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COMPARISON OF INVESTMENT FEASIBILITY ANALYSIS WITH GRAVITY AND PUMPING SYSTEMS AT SPAM IKK MOTHER WEST HALMAHERA DISTRICT

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Abstract

Water is a basic need for all living things on this earth, not least for individual humans themselves, that water is the support of daily activities for human survival. The average household water usage in Indonesia is 60 liters per day per person or 45% of the total usage is for drinking, cooking, washing clothes, cleaning houses and vehicles and performing worship. Kecamatan Ibu has a population of 12. 241 people who have not been covered by access to drinking water in the West Halmahera Regency area, but have a Drinking Water Supply System (SPAM) for the Sub-district Capital (IKK) which was built in 2004 supplying 700 house connections (SR) in 2 villages, namely; Maritango Village and Akeboso Village which is taken from Akeboso Spring of 20 L/Det, Since 2017 SPAM IKK Ibu has not functioned due to damage to the piping network due to road widening work, damage to generators and pumps, in this study the authors will analyze the feasibility of investment for 9 villages that will get water with a total population of 1. 102 people by estimating the Budget Plan Cost (RAB) using the PermenPU No. 1 of 2022 guidelines and calculating investment feasibility by calculating Net Present Value (NPV), Internal of Return (IRR), Benefit Cost Ratio (BCR) and Payback Period (PP) and the results obtained in the gravity system have a greater investment value of Rp 13,524,301,000 compared to the pumping system which is Rp 11,919,456,000 from the calculation of the Budget Plan Cost (RAB).

Keywords: *Cost Budget, Investment Feasibility, Water Suply System*

1. INTRODUCTION

1 Year 2022 (Guidelines for Preparing Estimates of Construction Costs for Public Works and Public Housing in 2022, 2022) and calculating investment feasibility by calculating Net Present Value (NPV), Internal of Return (IRR), Benefit Cost Ratio (BCR) and Payback Period (PP), thus eating on the feasibility analysis that will be carried out on the development of SPAM IKK Mother West Halmahera Regency will see which investment is more profitable whether with the gravity network system method using a water source taken from Kampung Naga Village or with a pompanization network system using a water source taken from Akeboso Village with consideration indicators on cost estimation and investment analysis where Water is the basic need of all living things on this earth, no exception for individual humans themselves, that water is the support of daily activities for human survival (Sukartini and Saleh 2016) to meet the needs of around 144 liters per day, with the largest use being for bathing purposes, namely 60 liters per day per person or 45% of total usage, the rest is for drinking, cooking, washing clothes, cleaning houses and vehicles and performing worship (Cipta Karya, 2006) and with water quality with characteristics that are colorless, odorless, with a fresh taste and safe to drink

(Ministry of Public Works and Public Housing, 2020). Planning Facilities and infrastructure in the Drinking Water Supply System (SPAM) IKK Mother, West Halmahera Regency is one of the keys to developing economic growth because it can encourage community productivity and increase the level of public health, so that the construction of this SPAM is expected to be implemented.

1.1. Problem Formulation

Looking at the background description above, the problem formulations in this study are as follows:

1. How much does it cost to make SPAM IKK Mother using gravity and pumping systems?
2. How is the feasibility of investment in SPAM IKK Mother using gravity and pumping systems?

1.2. Research Objectives

The objectives of this research are:

1. To calculate the costs incurred in making SPAM IKK Mother using gravity and pumping systems.
2. To determine the feasibility of investment in SPAM IKK Mother using gravity and pumping systems.

2. LITERATURE REVIEW

2.1. Cost Budget Plan

The Cost Budget Plan is a major activity in construction projects to estimate the costs that will be incurred in a construction project by calculating the resources and materials to be used (Guidelines for Preparing Estimates of the Cost of Construction Work in the Field of Public Works and Public Housing in 2022, 2022), with the aim of making RAB is to estimate the need for materials, workers' wages and safety systems at the time of work so that the costs incurred to realize a job in accordance with the plan drawing using existing guidelines and a regional approach to adjust the habits that exist there (Mokolensang, Arsjad, and Malingkas 2021)

The components that make up RAB are the cost components needed in a project to be implemented (Budiarso and Pamungkas 2018), The costs contained in the implementation of construction are; Direct Costs, Labor Costs, Material Costs, Subcontractor Costs, Equipment / Equipment Costs, Overhead Costs, Unexpected Costs and Profits.

2.2. Investment Feasibility

Investment is putting funds with a commitment to achieve the goal of obtaining results or economic returns from funds that are placed over a certain time with an agreement in the form of periodic cash flows or final value Wastam, (2019) with the aim of utilizing, protecting and developing assets that we have to achieve the goal of financial

gain in accordance with the time period, needs and financial goals (Huda and Hambali 2020).

Before making financial investments in a location, it is better to look at the market aspects and how to market it for that location because this is a very important thing to determine whether an investment can experience profit or not (Putri 2022), thus it is necessary to make decisions to analyze market and marketing aspects.

An investment can generate various profits and revenues such as the sale of goods and services or leasing facilities, in general there are several methods used to assess an investment whether it can be declared feasible or not to run (Wardhana, n.d.).

2.3. Previous Research

In writing this thesis, there are references to the use of previous research that is still relevant and used as a writing reference, including the first (Putri 2022) with research on Investment Feasibility Analysis in Dadapan Ika Residence Semarang Housing using the Net Present Value (NPV) method, Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), Break Even Point (BEP) and Profitability Index (PI).

The second reference is (Agustina 2020) with research on Investment Feasibility Analysis of Service-Based Hospitals using the Net Present Vaue (NPV) and Payback Period (PP) methods.

In the third reference according to (Budiarso and Pamungkas 2018) with research on the Calculation of the Budget Plan for the Cost of Structural Work and the Tender Process for the Semarang Jatidiri Stadium Renovation Project getting results on the calculation of the Budget Plan for Cost (RAB) on the structural work of the west stand of the Jatidiri Stadium.

In the fourth reference according to Mokolensang, Arsjad, and Malingkas (2021)with research on Cost Budget Plan Analysis on the Papua 1 Flats Construction Project in Muara Tami District, Jayapura City, Papua Province getting results on the Cost Budget Plan (RAB).

3. RESEARCH METHODS

3.1. Cost Budget Plan

Cost Budget Plan (RAB) by using the guidelines of PermenPU No. 1 of 2022.

3.2. Investment Feasibility

The method of assessing an investment project is declared feasible or not feasible to run according to Cintya I D (2020) is as follows:

1. Net Present Value (NPV)

Net Present Value is a method based on the difference between cash inflows and the present value of cash outflows over a certain period, NPV is used to analyze the profitability of a project to be invested, as for the Net Present Value (NPV) formula is as follows:

$$NPV = \sum_{t-1}^{T} \frac{Ct}{(1+r)t} - C0 \quad \text{.....(2.1)}$$

Where:
NPV = Net Present Value (in rupiah)
Ct = Cash flow per year in period t
C0 = Initial investment value in year 0 (in rupiah)
r = Interest rate or discount rate (in %)
t = Number of years
T = Project life

So, if the NPV value > 0, then the proposed project can be implemented, but if the NPV value < 0, then the proposed project cannot be implemented and if the NPV value = 0, then this condition is said to be neutral, namely the project can still be implemented or not implemented.

2. Internal Rate of Return (IRR)

Internal of Return is a calculation method to calculate the interest rate on an investment and equate it to the current value based on the calculation of net cash in the future period, if the IRR shows a value greater than the capital value, it is good to invest, but if the IRR value is smaller than the capital value, you should not invest, as for the Internal of Return (IRR) formula is as follows:

$$IRR = i_1 - NPV_1 * (i_2 - i_2) (NPV_2 - NPV_1) \text{ ……..(2.2)}$$

Where:
i1 = 1st interest rate
i2 = 2nd interest rate
NPV1 = Net Present Value at interest rate 1
NPV2 = Net Present Value at interest rate 2

If, IRR > take rate (i), then the proposed project investment will be accepted, but if IRR < take rate (i), then the proposed project investment is rejected.

The indicators used in calculating IRR are as follows:

IRR > to the commercial interest rate then it can be interpreted that the development is said to be feasible.

IRR < against the commercial interest rate then it can be interpreted that the development is not feasible.

IRR = commercial interest rate then it can be interpreted that this condition is considered as a neutral condition, namely the project can be implemented or cannot be implemented.

3. Benefit Cost Ratio (BCR)

Benefit Cost Ratio is a comparison between the benefits obtained from project investment and the expenditure or financing of project investment, if the BCR value is

greater than or equal to then a project can be said to be feasible, as for the formula for calculating BCR is as follows:

$$BCR = \frac{\sum Benefit}{\sum Cost} \quad \text{.....(2.3)}$$

Where:

If, BCR > 1, it means that an investment is feasible to run, but if BCR < 1, then an investment is not feasible to run because it is less profitable and if BCR = 1, then it is stated that this condition is neutral where the investment is not said to experience a loss or profit so that the investment can be run or not.

4. Payback Period (PP)

Paybeck Period is a calculation method to find out the years needed to return an investment capital, as for the formula used to calculate the Payback Period is as follows:

$$PP = \frac{n+(a+b)}{(c-b)} \; x \; 1 \; Year \quad \text{..... (2.4)}$$

Where:

n = The last year whose cumulative cash flow position is still negative
a = Initial investment value
b = Cumulative amount of cashflow value in year n
c = Cumulative amount of cashflow in year n+1

4. RESULTS AND DISCUSSION

4.1. Cost Budget Plan

After calculating the volume and unit price of work, the estimated costs used in the SPAM IKK Mother network in West Halmahera Regency using a gravity system are as follows:

Table 1. Cost Estimation of Gravity System

NO	ITEM PEKERJAAN	TOTAL HARGA (Rp)
I	PENERAPAN KESEHATAN DAN KESELAMATAN KERJA (K3)	339.800.000,00
II	PEKERJAAN PERSIAPAN	110.330.815,92
III	PENGADAAN PEMASANGAN PIPA DAN AKSESORIS PIPA	8.372.701.678,55
IV	PEKERJAAN JEMBATAN PIPA Dia. 200 mm (L. 10 M)	171.579.471,83
V	PEKERJAAN JEMBATAN PIPA Dia. 110 mm (L. 20 M)	186.777.841,58
VI	PEKERJAAN PERBAIKAN RESERVOIR EKSISTING	83.906.423,00
VII	PEKERJAAN RESERVOIR BAJA SANDBLASTING KAPS. 200 M3	1.690.558.382,07
VIII	PEKERJAAN MEKANIKAL ELEKTRIKAL	1.117.702.936,93
IX	PEKERJAAN BANGUNAN DESINFEKTAN	239.183.736,85
X	PENGADAAN DAN PEMASANGAN SAMBUNGAN RUMAH (SR) 700 UNIT	1.196.695.500,00
XI	COMMISIONING TEST	15.064.852,32
	JUMLAH	**13.524.301.639,07**
	PEMBULATAN	**13.524.301.000,00**
	TIGA BELAS MILYAR LIMA RATUS DUA PULUH EMPAT JUTA TIGA RATUS SATU RIBU RUPIAH	

Source: Author's Process (2023)

After calculating the volume and unit price of work, the estimated costs used in the SPAM IKK Mother network in West Halmahera Regency using a pumping system are as follows:

Table 2. Cost Estimation of the Pumping System

NO	ITEM PEKERJAAN	TOTAL HARGA (Rp)
I	PENERAPAN KESEHATAN DAN KESELAMATAN KERJA (K3)	339.800.000,00
II	PEKERJAAN PERSIAPAN	110.330.815,92
III	PENGADAAN PEMASANGAN PIPA DAN AKSESORIS PIPA	4.243.277.386,94
IV	PEKERJAAN JEMBATAN PIPA Dia. 200 mm (L. 10 M)	171.345.471,83
V	PEKERJAAN JEMBATAN PIPA Dia. 110 mm (L. 20 M)	186.543.841,58
VI	PEKERJAAN PERBAIKAN RESERVOIR EKSISTING	83.906.423,00
VII	PEKERJAAN RESERVOIR BAJA SANDBLASTING KAPS. 200 M3	1.690.558.382,07
VIII	PEKERJAAN MEKANIKAL ELEKTRIKAL	3.380.933.333,17
IX	PEKERJAAN BANGUNAN DESINFEKTAN	259.474.866,85
X	PEKERJAAN BANGUNAN INTAKE STAINLESS STEEL	244.426.848,05
XI	PENGADAAN DAN PEMASANGAN SAMBUNGAN RUMAH (SR) 700 UNIT	1.196.695.500,00
XII	COMMISIONING TEST	12.163.492,32
	JUMLAH	**11.919.456.361,76**
	PEMBULATAN	**11.919.456.000,00**
	SEBELAS MILYAR SEMBILAN RATUS SEMBILAN BELAS BELAS JUTA EMPAT RATUS LIMA PULUH ENAM RIBU RUPIAH	

Source: Author's Process (2023)

4.2. Investment Feasibility

Table 3. Revenue in Gravity System

Tahun Ke	Uraian												
	Pengaktifan Sambungan	Penambahan Sambungan	Total Sambungan	Kenaikan Konsumsi Air	Pemakaian Air Per SR/Bulan	Rencana Penjualan Air	Harga Sambungan Pelanggan	Total Biaya Sambungan	Rencana Penyesuaian Tarif	Harga Air Rata-rata	Subsidi	Penjualan Air	Total Pendapatan
	Unit	Unit	Unit	m3	m3	m3	Rp		%	Rp/m3	Rp/m3	Rp	Rp
1	700	300	1000	-	15,00	180.000,00	1.550.000	465.000.000		4.500	6.060	1.900.800.000	2.365.800.000
2	-	300	1300	0,10	15,10	235.560,00	1.550.000	465.000.000		4.500	6.060	2.487.513.600	2.952.513.600
3	-	300	1600	0,10	15,20	291.840,00	1.550.000	465.000.000		4.500	6.060	3.081.830.400	3.546.830.400
4	-	202	1802	0,10	15,30	330.847,20	1.550.000	313.100.000		4.500	6.060	3.493.746.432	3.806.846.432
5	-	23	1825	0,10	15,40	337.260,00	1.612.000	37.076.000	4%	4.680	6.060	3.622.172.400	3.659.248.400
6	-	23	1848	0,10	15,50	343.728,00	1.612.000	37.076.000		4.680	6.060	3.691.638.720	3.728.714.720
7	-	23	1871	0,10	15,60	350.251,20	1.612.000	37.076.000		4.680	6.060	3.761.697.888	3.798.773.888
8	-	23	1894	0,10	15,70	356.829,60	1.612.000	37.076.000		4.680	6.060	3.832.349.904	3.869.425.904
9	-	23	1917	0,10	15,80	363.463,20	1.612.000	37.076.000		4.680	6.060	3.903.594.768	3.940.670.768
10	-	23	1940	0,10	15,90	370.152,00	1.676.480	38.559.040	4%	4.867	6.060	4.044.724.934	4.083.283.974
11	-	23	1963	0,10	16,00	376.896,00	1.676.480	38.559.040		4.867	6.060	4.118.417.971	4.156.977.011
12	-	23	1986	0,10	16,10	383.695,20	1.676.480	38.559.040		4.867	6.060	4.192.714.189	4.231.273.229
13	-	23	2009	0,10	16,20	390.549,60	1.676.480	38.559.040		4.867	6.060	4.267.613.589	4.306.172.629
14	-	23	2032	0,10	16,30	397.459,20	1.676.480	38.559.040		4.867	6.060	4.343.116.170	4.381.675.210
15	-	23	2055	0,10	16,40	404.424,00	1.743.539	40.101.402	4%	5.062	6.060	4.497.958.433	4.538.059.834
16	-	23	2078	0,10	16,50	411.444,00	1.743.539	40.101.402		5.062	6.060	4.576.034.086	4.616.135.488
17	-	23	2101	0,10	16,60	418.519,20	1.743.539	40.101.402		5.062	6.060	4.654.723.668	4.694.825.070
18	-	23	2124	0,10	16,70	425.649,60	1.743.539	40.101.402		5.062	6.060	4.734.027.178	4.774.128.580
19	-	23	2147	0,10	16,80	432.835,20	1.743.539	40.101.402		5.062	6.060	4.813.944.617	4.854.046.018
20	-	16	2163	0,10	16,90	438.656,40	1.743.539	27.896.627		5.062	6.060	4.878.687.351	4.906.583.978

Source: Author's Process (2023)

Table 4. Net Profit on Gravity System

Tahun Ke	Total Pendapatan	Pengeluaran	Laba/(Rugi) Sebelum Penyusutan	Penyusustan	Laba/(Rugi) Setelah Penyusutan	Estimasi Pajak Penghasilan	Laba Bersih
1	2.365.800.000	518.516.927	1.847.283.073	584.003.907	1.263.279.166	277.921.417	985.357.750
2	2.952.513.600	608.799.120	2.343.714.480	584.003.907	1.759.710.573	387.136.326	1.372.574.247
3	3.546.830.400	695.830.537	2.850.999.863	584.003.907	2.266.995.956	498.739.110	1.768.256.846
4	3.806.846.432	762.405.121	3.044.441.311	584.003.907	2.460.437.404	541.296.229	1.919.141.175
5	3.659.248.400	835.730.279	2.823.518.121	584.003.907	2.239.514.215	492.693.127	1.746.821.087
6	3.728.714.720	887.476.915	2.841.237.805	584.003.907	2.257.233.898	496.591.458	1.760.642.440
7	3.798.773.888	942.548.651	2.856.225.237	584.003.907	2.272.221.330	499.888.693	1.772.332.638
8	3.869.425.904	1.001.166.485	2.868.259.419	584.003.907	2.284.255.512	502.536.213	1.781.719.299
9	3.940.670.768	1.063.566.507	2.877.104.261	584.003.907	2.293.100.354	504.482.078	1.788.618.276
10	4.083.283.974	1.130.000.939	2.953.283.035	584.003.907	2.369.279.128	521.241.408	1.848.037.720
11	4.156.977.011	1.200.739.268	2.956.237.743	584.003.907	2.372.233.836	521.891.444	1.850.342.392
12	4.231.273.229	1.276.069.443	2.955.203.787	584.003.907	2.371.199.880	521.663.974	1.849.535.906
13	4.306.172.629	1.356.299.164	2.949.873.465	584.003.907	2.365.869.558	520.491.303	1.845.378.255
14	4.381.675.210	1.441.757.265	2.939.917.946	584.003.907	2.355.914.039	518.301.089	1.837.612.950
15	4.538.059.834	1.592.432.106	2.945.627.728	584.003.907	2.361.623.821	519.557.241	1.842.066.580
16	4.616.135.488	1.629.788.553	2.986.346.934	584.003.907	2.402.343.028	528.515.466	1.873.827.562
17	4.694.825.070	1.733.138.881	2.961.686.189	584.003.907	2.377.682.282	523.090.102	1.854.592.180
18	4.774.128.580	1.843.275.372	2.930.853.208	584.003.907	2.346.849.301	516.306.846	1.830.542.455
19	4.854.046.018	1.960.656.866	2.893.389.153	584.003.907	2.309.385.246	508.064.754	1.801.320.492
20	4.906.583.978	2.085.773.913	2.820.810.066	584.003.907	2.236.806.159	492.097.355	1.744.708.804

Source: Author's Process (2023)

Table 5. Net Present Value of Gravity System

Tahun Ke	Laba Bersih	Diskon Faktor	Present Value
1	985.357.750	0,903	889.518.486,38
2	1.372.574.247	0,815	1.118.556.509,58
3	1.768.256.846	0,736	1.300.853.749,71
4	1.919.141.175	0,664	1.274.533.015,82
5	1.746.821.087	0,600	1.047.257.873,99
6	1.760.642.440	0,541	952.878.255,02
7	1.772.332.638	0,489	865.909.544,78
8	1.781.719.299	0,441	785.828.214,19
9	1.788.618.276	0,398	712.142.720,27
10	1.848.037.720	0,359	664.234.223,32
11	1.850.342.392	0,324	600.376.323,69
12	1.849.535.906	0,293	541.745.443,20
13	1.845.378.255	0,264	487.954.065,32
14	1.837.612.950	0,239	438.640.397,27
15	1.842.066.580	0,215	396.936.420,06
16	1.873.827.562	0,195	364.507.349,45
17	1.854.592.180	0,176	325.676.282,88
18	1.830.542.455	0,159	290.187.402,92
19	1.801.320.492	0,143	257.780.927,12
20	1.744.708.804	0,129	225.394.744,75
Total Present Value			13.540.911.949,70
Net Present Value			**16.610.949,70**

Source: Author's Process (2023)

The results of the Net Present Value (NPV) analysis in table 5, the investment in SPAM IKK Mother West Halmahera Regency with a gravity system has a positive value> 0, so the investment is said to be feasible:

Table 6. Benefit Coast Ratio of Gravity System

Tahun Ke	Laba Bersih	Diskon Faktor	PV Benefir	Pengeluaran	Diskon Faktor	PV Cost
1	985.357.750	0,903	889.518.486	518.516.927	0,903	468.084.198
2	1.372.574.247	0,815	1.118.556.510	608.799.120	0,815	496.130.697
3	1.768.256.846	0,736	1.300.853.750	695.830.537	0,736	511.901.744
4	1.919.141.175	0,664	1.274.533.016	762.405.121	0,664	506.325.700
5	1.746.821.087	0,600	1.047.257.874	835.730.279	0,600	501.038.785
6	1.760.642.440	0,541	952.878.255	887.476.915	0,541	480.311.865
7	1.772.332.638	0,489	865.909.545	942.548.651	0,489	460.501.520
8	1.781.719.299	0,441	785.828.214	1.001.166.485	0,441	441.564.994
9	1.788.618.276	0,398	712.142.720	1.063.566.507	0,398	423.461.593
10	1.848.037.720	0,359	664.234.223	1.130.000.939	0,359	406.152.585
11	1.850.342.392	0,324	600.376.324	1.200.739.268	0,324	389.601.098
12	1.849.535.906	0,293	541.745.443	1.276.069.443	0,293	373.772.038
13	1.845.378.255	0,264	487.954.065	1.356.299.164	0,264	358.631.998
14	1.837.612.950	0,239	438.640.397	1.441.757.265	0,239	344.149.174
15	1.842.066.580	0,215	396.936.420	1.592.432.106	0,215	343.144.111
16	1.873.827.562	0,195	364.507.349	1.629.788.553	0,195	317.035.526
17	1.854.592.180	0,176	325.676.283	1.733.138.881	0,176	304.348.436
18	1.830.542.455	0,159	290.187.403	1.843.275.372	0,159	292.205.893
19	1.801.320.492	0,143	257.780.927	1.960.656.866	0,143	280.583.021
20	1.744.708.804	0,129	225.394.745	2.085.773.913	0,129	269.456.128
		Total PV Benefit	13.540.911.950		Total PV Cost	7.968.401.103
			Benefit Cost Ratio	1,70		

Source: Author's Process (2023)

The results of the Benefit Cost Ratio (BCR) analysis in table 6, the investment in SPAM IKK Mother West Halmahera Regency with a gravity system has a positive value and > 1, so the investment is said to be feasible.

Table 7. Internal Rate of Return on Gravity System

Tahun Ke	Laba Bersih	Diskon Faktor	Present Value
			- 13.524.301.000
1	985.357.750	0,9026	889.379.009,59
2	1.372.574.247	0,8147	1.118.205.757,03
3	1.768.256.846	0,7353	1.300.241.922,77
4	1.919.141.175	0,6637	1.273.733.815,04
5	1.746.821.087	0,5991	1.046.437.079,55
6	1.760.642.440	0,5407	951.982.136,63
7	1.772.332.638	0,4880	864.959.567,45
8	1.781.719.299	0,4405	784.843.010,04
9	1.788.618.276	0,3976	711.138.372,46
10	1.848.037.720	0,3589	663.193.436,48
11	1.850.342.392	0,3239	599.341.603,93
12	1.849.535.906	0,2924	540.726.971,48
13	1.845.378.255	0,2639	486.960.352,91
14	1.837.612.950	0,2382	437.678.472,65
15	1.842.066.580	0,2150	396.003.847,68
16	1.873.827.562	0,1940	363.593.946,15
17	1.854.592.180	0,1751	324.809.246,50
18	1.830.542.455	0,1581	289.369.466,98
19	1.801.320.492	0,1427	257.014.027,40
20	1.744.708.804	0,1288	224.688.957,28
		Total Present Value	0,00
		Internal Rate of Return	10,79%
		Rencana Internal Rate of Return	10,77%
		Selisih	0,02%

Source: Author's Process (2023)

The results of the Internal Rate of Return (IRR) analysis in table 7, the investment in SPAM IKK Mother West Halmahera Regency with a gravity system has a yield of

10.79% and has a return of 0.02% above the bank discount rate yield of 10.77%, so the investment is said to be feasible.

Table 8. Payback Period of Gravity System

Tahun Ke	Laba Bersih	Present Value
0		- 13.524.301.000
1	985.357.750	- 12.538.943.250
2	1.372.574.247	- 11.166.369.003
3	1.768.256.846	- 9.398.112.157
4	1.919.141.175	- 7.478.970.982
5	1.746.821.087	- 5.732.149.895
6	1.760.642.440	- 3.971.507.454
7	1.772.332.638	- 2.199.174.817
8	1.781.719.299	- 417.455.518
9	1.788.618.276	1.371.162.759
10	1.848.037.720	3.219.200.479
11	1.850.342.392	5.069.542.871
12	1.849.535.906	6.919.078.777
13	1.845.378.255	8.764.457.033
14	1.837.612.950	10.602.069.983
15	1.842.066.580	12.444.136.563
16	1.873.827.562	14.317.964.125
17	1.854.592.180	16.172.556.305
18	1.830.542.455	18.003.098.760
19	1.801.320.492	19.804.419.251
20	1.744.708.804	21.549.128.055
Payback Periode		8,2

Source: Author's Process (2023)

The Present Value value is obtained from = Investment value - Net profit per year, so that the Payback Period is 8 years and 2 months with a surplus of Rp 1,371,162,759 and the investment shows a surplus of Rp 21,549,128,055 in year 20.

Table 9. Revenue on Pumping System

Tahun Ke	Uraian													
	Pengaktifan Sambungan	Penambahan Sambungan	Total Sambungan	Kenaikan Konsumsi Air	Pemakaian Air Per SR/Bulan	Rencana Distribusi Air	Rencana Penjualan Air	Harga Sambungan Pelanggan	Total Biaya Sambungan	Rencana Penyesuaian Tarif	Harga Air Rata-rata	Subsidi Harga Air	Penjualan Air	Total Pendapatan
	Unit	Unit	Unit	m3	m3	m3	m3	Rp		%	Rp/m3	Rp/m3	Rp	Rp
1	700	300	1000	-	15,00	216.336,96	180.000,00	1.550.000	465.000.000		4.500	6.060	1.900.800.000	2.365.800.000
2	-	300	1300	0,10	15,10	309.052,80	235.560,00	1.550.000	465.000.000		4.500	6.050	2.485.158.000	2.950.158.000
3	-	300	1600	0,10	15,20	386.316,00	291.840,00	1.550.000	465.000.000		4.500	6.050	3.078.912.000	3.543.912.000
4	-	202	1802	0,10	15,30	423.402,34	330.847,20	1.550.000	313.100.000		4.500	6.050	3.490.437.960	3.803.537.960
5	-	23	1825	0,10	15,40	463.579,20	337.260,00	1.612.000	37.076.000	4%	4.680	6.050	3.618.799.800	3.655.875.800
6	-	23	1848	0,10	15,50	466.669,73	343.728,00	1.612.000	37.076.000		4.680	6.050	3.688.201.440	3.725.277.440
7	-	23	1871	0,10	15,60	469.760,26	350.251,20	1.612.000	37.076.000		4.680	6.050	3.758.195.376	3.795.271.376
8	-	23	1894	0,10	15,70	472.850,78	356.829,60	1.612.000	37.076.000		4.680	6.050	3.828.781.608	3.865.857.608
9	-	23	1917	0,10	15,80	475.941,31	363.463,20	1.612.000	37.076.000		4.680	6.050	3.899.960.136	3.937.036.136
10	-	23	1940	0,10	15,90	479.031,84	370.152,00	1.676.480	38.559.040	4%	4.867	6.050	4.041.023.414	4.079.582.454
11	-	23	1963	0,10	16,00	482.122,37	376.896,00	1.676.480	38.559.040		4.867	6.050	4.114.649.011	4.153.208.051
12	-	23	1986	0,10	16,10	485.212,90	383.695,20	1.676.480	38.559.040		4.867	6.050	4.188.877.237	4.227.436.277
13	-	23	2009	0,10	16,20	488.303,42	390.549,60	1.676.480	38.559.040		4.867	6.050	4.263.708.093	4.302.267.133
14	-	23	2032	0,10	16,30	491.393,95	397.459,20	1.676.480	38.559.040		4.867	6.050	4.339.141.578	4.377.700.618
15	-	23	2055	0,10	16,40	494.484,48	404.424,00	1.743.539	40.101.402	4%	5.062	6.050	4.493.914.193	4.534.015.594
16	-	23	2078	0,10	16,50	497.575,01	411.444,00	1.743.539	40.101.402		5.062	6.050	4.571.919.646	4.612.021.048
17	-	23	2101	0,10	16,60	500.665,54	418.519,20	1.743.539	40.101.402		5.062	6.050	4.650.538.476	4.690.639.878
18	-	23	2124	0,10	16,70	503.756,06	425.649,60	1.743.539	40.101.402		5.062	6.050	4.729.770.682	4.769.872.084
19	-	23	2147	0,10	16,80	506.846,59	432.835,20	1.743.539	40.101.402		5.062	6.050	4.809.616.265	4.849.717.666
20	-	16	2163	0,10	16,90	509.937,12	438.656,40	1.743.539	27.896.627		5.062	6.050	4.874.300.787	4.902.197.414

Source: Author's Process (2023)

In Table 9. the net profit obtained on the investment of SPAM IKK Mother West Halmahera Regency using the gravity system has a good surplus and continues to increase from year 1 to year 20, there is no minus where expenses are greater than income every year.

Table 10: Net Profit on Pumping System

Tahun Ke	Total Pendapatan	Pengeluaran	Laba/(Rugi) Sebelum Penyusutan	Penyususstan	Laba/(Rugi) Setelah Penyusutan	Estimasi Pajak Penghasilan	Laba Bersih
1	2.365.800.000	613.384.961	1.752.415.039	475.840.145	1.276.574.894	280.846.477	995.728.417
2	2.950.158.000	750.774.101	2.199.383.899	475.840.145	1.723.543.753	379.179.626	1.344.364.128
3	3.543.912.000	880.185.050	2.663.726.950	475.840.145	2.187.886.804	481.335.097	1.706.551.707
4	3.803.537.960	972.297.307	2.831.240.653	475.840.145	2.355.400.508	518.188.112	1.837.212.396
5	3.655.875.800	1.074.455.829	2.581.419.971	475.840.145	2.105.579.826	463.227.562	1.642.352.264
6	3.725.277.440	1.137.118.271	2.588.159.169	475.840.145	2.112.319.024	464.710.185	1.647.608.839
7	3.795.271.376	1.203.593.491	2.591.677.885	475.840.145	2.115.837.740	465.484.303	1.650.353.437
8	3.865.857.608	1.274.123.901	2.591.733.707	475.840.145	2.115.893.562	465.496.584	1.650.396.978
9	3.937.036.136	1.348.967.926	2.588.068.210	475.840.145	2.112.228.065	464.690.174	1.647.537.890
10	4.079.582.454	1.428.401.096	2.651.181.359	475.840.145	2.175.341.213	478.575.067	1.696.766.146
11	4.153.208.051	1.512.717.209	2.640.490.842	475.840.145	2.164.650.696	476.223.153	1.688.427.543
12	4.227.436.277	1.602.229.581	2.625.206.696	475.840.145	2.149.366.551	472.860.641	1.676.505.910
13	4.302.267.133	1.697.272.374	2.604.994.759	475.840.145	2.129.154.614	468.414.015	1.660.740.599
14	4.377.700.618	1.798.202.026	2.579.498.592	475.840.145	2.103.658.447	462.804.858	1.640.853.589
15	4.534.015.594	6.672.701.876	- 2.138.686.282	475.840.145	- 2.614.526.427	-	- 2.614.526.427
16	4.612.021.048	2.019.268.292	2.592.752.756	475.840.145	2.116.912.610	465.720.774	1.651.191.836
17	4.690.639.878	2.140.243.425	2.550.396.453	475.840.145	2.074.556.308	456.402.388	1.618.153.920
18	4.769.872.084	2.268.786.067	2.501.086.017	475.840.145	2.025.245.871	445.554.092	1.579.691.780
19	4.849.717.666	2.405.389.158	2.444.328.509	475.840.145	1.968.488.363	433.067.440	1.535.420.923
20	4.902.197.414	2.550.578.817	2.351.618.597	475.840.145	1.875.778.452	412.671.259	1.463.107.192

Source: Author's Process (2023)

In table 10, the net profit obtained on the investment in SPAM IKK Mother West Halmahera Regency using the gravity system is in surplus from year 1 to year 14, in year 15 the cash flow is minus Rp 2,614,526,427 due to the purchase of a new pump that has entered the maximum usage time and in year 16 to year 20 it is in surplus.

Table 11. Net Present Value of Pumping System

Tahun Ke	Laba Bersih	Diskon Faktor	Present Value
1	995.728.417	0,903	898.880.467,53
2	1.344.364.128	0,815	1.095.567.142,67
3	1.706.551.707	0,736	1.255.459.122,16
4	1.837.212.396	0,664	1.220.122.774,86
5	1.642.352.264	0,600	984.626.504,13
6	1.647.608.839	0,541	891.703.277,82
7	1.650.353.437	0,489	806.314.098,63
8	1.650.396.978	0,441	727.908.436,91
9	1.647.537.890	0,398	655.971.221,21
10	1.696.766.146	0,359	609.863.170,60
11	1.688.427.543	0,324	547.840.186,49
12	1.676.505.910	0,293	491.063.425,15
13	1.660.740.599	0,264	439.132.261,46
14	1.640.853.589	0,239	391.673.703,54
15	- 2.614.526.427	0,215	- 563.389.386,25
16	1.651.191.836	0,195	321.199.011,00
17	1.618.153.920	0,176	284.156.462,80
18	1.579.691.780	0,159	250.421.209,17
19	1.535.420.923	0,143	219.728.932,69
20	1.463.107.192	0,129	189.015.308,12
Total Present Value			11.717.257.330,70
Net Present Value			**697.801.330,70**

Source: Author's Process (2023)

The results of the Net Present Value (NPV) analysis in table 11, the investment in SPAM IKK Mother West Halmahera Regency with a pumping system has a positive value and > 0, so the investment is said to be feasible.

Table 12. Benefit Cost Ratio of Pumping System

Tahun Ke	Laba Bersih	Diskon Faktor	PV Benefit	Pengeluaran	Diskon Faktor	PV Cost
1	995.728.417	0,903	898.880.468	613.384.961	0,903	553.725.042
2	1.344.364.128	0,815	1.095.567.143	750.774.101	0,815	611.830.843
3	1.706.551.707	0,736	1.255.459.122	880.185.050	0,736	647.525.853
4	1.837.212.396	0,664	1.220.122.775	972.297.307	0,664	645.718.530
5	1.642.352.264	0,600	984.626.504	1.074.455.829	0,600	644.160.032
6	1.647.608.839	0,541	891.703.278	1.137.118.271	0,541	615.420.399
7	1.650.353.437	0,489	806.314.099	1.203.593.491	0,489	588.040.343
8	1.650.396.978	0,441	727.908.437	1.274.123.901	0,441	561.953.002
9	1.647.537.890	0,398	655.971.221	1.348.967.926	0,398	537.094.863
10	1.696.766.146	0,359	609.863.171	1.428.401.096	0,359	513.405.588
11	1.688.427.543	0,324	547.840.186	1.512.717.209	0,324	490.827.860
12	1.676.505.910	0,293	491.063.425	1.602.229.581	0,293	469.307.231
13	1.660.740.599	0,264	439.132.261	1.697.272.374	0,264	448.791.977
14	1.640.853.589	0,239	391.673.704	1.798.202.026	0,239	429.232.963
15	- 2.614.526.427	0,215	- 563.389.386	6.672.701.876	0,215	1.437.862.465
16	1.651.191.836	0,195	321.199.011	2.019.268.292	0,195	392.799.289
17	1.618.153.920	0,176	284.156.463	2.140.243.425	0,176	375.838.166
18	1.579.691.780	0,159	250.421.209	2.268.786.067	0,159	359.660.130
19	1.535.420.923	0,143	219.728.933	2.405.389.158	0,143	344.227.166
20	1.463.107.192	0,129	189.015.308	2.550.578.817	0,129	329.503.159
		Total PV Benevit	11.717.257.331		Total PV Cost	10.996.924.899
			Benefit Cost Ratio	1,07		

Source: Author's Process (2023)

The results of the Benefit Cost Ratio (BCR) analysis in table 12, the investment in SPAM IKK Ibu West Halmahera Regency with a pumping system has a positive value and > 1, so the investment is said to be feasible.

Table 13. Internal Rate of Return on Pumping System

Tahun Ke	Laba Bersih	Diskon Faktor	Present Value
			- 11.019.456.000
1	995.728.417	0,895	890.969.200,78
2	1.344.364.128	0,801	1.076.367.298,85
3	1.706.551.707	0,716	1.222.601.209,00
4	1.837.212.396	0,641	1.177.732.137,71
5	1.642.352.264	0,574	942.052.838,35
6	1.647.608.839	0,513	845.638.703,43
7	1.650.353.437	0,459	757.930.685,68
8	1.650.396.978	0,411	678.207.733,94
9	1.647.537.890	0,368	605.803.138,98
10	1.696.766.146	0,329	558.264.340,98
11	1.688.427.543	0,294	497.075.222,51
12	1.676.505.910	0,263	441.638.133,64
13	1.660.740.599	0,236	391.457.906,88
14	1.640.853.589	0,211	346.078.713,72
15	- 2.614.526.427	0,189	- 493.423.560,16
16	1.651.191.836	0,169	278.834.282,52
17	1.618.153.920	0,151	244.506.413,71
18	1.579.691.780	0,135	213.581.963,14
19	1.535.420.923	0,121	185.755.405,26
20	1.463.107.192	0,108	158.384.231,09
		Total Present Value	0,00
		Internal Rate of Return	11,76%
		Rencana Internal Rate of Return	10,77%
		Selisih	0,99%

Source: Author's Process (2023)

The results of the Internal Rate of Return (IRR) analysis in table 13, the investment in SPAM IKK Mother West Halmahera Regency with a pumping system has a yield of 11.76% and has a return of 0.99% above the bank discount rate yield of 10.77%, so the investment is said to be feasible.

Table 14. Payback Period of Pumping System

Tahun Ke	Laba Bersih	Present Value
		- 11.019.456.000
1	995.728.417	- 10.023.727.583
2	1.344.364.128	- 8.679.363.455
3	1.706.551.707	- 6.972.811.748
4	1.837.212.396	- 5.135.599.352
5	1.642.352.264	- 3.493.247.087
6	1.647.608.839	- 1.845.638.249
7	1.650.353.437	- 195.284.812
8	1.650.396.978	1.455.112.166
9	1.647.537.890	3.102.650.057
10	1.696.766.146	4.799.416.203
11	1.688.427.543	6.487.843.746
12	1.676.505.910	8.164.349.656
13	1.660.740.599	9.825.090.255
14	1.640.853.589	11.465.943.843
15	- 2.614.526.427	8.851.417.416
16	1.651.191.836	10.502.609.252
17	1.618.153.920	12.120.763.172
18	1.579.691.780	13.700.454.951
19	1.535.420.923	15.235.875.875
20	1.463.107.192	16.698.983.067
Payback Periode		7,1

Source: Author's Process (2023)

The Present Value value is obtained from = Investment value - Net profit per year, so that the Payback Period is 7 years and 1 month with a surplus of Rp 1,455,112,166 and the investment shows a surplus of Rp 16,698,983,067 in year 20.

5. CONCLUSION

1. The cost incurred to create SPAM IKK Ibu using the gravity system is Rp 13,524,301,639 and using the pompanization system is Rp 11,919,456,000.
2. The feasibility of investment in SPAM IKK Ibu in the NPV value of the gravity system and pompanization with financing with subsidies has a positive value> 0, so the investment is said to be feasible, while for the calculation of BCR in the gravity system and pompanization with financing analysis with subsidies has a positive value> 1, so the investment is said to be feasible, while the IRR value in the gravity system and pompanization with financing analysis with subsidies> than the bank interest rate of 10.77%, so the investment is said to be feasible, In the calculation of PP gravity system with financing analysis with subsidies for 8 Years 2 Months with a surplus of Rp 21. 549,128,055 while in the pompanization system

with financing analysis with subsidies for 7 years 1 month with a surplus of Rp 16,698,983,067.

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