

Business Report:

Capital Investment Project – Machine Overhaul

Financial Management & Planning:

Project Appraisals (ACPA7002)

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1. Summary

In line with the business' industrial strategy, essential capital equipment is housed within the company's manufacturing unit. The capital equipment is required in order to support new product introduction, aftermarket demands, and complex low volume parts whereby the cost is greater in the external supply chain. The existing capital equipment is now aged with the average age of machinery over 25 years old. The age of the machinery is having a significant effect on the reliability of the equipment, increasing downtime and associated maintenance and repair costs.

Due to the effects of the COVID-19 pandemic, the initial Capex budget agreed for 2020 that included the renewal of the manufacturing unit's machinery was later rejected to enable the business to strengthen its finances during this difficult period. As we approach 2023, demand is on the increase and the machinery in its current state is not efficient or reliable enough to deliver the required performance.

The aim of this business report is to outline a project appraisal to overhaul the existing machinery rather than renewing the machines, focusing on the projects financials that will enable the business to make an informed decision on whether to proceed with the project or not.

2. Technical Solution

The proposed solution is to overhaul existing machinery, replacing essential components in the three areas:

Metallic Machining: Tool pre-set refurbishment, replacement of worn spindles.

Vacuum Forming: Machine repairs following PPM report. (Heater and hydraulic systems), ultra-sonic welding repairs following PPM report, electrical oven repairs following PPM report.

Rapid Prototyping: Replacement of key components.

3. Project Cost

All costs related to the project are shown in figure 1...

	Total Cost
Mechanical Equipment	£61,680.00
Spare Parts	£2,000.00
Labor	£7,080.00
Others	£1,740.00
Carbon Impact	£1,500.00
Total	£74,000.00

Figure 1: Machine Upgrade Costs (Internal Finance, 2022)

4. Financial Summary

4.1. Business Rationale

The rationale for all projects within the business is:

- Payback Period – within 3 years
- Internal Rate of Return (IRR) – Greater than 20%
- The life span of this project will be 5 years.

4.2. Payback

Using the payback method will provide an estimate as to how long it will take a project to pay for itself. The recovery of a project investment is usually measured in terms of ‘net cash flow’ or ‘benefits’, this is the difference between cash coming in and cash going out of the business in a period of time (Dyson & Franklin, 2020).

The payback period for this project will be **1.16 years**.



Year	0	1	2	3	4	5
Investment	£74,000					
Benefits	-£74,000	£65,000	£55,000	£45,000	£45,000	£40,000
Net Benefit	-£74,000	-£9,000	£46,000	£91,000	£136,000	£176,000

Figure 2: Machine Upgrade Project Financial Data (Internal, 2022)

The full calculations using the payback method are shown in Appendix A.

4.3. Net Present Value (NPV)

To determine the project's Internal Rate of Return (IRR), it is first necessary to calculate the Net Present Value (NPV). Unlike the payback method, NPV takes into account the time value of money (Dyson & Franklin, 2020). The decision ruling is based on the absolute sum of the NPV of the surplus that is generated by the project (Weetman, 2013). The basic principle of NPV is to work out at what point (based on the discounted tables) the project will break even, the higher the break-even point the better the return on investment.

As shown in figure 3, our initial investment of £74k after 5 years with a discount rate of 8% would see an NPV of £129,370.

	Investment	year 1	year 2	year 3	year 4	year 5
Annual Cash Flow (After Tax)	-£74,000.00	£65,000	£55,000	£45,000	£45,000	£40,000
Discount Rate	8%					
Denominator	1.000	0.926	0.857	0.794	0.735	0.681
Future Value	-£74,000.00	£60,190.00	£47,135.00	£35,730.00	£33,075.00	£27,240.00
NPV	£129,370					

Figure 3: Machine Upgrade Costs NPV (Internal Finance, 2022)

NPV that is greater than zero is considered good (Fernando, 2022), giving this project the green light for businesses who's rationale is to have a positive NPV. The payback method calculation is shown in Appendix B.

4.4. Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is an additional tool to NPV that considers the time value of money. IRR is defined as a discount rate, which leads to a NPV of zero, where the present value of the cash flows in equal exactly the cash flows out (Weetman, 2013). In short "IRR is the discount rate that makes the NPV equal zero" (McLaughlin, 2013). Unlike NPV, IRR results in an answer expressed as a percentage. According to Weetman (2013), there is evidence from research in project appraisal tools that decision makers feel more comfortable with a percentage output rather than an absolute amount.

For this particular project, the expected IRR is **70.78%**. The general decision rule here is that a project is accepted if the IRR is greater than the cost of capital where the NPV of the project will be positive. A project should not be accepted if the IRR is less than the cost of capital, this will be validated by a negative NPV (Weetman, 2013). The project's IRR calculation is shown in Appendix D.

4.5. Profitability Index

On occasion, organisations may be required to choose between two projects that are classed as 'mutually exclusive', for reasons such as limited capacity or there is only sufficient demand for one of the projects. If this is the case, then care should be taken when using NPV and IRR as decision-making tools as occasionally they can provide different answers, arguing the case to move forward with either project (Weetman, 2013). To help assist with such a decision, the profitability index tool can help in this scenario if the business is aiming to maximise the NPV.

The Profitability Index can be determined by taking the present value of a project's cash flows, of which is discounted at the cost of capital, and divide it by the present value of the of the total investment needed to produce the cash flows (Dyson & Franklin, 2020), the output is that of a ratio. A score of less than 1.0 indicates that the deficit of the project's outflows is greater than the discounted inflows, and the project should not be accepted. An output of 1.0 or greater, the project should be accepted (Chen, 2022).

For this particular project (Machine Overhaul), the calculation resulted in a profitability index of 2.75, as this is above 1.0 the project should be accepted as for every £1 that is put in we would get £2.75 back out. The profitability index calculation is shown in Appendix E.

4.6. Benefit-Cost Ratio

The benefit-cost ratio (BCR) summarises the overall relationship between the costs and the benefits of a proposed project and is given as a ratio. If a project has a BCR greater than 1.0, the benefits outweigh the costs; therefore, the decision should be to accept the project (Dyson & Franklin, 2020). BCR is a useful tool when ranking a number of projects to help decide on which project should be accepted, the higher the BCR the better.

The calculated BCR ratio for this project is 1.75; therefore, the project benefits outweigh our total costs and can be accepted. The BCR calculation can be found in Appendix F.

5. Funding Options

In order to determine what type of funding may be required for a project will depend on a number of factors such as the amount of funding required, duration of borrowing, the risks involved and how soon the funds are needed. Finance can be obtained internally or externally and either short term or long term. A number of financing options are identified in figure 4, for the machine overhaul project, the project will be funded by the sales profits from the previous year and applied for through a Capex application.

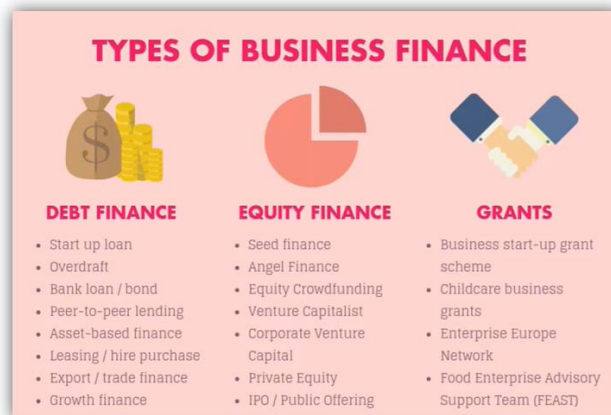


Figure 4: Types of Business Finance (Work Life Blend, 2020)

6. Findings and Recommendations

Each of the five project appraisal tools that have been discussed (Payback, NPV, IRR, Profitability Index and BCR) have their own strengths and weaknesses as identified in the Appendices (A-F). Depending on the business rationale and the accuracy of the analysis required at the time, each tool could be used independently or in conjunction with another to provide a more accurate understanding of the project's potential financially.

For the sake of this project, the business rationale was payback within 3 years and an IRR greater than 20%. Therefore, to determine this, the payback method provides a simple calculation to determine when the initial investment would be returned, this equated to 1.16 years, well within the 3-year requirement. If payback exceeded 3 years, it is highly unlikely the project would be accepted at the first stage.

The next stage required the IRR to be calculated which would take into account the time money value, providing a more accurate calculation as this would factor in the depreciation over the 5 year project lifespan. To achieve IRR it is first necessary to determine the NPV for the project, together this provides a solid calculation and results in IRR as a percentage which is simple for the business decision makers to understand. For any projects going forward it is recommend the business continues to use this two-stage approach for a clear and decisive result on whether a project should proceed or not. If a decision is to be made between two or more projects, then using the Benefit-Cost ratio is also recommended to rank them.

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Appendices

Appendix A - Payback Period Calculation

The basic calculation for payback period is $\text{Payback Period} = \text{Investment required} / \text{Net annual cash flow}$. For the project in question we need to know the investment and also the future benefit per year. The payback period is looking for the point where the net benefit turns from a negative to a positive. We can see in the table below that this happens between year 1 and year 2. The calculation to obtain the exact payback period would be:

$$1 \text{ year} + (9000/55000) = \mathbf{1.16 \text{ Years}}$$



Year	0	1	2	3	4	5
Investment	£74,000					
Benefits	-£74,000	£65,000	£55,000	£45,000	£45,000	£40,000
Net Benefit	-£74,000	-£9,000	£46,000	£91,000	£136,000	£176,000

Appendix B - NPV Calculation

NPV Formula:

$$NPV = \frac{\text{Cash flow}}{(1+i)^t} - \text{initial investment}$$

where:

i = Required return or discount rate
 t = Number of time periods

(Real Vantage, 2020)

Based on the organisations set project discount rate (WACC) of 8%, the yearly discount rate denominator values were obtained from the ‘Present Value Table’ issued by The Chartered Institute of Management Accountants (2010) shown in Appendix C.

	Investment	year 1	year 2	year 3	year 4	year 5
Annual Cash Flow (After Tax)	-£74,000.00	£65,000	£55,000	£45,000	£45,000	£40,000
Discount Rate	8%					
Denominator	1.000	0.926	0.857	0.794	0.735	0.681
Future Value	-£74,000.00	£60,190.00	£47,135.00	£35,730.00	£33,075.00	£27,240.00
NPV	£129,370					

Therefore... $\text{NPV} = \text{sum of discounted cash flow} - \text{initial investment}$

$$\text{NPV} = £203,370 - £74,000 = \mathbf{£129,370}$$

Appendix C – Present Value Table

PRESENT VALUE TABLE										
Present value of \$1, that is $(1+r)^{-n}$ where r = interest rate; n = number of periods until payment or receipt.										
Periods (n)	Interest rates (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180
19	0.828	0.686	0.570	0.475	0.396	0.331	0.277	0.232	0.194	0.164
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149

Periods (n)	Interest rates (r)									
	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.079	0.065
16	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054
17	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045
18	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038
19	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031
20	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026

Present Value Table' issued by The Chartered Institute of Management Accountants (2010).

Appendix D – Internal Rate of Return Calculation

Internal Rate of Return formula:

$$IRR = R_1 + \frac{(NPV_1 \times (R_2 - R_1))}{(NPV_1 - NPV_2)}$$

where:

R_1, R_2 = randomly selected discount rates

NPV_1 = higher net present value

NPV_2 = lower net present value

(Investopedia, 2021)

	A	B	C	D	E	F	G	H
1								
2		Machine Overhaul		Year				
3			Investment	1	2	3	4	5
4		Present Value	(74,000)	65000	55000	45000	45000	40000
5								
6		Payback	1 Yrs 10 mths	Manually Calculated				
7								
8		Discount Rate (WACC)	8.00%					
9			1	From Present Value Table				
10		Denominator	1.000	0.926	0.857	0.794	0.735	0.681
11								
12		Future Value	(74,000)	60,190.00	47,135.00	35,730.00	33,075.00	27,240.00
13								
14		NPV	129,370					
15								
16		NPV (Excel Calculated)	129,361			PI	2.75	
17						BCR	1.75	
18		IRR (Excel Calculated)	70.78%					

Using the project table above we can calculate IRR simply by using the IRR formula within Microsoft Excel where $IRR = IRR(C4:H4, X\%)$

The percentage can be a randomly selected discount rate and excel will determine at what rate of return will NPV be zero, in this case the IRR was calculated at 70.78%.

To validate this, in the table below the IRR of 70.78% was entered into the discount rate cell 'C8'. Using the Excel formula for NPV ($=C12+NPV(C8,D4:H4)$), the NPV changed to zero confirming the calculation is accurate.

	A	B	C	D	E	F	G	H
1								
2		Machine Overhaul		Year				
3			Investment	1	2	3	4	5
4		Present Value	(74,000)	65000	55000	45000	45000	40000
5								
6		Payback	1 Yrs 10 mths	Manually Calculated				
7								
8		Discount Rate (WACC)	70.78%					
9				From Present Value Table				
10		Denominator	1.000	0.926	0.857	0.794	0.735	0.681
11								
12		Future Value	(74,000)	60,190.00	47,135.00	35,730.00	33,075.00	27,240.00
13								
14		NPV	129,370					
15								
16		NPV (Excel Calculated)	(0)				PI	2.75
17							BCR	1.75
18		IRR (Excel Calculated)	70.78%					

Appendix E - Profitability Index Calculation

	Investment	year 1	year 2	year 3	year 4	year 5
Annual Cash Flow (After Tax)	-£74,000.00	£65,000	£55,000	£45,000	£45,000	£40,000
Discount Rate	8%					
Denominator	1.000	0.926	0.857	0.794	0.735	0.681
Future Value	-£74,000.00	£60,190.00	£47,135.00	£35,730.00	£33,075.00	£27,240.00
NPV	£129,370					

Profitability Index = Gross Present Value of cash flows / Investment = £203,370 / £74000 = 2.75

Appendix F– Benefit-Cost Ratio Calculation

	Investment	year 1	year 2	year 3	year 4	year 5
Annual Cash Flow (After Tax)	-£74,000.00	£65,000	£55,000	£45,000	£45,000	£40,000
Discount Rate	8%					
Denominator	1.000	0.926	0.857	0.794	0.735	0.681
Future Value	-£74,000.00	£60,190.00	£47,135.00	£35,730.00	£33,075.00	£27,240.00
NPV	£129,370					

BCR = Net Present Value of Cash Flows / Investment = £129,370 / £74000 = 1.75

Appendix G – Pro's and Cons of Appraisal Tools

Payback Method:

Payback Method	PRO'S	CON'S
	Simplicity	Ignores time-value of money
	Offers quick evaluation	Emphasises on liquidity rather than profitability
	The term is universally understood	Only cash returns within the period are considered

NPV:

NPV	PRO'S	CON'S
	Considers Time-value of money	Cannot be used to Compare Projects of Different Sizes
	Provides easier decision making	Does not consider hidden costs

(Srivastav, 2019)

IRR:

IRR	PRO'S	CON'S
	Considers Time-value of money	Cannot be used to Compare Projects of Different Sizes
	Reviews liquidity of projects	Can be difficult to calculate manually
	Excel simplifies process	

Profitability Index:

Profitability Index	PRO'S	CON'S
	Considers the time value of money	Information generated is based on estimates
	Takes into consideration all cash flows from a project	May not provide correct decision making criteria for certain projects
	Considers the risks which are involved with future cash flows	Can be difficult to estimate opportunity costs.

Benefit-Cost Ratio:

Benefit-Cost Ratio	PRO'S	CON'S
	Provides an added level of clarity	Can lead to false confidence
	Takes a look at a project's overall feasibility	Does not always factor in the indirect benefits.
	Helps to provide insight into the unknown	May add more value to biased variables

(Gaille, 2018)