dated October 15, 2019 concerning the National Movement for Sorting Waste from Home. This circular emphasizes 5 aspects of values and socialization :

1. Carry out a movement to increase and understand and care for the public through campaigns, education and information to the public to sort waste starting at home.
2. Distribute recyclable waste to waste banks or through the nearest TPS3R/PDU and recycle organic waste into compost.
3. Encourage and ensure the movement of sorting waste in every RW or Kelurahan/Village.
4. Provide and develop a segregated or scheduled management of waste collection and transportation.
5. Build integration of programs such as proklim and adiwiyata, as well as collaboration of business actors including local governments, communities, NGOs and the business world and others.

Referring to the SE ministerial statement, it is clear the message conveyed that waste management must reach the RT/RW level, including by utilizing a Waste Bank and also providing a Reduce Reuse Recycle Waste Management Place (TPS3R) or a Recycling Center (PDU). TPS3R is a waste processing site that is as close as possible to the source. Where waste is sorted according to its type, where non-organic waste that is still feasible and has economic value can be brought to the waste bank, while organic waste is used as compost. Meanwhile, residual waste or those that have no value, such as batteries, chemicals, pampers, glass, etc., are taken to the TPA so that the TPA will specifically receive residual waste. The 3R (reuse, reduce, recycle) concept in Trisnawati and Agustana (2018) is as follows:

1. Reuse is an activity to directly reuse waste that is still fit for use for the same or another function, or reuse materials or materials so they don't become waste (without going through a processing process), such as: containers/packaging for the same function or can be used over and over again, used drink bottles for water.
2. Reduce is all activities that are able to reduce and prevent waste generation in the source environment and can even be carried out since before waste is generated, each source can make efforts to reduce waste by changing consumptive lifestyles, namely changing habits from wasteful and producing a lot of waste to being efficient Efficient and less wasteful, but it takes public awareness and willingness to

change these behaviors, such as: choose products that can be recycled, reduce the use of single-use materials.

3. Recycle is an activity to manage waste to be used as a new product or to reuse waste after undergoing a processing process, or to recycle another material after going through a processing process such as: organic waste into compost, while inorganic waste, especially detergent wrappers, can be processed into work bags.

However, the government's limitations on the budget side in building TPS3R and PDU, it is necessary to collaborate with the business world, especially in the Corporate Social Responsibility (CSR) program or Environmental Social Responsibility (TJSL). The existence of a village-scale TPS is very much needed, starting at the RW level in that one village, at least, while the land to build TPS3R can be provided by the local government. This means that this is a collaboration and synergy between the government in providing land, while the business world builds TPS3R through CSR or TJSL programs.

LITERATURE REVIEW

TPS3R Comparison

In the urban system, the 3R TPS acts as an infrastructure in handling waste. The amount, capacity, and function must be ensured, because it is an effort to reduce the quantity and/or characteristics of the waste that still has to be further processed at the waste landfill, where waste reduction is carried out from the waste source (garbage container at the waste source location) to the existing waste container. outside the source of the waste, before it is collected or transported through the city system to the 3R TPS, institution-based Integrated Waste Processing Site (TPST) or waste TPA. In order to make it easier for various parties to implement the waste reduction program, a General Operational Procedure for Reduce-Reuse-Recycle Waste Management (TPS 3R) has been prepared.

Table 4. Some TPS3R in Sumatra

No	Province	Nam3 TPS3R	Waste (ton/year)
1	Aceh	KSM Muda Berjuang	200,75
2	Aceh	Guna Bersama	228,15
3	Sumatera Utara	Lubuk Pakam	730,00
4	Sumatera Utara	Bestari Sakti	192,98
5	Sumatera Barat	Balai Kaman	550,63
6	Sumatera Barat	Taratak Capo Talawi Hilir	120,45
7	Riau	Kualu	60,59
8	Riau	Kubang Jaya	73,00
9	Jambi	Sungai Ngawan	3.777,75
10	Jambi	Tiga Saudara	4.197,50
11	Palembang	TB Gemilang	127,75
12	Palembang	Idris	182,50
13	Bengkulu	Tambak Rejo	1.825,00
14	Bengkulu	KSM Murah Sari	43,80
15	Lampung	KWT Anggrek Bulan	302,22
16	Lampung	Wiyono Berseri	730,00
17	Bangka Belitung	Kawa Begawe	219,00
18	Bangka Belitung	Berkah	182,50
19	Kep. Riau	Maju Mandiri	292,00
20	Kep. Riau	Daik	97,09

Source : Ministry of Environment 2021

TPS3R is no stranger to Indonesia because its existence is almost evenly distributed, from table 5 above, several TPS3Rs on the island of Sumatra are taken as a comparison of the amount of waste they manage per

year. With the TPS3R, it is hoped that it will be able to reduce the waste that goes to the TPA because the sorting process has been carried out at the TPS3R so that only residual waste goes to the TPA.

TPS3R Needs Analysis

TPS3R is a place where collection, sorting, reuse, recycling and processing activities are carried out on an area scale. According to the Minister of Public Works No. 3 of 2013 regarding TPS as referred to in Article 29 paragraph (2) and paragraph (3) letter a must meet technical requirements such as:

a. TPS 3R area, greater than 200 m;
b. Facilities are available to classify waste into at least 5 (five) types of waste;
c. TPS 3R is equipped with a room for sorting, composting organic waste, and/or a bio gas generating unit, warehouse, buffer zone, and not disturbing aesthetics and traffic.
d. The type of construction of the waste processing container at TPS 3R is not a permanent container;
e. Placing the location of the 3R TPS as close as possible to the service area within a radius of no more than 1 km;
f. Location area and capacity as needed;
g. The location is easily accessible;
h. Does not pollute the environment; and
i. Have a collection and transport schedule.

The TPS3R as referred to in the scope of the residential environment is carried out using a community-based method. The existence of 3R TPS as referred to in paragraph 2 can be integrated with a community-based waste management system such as a waste bank. Where, the Waste Bank that will cooperate is the Pematang Pudu Clean Waste Bank (BSPPB) located in Pematang Pudu District.

TPS3R development must consider several stages of analysis from several aspects that have been carried out, namely :

1. Technical Aspect
   a. This aspect includes the calculation of the population, using the projection method for calculating waste generation per person per day.
   b. Analysis of the needs of the facilities and infrastructure needed include:
      1) Garbage reception area
      2) Garbage sorting place, in this case it is also taken into account how quickly the sorter performs waste sorting so that there is no garbage accumulation
      3) Composting site, land for composting is very necessary where later compost will become one of the products that will be produced by the 3R TPS
      4) Storage warehouse, the warehouse is needed for waste storage before being transported to the Pematang Pudu Clean Garbage Bank

In connection with Pematang Pudu Village, there is no waste selection facility such as TPS3R, while there is already a Pematang Pudu Clean Waste Bank (BSPPB), the estimated amount of waste generated per day is 2,900 kg from a total population of 29,986 people and this is the largest number 2 (two) in the District. saber. For now, only 1.4% or the equivalent of 417 kg of waste is managed by BSPPB, the rest is taken to the nearest TPA, burned by residents, dumped on the streets and others. Based on this technical aspect, it is necessary to build TPS3R as the first step in managing waste more systematically.

With this TPS3R, organic waste will go through a composting process to become compost and the results can be sold to the community and oil palm farmers at affordable prices. Meanwhile, the inorganic waste will be taken to the waste bank to be processed, partly into creative goods and partly sold as industrial raw materials such as plastic bottles, paper, karah, cans, iron, aluminum and others.

2. Financial Aspect

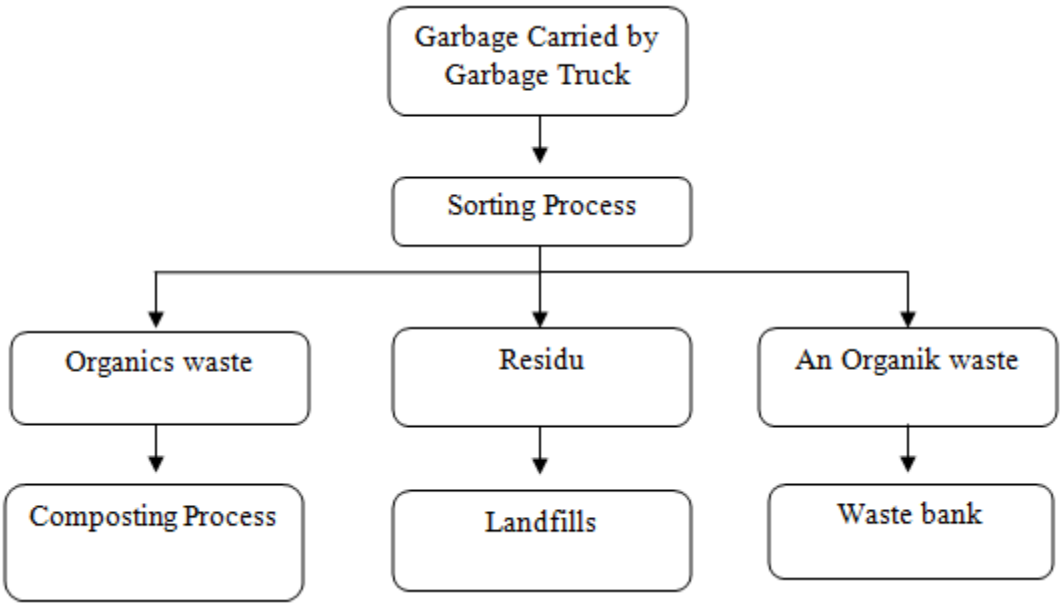
   Includes an analysis of the budgeted financing by Pertamina Hulu Rokan (PHR). The financial aspect includes the cost of building facilities and infrastructure. In addition, investment analysis will be carried

out using the following calculations: 1) Net Present Value, 2) Payback Period 3) Internal Rate of Return and 4) Benefit Cost Ratio.

TPS3R Working Process

The work process of the 3R TPS that will be built has the following work process. Starting from the garbage that goes to TPS3R which is carried by motorbikes carrying garbage and garbage cars, it is immediately sorted by the sorting officers at TPS 3R. Sorting is done to separate organic waste and inorganic waste. Organic waste is used as compost, and inorganic waste will be transported to the Waste Bank. The remaining waste that cannot be utilized will be transported to the TPA. The following is a chart of the work process at TPS 3R:

Picture 2. TPS3R working process



METHODS

This study uses quantitative and qualitative methods, according to Sugiyono (2011), suggests that qualitative methods describe and understand the meaning behind the visible data. While the quantitative method is to see objects with numbers statistically. The population of this research is the community, the Pematang Pudu waste bank and the local government to discuss collecting materials and information that will be used to produce studies and recommendations.

RESULT AND DISCUSSION

Cost

In planning the construction of the 150 m3 TPS3R area, the following will describe the costs required :

Table 5. Budget detail

No	Uraian Pekerjaan	Total Biaya (Rp)
1	Pekerjaan Pendahuluan	5.000.000
2	Pekerjaan Bangunan Utama	176.300.000
3	Pekerjaan Bangunan Pendukung	19.000.000
4	Pengadaan Peralatan	2.300.000
Total		202.600.000

Income

With the amount of waste produced per day as much as 2,900 kg, we do not expect to be able to manage all of it immediately, at least being able to manage 1,000 kg (1 ton) per day is very good because this is a pilot project in Bengkalis Regency. The composition of the waste produced today is 60% organic waste and 40% inorganic waste

Organic waste

Organic waste can be used as raw material to make compost and can be marketed to the community and oil palm farmers. If 1,000 kg of waste is produced there is 60% organic waste, meaning that 600 kg of waste is available as raw material for compost. When it is processed into compost, it is predicted to shrink to 300 kg of compost per day, if in 30 days it means that it can produce 9000 kg (9 tons) of compost. With the selling value of compost Rp. 2,000 per kg, Meanwhile, production costs consist of: (1) sacks, (2) cow dung, (3) EM4. The sacks needed are 50 kg, if the production reaches 9000 kg, it means 180 sacks are needed, but to maintain stock, if any are damaged, 200 sacks are provided per month, with the price of sacks @ Rp. 1,000 so that the cost of sacks per month is Rp. 200,000 per month

Other needs such as cow dung is estimated to be 50% of the compost produced, if the estimated compost is 9,000 kg per month, then the cow dung needed is 4,500 kg per month, if the price of cow dung is IDR 100 per kg it will cost IDR 4,500,000 per month to buy cow dung. While other needs are EM4 as a mixture for making compost, its function is as a decomposer bacteria for the composting process, while the price per bottle is Rp. 30,000, if the production is 9,000 kg, it takes 30 bottles of EM4, then the cost required for EM4 is Rp. 900,000 per month.

Table 6. Estimated cost of composting

No	Item	Cost (Rp)
1	Bag	200.000
2	Cow dung	4.500.000
3	EM4	900.000
Total (Rp)		5.600.000

Estimated need for compost production costs Rp 5,600,000 per month to produce 9,000 kg of compost. Then it is also necessary to calculate the estimated monthly income that can be generated from the sale of compost.

Table 7. Estimated income for compost

Price kompos (Rp)	Amount of compost per month (Kg)	Sales estimate (Rp)	Monthly production cost (Rp)	Profit (Rp)
2.000	9.000	18.000.000	5.600.000	12.400.000

The estimated profit is obtained from the sale of Rp. 18,000,000 minus the production costs of Rp. 5,600,000, so the profit is Rp. 12,400,000 per month. If you use 2 workers with a salary of IDR 2,000,000 per month, then the labor cost is IDR 4,000,000 per month. So that a net profit of IDR 8,400,000 is obtained by calculating: = Profit IDR 12,400,000 – Labor cost IDR 4,000,000 = IDR 8,400,000,-

An-organic waste

Of the estimated 1,000 kg of waste that enters the TPS3R, about 40% or the equivalent of 400 kg is inorganic waste mixed with residue, it is estimated that 200 kg per day is waste that can be transported to a waste bank with economic value. Of course, this inorganic waste is still mixed, such as cardboard, paper, cans, carats, aluminum, plastic bottles, plastic bags. With an estimated selling value of Rp. 500/kg, if the estimate is 200 kg, you get Rp. 100,000 per day. If it is 30 days, the income is Rp. 3,000,000.-. Overall, the net benefits that can be obtained by the Pematang Pudu Waste Bank (BSPPB) with the TPS3R are :

= organic waste income + inorganic waste income
= IDR 8,400,000 + IDR 3,000,000
= IDR 11,400,000 per month x 12
= IDR 136.800.000,- per year

Net present value (NPV)
By calculating the Net Present Value (NPV) we can see that this social investment can have a positive value for 2 (two) years, with an investment value of Rp. 202,600,000 and an average income of Rp. 136,800,000 per year. the following is the calculation of NPV in table 8 below:

Table 8. Net Present Value (NPV)

Year	Net Cash Flow	Faktor PV	PV
1	136.800.000	0,962	131.601.600
2	136.800.000	0,923	126.266.400
		NPV	257.868.000
		INVESTASI	202.600.000
		PROFIT INVESTASI	55.268.000

Payback Period
With the construction cost of TPS3R of Rp. 202,600,000, it is necessary to calculate how long the Payback Period or the return of development capital will take, so that it becomes a reference if other TPS3R developments are carried out as developments.

Tabel 9. Payback Period

Year	Cash Flow	Cash Flow comulative
0	(202.600.000)	(202.600.000)
1	136.800.000	(65.800.000)
2	136.800.000	71.000.000
3	136.800.000	207.800.000

From table 9 above, we can see that in the second year we were able to return the cost of TPS3R construction so that in the future it can be developed into several TPS3R, when the Pematang Pudu Waste Bank (BSPPB) is able to control its cash flow, it can add TPS3R in other urban villages.

Internal Rate of Return (IRR)
Referring to the cash flow in table 9 above, an IRR of 46% is obtained, meaning that the rate of return on investment is greater than the current interest rate of 4%, meaning that the costs incurred for the construction of TPS3R are very realistic and are actually able to return a larger investment of 46% of the current interest rate of 4%.

Benefit Cost Ratio
Benefit cost ratio (B/C) is an analysis of project selection which is usually done because it is easy, namely the comparison between benefits and costs. If the value is < 1 then the project is not economical, and if > 1 means the project is feasible. If the B/C ratio = 1, the project is said to be marginal (no loss and no profit).

Benefit Cost Ratio : $B/C = \frac{\text{Benefit}}{\text{Cost+Investasi}}$

If it is included in the projection of the establishment of 3R TPS, the following is the calculation :

$$B/C = \frac{136.800.000}{5.600.000 + 202.600.000}$$

$$B/C = \frac{136.800.000}{208.200.000}$$

$$B/C = 0{,}57$$

This means that the calculation of the establishment of the 3R TPS using the benefit cost ratio analysis is still smaller than 1, where the construction project is still not feasible. But this calculation is only done by using the first year's profit only. whereas from the previous calculation using the NPV and payback period, the calculation is carried out for the second year of waste. If the B/C calculation is also carried out using 2 years of profit, the following results will be obtained :

$$B/C = \frac{273.600.000}{213.800.000} \; B/C = 1{,}28$$

This means that the results of the calculation of B/C > 1 where the establishment of TPS3R is feasible to be funded and can be profitable from a financial and economic perspective.

CONCLUSION

From the explanation that has been discussed above that the construction of TPS3R in Pematang Pudu Village, precisely near the BSPPB location, technically and financially analysis is very feasible, because this is a social investment so that the impact from the economic side will also relate to the social community. Where the existence of TPS3R will help reduce waste to the TPA as well as create job opportunities for the community and also increase income for BSPPB.

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