

Sensitivity Analysis of North Surabaya Hospital Investment Feasibility

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Abstract. The aim of this research is to analyze the feasibility of investing in North Surabaya Hospital, Bulak District, Surabaya City with the parameters Net Present Value, Internal Rate of Return, Benefit Cost Ratio (BCR) and Payback Period. This research focuses on the North Surabaya Hospital which was built by the Surabaya City Government Health Service with a budget for 2026. The research instruments used were interview guidelines and observation sheets, with data collection procedures via location with related parties in the construction of the hospital, site observation, as well as documentation that includes primary and secondary data. Based on investment analysis of North Surabaya Hospital and evaluation of sensitivity to operational costs and potential income, the conclusion obtained is: Alternative 1 is feasible because it produces an NPV value of Rp. 211,014,227,005, IRR of 9.85%, BCR of 1.23 and PP of 7.69 years, but will be sensitive to the point that it is not feasible if there is an increase in hospital operational costs above 2.05% or a decrease in hospital service levy rates above 1.39%. Alternative 2 is not feasible because it produces an NPV value of Rp. 28,416,192,984, IRR of 6.57%, BCR of 1.14 and PP of 8.34 years, but it will be sensitive and feasible if there is a decrease in hospital operational costs above 7.73% or an increase in hospital service levy rates above 5.59%. Alternative 3 is not feasible because it produces an NPV value of Rp. 66,444,241,124, IRR of 7.30%, BCR of 1.16 and PP of 8.20 years, but it will be sensitive and feasible if there is a decrease in hospital operational costs above 5.7% or an increase in hospital service levy rates above 4.08%. Alternative 4 is feasible because it produces an NPV value of Rp. 166,294,504,181, IRR of 9.26%, BCR of 1.20 and PP of 7.70 years, but it will be sensitive to the point of being unfeasible if there is an increase in hospital operational costs above 0.15% or a decrease in hospital service levy rates above 0.10%.

Keywords: Feasibility of Development, Hospital, Income, Management Costs, Sensitivity

1. INTRODUCTION

The city of Surabaya is the capital of East Java Province which has a strategic location to support the development and growth of the city. With an area of 335,925 km², Surabaya is inhabited by 3,017,382 people who are registered as city residents. Apart from registered residents, there are also residents who live permanently and non-permanently in Surabaya, which also contributes to population density. This density triggers various complex problems that require special attention from stakeholders, especially the Regional Government. One of the negative impacts of Surabaya's growth is the emergence of densely populated settlements with inadequate infrastructure, environmental and sanitation conditions (Dahliana et al., 2022; Ramadhani et al., 2022). Regional Governments focus on improving the quality of life of the community, especially in densely populated areas. One of the priorities is to provide quality health services through a comprehensive, integrated and sustainable promotive, preventive, curative and rehabilitative approach (Adiputra et al., 2019; Djuhatmoko et al., 2019). For this reason, the Surabaya City Government has decided to build a class C hospital in a strategic area on the north side of the city, precisely in Bulak District. It is hoped that the North Surabaya Hospital will be able to complete the referral system for public health services from first level health facilities before going to class A and B hospitals.

Based on research conducted by Agni (2022); A. F. Hidayat et al. (2021) related to the financial feasibility of investment in the Hospital Inpatient and Outpatient Service Development Plan, cash flow analysis takes into account all cost components, including investment costs, operational costs, and revenue derived from inpatient and outpatient service rates (Giatman, 2011; Zainuri, 2021). The investment analysis was conducted using the discounted cash flow method with Payback Period (PP), Net Present Value (NPV), and Internal Rate of Return (IRR) parameters. The results showed that the investment is feasible. This is reflected in the parameters used, namely the positive Net Present Value (NPV) value, the Internal Rate of Return (IRR) which is greater than required, and the Payback Period (PP) which is shorter than the life of the investment plan that has been determined (Abdurrabby et al., 2020; Yan & Zhang, 2022). However, the research has not taken into account the components that have a significant influence on the success or failure of the investment process (Khairani et al., 2023; Nathanael & Indryani, 2023; Tenawaheng et al., 2021). Therefore, in addition to the investment feasibility analysis, it is necessary to conduct a sensitivity analysis to measure the effect of changes in cost components on investment feasibility. This sensitivity analysis will evaluate how much influence certain variables have on the overall investment feasibility (W. H. Hidayat et al., 2022; Isya et al., 2021). These variables can be selected based on the level of global economic fluctuations, vulnerability to policy changes, or variables related to the business development innovations to be implemented.

Considering the above background, this research aims to analyze the Benefit Cost Ratio (BCR) and Payback Period (PP) of the investment sensitivity level of North Surabaya Hospital, Bulak Sub-district, Surabaya City on the components of revenue costs and management costs. As well as alternative tariff increase scheme of North Surabaya Hospital service levy that can be applied by considering feasibility aspects.

2. METHODS

Research Subject

The subject of this research was North Surabaya Hospital. North Surabaya Hospital was built by the Surabaya City Government Health Service where the construction allocation was carried out through the 2026 fiscal year budget.

Object

As the problem formulation has been determined, in this case the research object is:

- Various types of costs that can affect the feasibility of investment, including investment costs, operational / management costs and income from health services at North Surabaya Hospital;
- 2) Sensitivity of factors influencing investment in North Surabaya Hospital, namely health service rates, operational costs.

Research Instrument

In the process of carrying out research, it is necessary to use research instruments that are valid and trustworthy so that they can produce appropriate data and information that leads to conclusions that describe the actual situation. The instruments used in this research were interview guides and observation sheets or observation guides as data collection instruments.

Data Collection Procedur

According to Waruwu (2023), there are several types of research data collection methods, including observation, interviews (directly or through intermediaries with other parties), documentation, questionnaires, literature studies. Based on the type, the data collected in this research can be categorized as follows:

Primary Data

a) Interview

Interviews related to Surabaya City General Hospital financing which includes components that compose operational costs, service rates and revenues of both the Surabaya City Government Budget Team as planners and financial managers. Interviews were conducted with the Head of Government and Human Development at the Regional Development Planning, Research and Development Agency.

- b) Observation
- The location of the Hospital plan, which is on Jalan Benteng, Kedung Cowek Village, Bulak District, Surabaya City.
- Surabaya City Regional General Hospital that has been operating as a comparison material, namely Dr. M. Soewandhie Hospital and Bhakti Dharma Husada Hospital.

Secondary Data

- c) Regional Development Planning, Research and Development Agency of Surabaya City:
- Regional Medium-Term Development Plan (RPJMD) Document of Surabaya City 2021-2026

- Initial Draft Document of Regional Government Work Plan (RKPD) of Surabaya City Year 2025
- d) Surabaya City Regional Financial and Asset Management Agency:
- Hospital construction budget allocation data
- Revenue realization data
- e) Public Housing, Settlement Area and Land Agency of Surabaya City:
- Detailed City Spatial Plan of the hospital construction site
- f) Surabaya City Health Office:
- Detailed health service tariff data
- FS Document for Hospital Construction
- Detailed data on hospital operating costs

Data Analysis Technique

Data analysis is the process of systematically searching and compiling data obtained from interviews, field observations, information documentation and literature studies, then sorting according to what the research will do. The purpose of this data analysis is to interpret the data so that it is easy to carry out further calculations in accordance with the predetermined theoretical basis, so that it can be used as a basis for preparing research conclusions (Yusup, 2018).

3. RESULTS

The projection of cash flow over the investment life is 10 (ten) years for each alternative scheme of service levy planned, so that the cash flow can be accumulated annually into net cash flow. In preparing the cash flow, the calculation of cash inflow is obtained from health service levies and subsidies provided through the APBD, while the cash outflow is obtained from the components of hospital management costs. The details of the cash flow can be presented in the table and diagram as follows:

1) Alternative Tariff 1

Based on the cash flow calculation prepared in alternative tariff 1, the net cash flow still shows a negative value in year 7, while in year 8 the net cash flow starts to show a positive value. At the end of the investment year, the net cash flow reaches a value of Rp. 720,017,665,526.

Year	Inflow (Rp)	Outflow (Rp)	Cashflow (Rp)	Net Cashflow (Rp)
0		684,974,889,676	-684,974,889,676	-684,974,889,676
1	197,333,400,000	204,239,448,243	-6,906,048,243	-691,880,937,919
2	224,941,680,000	211,227,705,204	13,713,974,796	-678,166,963,124
3	256,413,460,320	218,607,578,769	37,805,881,551	-640,361,081,573
4	292,289,479,574	226,403,125,028	65,886,354,547	-574,474,727,026
5	333,186,165,797	234,640,123,523	98,546,042,275	-475,928,684,751
6	379,806,231,655	243,346,210,666	136,460,020,989	-339,468,663,762
7	432,950,752,864	252,551,024,430	180,399,728,434	-159,068,935,329
8	493,532,937,458	262,286,361,320	231,246,576,138	72,177,640,809
9	562,593,822,594	272,586,346,729	290,007,475,865	362,185,116,674
10	641,320,168,760	283,487,619,907	357,832,548,853	720,017,665,526

Table 1. Projected Cash Flow of Alternative 1

Source: Author's Processed Data (2024)

2) Alternative Tariff 2

Based on the cash flow calculation prepared in alternative tariff 2, the net cash flow still shows a negative value in year 8, while in year 9 the net cash flow starts to show a positive value. At the end of the investment year, the net cash flow reaches a value of Rp. 433,035,338,838.

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Year	Inflow (Rp)	Outflow (Rp)	Cashflow (Rp)	Net Cashflow (Rp)
0		684,974,889,676	-684,974,889,676	-684,974,889,676
1	197,333,400,000	204,239,448,243	-6,906,048,243	-691,880,937,919
2	221,732,592,000	211,227,705,204	10,504,886,796	-681,376,051,124
3	249,160,921,440	218,607,578,769	30,553,342,671	-650,822,708,453
4	279,996,105,264	226,403,125,028	53,592,980,236	-597,229,728,216
5	314,663,181,498	234,640,123,523	80,023,057,975	-517,206,670,241
6	353,640,467,457	243,346,210,666	110,294,256,791	-406,912,413,450
7	397,466,272,132	252,551,024,430	144,915,247,701	-261,997,165,748
8	446,746,458,730	262,286,361,320	184,460,097,409	-77,537,068,339
9	502,162,965,667	272,586,346,729	229,576,618,938	152,039,550,599
10	564,483,408,146	283,487,619,907	280,995,788,239	433,035,338,838

Table 2. Projected Cash Flow of Alternative 2

Source: Author's Processed Data (2024)

3) Alternative Tariff 3

Based on the cash flow calculation prepared in alternative tariff 3, the net cash flow still shows a negative value in year 9, while in year 10 the net cash flow starts to show a positive value. At the end of the investment year, the net cash flow reached a value of Rp. 493,823,616,193.

Year	Inflow (Rp)	Outflow (Rp)	Cashflow (Rp)	Net Cashflow (Rp)
0		684,974,889,676	-684,974,889,676	-684,974,889,676
1	197,333,400,000	204,239,448,243	-6,906,048,243	-691,880,937,919
2	220,778,808,000	211,227,705,204	9,551,102,796	-682,329,835,124
3	251,067,329,760	218,607,578,769	32,459,750,991	-649,870,084,133
4	280,879,695,955	226,403,125,028	54,476,570,927	-595,393,513,205
5	319,589,787,648	234,640,123,523	84,949,664,126	-510,443,849,079
6	357,515,175,560	243,346,210,666	114,168,964,894	-396,274,884,185
7	407,016,786,393	252,551,024,430	154,465,761,963	-241,809,122,222
8	455,285,182,528	262,286,361,320	192,998,821,208	-48,810,301,014
9	518,623,469,614	272,586,346,729	246,037,122,885	197,226,821,871
10	580,084,414,229	283,487,619,907	296,596,794,322	493,823,616,193

Table 3. Projected Cash Flow of Alternative 3

Source: Author's Processed Data (2024)

Alternative Tariff 4

With an additional subsidy of Rp. 16,500,000,000 in year 1 and gradually decreasing by 5% in the following years, based on the cashflow calculation prepared in tariff alternative 4, the net cashflow still shows a negative value in year 7, while in year 8 the net cashflow starts to show a positive value. At the end of the investment year, the net cash flow reaches a value of Rp. 626,240,426,244.

Year	Inflow (Rp)	Outflow (Rp)	Cashflow (Rp)	Net Cashflow (Rp)
0		684,974,889,676	-684,974,889,676	-684,974,889,676
1	213,833,400,000	204,239,448,243	9,593,951,757	-675,380,937,919
2	236,453,808,000	211,227,705,204	25,226,102,796	-650,154,835,124
3	265,958,579,760	218,607,578,769	47,351,000,991	-602,803,834,133
4	295,026,383,455	226,403,125,028	68,623,258,427	-534,180,575,705
5	333,029,140,773	234,640,123,523	98,389,017,251	-435,791,558,454
6	370,282,561,029	243,346,210,666	126,936,350,363	-308,855,208,091
7	419,145,802,589	252,551,024,430	166,594,778,158	-142,260,429,933
8	466,807,747,914	262,286,361,320	204,521,386,594	62,260,956,661
9	529,569,906,731	272,586,346,729	256,983,560,002	319,244,516,662
10	590,483,529,490	283,487,619,907	306,995,909,582	626,240,426,244

Table 4. Projected Cash Flow of Alternative 4

Source: Author's Processed Data (2024)

Based on the presentation of the cashflow table and net cashflow diagram of the 4 (four) tariff alternatives as previously described, it certainly illustrates the condition of investment performance on each tariff alternative. However, to find out more accurately the investment performance, further analysis needs to be done by taking into account the investment feasibility parameters that have been determined. Investment evaluation of North Surabaya Hospital needs to be carried out to determine the feasibility of investment during the life of the investment plan. In this research, investment evaluation is analyzed using several parameters. From the calculation results of each parameter, an analysis will then be carried out on the investment feasibility of each alternative that has been determined.

The results of the North Surabaya Hospital investment evaluation on predetermined parameters are presented in the following table:

Service Alternative	NPV (Rp)	IRR (%)	BCR	PP (Year)	Conclusion
Alternative 1	211,014,227,005	9.85	1.23	7.69	Feasible
Alternative 2	28,416,192,984	6.57	1.14	8.34	Not Feasible
Alternative 3	66,444,241,124	7.30	1.16	8.20	Not Feasible
Alternative 4	166,294,504,181	9.26	1.20	7.70	Feasible

Table 5. Investment Evaluation Results of North Surabaya Hospital

Source: Author's Processed Data (2024)

Sensitivity Analysis of Management Fees

Sensitivity Analysis of Hospital Management Costs is presented in the following table:

%	NPV	IRR	PP	BCR	Conclusion
Alternati	ve 1 (increase)				
2.04%	175,465,177,107	9.212%	7.85	1.21	Feasible
2.05%	175,290,917,059	9.209%	7.85	1.55	Not Feasible
Alternati	ve 2 (decrease)				
7.72%	162,944,950,439	9.211%	7.68	1.21	Not Feasible
7.73%	163,119,210,488	9.215%	7.85	1.59	Feasible
Alternative 3 (decrease)					
5.70%	165,772,468,779	9.209%	7.89	1.21	Not Feasible
5.71%	165,946,728,827	9.212%	7.89	1.58	Feasible
Alternative 4 (increase)					
0.14%	163,854,863,502	9.212%	7.71	1.20	Feasible
0.15%	163,680,603,454	9.209%	7.87	1.54	Not Feasible

Table 6. Sensitivity Analysis of Management Fee

Source: Author's Processed Data (2024)

Based on the table above, the following conclusions can be drawn:

- 1. Alternative 1 is not feasible and becomes sensitive if there is an increase in hospital operating costs above 2.05%;
- 2. Alternative 2 is feasible and sensitive if there is a decrease in hospital operating costs above 7.73%;
- 3. Alternative 3 is feasible and sensitive if there is a decrease in hospital operating costs above 5.7%;
- 4. Alternative 4 is not feasible and becomes sensitive if there is an increase in hospital operating costs above 0.15%.

Sensitivity Analysis of Retribution Rates

Sensitivity Analysis of Hospital Retribution Rates is presented in the following table:

Alternative 1 (decrease) 1.38% 174,601,690,499 9.212% 7.84 1.22 Feasible 1.39% 174,337,831,539 9.207% 7.84 1.56 Not Feasible Alternative 2 (increase) - - - - 5.58% 165,460,522,469 9.208% 7.71 1.20 Not Feasible 5.59% 165,706,121,626 9.213% 7.89 1.55 Feasible Alternative 3 (increase) - - - - 4.07% 167,950,839,494 9.211% 7.75 1.21 Not Feasible 4.08% 168,200,241,456 9.215% 7.93 1.55 Feasible Alternative 4 (decrease) - - - - 0.09% 163,960,021,290 9.215% 7.71 1.20 Feasible	%	NPV	IRR	PP	BCR	Conclusion			
1.38% $174,601,690,499$ $9.212%$ 7.84 1.22 Feasible $1.39%$ $174,337,831,539$ $9.207%$ 7.84 1.56 Not FeasibleAlternative 2 (increase) $$	Alternat	Alternative 1 (decrease)							
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Alternative 2 (increase) Image: Constraint of the second sec	1.39%	174,337,831,539	9.207%	7.84	1.56	Not Feasible			
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4.07% 167,950,839,494 9.211% 7.75 1.21 Not Feasible 4.08% 168,200,241,456 9.215% 7.93 1.55 Feasible Alternative 4 (decrease) 9.215% 7.71 1.20 Feasible	Alternat	ive 3 (increase)							
4.08% 168,200,241,456 9.215% 7.93 1.55 Feasible Alternative 4 (decrease) 0.09% 163,960,021,290 9.215% 7.71 1.20 Feasible	4.07%	167,950,839,494	9.211%	7.75	1.21	Not Feasible			
Alternative 4 (decrease) 0.09% 163,960,021,290 9.215% 7.71 1.20 Feasible	4.08%	168,200,241,456	9.215%	7.93	1.55	Feasible			
0.09% 163,960,021,290 9.215% 7.71 1.20 Feasible	Alternative 4 (decrease)								
	0.09%	163,960,021,290	9.215%	7.71	1.20	Feasible			
0.10% 163,700,634,302 9.210% 7.87 1.54 Not Feasibl	0.10%	163,700,634,302	9.210%	7.87	1.54	Not Feasible			

Table 7. Sensitivity Analysis of Retribution Rates

Source: Author's Processed Data (2024)

Based on the table above, the following conclusions can be drawn:

- 1. Alternative 1 is not feasible and becomes sensitive if there is a decrease in the hospital service charge rate above 1.39%;
- 2. Alternative 2 is feasible and sensitive if there is an increase in the hospital service charge rate above 5.59%;
- 3. Alternative 3 is feasible and sensitive if there is an increase in the hospital service charge rate above 4.08%;
- 4. Alternative 4 is not feasible and becomes sensitive if there is a decrease in the hospital service charge rate above 0.10%;

4. CONCLUSION

By considering the results of data analysis related to the North Surabaya Hospital investment in this study, and the results of investment evaluation and sensitivity analysis of management costs and potential income of North Surabaya Hospital on the parameters of Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP) and Benefit Cost Ratio (BCR), it results in the following conclusions. First, Alternative 1 is feasible to implement, but will become sensitive to infeasible if there is an increase in hospital operating costs above 2.05% or a decrease in hospital service levy rates above 1.39%. Second, Alternative 2 is not feasible to implement, but will become sensitive of 7.73% or an increase in hospital service levy rates above 5.59%. Third, Alternative 3 is not feasible to implement, but will become sensitive and feasible if an increase in hospital service levy rates above 5.59%. Third, Alternative 3 is not feasible to implement, but will become sensitive and feasible to implement, but will become sensitive and feasible if there is an increase in hospital service levy rates above 5.59%.

feasible if there is a decrease in hospital operating costs above 5.7% or an increase in hospital service levy rates above 4.08%. Lastly, Alternative 4 is feasible, but will become sensitive to infeasible if there is an increase in hospital operating costs above 0.15% or a decrease in hospital service levy rates above 0.10%.

For project owners, in determining the tariff setting policy, they can consider choosing the highest alternative tariff scheme, namely alternative 1 or 4. However, the Hospital management can apply lower tariff schemes, namely alternative tariffs 2 and 3 if needed while still paying attention to the limits according to the sensitivity analysis.

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