MATEC Web of Conferences **406**, 11001 (2024) https://doi.org/10.1051/matecconf/202440611001
2024 RAPDASA-RobMech-PRASA-AMI Conference

Assessment of the financial feasibility of the rapid sand casting process using the discounted payback period

Anazo Msani[1*] and *Didier* Nyembwe[2]

[1]Department of Engineering Management, University of Johannesburg, South Africa
[2]Department of Mechanical and Mechatronic Engineering, Cape Peninsula University of Technology, South Africa

Abstract. The rapid sand casting of sand moulds has gained significant attention in the foundry industry. However, existing technologies for this process are still quite expensive, and financial assessments are required to justify the adoption of this process in foundries. To that end, a paper was previously published on the financial feasibility of the Voxeljet VX1000 system using the payback period method. This study takes the analysis one step further by considering the time value of money by using a discounted payback period method. The accuracy of the two methods as a means of providing accurate results is compared to guide local foundry men in adopting this process in the local foundry industry.

1 Introduction

Sand casting in the foundry industry has been regarded as the main process for producing casting components. This process involves molten metal being poured into the cavity of the sand mould to form the finished product [1]. The quality of the sand used for manufacturing sand moulds for casting plays a significant role in the quality of the final casting, affecting its strength and thermal expansion rate. The casting process is currently regarded as the key component in the production of metal equipment or tooling, thus making it a key player in the world's economy [2]. For the above reasons, it is important for the local foundry industry to keep abreast of global competition by adopting additive manufacturing (AM) for the manufacturing of sand moulds.

Three-dimensional printing (3DP) or additive manufacturing (AM), as it is also known, has evolved noticeably in the past years, and has gained traction in various industries as an efficient method to manufacture prototypes. This technology has since been available in South Africa for more than three decades, and its growth has been steadily recognised in research institutes and some universities [3]. Figure 1 shows the global market size for AM, which was estimated at USD17.99 billion in 2023, and is anticipated to reach around USD110.13 billion by 2033, if the predicted compound annual growth rate (CAGR) of 19.85% from 2024 to 2033 is realised. The growth factors driving AM include the attraction of investments and funding into 3D printing companies. Such startup investment drives innovation, which is recognised as a key factor in the market's growth and expansion [4].

* Anazo Msani: anazo.majoka.m@gmail.com

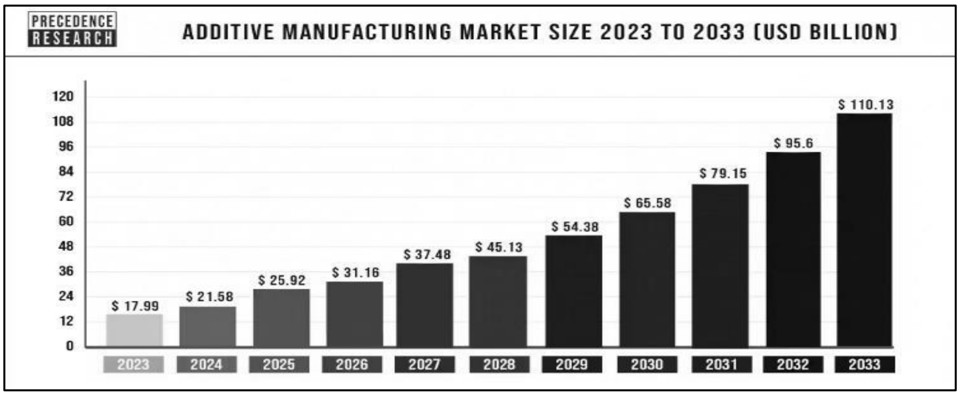

Fig. 1. Additive manufacturing market size [4]

The rapid sand casting process is defined as application of AM processes for direct production of sand moulds and cores, and this specific application of AM for creating sand moulds is known as binder jetting, a method that allows for the printing of sand moulds used in the foundry casting process as defined by various authors [5-9]. In rapid sand casting, a form of binder jetting, sand is deposited in single layers of a specified thickness by the 3D printer over the entire build box in which the mould will be built, and which is essential for foundry casting applications [6]. After each layer is deposited, the print head deposits binder, according to a computer-aided design (CAD), where the mould is going to be built. This enables the layers of sand to bind to each other only where the mould is being built. Once the part is complete, the sand is removed, leaving the completed mould. Figure 2 is a diagrammatic representation of the binder jetting process [10]. The binder jetting process utilizes various powdered raw materials, including metal, sand, plaster, and ceramic[11] depending on the type of component to be printed, and its application.

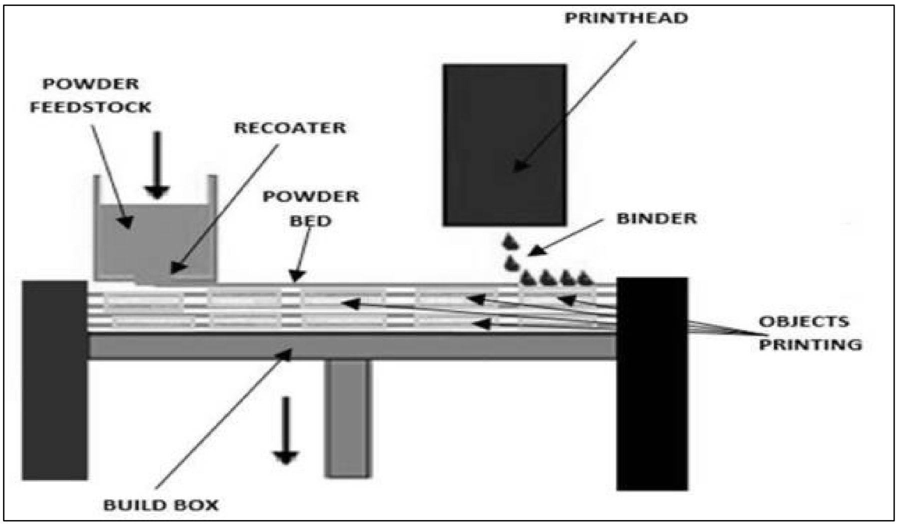

Fig. 2. Binder jetting process [10]

The use of CAD data [12] to manufacture a part or mould means waste material is minimised, thus making it more advantageous than traditional methods. In traditional manufacturing a part is shaped and formed by removing material, while the layer-by-layer format of AM adds material to build tailored parts for specific applications [13]. Other AM advantages include the cost-effectiveness of producing lightweight parts which are flexible in design [14]. Lighter parts reduce fuel consumption and improve efficiency. Another major advantage of AM over traditional methods is its elimination of the need for a pattern for the mould. Instead, a part can be designed directly using a CAD model, as demonstrated in Figure 3. The other reasons for the adoption of AM across various industries is its environmental advantages, including energy conservation and waste reduction[2].

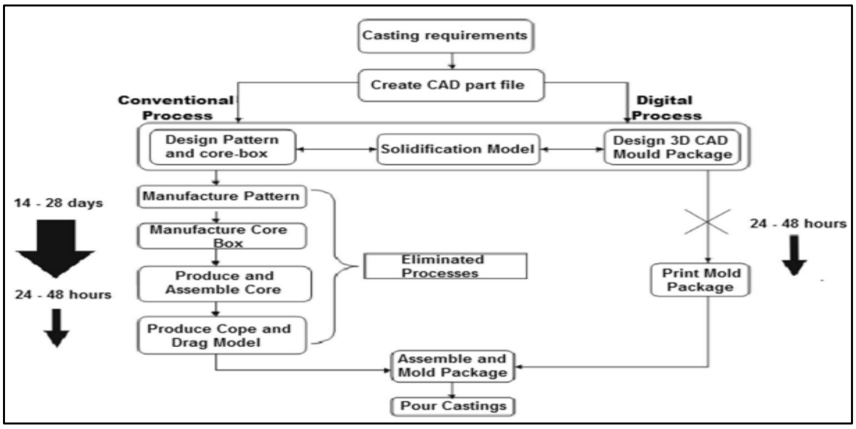

Fig. 3. Additive manufacturing comparison with traditional manufacturing method [7]

Despite its potential benefits, there remains a limited understanding of the viability of rapid sand casting within foundries, hindering its widespread adoption. Seated within the realm of the fourth industrial revolution (4IR), 3D printing continues to evolve, offering solutions to reducing manufacturing costs, producing intricate moulds, and streamlining pattern making processes in the industry [15]. Despite these advantages, the process of rapid sand casting has not penetrated the mainstream local foundry industry due to a lack of knowledge of the financial analysis that could be utilised to predict return on investment from this technology. In addition, the effects of machine parameters on the financial analysis remains poorly understood.

The Voxeljet VX1000 printers can make sand cores and moulds for foundries [16-17]. This machine and others that are accessible in South Africa for rapid sand casting are housed at different institutions, including the Vaal University of Technology (VUT) and University of Johannesburg (UJ). These institutions extend their services to industries, particularly foundries, assisting them in overcoming existing challenges [18], while they, in return, support students from various institutions in their research.

Previous research on the payback period (PP) has been carried out [19]. This current study analyses the discounted payback period (DPP), which factors in the time value of money (TVM) and compares it to the PP method. Besides reflecting the timing of the cash flows, a further advantage of the DPP is that it serves as a good indicator of profitability. The PP method has limitations: besides its failure to account for the time value of money (which recognises that money devalues over time), it ignores any cash flows that are generated after the decided cutoff date of the investment. This means it does not predict clearly the investment's performance in the future or the total value it will add.

This study analyses the costs of a sand mould printed for the foundry industry using the Voxeljet VX1000 printer housed at the Vaal University of Technology. The methodology of the analysis is outlined in the next section.

2 Methodology

This section outlines the methodology that was used to assess the feasibility of the rapid sand casting process using the DPP as opposed to the PP. Figure 4 outlines the phases of the methodology, beginning with the case study on which this study was based, i.e., the use of VX1000 for printing an impeller sand mould. This was followed by the direct cost model analysis of printing this impeller sand mould, which is comprised of the sand cost, the binder cost, the print head operational cost and the cleaner cost. After the cost of printing the impeller sand mould was determined and from that the income statement was generated to obtain the direct cash flows of this process. The income statement is comprised of three sections – the revenues, the cost of goods sold and the gross profit cash flows. The direct gross profit cash flows were subsequently used for the capital budgeting techniques, namely the DPP and the PP.

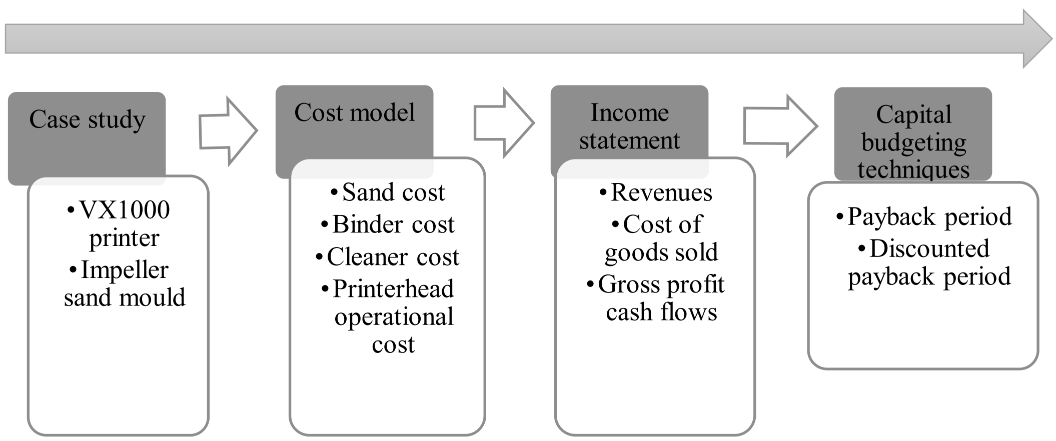

Fig. 4. The methodology of the study.

2.1 Case study

The case study was based on printing an impeller sand mould using the VX1000 printer available at VUT. Table 1 presents the dimensions of the impeller mould. It also includes the price of the VX1000 printer [20], its dimensions, and its printing parameters, all of which are crucial in the direct cost model analysis. The impeller sand mould was chosen because impellers are widely used, and the moulds required to cast them are one of the most complex that the VX1000 printer can print. The direct cost of printing the impeller sand mould was calculated using the dimensions of the mould, the printing parameters and the dimensions of the VX1000 printer. The following section discusses how the cost and the price were calculated using the information laid out in Table 1.

Table 1. The case study dimensions and printing properties of VX1000 printer.

The dimensions of the VX1000 printer	
Price of the printer	R15 200 000.00
Length (mm)	1 100

Width (mm)	637
Height (mm)	500
The printing parameters of the VX1000 printer	
Printing time per layer (seconds)	35
Layer thickness (mm)	0.30
Volume per layer (L)	0.210 21 (sand)
Weight per layer (kg)	0.336 (sand)
Density (kg/L)	1.60 (sand)
Bottom plate size (mm)	5
Dimensions of the impeller sand mould to be printed	
Height (mm)	310
Job volume (mm^3)	137 937 929.14
Total job volume (mm^3)	141 087 929.14
Total number of layers	1 050
Printing time of the mould (hours)	10.21

2.2 Cost model

This section calculates the cost of printing the impeller sand mould. A cost model is defined as a tool designed to extensively identify and categorise all costs associated with a production process, whether they are direct, indirect, variable or fixed. For this study, the cost model was specifically based on the direct cost of printing a mould using binder jetting with the VX1000 printer. The cost was calculated from the four main components: sand cost, binder cost, print head operational cost and cleaner cost. After the cost of printing a mould was calculated, the mark-up and VAT were added.

- The sand cost was calculated based on the per kg sand price, the height of the impeller mould, and the length and width of the printer's build platform, also taking into account the density of the silica sand, and the mixing ratio of the new sand with the reused sand.
- The binder cost was calculated by multiplying the binder distributed per layer by the total volume of the sand mould, the binder cost per unit and its safety factor. The safety factor helped account for any uncertainties in the binder usage per volume

per layer. The binder cost component also took into account the total number of layers to be printed which includes the layers of the sand mould to be printed and the layers of the bottom plate which acts as a base for the sand mould, the total volume of the sand mould and the layer thickness.

- The cleaner cost was determined by multiplying the number of layers by the amount of cleaner used per layer and the cleaner cost per litre.
- The print head operational cost was calculated based on its replacement cost and expected lifespan, considering the operational cost per hour and the total printing time for the mould. At the time of this study and as per the data collected at VUT, replacing the VX1000 printer's print head costed R750 000.00, and its lifespan was 6 000 hours. Consequently, the total operational cost of the printer was R125.00 per hour as shown in Table 2.

Table 2. VX1000 print head operational cost.

Print head operational cost per hour	
Replacement cost	R750 000.00
Lifetime of the printer	6000 h
Operational cost per hour	R125.00

2.2.1 The price of the impeller sand mould

Once the cost of printing a mould was calculated, the selling price of the mould was determined, inclusive of the mark-up and VAT. Benchmarking provides a reference point for comparing similar items, and this data was used to measure and compare with the performance of the foundry process, specifically in sand mould manufacturing. The median gross margin ratio from benchmarking data was used as a mark-up for this study, averaging years 1, 2, 3, 4 and 5, as shown in Table 3, to cost the impeller sand mould.

Table 3. Gross profit margins [21].

Years	**Gross profit margin**
1 (2019)	39.9%
2 (2020)	39.8%
3 (2021)	40.1%
4 (2022)	39.9%
5 (2023)	39.9%
Average	**39.9%**

2.3 The income statement

The income statement was calculated from the revenues, the cost of goods sold (COGS) and the gross profit cash flows (GPCF). The income statement that was used to calculate these three sections is presented in Appendix A.

- Revenues represent the income generated from selling the impeller sand moulds produced annually over five years. Based on this case study's impeller sand mould, the VX1000 printer can produce a total of 520 moulds annually, assuming that two moulds are printed each day over 260 operational days per year, excluding weekends and holidays.
- COGS reflects the direct expenses incurred in manufacturing the impeller sand moulds and was calculated by adding together the consumable costs and operational costs associated with printing the sand mould.
- GPCF were computed as the primary cash flow measure. These cash flows signify profits after deducting COGS, which include expenses directly linked to printing impeller sand moulds, serving as a key metric of operational efficiency. The GPCF were utilised as the main cash flow in the analysis of the financial feasibility of this process. These cash flows were projected from year 1 to 5, by subtracting the COGS from revenues.

In calculating the cash flows used for the analysis, the discount and inflation rates were considered. A discount rate is an interest rate used to calculate the current value of future cash flows, taking into account both the time value of money and its expected growth. In this study, a 7% South African interest rate was applied as the discount rate to discount the future cash flows of the rapid sand casting process to their current values. In the study, an inflation rate of 5%, based on South Africa's average consumer price index (CPI) from 2018 to 2023, was applied annually to adjust the income statement sections and cash flows for escalation purposes.

2.4 Capital budgeting techniques

Capital budgeting techniques are investment procedures used to analyse and evaluate a potential or proposed project or procedure through analysis of the cash flows generated by the proposed process [22]. The PP and DPP are two capital budgeting techniques. After calculating the three sections of the income statement discussed above, the GPCF was then used as the main cash flow to analyse the PP and the DPP for printing the impeller sand mould using the VX1000 machine. Figure 5 illustrates the procedure used in the study for calculating these two budgeting techniques.

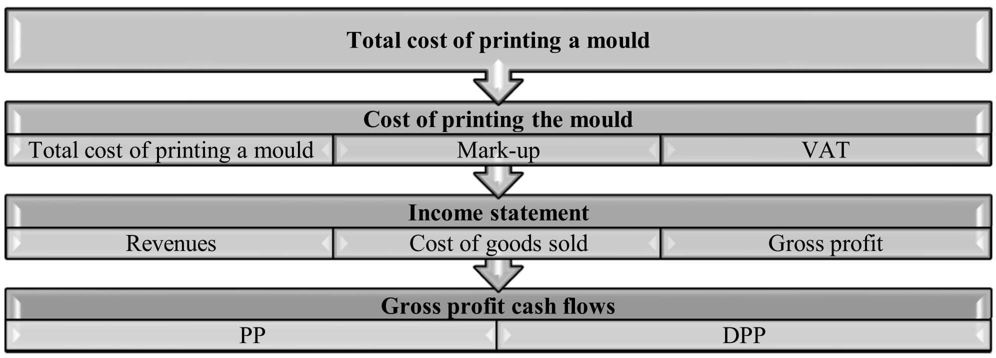

Fig. 5. The methodology used in calculating the PP and DPP.

Figure 6 illustrates the difference between these two techniques. Both methods consider two major components: the cash flows generated by the process or project, and the initial investment, which is the cost of purchasing the machine being analysed. The only difference being the discounted cash flows used in the DPP.

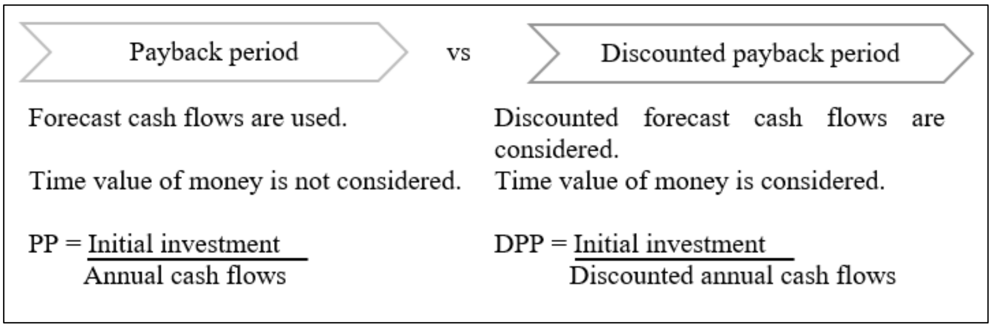

Fig. 6. The difference between calculating the PP and the DPP [22].

2.4.1 Payback period

The PP is defined as the time required to recover the initial investment of a project or reach the break-even point. While this method is easy to understand, one of its shortcomings is that it does not take into account the time value of money. Instead, it only considers the annual cash flow, with the duration dependent on the analysis of the proposed project. For the purpose of this study, the cash flows from the binder process were analysed over a five-year period to obtain the most accurate results. This duration was chosen based on the general principle that the lifespan of an investment in machinery is typically five years. The PP can be calculated in two forms: firstly, it can be calculated on the assumption that the cash flows remain constant for the period of analysis, i.e. each year's cash flow remains the same. The second method assumes that the cash flows generated per year change according to the inflation rate, and that the cash flows are accumulated until the initial investment or cost of the printer is recovered. Equation (1) is used when the cash flows are constant.

$$PP = \frac{Initial\ investment}{Annual\ cash\ flows} \tag{1}$$

2.4.2 Discounted payback period

As with the PP, the DPP measures the time required to recover the initial investment of a project. However, the DPP considers the time value of money. This means that the future cash flows in the DPP calculation are discounted to their current value, reflecting the changing value of money over time. Equation 2 illustrates the calculation of discounted cash flows used to calculate the DPP. In this equation, $(1+r)^n$ represents the discounting factor, where r is the discount rate, and n is the number of years of the analysis, in this case 5 years. The discount rate utilised was 7%, based on the average South African interest rate for the past five years. This interest rate accounts for both the present value of money and its expected future growth.

$$Discounted\ cash\ flows = \frac{Initial\ investment}{(1+r)^n} \tag{2}$$

3 Results and discussion

In this section the outcomes derived from the methodology detailed in Section 2 are presented. This includes the results of both the PP and DPP. In addition, these results are compared for the assessment and analysis of financial feasibility.

3.1 Cost model

Table 4 presents the cost model results, including the total price and the price of purchasing this machine. The mark-up of 39.9% used is based on benchmarking in the manufacturing process as discussed in Section 2.1.1.

Table 4. Cost model results for a VX1000.

Costing components	**Total cost and price of printing**
Sand cost	R834.11
Binder cost	R7 511.76
Printing head cost	R1 276.04
Cleaner cost	R72.38
Total printing cost	R9 694.29
Total price + Mark-up	R20 174.89 (39% mark-up)
Price of printing a mould (incl. VAT 15%)	R23 201.119

3.2 Capital budgeting techniques

Table 5 presents the cash flows calculated from the generated income statement for the VX1000 printer. The discounted GPCF were calculated using Equation 2, in Section 2.3.2, and they were used to calculate the PP and DPP. Appendix A shows in detail how the 3 sections of the income statement were calculated.

- PP_1 used Equation 1 to calculate the PP assuming a constant cash flow of the process from year 1 to 2.
- PP_2 was calculated using a GPCF that escalates each year based on inflation rate.
- DPP was calculated from the discounted GPCF.

Table 5. The three sections of the income statement for the VX1000 printer.

			PP_1	**PP_2**	**DPP**
Year	**Revenues**	**COGS**	**GPCF**	**GPCF**	**Discounted GPCF**
0	R0	R0	-R15 200 000.00	-R15 200 000.00	-R15 200 000.00
1	R12 064 581.94	R5 041 031.71	R7 023 550.24	R7 023 550.24	R6 564 065.64
2	R12 667 811.04	R5 293 083.29	R7 023 550.24	R7 374 727.75	R6 441 372.83
3	R13 301 201.59	R5 557 737.46	R7 023 550.24	R7 743 464.14	R6 320 973.33
4	R13 966 261.67	R5 835 624.33	R7 023 550.24	R8 130 637.34	R6 202 824.30
5	R14 664 574.75	R6 127 405.54	R7 023 550.24	R8 537 169.21	R6 086 883.66
			2.16 years	**2.10 years**	**2.35 years**

- PP_1 = 2.16 years
- PP_2 = In year 1, R7 023 550.24 of the initial investment of R15 200 000.00 would be recovered. In year 2, R14 398 277.99 would be recovered (R7 023 550.24 from year 1 and R7 374 727.75 from year 2). In year 3 only 10.35% of R7 743 464.14 would be needed to recover the whole amount of R15 200 000.00. Therefore, the PP_2 would be 2.10 years.
- DPP = In year 1, R6 564 065.64 would be recovered (year 1 of the initial investment of R15 200 000.00). In year 2, R13 005 438.47 would be recovered (R6 564 065.64 from year 1 and R6 441 372.83 from year 2). In year 3, only 34.72% of R6 320 973.33 would be recovered. Therefore, the DPP would be 2.35 years.

Figure 7 shows the analysis of the results of the different payback periods. Comparing the PP and DPP for the VX1000 printer demonstrates that accounting for the time value of money in future cash flows results in a longer overall payback time compared to not considering the time value of money. Due to accounting for the time value of money, the time taken to recover the initial investment is significantly longer. However, since this extended payback period still falls within the five-year timeframe of the analysis, the mould-printing process remains financially feasible for adoption by the local foundry industry.

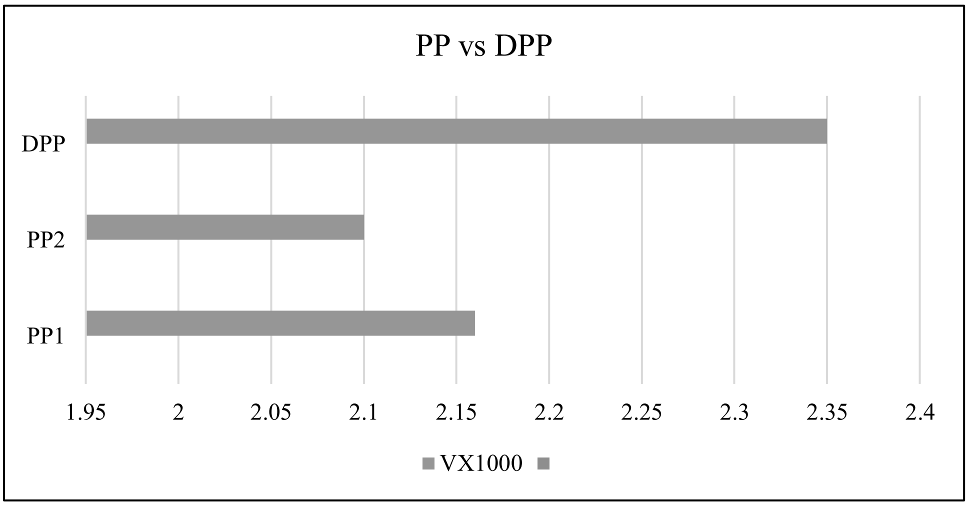

Fig. 7. The difference between calculating the PP and DPP.

4 Conclusion

Using the capital budgeting techniques method, this study assessed the financial feasibility of the rapid sand casting process used when printing an impeller sand mould on a VX1000 printer. The DPP was compared to the PP method, and both methods were proven to be financially feasible for adoption by the local foundry industry. The time taken to recover the initial investment falls within five years for both methods. Although the DPP takes longer than the PP due to the consideration of the time value of money, both still fall within the five-year analysis period of the study. The results also indicate that for a preliminary analysis of a process before making investment decisions, the payback period analysis can be used to estimate the time it might take to recover the initial investment.

5 Limitations

The study focused exclusively on the binder jetting process using the VX1000 printer to print impeller sand moulds. Due to the study being restricted to one type of machine, and one type of mould, the findings of this study cannot be extrapolated to other additive manufacturing technologies or machines used for sand mould printing.

6 Future work

This research represents the initial exploration of the economic feasibility of rapid sand mould printing using Voxeljet printer that uses binder jetting technology at VUT. The study offers an initial approach and preliminary findings using the payback period and discounted payback period methods, relying on cost modelling and technical assumptions. Future work will need to delve more deeply into how the local foundry industry approaches investments in new technologies, including regulated processes and procedures. Future work should also explore which investment techniques are most suitable for adoption of and investment in new technologies within the foundry industry. In addition, future studies would need to investigate other acceptable payback periods or discounted payback periods; and, if other methods such as net present value (NPV) or internal rate of return (IRR) are employed, when the break-even points are expected to occur. Future work will also concentrate on evaluating the economic feasibility by considering operating expenses, including asset depreciation and tax. Additionally, the cost of printing the sand mould will be compared to that of the traditional green sand mould method, which is the conventional approach to mould production.

References

1. K. G. Swift and J. D. Booker. *Manufacturing process selection handbook*, Butterworth-Heinemann (2013)
2. Y. Shi, J. Zhang, S. Wen, B. Song, C. Yan, Q. Wei, J. Wu, Y. Yin, J. Zhou, R. Chen, W. Zhou, H. Jia, H. Yang and H. Nan. Additive manufacturing and foundry innovation. China Foundry, **18**(4), pp. 286–295. doi: 10.1007/s41230-021-1008-8 (2021)
3. A. Msani and K. D. Nyembwe. Rapid sand casting in South Africa: Status quo and future: A literature review. Available: https://www.saiie.co.za/sites/default/files/2021-10/SAIIE32%20Proceedings%20Final%2020102021.pdf (2021)
4. Precedence Research. *Additive manufacturing market size to hit USD 110.13 bn by 2033*. Available: https://www.precedenceresearch.com/additive-manufacturing-market (2024)
5. K. D. Nyembwe, K. Van Der Walt, D. J. De Beer and E. Gonya. A case study of rapid sand casting defects. Available: https://core.ac.uk/download/222967871.pdf (2017)
6. S. Cecchel and G. Cornacchia. Additive Manufacturing for Rapid Sand Casting: Mechanical and Microstructural Investigation of Aluminum Alloy Automotive Prototypes. Metals, **14**(459). https://doi.org/10.3390/ met14040459 (2024).
7. S. D. Oguntuyi, K. Nyembwe, M. B. Shongwe, and T. Mojisola. Challenges and recent progress on the application of rapid sand casting for part production: A review. Int. J. Adv. Manuf. Tech. **126**(3–4), pp. 891–906. doi: 10.1007/s00170-023-11049-1 (2023)
8. M. Upadhyay, T. Sivarupan and M. El Mansori. 3D printing for rapid sand casting—A review. J. Manuf. Process. **29**(2017), pp. 211-220. http://dx.doi.org/10.1016/j.jmapro.2017.07.017 (2017)
9. C. Sithole and Nyembwe D.K. *Application of six sigma framework to rapid sand casting*. Available: https://site.rapdasa.org/wp-content/uploads/2020/04/381-Sithole.pdf (2019)
10. AZOTH3D. *What is a sintering in a binder jetting 3D printing process?* Available: https://www.azoth3d.com/what-is-a-sintering-in-a-binder-jetting-3d-printing-process/ (2021)
11. Abigail. *Explanation of binder jetting.* 3DSPRO. Available: https://3dspro.com/resources/blog/explanation-of-binder-jetting (2024)
12. International Standards Organization (ISO). ISO/ASTM 52900:2021(en): *Additive manufacturing: General principles: Fundamentals and vocabulary*. Available: https://www.iso.org/obp/ui/#iso:std:iso-astm:52900:ed-2:v1:en (2021)
13. E. Sánchez-García, J. Martínez-Falcó, B. Marco-Lajara and E. Manresa-Marhuenda. Revolutionizing the circular economy through new technologies: A new era of sustainable progress. ENVIRON. TECHNOL. INNO. **33**, 103509. doi: 10.1016/j.eti.2023.103509 (2024)
14. A. Bhatia and A. K. Sehgal. Additive manufacturing materials, methods and applications: A review. Mater. Today Proc. **81**(2), pp. 1060–1067. doi: 10.1016/J.MATPR.2021.04.379 (2023)

15. S. Rapulane. *VUT'S Technology Station for materials and processing technologies strengthens ties with industry*. Vaal University of Technology. Available: https://www.vut.ac.za/vuts-technology-station-for-materials-and-processing-technologies-strengthens-ties-with-industry/ (2023)
16. Voxeljet. N. D. VX1000 - Multi material 3D printer for small series. Available: https://www.voxeljet.com/industrial-3d-printer/prototyping/vx1000/
17. ExOne. N. D. Sand 3D printers. Available: https://www.exone.com/en-US/3D-printing-systems/sand-3d-printers
18. P. J. M. Van Tonder. *Development of a quality assurance framework for chemical coated sand used in Additive Manufacturing technologies*. Master's dissertation. Potchefstroom: North-West University (2019)
19. A. Msani and K. D. Nyembwe. *Technical and financial feasibility assessment of producing an impeller sand mould by three-dimensional printing using a Voxeljet VX 1000 machine.* MATEC Web of Conferences, **388**(09002) doi: 10.1051/matecconf/202338809002 (2023)
20. Voxeljet AG. *Industrial 3D printing. NYSE: VJET*. Available: https://s26.q4cdn.com/298067288/files/doc_multimedia/2020/01/VJET-Industrial-3D-Printing-(February-2020).pdf (2020)
21. Miscellaneous Manufacturing Industries: industry financial ratios benchmarking. N. D. Available: https://www.readyratios.com/sec/industry/39/
22. W. Kenton. *Capital budgeting: Definition, methods, and examples*. Investopedia. Available: https://www.investopedia.com/terms/c/capitalbudgeting.asp (2024)

Appendix A: Income statement for the VX1000 printer

Input variable of the income statement

Price of the VX1000 printer	R15 200 000.00
Volume of printed mould	141 087 929.14 mm^3
Total cost of printing mould	R9 694.29
Price of mould	R23 201.12
Number of moulds that can be printed per day	2 per print
Total number of operational days per year	260 days
Total number of moulds produced per year	520 moulds (2 moulds per print × 260 days)
Average inflation rate (from 2019 to 2023)	5%
Discount rate	7%

	0	**1**	**2**	**3**	**4**	**5**
Year	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Revenues		**R12 064 581.94**	**R12 667 811.04**	**R13 301 201.59**	**R13 966 261.67**	**R14 664 574.75**
Cost of goods sold		**R5 041 031.71**	**R5 293 083.29**	**R5 557 737.46**	**R5 835 624.33**	**R6 127 405.54**
Gross profit cash flows		**R7 023 550.24**	**R7 374 727.75**	**R7 743 464.14**	**R8 130 637.34**	**R8 537 169.21**
Discount factor	1.000	0.935	0.873	0.816	0.763	0.713
Discounted Gross Profit Cash Flows		**R6 564 065.64**	**R6 441 372.83**	**R6 320 973.33**	**R6 202 824.30**	**R6 086 883.66**