

Capital Project Appraisal

Power Loom Project

Business Report

For Melin Tregwynt

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Executive Summary

Melin Tregwynt is a weaving manufacturer and retailer, producing luxury woollen fabrics predominantly for the interiors market. The company became an Employee Ownership Trust (EOT) in 2022 with the aim of securing the business' future for the benefit of its employees. A partial deferred payment is due as a vendor loan, which the company needs to consider in its financial forecasting. The impacts of Brexit, the pandemic, and the current cost of living crisis have presented financial and logistical challenges for the company, and therefore considerations in financial management and planning are focused on profitability and financial security to ensure success for the EOT in concluding its first year and beyond.

Introduction

The aim of this project appraisal is to assess options to invest in a new power loom to replace one which is failing, impacting productivity. The company could invest in a new loom (Option A: 'OA'), which would be made to specification with a 6-9 months' lead time, or source a second-hand loom (Option B: 'OB'), with a 4-6 weeks' lead time. This project appraisal will present a financial analysis of both options, to reach a conclusion on the most beneficial investment for the company, balanced by wider considerations.

Use and Limitations of Models

The purpose of the financial project appraisal is to assess whether a favourable return is likely to be generated which satisfies the business' aims, considering the potential beneficial and challenging impacts. Commonly, future financial return is the primary goal; the higher the return on investment, the more attractive the project (Fields, 2011, p. 189; Marsh, 2012, p. 56). Financial risk is involved; a balanced assessment prior to investment can improve decision-making, although risk cannot be completely negated due to the uncertainties in future forecasting (Fields, 2011, p. 190). Although finance is the primary concern in the appraisal, wider factors should be considered, for example ecological and legal impacts (Marsh, 2012, p. 56, 62; Atrill and McLaney, 2019, p. 393).

Limitations	Models	Uses	Models
Does not consider the future value of money	PP; ARR	Considers future value of money	NPV; PI; BCR; IRR
Does not consider increased wealth	PP; PI; BCR; IRR, ARR	Considers increased wealth	NPV
Does not consider timing of cash flows	PP; IRR; ARR	Considers opportunity cost	NPV
Subjective benchmark for approval/elements based on judgement	PP; ARR; NPV	Simple method	PP; BCR; ARR
Does not consider rate of return	NPV; PP	Considers rate of return	PI; BCR; IRR; ARR
Does not consider scale of the project	PI; BCR; IRR; ARR	Considers liquidity	PP; PI

Table 1 (Fields, 2011, Chapter 10, p. 193, 200-202; p. 301; Marsh, 2012, p. 57, 58, 60; Patrick and French, 2016; Atrill and McLaney, 2019, Chapter 10, p. 370-391; Chen, 2021; CFI Education Inc., 2022; Hayes, 2022; Fernando, 2022).

The standard tools used in this appraisal are Payback Period (PP), Net-Present Value (NPV), Internal Rate of Return (IRR), Accounting Rate of Return (ARR), Profitability Index (PI), and Benefits Cost Ratio (BRC). These models are methods of analysing financial data for project assessment and comparison, utilised depending on the financial information available and business needs (Atrill and McLaney, 2019, p. 396-397). They vary in uses and limitations; utilising multiple models in analysis

provides a holistic perspective (Fields, 2011, p. 192; Marsh, 2012, p. 62; Atrill and McLaney, 2019, p.368-369, 396). Table 1 summarises these uses and limitations.

A common limitation across the models is the forecasted financial data is based on assumptions and therefore expected returns might not be achieved. Investors should balance the degree of risk posed by future uncertainties, against the increased wealth and rate of return that investment could generate (Atrill and McLaney, 2019, p. 380; CFI Education Inc., 2022; Fernando, 2022). One key distinction between these models concerns the time value of money. PP and ARR do not consider the future value of money, nor the timing of the projected cash flows. This is a limiting factor in their use as they do not consider any future depreciation of monetary value, the opportunity cost of investment, nor varying potential financial benefit across the project lifespan (Atrill and McLaney, 2019, p380-381). However, PP and ARR are simple to calculate and can act as initial screening tools when considering investment opportunities. Projects that meet the company's rationale can be analysed in further detail, compared with other model outcomes which do adjust data for the future value of money. However, rationale benchmarks for PP and ARR are set by judgement, therefore are flexible, and due to their limitations could potentially preclude beneficial projects from wider consideration when screened in this way (Atrill and McLaney, 2019, p.374, 378).

Companies can also utilise capital rationing to manage investment portfolios. Constraints are imposed on project investment, ensuring best practice in financial management. Under-performing prior investments may prompt increased business asset safeguarding. Hard rationing is undertaken to limit spending due to difficulties raising external capital. Soft rationing arises from internally set limits on desired company spending. The method creates a portfolio wherein the total resulting NPV is highest (Hayes, 2020). For indivisible projects investment is only possible if within the budget, but for divisible projects best return on investment is prioritised, and the remaining capital invested in a portion of the next most-profitable opportunity. This method can be useful to progress various projects across business departments, where present funds are limited, investing based on the highest combined expected return (Marsh, 2012, p. 61).

Discussion on Funding options

The most financially beneficial funding option should be identified, considering the levels of risk involved. Sources can be categorised as 'internal', using the company's liquid assets, and 'external',

obtaining funds from outside the company, and as 'long-term' and 'short-term' (Atrill and McLaney, 2019, p. 409). Internal sources include retained earnings for long-term financing and through management of working capital to improve short-term liquidity. The impact on relationships with shareholders, suppliers, and customers should be factored into funding decision-making (Atrill and McLaney, 2019, p.410-412). External sources of long-term financing include various forms of borrowings and issuing of shares. Bank overdrafts and debt factoring could be utilised for short-term external sources (Atrill and McLaney, 2019, p. 414, 428). Sourcing finance externally involves financial risk, for example the security of the business or its' assets in case obligations cannot be met (Atrill and McLaney, 2019, p. 415-416). Determining the appropriate source of funding for the specific project and business needs is important for a successful financial outcome (Fields, 2011, p. 223). Often, matching the longevity of financing with the longevity of the project type is beneficial (Marsh, 2012, p.63). Repayment terms and interest rates should also be considered when deciding on sources of financing (Marsh, 2012, p.75; Atrill and McLaney, 2019, p.430-431). For this long-term project, the company has decided to source 25% of the investment capital internally, and 75% externally. In sourcing long-term external finance for the project, the company's level of gearing may impact the lender's perception of risk (Marsh, 2012, p. 72).

Analysis

Table 2 shows the results of the financial modelling for the two options. An analysis of the results follows.

Model	Option A – New Loom	Option B – Second-hand Loom
Payback Period (PP)	1 year 3.5 months	5 months
Net Present Value (NPV)	£205,970	£269,370
Internal Rate of Return (IRR)	72.6%	235.22%
Accounting Rate of Return (ARR)	87.6%	286.7%
Profitability Index (PI)	3.19	9.68
Benefits-Cost Ratio (BCR)	2.19	8.68

Table 2 (See Appendix for financial data and calculations).

PP: The loan to partially finance the investment is over a 5-year term, which the company has set as the required payback period. Both options meet this requirement, with *OB* having the shortest period.

NPV: Both options show a return on investment should be generated. This suggests both options should increase wealth, with *OB* generating the higher return (Atrill and McLaney, 2019, p. 383, 386).

IRR: Both options have an IRR greater than the project's cost of capital. The IRR of *OB* is preferable at over 3 times higher than *OA* (Marsh, 2011, p. 60; Atrill and McLaney, 2019, p. 390).

ARR: Both options show a high ARR, with *OB* significantly higher, suggesting on average *OB* would generate a much higher rate of return when compared with its average investment cost (Atrill and McLaney, 2019, p. 374).

PI: Both options generate a PI exceeding 1, *OB* significantly, showing that the expected returns will exceed the cost of investment, indicating a profitable outcome (Fields, 2011, p.200; Chen, 2021).

BCR: The BCR for both options exceeds 1, reconfirming that they will generate a positive NPV and a favourable IRR. The significantly higher BCR of *OB* indicates the favourable balance between the NPV of cash flows and costs is greater compared with *OA* (Hayes, 2022).

Summary of Findings

As an initial screening tool, the payback period suggests either option could go ahead, but that *OB* would be favourable due to the much shorter payback period (Atrill and McLaney, 2019, p.376). The ARR supports this initial assessment, with *OB*'s significantly higher return. As neither PP nor ARR consider the future value of money, the other models aligning with these findings gives greater elucidation. NPV importantly shows that both options should increase company profits, again with *OB* leading, and this is supported by the IRR, which demonstrates a vast difference in return on investment between *OA* and *OB*. Similarly, PI and BCR present *OB* as more profitable and generating a higher rate of return respectively. In summary, both options create a favourable investment prospect for the company. However, *OB* is presented as the choice for maximised financial benefit.

Conclusion and Recommendation

If considered independently, the results of the analysis suggest that either option could proceed, both meeting the company's rationale and generating positive financial returns. However, considering the financial data presented, all models point to *OB* as the more favourable choice for the investment.

OA would be the more innovative choice due to additional development potential, for example skills expansion, improved data capture, advanced technology, and reduced waste through increased digitisation; but technological innovation is not the priority of the company in this case. The priority in this project is continued production and sales. The NPV result, endorsed by the other models, should be considered the key decision-making factor as it suggests cash gains which create greater security for the company to be able to repay the funding loan and generate capital for business use. Although

IRR, PI, and BCR all demonstrate the high profitability and rates of return generated by *OA*, these are surpassed by comparison with *OB*.

The significant difference between investment cost for *OA* and *OB* results in a substantially faster payback period for *OB*, reflected in *OB*'s ARR. As the company expects to generate similar future cash flows from both options, the greater speed and volume of returns generated from *OB* creates future opportunity for investment in other business projects. Further, if the company can source 25% of investment capital internally for *OA*, by choosing *OB* the company would save almost £12,000 initial internal cash outlay. This could be utilised for other investment opportunities through capital rationing, splitting capital between divisible projects for maximised financial return, or otherwise in the business, for example preserving these retained earnings for EOT commitments or towards capital expenditure needed elsewhere in the business.

Wider considerations also supporting *OB* as the preferred choice are speed for installation, reducing prolonged risk of disruption to production and sales, and consideration of environmental impacts. Sourcing a second-hand loom repurposes an existing machine, suggesting reduced impact compared with newly manufactured, and replacement parts can be sourced from refurbished options, also reducing maintenance costs.

In conclusion, this report recommends that the company invests in *OB*, sourcing a second-hand loom. This highly profitable option can be installed quickly, with reduced cost impact and liability for the business, and reduced risk in investment. As a future recommendation, once this option is secured the company could further consider *OA* as a viable future investment opportunity for technological advancement and innovation.

Appendices

Option A – New Loom

Data:

Project period (Years)	5
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Total investment cost	£94,234.40	Machine, delivery, comissioning, training, additional parts, works for installation
Scrap value of old loom	£250.00	
Total investment outlay	£93,984.40	

Depreciation of Loom value	Depreciation expense	Carrying Amount	Depreciation using reducing-balance method at 10% (Atrill & McLaney, 2019, p.92)
Year 1	9,398.44	84,585.96	
Year 2	8,458.60	76,127.36	
Year 3	7,612.74	68,514.63	
Year 4	6,851.46	61,663.16	
Year 5	6,166.32	55,496.85	
Residual value	55,496.85		

Expected Annual Cash Flows	£74,316.79	Payable year 1 (1% of Loan amount = 75% of investment cost)
Loan set up fee	£704.88	
Annual maintenance costs	£1,000.00	

N.B. Figures not adjusted for inflation

Year 1 Net Cash Flow	£72,611.91	Expected annual cash flows - (Loan set up fee + Maintenance costs)
Year 2 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintenance costs
Year 3 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintenance costs
Year 4 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintenance costs
Year 5 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintenance costs

WACC (%)	7
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Excel Calculations:

Option A		Year				
	Investment	1	2	3	4	5
Present Value	(93,984)	72611.91	73316.79	73316.79	73316.79	73316.79
Payback	1 Yrs 3.5 mths	Manually Calculated				
Discount Rate (WACC)	7.00%	From Present Value Table				
Denominator	1.00					
		0.935	0.873	0.816	0.763	0.713
Future Value	(93,984)	67,861.60	64,037.72	59,848.34	55,933.03	52,273.86
NPV (Excel Calculated)	205,970	PI3.19 BCR2.19				
IRR (Excel Calculated)	72.60%					
ARR	87.60%	Manually Calculated				

Option B: Second-hand Loom

Data:

Project period (Years)	5
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Total investment cost	£31,276.00	Machine, delivery, comissioning, training, additional parts, works for installation
Scrap value of old loom	£250.00	
Total investment outlay	£31,026.00	

Depreciation of Loom value	Depreciation expense	Carrying Amount	Depreciation using reducing-balance method at 10% (Atrill & McLaney, 2019, p.92)
Year 1	£3,102.60	£27,923.40	
Year 2	£2,792.34	£25,131.06	
Year 3	£2,513.11	£22,617.95	
Year 4	£2,261.80	£20,356.16	
Year 5	£2,035.62	£18,320.54	
Residual value	£18,320.54		

Expected Annual Cash Flows	£74,316.79	Payable year 1 (1% of Loan amount = 75% of investment cost)
Loan set up fee	£232.70	
Annual maintainence costs	£1,000.00	

		N.B. Figures not adjusted for inflation
Year 1 Net Cash Flow	£73,084.09	Expected annual cash flows - (Loan set up fee + Maintainence costs)
Year 2 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintainence costs
Year 3 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintainence costs
Year 4 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintainence costs
Year 5 Net Cash Flow	£73,316.79	Expected annual cash flows - Maintainence costs

WACC (%)	7
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Excel Calculations:

Option B		Year				
	Investment	1	2	3	4	5
Present Value	(31,026)	73084.09	73316.79	73316.79	73316.79	73316.79
Payback	5 mths	Manually Calculated				
Discount Rate (WACC)	7.00%	From Present Value Table				
Denominator	1.00	0.935	0.873	0.816	0.763	0.713
Future Value	(31,026)	68,302.89	64,037.72	59,848.34	55,933.03	52,273.86
NPV (Excel Calculated)	269,370				PI	9.68
					BCR	8.68
IRR (Excel Calculated)	235.22%					
ARR	286.70%	Manually Calculated				

Manual Calculations

Option A – New Loom

Payback Period

PP = Sum of cumulative net cash flows to breakeven point

N.B. For precise payback period, the negative cash flow figure at the end of the last full payback year, is divided by projected cashflow for the following year (i.e. proportion of projected cashflow required to breakeven). This fraction is added to the full payback years.

Year		Net Cash Flows	Calculation	Cumulative Net Cash Flows
0	Investment Cost	(£93,984.40)		(£93,984.40)
1	Net Cash Flow	£72,611.91	(£93,984.40) + £72,611.91	(£21,372.49)
2	Net Cash Flow	£73,316.79	(£21,372.49) + £73,316.79	£51,944.30
3	Net Cash Flow	£73,316.79	£51,944.30 + £73,316.79	£125,261.09
4	Net Cash Flow	£73,316.79	£125,261.09 + £73,316.79	£198,577.88
5	Net Cash Flow	£73,316.79	£198,577.88 + £73,316.79	£271,894.67

Calculation Ref: (Atrill and McLaney, 2019 p.376)

Payback Period = 1 Year + (£21,372.49 / £73,316.79) years = **1.29 years**

(Or 1yr and 3.5mths)

Net Present Value (NPV)

Using formula (WACC 7%)

NPV = Sum of: (Net cashflow of project year) / ((1+opportunity cost as decimal)*project year)

Year	Net Cash Flows	Calculation	Present Value
0	(£93,984.40)	(£93,984.40) / (1+0.07) ^{*0}	(£93,984.40)
1	£72,611.91	£72,611.91 / (1+0.07) ^{*1}	£67,861.60
2	£73,316.79	£73,316.79 / (1+0.07) ^{*2}	£64,037.73
3	£73,316.79	£73,316.79 / (1+0.07) ^{*3}	£59,848.34
4	£73,316.79	£73,316.79 / (1+0.07) ^{*4}	£55,933.03
5	£73,316.79	£73,316.79 / (1+0.07) ^{*5}	£52,273.86
	Net Present Value	Sum of present values year 0 to 5	£205,970.16

Calculation Ref: (Atrill and McLaney, 2019, p.382-383)

NPV = £205,970.16

Using Present Value Table (WACC 7%)

NPV = Sum of: (Net cashflow of project year*denominator)

Year	Net Cash Flows	Denominator	Calculation	Present Value
0	(£93,984.40)	1	(£93,984.40) * 1	(£93,984.40)
1	£72,611.91	0.935	£72,611.91 * 0.935	£67,892.14
2	£73,316.79	0.873	£73,316.79 * 0.873	£64,005.56
3	£73,316.79	0.816	£73,316.79 * 0.816	£59,826.50
4	£73,316.79	0.763	£73,316.79 * 0.763	£55,940.71
5	£73,316.79	0.713	£73,316.79 * 0.713	£52,274.87
	Net Present Value		Sum of present values year 0 to 5	£205,955.38

Calculation Ref: (Atrill and McLaney, 2019, p.384)

NPV = £205, 955.38

Profitability Index

PI = (Sum of Present Values of Cash Flows) / Cost of Investment

Year	Cash Flow Present Values
1	£67,861.60
2	£64,037.73
3	£59,848.34
4	£55,933.03
5	£52,273.86
Sum of NPV	£299,954.56
Investment Cost	£93,984.40

Calculation Ref: (Chen, 2021)

PI = £299,954.56 / £93,984.40 = 3.19

Benefit-Cost Ratio

BCR = NPV / Cost of Investment

NPV	£205,970.16
Investment Cost	£93,984.40

Calculation Ref: (Hayes, 2022)

BCR = £205,970.16 / £93,984.40 = 2.19

Internal Rate of Return

IRR = Sum of: (Net cashflow of project year) / ((1+opportunity cost as decimal)*project year)
where the sum is equal to 0.

At 72.6%

Year	Net Cash Flows	Calculation	Present Value
0	(£93,984.40)	(£93,984.40) / (1+0.726) ^{*0}	(£93,984.40)
1	£72,611.91	£72,611.91 / (1+0.726) ^{*1}	£42,069.47
2	£73,316.79	£73,316.79 / (1+0.726) ^{*2}	£24,610.58
3	£73,316.79	£73,316.79 / (1+0.726) ^{*3}	£14,258.74
4	£73,316.79	£73,316.79 / (1+0.726) ^{*4}	£8,261.15
5	£73,316.79	£73,316.79 / (1+0.726) ^{*5}	£4,786.30
	Net Present Value	Sum of present values year 0 to 5	£1.84

Calculation Ref: (Atrill and McLaney, 2019, p.382-383, p.387-389)

At 72.7%

Year	Net Cash Flows	Calculation	Present Value
0	(£93,984.40)	(£93,984.40) / (1+0.727) ^{*0}	(£93,984.40)
1	£72,611.91	£72,611.91 / (1+0.727) ^{*1}	£42,045.11
2	£73,316.79	£73,316.79 / (1+0.727) ^{*2}	£24,582.09
3	£73,316.79	£73,316.79 / (1+0.727) ^{*3}	£14,233.98
4	£73,316.79	£73,316.79 / (1+0.727) ^{*4}	£8,242.03
5	£73,316.79	£73,316.79 / (1+0.727) ^{*5}	£4,772.45
	Net Present Value	Sum of present values year 0 to 5	(£108.74)

At 72.601%

Year	Net Cash Flows	Calculation	Present Value
0	(£93,984.40)	(£93,984.40) / (1+0.72601) ^{*0}	(£93,984.40)
1	£72,611.91	£72,611.91 / (1+0.72601) ^{*1}	£42,069.23
2	£73,316.79	£73,316.79 / (1+0.72601) ^{*2}	£24,610.30
3	£73,316.79	£73,316.79 / (1+0.72601) ^{*3}	£14,258.49
4	£73,316.79	£73,316.79 / (1+0.72601) ^{*4}	£8,260.95
5	£73,316.79	£73,316.79 / (1+0.72601) ^{*5}	£4,786.16
	Net Present Value	Sum of present values year 0 to 5	£0.73

IRR = 72.601%

Accounting Rate of Return

$ARR = (\text{Average Annual Operating profit} / \text{Average investment cost}) * 100$

Year	Net Cash Flow	(Investment cost) Depreciation at 10%
0		(£93,984.40)
1	£72,611.91	£84,585.96
2	£73,316.79	£76,127.36
3	£73,316.79	£68,514.63
4	£73,316.79	£61,663.16
5	£73,316.79	£55,496.85
Sum	£365,879.07	
Residual Value		£55,496.85

Calculation Ref: (Atrill and McLaney, 2019, p.370)

Average Profit = (Sum of net cash flows – (Investment cost – residual value)) / No. Years

Average Profit = (£365,879.07 – (£93,984.40 - £55,496.85)) / 5 = £65,478.30

Average Investment = (Investment cost + residual value) / 2

Average Investment = (£93,984.40 + £55,496.85) / 2 = £74,740.63

ARR = (£65,478.30 / £74,740.63)*100 = 87.6%

Option B – Second-Hand Loom

Payback Period

PP = Sum of cumulative net cash flows to breakeven point

N.B. For precise payback period, the negative cash flow figure at the end of the last full payback year, is divided by projected cashflow for the following year (i.e. proportion of projected cashflow required to breakeven). This fraction is added to the full payback years.

Year		Net Cash Flows	Calculation	Cumulative Net Cash Flows
0	Investment Cost	(£31,026.00)		(£31,026.00)
1	Net Cash Flow	£73,084.09	(£31,026.00) + £73,084.09	£42,058.09
2	Net Cash Flow	£73,316.79	£42,058.09 + £73,316.79	£115,374.88
3	Net Cash Flow	£73,316.79	£115,374.88 + £73,316.79	£188,691.67
4	Net Cash Flow	£73,316.79	£188,691.67 + £73,316.79	£262,008.46
5	Net Cash Flow	£73,316.79	£262,008.46 + £73,316.79	£335,325.25

Calculation Ref: (Atrill and McLaney, 2019, p.376)

Payback Period = 0 Year + (£31,026.00 / £73,084.09) years = **0.42 years**

(Or 5mths)

Net Present Value (NPV)

Using formula (WACC 7%)

NPV = Sum of: (Net cashflow of project year) / ((1+opportunity cost as decimal)*project year)

Year	Net Cash Flows	Calculation	Present Value
0	(£31,026.00)	(£31,026.00) / (1+0.07) ^{*0}	(£31,026.00)
1	£73,084.09	£73,084.09 / (1+0.07) ^{*1}	£68,302.89
2	£73,316.79	£73,316.79 / (1+0.07) ^{*2}	£64,037.72
3	£73,316.79	£73,316.79 / (1+0.07) ^{*3}	£59,848.34
4	£73,316.79	£73,316.79 / (1+0.07) ^{*4}	£55,933.03
5	£73,316.79	£73,316.79 / (1+0.07) ^{*5}	£52,273.86
	Net Present Value	Sum of present values year 0 to 5	£269,369.84

Calculation Ref: (Atrill and McLaney, 2019, p.382-383)

NPV = £269,369.84

Using Present Value Table (WACC 7%)

NPV = Sum of: (Net cashflow of project year*denominator)

Year	Net Cash Flows	Denominator	Calculation	Present Value
0	(£31,026.00)	1	(£31,026.00) * 1	(£31,026.00)
1	£73,084.09	0.935	£73,084.09 * 0.935	£68,333.62
2	£73,316.79	0.873	£73,316.79 * 0.873	£64,005.56
3	£73,316.79	0.816	£73,316.79 * 0.816	£59,826.50
4	£73,316.79	0.763	£73,316.79 * 0.763	£55,940.71
5	£73,316.79	0.713	£73,316.79 * 0.713	£52,274.87
	Net Present Value		Sum of present values year 0 to 5	£269,355.26

Calculation Ref: (Atrill and McLaney, 2019, p.384)

NPV = £269,355.26

Profitability Index

PI = (Sum of Present Values of Cash Flows) / Cost of Investment

Year	Cash Flow Present Values
1	£68,333.62
2	£64,005.56
3	£59,826.50
4	£55,940.71
5	£52,274.87
Sum of NPV	£300,381.26
Investment Cost	£31,026.00

Calculation Ref: (Chen, 2021)

PI = £300,381.26 / £31,026.00 = 9.68

Benefit-Cost Ratio

BCR = NPV / Cost of Investment

NPV	£269,369.84
Investment Cost	£31,026.00

Calculation Ref: (Hayes, 2022)

BCR = £269,369.84 / £31,026.00 = 8.68

Internal Rate of Return

IRR = Sum of: (Net cashflow of project year) / ((1+opportunity cost as decimal)*project year)
where the sum is equal to 0.

At 235.22%

Year	Net Cash Flows	Calculation	Present Value
0	(£31,026.00)	(£31,026.00) / (1+2.3522)^{*0}	(£31,026.00)
1	£73,084.09	£73,084.09 / (1+2.3522) ^{*1}	£21,801.83
2	£73,316.79	£73,316.79 / (1+2.3522) ^{*2}	£6,525.22
3	£73,316.79	£73,316.79 / (1+2.3522) ^{*3}	£1,946.32
4	£73,316.79	£73,316.79 / (1+2.3522) ^{*4}	£580.61
5	£73,316.79	£73,316.79 / (1+2.3522) ^{*5}	£173.20
	Net Present Value	Sum of present values year 0 to 5	£1.18

Calculation Ref: (Atrill and McLaney, 2019, p.382-383)

At 235.23%

Year	Net Cash Flows	Calculation	Present Value
0	(£31,026.00)	(£31,026.00) / (1+2.3523)^{*0}	(£31,026.00)
1	£73,084.09	£73,084.09 / (1+2.3523) ^{*1}	£21,801.18
2	£73,316.79	£73,316.79 / (1+2.3523) ^{*2}	£6,524.06
3	£73,316.79	£73,316.79 / (1+2.3523) ^{*3}	£1,946.14
4	£73,316.79	£73,316.79 / (1+2.3523) ^{*4}	£580.54
5	£73,316.79	£73,316.79 / (1+2.3523) ^{*5}	£173.18
	Net Present Value	Sum of present values year 0 to 5	(£0.98)

IRR = 235.22 to 235.23%

Accounting Rate of Return

ARR = (Average Annual Operating profit / Average investment cost) * 100

Year	Net Cash Flow	(Investment cost) Depreciation at 10%
0		(£31,026.00)
1	£73,084.09	£27,923.40
2	£73,316.79	£25,131.06
3	£73,316.79	£22,617.95
4	£73,316.79	£20,356.16
5	£73,316.79	£18,320.54
Sum	£366,351.25	
Residual Value		£18,320.54

Calculation Ref: (Atrill and McLaney, 2019, p.370)

Average Profit = (Sum of net cash flows – (Investment cost – residual value)) / No. Years

Average Profit = (£366,351.25 – (£31,026.00 - £18,320.54)) / 5 = £70,729.16

Average Investment = (Investment cost + residual value) / 2

Average Investment = (£31,026.00 + £18,320.54) / 2 = £24,673.27

ARR = (£70,729.16 / £24,673.27)*100 = 286.7%

References

- Atrill, P. and McLaney, E. (2019) *Accounting and Finance for Non-Specialists*. 11th edn. Harlow: Pearson.
- CFI Education Inc. (2022) *Benefit-Cost Ratio (BCR)*. Available at: <https://corporatefinanceinstitute.com/resources/knowledge/finance/benefit-cost-ratio-bcr/> (Accessed: 24th August 2022).
- Chen, J. (2021) 'Profitability Index (PI) Rule', *Investopedia*. 31st May. Available at: <https://www.investopedia.com/terms/p/profitability-index-rule.asp> (Accessed: 12th August 2022).
- Fernando, J. (2022) 'Net Present Value (NPV)', *Investopedia*. 5th August. Available at: <https://www.investopedia.com/terms/n/npv.asp> (Accessed: 11th August 2022).
- Fields, E. (2011) *The Essentials of Finance and Accounting for Nonfinancial Managers*. 2nd edn. New York: AMACOM.
- Hayes, A. (2020) 'Capital Rationing', *Investopedia*. 28th October. Available at: <https://www.investopedia.com/terms/c/capitalrationing.asp#:~:text=Capital%20rationing%20is%20the%20act,specific%20portions%20of%20a%20budget>. (Accessed: 17th September 2022).
- Hayes, A. (2022) 'Benefit-Cost Ratio (BCR)', *Investopedia*. 28th March. Available at: [https://www.investopedia.com/terms/b/bcr.asp#:~:text=The%20benefit%2Dcost%20ratio%20\(BCR\)%20is%20an%20indicator%20showing,a%20firm%20and%20its%20investors](https://www.investopedia.com/terms/b/bcr.asp#:~:text=The%20benefit%2Dcost%20ratio%20(BCR)%20is%20an%20indicator%20showing,a%20firm%20and%20its%20investors). (Accessed: 12th August 2022).
- Marsh, C. (2012) *Financial Management for Non-Financial Managers*. London: Kogan Page Ltd.
- Patrick, M., and French, N. (2016) 'The Internal Rate of Return (IRR): Projections, Benchmarks and Pitfalls', *Journal of Property Investment and Finance*, 34 (6), pp. 664-669. DOI:10.1108/JPIF-07-2016-0059