ANALYSIS OF PAYBACK PERIOD, NPV, IRR, PI AND ROI OF COMPUTED TOMOGRAPHY SCAN (CT-SCAN) MEDICAL EQUIPMENT (CASE STUDY OF CARUBAN REGIONAL PUBLIC HOSPITAL)

[1]Andrea Wahyu Ferdiawan, [2]Muhammad Imron, [3]Andik Susanto

[1,2,3]Management, Faculty of Economics, Universitas Merdeka Madiun, Madiun, Indonesia

Author's email:
[1]andrea.wahyu@unmer-madiun.ac.id, [2]muhammad.imron@unmer-madiun.ac.id,[3]andiksusanto@unmer-madiun.ac.id

Corresponding author: andiksusanto@unmer-madiun.ac.id

Abstract. *This study aims to analyze the financial feasibility of procuring Computed Tomography Scan (CT-Scan) medical equipment at the Caruban Regional Public Hospital. In the context of improving the quality of healthcare services, this investment is expected to support government programs in enhancing the community's health status. The analysis methods used include Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), and Return on Investment (ROI). The analysis results indicate that the procurement of the CT-Scan equipment is financially feasible, with a Payback Period showing an optimal payback time of 2.38 years and a positive NPV of IDR 505,022,716. The obtained IRR also indicates that the expected return is greater than the cost of capital (IRR of 25% > 9.48%). By using a PI of 1.72 and an ROI of 45.7%, this study provides a clear picture of the investment efficiency in improving the quality of services and the financial performance of the hospital. This research contributes to a better understanding of the application of investment analysis methods in the healthcare sector, while also providing recommendations for rational investment decision-making to enhance the effectiveness of hospital financial management.*

Keywords: *Investment, IRR, NPV, PP, ROI.*

1. INTRODUCTION

The Investment return analysis is very important in investment decision-making, especiallly related to the procurement of medical equipment. The purpose of this analysis is to assess the effectiveness on investments in generating profit or benefits. Additionally, this analysis serves to minimize risks and support more effective resource allocation and improve accountability in hospital financial management.

Payback Period becomes the main method used to measure the time required to recover the initial investment, such as the procurement of CT-Scan equipment at Caruban Regional Public Hospital. By knowing the PP, the hospital can schedule when the investment will start to yield financial benefits. However, despite the advantages of the Payback Period in its straightforward calculations, this method also has several weaknesses, such as not accounting for the time value of money, ignoring cash flows after the break-even point, and not considering investment risk factors. Therefore, it is important to use this method in combination with other analyses.

Previous research by Gustirani (2017) indicated that the investment in CT-Scan is feasible based on a Payback Period that is shorter than the lifespan of the investment. However, this research will focus on Caruban Regional Public Hospital to provide a deeper understanding of the feasibility of the CT-Scan investment. In addition to the Payback Period, this study will also utilize the Net Present Value (NPV) method to provide a more accurate picture of the long-term financial impact of the CT-Scan investment. The findings of Fitria (2024) demonstrate the importance of NPV, where even though the Payback Period shows a quick return of capital, NPV indicates a negative cash flow in the early period.

In this analysis, the Internal Rate of Return (IRR) will also be included. This method facilitates the interpretation of the expected return on investment and allows for comparisons between projects. The results of Nugroho's (2024) study prove that IRR is very useful in analyzing investment activities. Furthermore, Profitability Index (PI) and Return on Investment (ROI) will also be used to express the efficiency and effectiveness of the investment. With this approach, the research will provide a comprehensive and thorough analysis of the feasibility of CT-Scan investment.

The implementation of CT-Scan equipment at Caruban Regional Public Hospital is expected to provide significant benefits to patients and enhance the quality of healthcare services and the hospital's reputation. Given the increasing demand for CT-Scan examinations, this analysis becomes very relevant and important for the community.

2. LITERATURE REVIEW

2.1 Payback Period (PP)

The payback period is a specific timeframe that indicates the occurrence of cumulative cash inflows equal to the investment amount in present value terms (Ibrahim, 1997). This explanation emphasizes that the payback period is not just about calculating time, but also considers the time value of money. In other words, the concept of present value in the payback period provides significant meaning in investment decision-making, allowing stakeholders to more easily evaluate the feasibility and potential profitability of the projects to be undertaken. The formula for PP according to Ibrahim (1997) can be elaborated as follows.

$$\boldsymbol{Payback\ Period} = \mathrm{Tp} - 1 + \frac{Ii - B\ icp - 1}{B\ p}$$

From the elaboration of the payback period formula, indicators are needed to determine whether the results are good or not. The indicators for the payback period according to Sartono (2004) are as follows:

1. If the payback period is shorter than the maximum payback period, then the project is deemed feasible.
2. If it is longer than the maximum payback period, then it is not feasible.

2.2 Net Present Value (NPV)

According to Sartono (2004), Net Present Value (NPV) is the difference between the present value of net cash inflows, often referred to as proceeds, and the present value of investments. This approach emphasizes the importance of not only considering cash inflows and outflows but also how the value of these cash flows is measured in the context of time. According to Ibrahim (1997), the NPV formula can be elaborated as follows.

$$\boldsymbol{Net\ Present\ Value}\ (\mathbf{NPV}) = \sum_{t}^{n} 1 \frac{NBi}{(1+i)^n}$$

In calculating NPV, it is necessary to have a reference to make future decisions, which is an indicator. The NPV indicators according to Ibrahim (1997:146) are as follows:
1. If the NPV calculation results in a positive value, then the investment project is predicted to generate profits greater than the initial costs incurred.
2. If the NPV calculation results in zero, then the investment project is predicted not to generate any profit or loss. The project is at the break-even point

2.3 Internal Rate of Return (IRR)

Internal Rate of Return is a discount rate that results in a net present value of zero (0) (Ibrahim, 1997). In other words, IRR indicates the rate of return at which the total expected cash flows from an investment are equal to the initial investment costs, indicating the break-even point. The formula for IRR according to Ibrahim can be elaborated as follows.

$$\boldsymbol{IRR} = i1 + \frac{NPV1}{NPV1 - NPV2} + (i1 - i2)$$

According to Ibrahim (1997:147), the IRR indicators are as follows:

1. If the IRR calculation results are greater than the Social Opportunity Cost of Capital (SOCC), then the project is considered feasible.
2. If it is equal to the SOCC, it means the project breaks even, and if it is below the SOCC, then the project is not feasible.

2.4 Profitability Index (PI)

To understand more deeply about the profitability index, we refer to the explanation that the profitability index is a comparison between the present value of all the returns obtained and the total investment made. According to Gitosudarmo (1996), the profitability index is the comparison between the present value of all proceeds and the total investment. In other words, PI provides an overview of how effectively a project generates profit relative to the costs incurred. The PI formula according to Gitosudarmo (1996) is defined as follows.

$$\boldsymbol{Profitability\ Index} = \frac{P1/(1+i)^1}{\mathrm{I}}$$

The indicators of the Profitability Index (PI) results according to Samryn (2013) are as follows:

1. PI > 1: The project is financially feasible. A value greater than 1 indicates a more profitable project.
2. PI = 1: The project will generate a return exactly equal to its investment cost.
3. PI < 1: The project is not financially feasible because the present value of cash inflows is less than the investment cost.

2.5 Return on Investment (ROI)

One of the ratios commonly used to assess investment success is Return on Investment (ROI). The advantage of Return on Investment (ROI) is its ease of interpretation. According to Hutabarat (2023), Return on Investment is a ratio that measures how far the invested capital can provide returns in accordance with expectations. ROI illustrates how efficient an investment is in generating profits. By using ROI, a company can determine whether the investment made is profitable or not. The ROI formula according to Hutabarat (2023) is elaborated below.

$$\boldsymbol{Return\ on\ Investment} = \frac{EAT}{Asset\ Total}\, x\ 100\%$$

The researcher elaborates the criteria for Return on Investment (ROI) according to Hutabarat (2023) as follows:

1. A positive ROI value indicates that the investment generates profit.
2. An ROI that is higher than the cost of capital indicates that the project is capable of generating returns greater than the costs incurred to obtain the investment funds.

3. RESEARCH METHODS

The research method to be conducted in this study is descriptive quantitative research. Quantitative research is a method based on the philosophy of positivism, used to study specific populations and samples. Data is collected using research instruments, and data analysis is quantitative/statistical in nature, with the aim of testing the hypotheses that have been applied (Sugiyono, 2022). This research was conducted at RSUD Caruban with a duration from November to January. The timing was chosen to assess the feasibility of CT-Scan equipment investment, considering the urgency of the hospital in serving patients from three sub-districts, which makes it quite busy. This

investment feasibility analysis is expected to encourage other hospitals to follow a similar path.

The research instrument used is the financial report in the field of radiology at RSUD Caruban. The data analysis stages involve compiling cash flows and profit and loss statements based on the information provided by the hospital. Subsequently, the data is analyzed using the Payback Period (PP), Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), and Return on Investment (ROI) methods. Based on the criteria described in the theoretical framework, this research will conclude whether the investment in the CT-Scan equipment is feasible or not.

4. RESULTS AND DISCUSSION

4.1 Payback Period (PP)

To calculate the Payback Period for the purchase of the Toshiba Asteion 4-Slice CT Scanner priced at Rp 1,105,000,000, the researcher detailed the net cash flows generated by RSUD Caruban during the period from 2020 to 2024. The researcher calculated the time required for the company to recover its investment from the cash inflows.

Table 1. Net Cash Flow 2020-2024

Year	Net Cash Flow (IDR)
2020	Rp 504.100.000
2021	Rp 461.500.000
2022	Rp 442.500.000
2023	Rp 409.500.000
2024	Rp 396.500.000

(Source: secondary data, 2025.)

Next, the researcher calculates the net cash accumulation from year to year and then compares it with the total investment. The researcher presents the net cash accumulation (Net Cash Flow) as follows.

Table 2. Calculation of Payback Period

Year	Net Cash Flow (IDR)	Accumulate Net Cash Flow (IDR)	Description
2020	Rp 504.100.000	Rp 504.100.000	Not yet reaching the investment
2021	Rp 461.500.000	Rp 965.600.000	Not yet reaching the investment
2022	Rp 442.500.000	Rp 1.408.100.000	Investment has been paid off

(Source: processed by researcher, 2025.)

The conclusion of the payback period calculation shows that based on the net cash flow in 2022 amounting to Rp 442,500,000, the company still needs to reach the remaining investment of Rp 139,400,000. The time needed to achieve this remaining investment is approximately 0.315 years, which is equivalent to about 3.8 months. Therefore, the total payback period for the investment in the Toshiba Asteion 4-Slice CT Scanner is approximately 2 years and 3.8 months by the end of 2022.

4.2 Net Present Value (NPV)

The researcher outlines the initial investment amounting to -Rp 1,105,000,000 (considered negative because it represents cash flow). The cash flow per year (from the cash flow table) is as follows:

a. 2020: Rp 504,100,000
b. 2021: Rp 461,500,000

c. 2022: Rp 442,500,000
d. 2023: Rp 409,500,000
e. 2024: Rp 396,500,000

Furthermore, the researcher presents the BI Rate for each year (in decimal) as follows:
a. 2020: 4.25% → 0.0425
b. 2021: 3.50% → 0.0350
c. 2022: 4.04% → 0.0404
d. 2023: 5.77% → 0.0577
e. 2024: 6.14% → 0.0614

The researcher outline the calculation of PVIF (Present Value Interest Factor) or the present value factor. The function of PVIF is to understand how much present value of money to be received in the future is. The researcher present PVIF as follows.

a. Year 0 (2020) : $PVIF = \frac{1}{(1+0.0425)^0} = 1$
b. 1st Year (2020) : $PVIF = \frac{1}{(1+0.035)^1} = 0.9662$
c. 2nd Year (2021) : $PVIF = \frac{1}{(1+0.0404)^2} = 0.9238$
d. 3rd Year (2022) : $PVIF = \frac{1}{(1+0.0577)^3} = 0.8451$
e. 4th Year (2023) : $PVIF = \frac{1}{(1+0.0614)^4} = 0.7879$
f. 5th Year (2024) : $PVIF = \frac{1}{(1+0.0614)^4} = 0.7385$

Next, the researcher outlines the NPV calculation using the PVIF that was calculated in the previous step. The researcher presents the NPV calculation as follows.

Table 3. Calculation of Payback Period

Year	Net Cash Flow (IDR)	PVIF	NPV (IDR)
0	(Rp 1.105.000.0000)	1.0000	(1,105,000,000)
2020	Rp 504.100.000	0.9662	487,053,140.10
2021	Rp 461.500.000	0.9238	426,354,664.11
2022	Rp 442.500.000	0.8451	373,960,526.00
2023	Rp 409.500.000	0.7879	322,654,385.90
2024	Rp 396.500.000	0.7385	292,989,423.29
NPV			**Rp 505.022.716**

(Source: processed by researcher, 2025.)

Referring to the applicable BI Rate each year, the Net Present Value (NPV) calculation yields an amount of Rp 505,022,716. This positive NPV result indicates that the project can not only cover the initial investment costs but also has the potential to generate substantial profits.

4.3 Internal Rate of Return (IRR)

Based on the NPV calculation, the researcher performs the IRR calculation from the NPV output with discount factor amount is 25%. The researcher presents the NPV table as follows.

Table 4. Calculation of IRR

Tahun	Net Cash Flow (IDR)	NPV (*Discount Factor = 20%)*	NPV (*Discount Factor = 25%)*
0	(Rp 1.105.000.000)	(Rp 1.105.000.000)	(Rp 1.105.000.000)
2020	Rp 504.100.000	Rp 420,083,333	Rp 403,280,000

2021	Rp 461.500.000	Rp 384,583,333	Rp 369,600,000
2022	Rp 442.500.000	Rp 366,250,000	Rp 353,500,000
2023	Rp 409.500.000	Rp 340,833,333	Rp 336,000,000
2024	Rp 396.500.000	Rp 317,500,000	Rp 319,500,000
	NPV	**Rp 248.472.929**	**Rp 117.856.320**

(source: processed by researcher, 2025.)

Based on the previous calculations, the researcher outlines that:
1. r1 (discount 20%): NPV1 = Rp 248,472,929.53
2. r2 (discount 25%): NPV2 = Rp 117,856,320.00

From the calculations above, the researcher presents the IRR formula as follows.

$$\boldsymbol{IRR} = 0.20 + \left(\frac{248{,}472{,}929.53}{(284{,}472{,}929.53 - 117{,}856{,}320.00)} \right) x\ (0.25 - 0.20)$$

$$\boldsymbol{IRR} = 0.20 + \left(\frac{248{,}472{,}929.53}{130{,}616{,}609.53} \right) x\ 0.05$$

$$\boldsymbol{IRR} = 0.20 + (\ 1.9001981385) x\ 0.05$$

$$\boldsymbol{IRR} = 0.20 + 0{,}095009907$$

$$\boldsymbol{IRR} = 0.295009907 = 0{,}25\ or\ 25\%$$

Based on the WACC calculation, the resulting WACC or Cost of Capital is 9.48%. The IRR, which lies between 20% and 25% and is greater than the WACC, indicates that every rupiahs invested in the purchase of the Toshiba Asteion 4-Slice CT Scanner is expected to generate more than what was spent. This suggests that the project will not only return the initial capital invested (Rp 1,105,000,000) but also provide substantial additional profits.

4.4 Profitabillity Index (PI)

Total NPV = 487.053.140,10 + 426.354.664,11 + 373.960.526,00 + 322.654.385,90 + 292.989.423,29

= Rp 1.902.012.139,40

Based on the NPV calculation above, the researcher performs the calculation using the PI formula.

$$\boldsymbol{PI} = \frac{1.902.012.139{,}40}{1.105.000.000}$$

$$\boldsymbol{PI} = 1{,}72$$

From the calculations above, after the researcher performed the calculation using the PI formula, the result obtained is 1.72. This indicates that the investment in the CT-Scanner is financially feasible since it is greater than 1.

4.5 Return on Investment (ROI)

ROI is used to complement the information in percentages regarding the feasibility of the investment. Based on the after-tax profit of Rp 505,022,716 and the total investment of Rp 1,105,000,000. From this information calculation:

$$\boldsymbol{Return\ on\ Investment} = \frac{EAT}{Asset\ Total}\ x\ 100\%$$

$$= \frac{505.022.716}{1.105.000.000} x\ 100\%$$
$$= 0{,}457x\ 100\%$$
$$= 45{,}70\ \%$$

From the previous calculations, the researcher obtained an ROI of 45.70%. This means that for every Rp 1,105,000,000 invested in the purchase of the CT-Scanner, RSUD Caruban is expected to gain a net profit of Rp 0.457 for every Rp 1 invested.

CONCLUSION

Based on all the analyses conducted on the investment in the CT-Scanner at RSUD Caruban, the researcher concludes that the analysis using various methods such as PP, NPV, IRR, PI, and ROI for the investment in the Toshiba Asteion 4-Slice CT Scanner is feasible. All indicators show that the purchase of this equipment will not only cover the investment costs but also provide substantial profits, thereby strengthening the financial and operational position of the hospital in delivering better healthcare services to the community.

REFERENCES

Fitria, A. (2024). Analisis Studi Kelayakan Usaha Dan Strategi Pengembangan Usaha. *Jurnal Ilmiah Multidisiplin Nusantara*. Retrieved from https://jurnal.padangtekno.com/index.php/jimnu/article/download/277/203

Gitosudarmo, I. (1996). *Prinsip Dasar Manajemen.* 1st Edition. Yogyakarta: BPFE Yogyakarta.

Gustirani, I. (2017). Analisis Investasi Proyek Pengadaan CT-Scanner Terhadap Pendapatan Perusahaan. *SIKAP Journal*. Retrieved from https://core.ac.uk/download/pdf/286345948.pdf

Hutabarat, F. (2023). *Analisa Laporan Keuangan : Perspektif Warren Buffet.* 1st Edition. Deepublish.

Ibrahim, Y. (1997). *Studi Kelayakan Bisnis.* 1st Edition. Jakarta: Rineka Cipta.

Nugroho, F. A. (2024). Analisis Kelayakan Investasi Pada Usaha Pertanian Sayur Menggunakan Metode NPV, IRR dan PP di Kampung Pojok Desa Jaya Mekar Kecamatan Padalarang Kabupaten Bandung Barat. *JSIM: Jurnal Ilmu Sosial dan Pendidikan*. Retrieved from https://www.jurnal.syntaximperatif.co.id/index.php/syntax-imperatif/article/download/465/390

Samryn. (2013). *Akuntansi Manajemen.* 4th Edition. Jakarta: Prenadamedia.

Sartono, A. (2004). *Manajemen Keuangan : Teori dan Aplikasi.* 4th Edition. Yogyakarta: BPFE-Yogyakarta.

Sugiyono. (2022). *Metode Penelitian : Kuantitatif, Kualitatif, dan R&D.* 22th Edition. Bandung: CV. Alfabeta.