A report on

Financial Management and Planning

ACPA 7002 Assignment 1

University of Wales Trinity Saint David (MADE Project)

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Assignment 1 – Capital Project Appraisal Report

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Introduction

In 1978 the first tree shelters were conceived and trailed by Graham Tuley of the UK Forestry Commission. The Tubex brand of tree shelters initial concept was developed in the mid 1980's and has since developed continuously and once production was scaled up Tubex moved to the Aberdare sit. In the basic sense Tree shelter protect saplings during the critical years of growth.

£21 Million Shelters leave the Aberdare plan each year with a large majority being made from sustainable plastic. Over the years Tubex has developed unique features that all contribute to the effective establishment of tree growth. At the end of life the Tubex shelters can be 100% recycled back into Tube production to create a circular product life cycle.

An offering that sets Tubex apart from it competitors is that the completed unit are sold with fixing ties already inserted into the product for quick installation. This is where the problem at site occur as this part of the process is very labour intensive and the bottleneck of the process. Automation of this part of the process will have a dramatic impact on the business as a whole and also potential financial gains for the customers.

Process analysis

The process of extruding tree shelters entails raw material beads being melted and formed through dies into solid plastic twin wall tubes before being converted into finished goods after they are cut on a guillotine. After being cut is where the process becomes labour intensive so it's at this point the project starts. The process steps are:

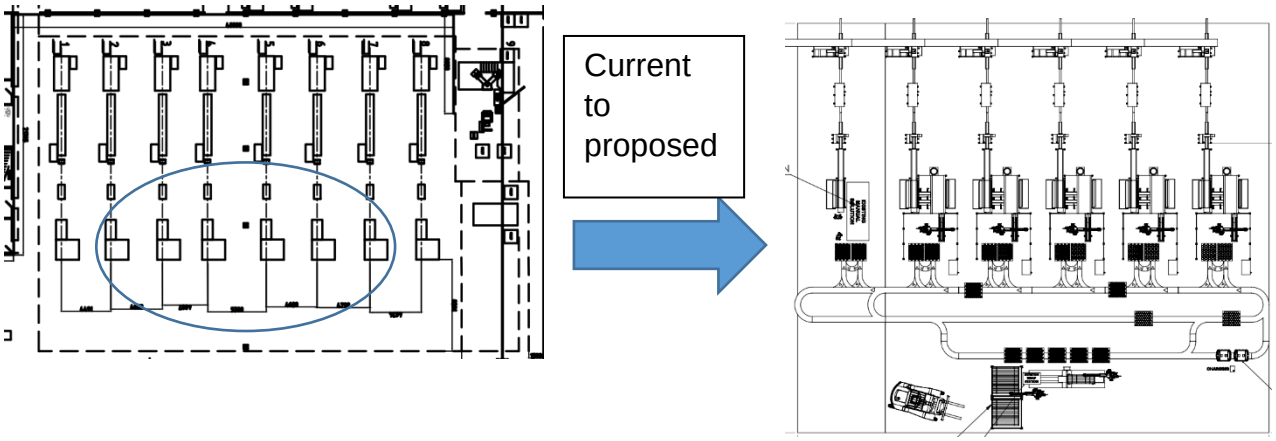
• Tubes are presented to Guillotine

• Tube enters a conversion machine where they're heated and flared.

• Operators Insert and secure tie wraps.

•Operators Nest 5 tube diameters inside one another and pack nested tubes into stillage's.

• Operators move and decant from stillage's then bundle and band nested tubes.



The Tree shelters are extruded on near identical lines but batch run products are run over 5 lines.

	Time rates (Secs) 1 op	Time rates (Secs) 2 op	Unit per person	Description	Total Units sold last 12 Months	Total (Secs)	Total (Mins)	Total (Hours)	Units per Hour per line	Units per Hour 5 lines	Line Hrs needed	Line Ops	Floor Ops	Breakcover	Line leaders	Totals
Current 10 ops, 2 floor and two line leaders	11.5	8	16	Tubex Std 1.2m x 73-105mm GRN	4,668,416	74,694,656	1,244,911	20,749	450	2,250	2,075	20,749	4,150	4,150	4,150	33,198
	7	5.5	11	Tubex Std 40cm x 73-105mm GRN	57,122	628,342	10,472	175	655	3,273	17	175	35	35	35	279
	7	5.5	11	Tubex Std 50cm x 73-105mm GRN	69,620	765,820	12,764	213	655	3,273	21	213	43	43	43	340
	7	5.5	11	Tubex Std 55 cm x 73-105mm GRN	0	0	0	0	655	3,273	0	0	0	0	0	0
	7	5.5	11	Tubex Std 60cm x 73-105mm GRN	1,407,617	15,483,787	258,063	4,301	655	3,273	430	4,301	860	860	860	6,882
	11.5	8	16	Tubex Std 60cmx73-105mm GRN 2T	40,600	649,600	10,827	180	450	2,250	18	180	36	36	36	289
	11.5	8	16	Tubex Std 75cm x 73-105mm GRN	531,400	8,502,400	141,707	2,362	450	2,250	236	2,362	472	472	472	3,779
	11.5	8	16	Tubex Std Pls 1.2mx80-120 DGRN	5,040	80,640	1,344	22	450	2,250	2	22	4	4	4	36
	11.5	8	16	Tubex Std Pls 1.2mx80-120 GRN	58,358	933,728	15,562	259	450	2,250	26	259	52	52	52	415
	14	11	22	Tubex Std Pls 1.5mx80-120 GRN	493,580	10,858,760	180,979	3,016	327	1,636	302	3,016	603	603	603	4,826
	15	13	26	Tubex Std Pls 1.8mx80-120 GRN	64,682	1,681,732	28,029	467	277	1,385	47	467	93	93	93	747
	11.5	11	22	Ventex 1.2m x 80-120mm CLR	46,440	1,021,680	17,028	284	327	1,636	28	284	57	57	57	454
	11.5	8	16	Ventex 1.2m x 80-120mm GRN	2,632,280	42,116,480	701,941	11,699	450	2,250	1,170	11,699	2,340	2,340	2,340	18,718
	15	15	30	Ventex 1.5m 80-120mm CLR	111,540	3,346,200	55,770	930	240	1,200	93	930	186	186	186	1,487
	14	11	22	Ventex 1.5m x 80-120 GRN	231,732	5,098,104	84,968	1,416	327	1,636	142	1,416	283	283	283	2,266
	15	16	32	Ventex 1.8m x 80-120mm CLR	4,140	132,480	2,208	37	225	1,125	4	37	7	7	7	59
	15	12	24	Ventex 1.8m x 80-120mm GRN	150,540	3,612,960	60,216	1,004	300	1,500	100	1,004	201	201	201	1,606
	11.5	8	16	Ventex 90cm x 80-120mm GRN	52,620	841,920	14,032	234	450	2,250	23	234	47	47	47	374
	11.5	11.5	23	Nature Tube 1.2m x73-105mm	280,279	6,446,417	107,440	1,791	313	1,565	179	1,791	358	358	358	2,865
	7	7	14	Nature Tube 0.6m x73-105mm	177,196	2,480,744	41,346	689	514	2,571	69	689	138	138	138	1,103
											4,983	49,827	9,965	9,965	9,965	79,723

The step of the process where a tie is inserted into the product is where the labour has all the touch on the product and where a big part of the product cost comes from in the Bill of material (BOM) make up. Introducing electronic control system such as PLC's and fast acting valves have made the task easier and quicker for the operator. Looping a cable tie through a hole sounds relatively simple but the human hand is very dexterous and can work in various motion. Trying to get a machine to do this has always been near impossible without access to substantial investment which could then allow machines that would not just be able to carry out the task but also speed up the process.

	Time rates (Secs) 1 op	Time rates (Secs) 2 op	Unit per person	Description
Current 10 ops, 2 floor and two line leaders	11.5	8	16	Tubex Std 1.2m x 73-105mm GRN
	7	5.5	11	Tubex Std 40cm x 73-105mm GRN
	7	5.5	11	Tubex Std 50cm x 73-105mm GRN
	7	5.5	11	Tubex Std 55 cm x 73-105mm GRN
	7	5.5	11	Tubex Std 60cm x 73-105mm GRN
	11.5	8	16	Tubex Std 60cmx73-105mm GRN 2T
	11.5	8	16	Tubex Std 75cm x 73-105mm GRN
	11.5	8	16	Tubex Std Pls 1.2mx80-120 DGRN
	11.5	8	16	Tubex Std Pls 1.2mx80-120 GRN
	14	11	22	Tubex Std Pls 1.5mx80-120 GRN
	15	13	26	Tubex Std Pls 1.8mx80-120 GRN
	11.5	11	22	Ventex 1.2m x 80-120mm CLR
	11.5	8	16	Ventex 1.2m x 80-120mm GRN
	15	15	30	Ventex 1.5m 80-120mm CLR
	14	11	22	Ventex 1.5m x 80-120 GRN
	15	16	32	Ventex 1.8m x 80-120mm CLR
	15	12	24	Ventex 1.8m x 80-120mm GRN
	11.5	8	16	Ventex 90cm x 80-120mm GRN
	11.5	11.5	23	Nature Tube 1.2m x73-105mm
	7	7	14	Nature Tube 0.6m x73-105mm

	Time rates (Secs) 1 op	Time rates (Secs) 2 op	Unit per person	Description
Proposed	5.5	N/A		Tubex Std 1.2m x 73-105mm GRN
	5.5	N/A		Tubex Std 40cm x 73-105mm GRN
	5.5	N/A		Tubex Std 50cm x 73-105mm GRN
	5.5	N/A		Tubex Std 55 cm x 73-105mm GRN
	5.5	N/A		Tubex Std 60cm x 73-105mm GRN
	5.5	N/A		Tubex Std 60cmx73-105mm GRN 2T
	5.5	N/A		Tubex Std 75cm x 73-105mm GRN
	5.5	N/A		Tubex Std Pls 1.2mx80-120 DGRN
	5.5	N/A		Tubex Std Pls 1.2mx80-120 GRN
	5.5	N/A		Tubex Std Pls 1.5mx80-120 GRN
	5.5	N/A		Tubex Std Pls 1.8mx80-120 GRN
	5.5	N/A		Ventex 1.2m x 80-120mm CLR
	5.5	N/A		Ventex 1.2m x 80-120mm GRN
	5.5	N/A		Ventex 1.5m 80-120mm CLR
	5.5	N/A		Ventex 1.5m x 80-120 GRN
	5.5	N/A		Ventex 1.8m x 80-120mm CLR
	5.5	N/A		Ventex 1.8m x 80-120mm GRN
	5.5	N/A		Ventex 90cm x 80-120mm GRN
	11.5	N/A		Nature Tube 1.2m x73-105mm
	11.5	N/A		Nature Tube 0.6m x73-105mm

The above table shows the difference in current and proposed rates of the targeted SKU's. Using data collected on the number of units produced of each SKU in the last 12 months we can work out the difference on line hors needed to produce them at current and proposed speeds. This will also give us a cost of current manning that is needed to produce the product at the said rates. 11.5 seconds is the bottle neck on speed that operators can consistently achieve on the 1.2 products. Adding and additional operator doesn't half the speed but reduces it to 7 seconds per product so is an inefficient use of labour.

Any process improvements to remove or speed up labour will have a big benefit to the company and that is without including the inefficiency of bringing in temporary labour which is what is done when two people have to be added to lines.

Automation solution.

Company policy requires three quotations for investments of more than £50,000, so three automation integrators were approached to provide solutions for the line automation. They were asked to provide a solution thats:

1. Safe with all human interaction.
2. Has a five second cycle time on the 5 standard lines.
3. Robust process design, with quick change tooling.
4. Be modular and mobile so quickly removed when not required.
5. Simple human interaction.
6. Provide accurate runtime and downtime data.
7. Minimum process uptime matching or bettering existing 98%.

The estimated budget cost would have to be under £3Million to fit with 3 year payback.

The automated solution must be capable of a cycle time of 5 seconds per 1.2m tube, equalling the maximum extruding speed. The automated solution therefore increases productivity by a factor of 2.2 and increases extruding machine utilisation.

The successful integrator will be chosen based on running operation, its reputation and the in-house skills it possesses ensure that any problems would be dealt with by the same core team without the need to engage with sub-contactors (Worster, et al., 2013).

Project timeline.

The time line will need to be a collaboration with our integrator to fit around our seasonal business and this was made clear at the very start of proceedings. There is a short window to work within and that is our summer months. An example of the project time lines is shown below along with an example of payment terms we expect to see.

Payment Schedule

Milestone	Amount Invoiced (% total order value)
Order placement	30%
Sign off URS	10%
Sign off drawings	30%
Completion FAT	20%
Completion SAT	10%

Project: End of line

Tile:Schedule Calender

Berry

TUBEX

Year	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023
Month	Jun	Jun	Jul	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Oct	Oct	Oct	Nov
w/c	19-Jun	26-Jun	03-Jul	10-Jul	17-Jul	24-Jul	31-Jul	07-Aug	14-Aug	21-Aug	28-Aug	04-Sep	11-Sep	18-Sep	25-Sep	02-Oct	09-Oct	16-Oct	23-Oct	30-Oct	06-Nov
Week No	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Project Wk	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Section	Start	Finish	Days	
P/O Raised	19/06/23	20/06/23	1	0
Design Sign off- mechanical	03/07/23	08/07/23	5	0
Design Sign off- electrical	10/07/23	15/07/23	5	0
Design Sign off- Control	17/07/23	22/07/23	5	0
Manufacture in workshop	22/07/23	20/09/23	60	0
Test production run	25/09/23	09/10/23	14	0
FAT test	16/10/23	21/10/23	5	0
Installation	23/10/23	28/10/23	5	0
Commission	30/10/23	01/11/23	2	0
SAT	23/07/23	24/07/23	1	0

- 21 weeks between order & line start
- 18 weeks between order & Factory acceptance test (FAT)

Financial analysis.

Payback Period.

Payback Period (PP) is defined by Atrill & McLaney as "the time taken for an initial investment to be repaid out of the net cash inflows from a project" (Atrill & McLaney, 2017). Berry Global maximum PP for investment varies depending on starting project value and cd be 2.5, 3, 5, 10 years. For this value project it is under 3 years for local sign off.

Payback Period

	investmen	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
		-313,688	-141,857	33,411	212,184	394,533
Pay back Yrs	2.81	1	1	0.81		
		←	+	←		

PP = 1 + (^{141857} / $_{175268}$) 0.81 = **2.81** years or **2 years 10 months**.

Major issues with using PP as a viable project indicator is that it does not factor the effect of time on returns, or cash flow after the Payback Period has finished. Time is an important factor in considering the value of cash flow, £100 now is worth more than £100 in a years' time (Atrill & McLaney, 2017), so recouping investment returns early in a project (year 1) is more valuable than recouping the same amount in year 2. Project dependant, the returns after the PP could be much greater than during the PP, potentially making a profitable project deemed to be not viable.

For a project of this value (£200k-£500K) Berry criteria would like to see a payback period under 5 years but if the payback was under 3 years it would fall in for local approval. This would mean using PP as a project indictor would have either go to regional sign off or have other justify factors to be taken into account such as:

- Safety improvements
- Gross Sales
- Incremental metric ton
- Productivity saving

Net Present Value.

Net present value is the present value of the cash flows at the required rate of return of your project compared to your initial investment (Gallo, 2014). When a manager needs to compare projects and decide which ones to pursue, there are generally three options available: internal rate of return, payback method, and net present value. NPV is the tool of choice for most financial analysts. There are two reasons for that.

- One, NPV considers the time value of money, translating future cash flows into today's dollars.
- Two, it provides a concrete number that managers can use to easily compare an initial outlay of cash against the present value of the return.

Net Present Value (NPV) is better approach than PP as it considers the costs and benefits of an investment, along with the effect of time (Atrill & McLaney, 2017). NPV uses Present Value Tables acting as a discount factor to show the effect of time on project annual cash flow.

Calculating NPV

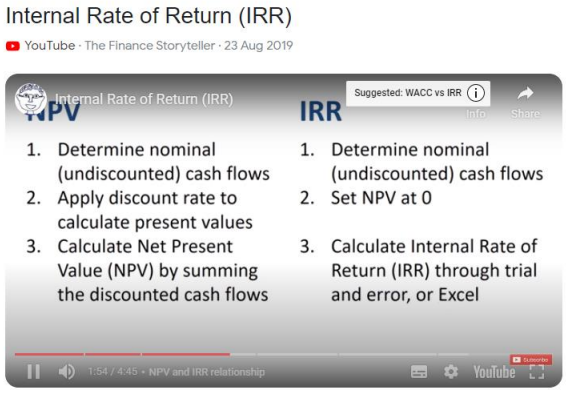
	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881	-329,018	-187,085	-55,459	66,643	179,881
Pay back	3.17	1	1	1	0.168	
NPV using excel	180,017					

A net present value that is a positive amount means that the actual return on investment exceeds the target rate" (Fields, 2016) of the Berry Global 10% discount factor. The positive NPV value indicates a viable investment opportunity.

IRR

The internal rate of return (IRR) is very closely related to IRR. With net NPV we take future value as and convert them to present values using a discounted rate (WACC). With IRR the nominal cash flows for the years is set over the allocated time period. NPV is then set at zero so the IRR can be calculated as an output variable the difference to get to zero.

(IRR, 2019)



Project

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
NPV using excel	180,017					

Project

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	23.527%					
Denomiator	1.000	0.833	0.694	0.579	0.482	0.402
Future value	-482,150	140,329	119,251	101,480	86,169	73,304
NPV	38,383					
NPV using excel	0					

BY altering the discount rate in the above table we can see what % movement is needed to get the NPV of zero. When Zero NPV is achieved we can see the required change is 23.5%.

The higher an internal rate of return, the more desirable an investment is to undertake (FERNANDO, 2023). IRR is generally the metric used with in Berry for analysis of Capital investment projects as it allows the company to assess annual return overtime. An IRR of

23.5% would generally not be challenged too much once a project is submitted to Berry's Capital committee.

Profitability Index.

The profitability index (PI), alternatively referred to as value investment ratio (VIR) or profit investment ratio (PIR), describes an index that represents the relationship between the costs and benefits of a proposed project. (chen, 2023)

The profitability index is calculated as the ratio between the present value of future expected cash flows and the initial amount invested in the project. A higher PI means that a project will be considered more attractive.

It compares the value of future cash by the initial investment**.**

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
Pay back	3					
NPV using excel	180,017					
IRR	23.53%					

$$PI \quad \frac{\text{PV of future cash}}{\text{Investment}} \quad \frac{662{,}031}{482{,}150} \quad 1.37$$

Calculating each year's cash flow highlighted grey in the above table equals a total of £662031 and when divided by the investment of £482,150 returns a PI of 1.37. Values over 1.0 indicate that the value of the project are an improvement on initial investment. For example if a project delivered a PI of 1.0 then there would be no improvement on initial on investment.

Benefit-Cost Ratio.

The benefit-cost ratio (BCR) is a profitability indicator used in cost-benefit analysis to determine the viability of cash flows generated from an asset or project. The BCR compares the present value of all benefits generated from a project to the present value of all costs. A BCR exceeding one indicates that the asset/project is expected to generate incremental value. (team, 2022).The Benefit-Cost Ratio (BCR) is like PI except it uses the NPV in its calculation.

BCR

Project A

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
Pay back	3.17					
NPV using excel	180,017					
IRR	23.53%					

$$BCR \frac{NPV}{Investment} \quad \frac{180,017}{482,150} \quad 0.37$$

The BCR of more than 1 indicates the profitability exceeds the discount factor (10%) used in the NPV calculation and is an additional indicator of a viable investment project (Hayes, 2022).

Accounting Rate of Return.

Annual Recurring Revenue (ARR) is a metric that shows money that comes in every year for the life of a project. The Accounting Rate of Return (ARR) uses the annual average operating profit and the average investment to produce a percentage return that would need to achieve a Company Target ARR to be deemed a viable investment. ARR is not a metric that is recognised as a usable metric in Berry.

Cash in	£	Residual Value
Yr1	168,462	175,337
Yr2	171,831	
Yr3	175,268	
Yr4	178,773	
Yr5	182,349	
Net cash flow	876,683	

701,346

	Total profit	Years	Average
Average annual profit	876,683	10	87,668

	Investment	Residual	Average
Average annual profit	482,150	175,337	328,743

ARR $\frac{87,668}{328,743} \times 100\% = 27\%$

$$\text{Annual Rate of Return} = \frac{\text{Average Annual Profit}}{(\text{Initial Investment} + \text{Future Residual Value})/2}$$

An issue with ARR is that it does not distinguish between when the cash flow occurs in the project and could give projects that return capital later in the project equal or better ARR than faster returns with lower project ARR (Atrill & McLaney, 2017).

Project Analysis

The project Analysis indicates that the payback Just exceeds the 3 years that is required for local Capex approval but is still a very viable project as it falls under the 5 year threshold. Within Berry projects with payback of under 2 years has local sign off, 3-5 would require a deeper presentation on the project and over 5 would need a direct report to corporate finance and the Capital committee.

The project sees a positive NPV with a WACC of 10%

The metric Berry would be more interested in for Capital expenditure alongside EBITDA is IRR which for this project is a positive 23.53%. and a positive incremental EBITDA of £182k/5years.

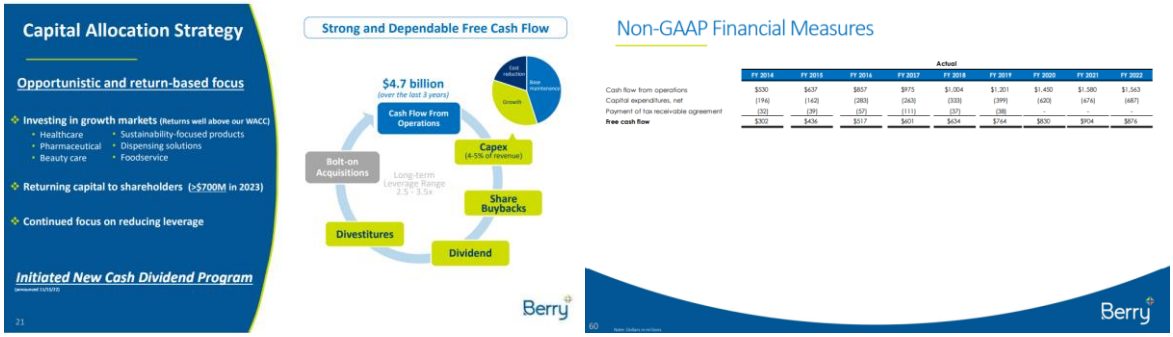
Project Analysis

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
Pay back	3.17					
NPV using excel	180,017					
IRR	23.53%					
ARR	26.67%					
PI	1.37	660,546				
BCR	0.37					

Total Cashflow	876,683
Depreciation	701,346
Net income	175,337
project length	10
Average	17,534
ARR	26.67%

Funding options.

Berry Global tend to capitalise most projects themselves but I have also once been involved in a project so Berry that did have partial Government funding. That particular project was during COVID and had a direct impact towards the pandemic so securing funding was easier and more widely available. (Global, 2023)



New Temporary Tax Reliefs on Qualifying Capital Asset Investments were introduced from 1 April 2021 relating to temporarily increased tax relief on expenditure for

plant and machinery. This measure is designed to stimulate business investment. Capital allowances allow businesses to write off the costs of tangible capital assets, such as

plant or machinery, against their taxable income. They take the place of commercial

depreciation, which is not an allowable tax deduction.

A project such as this may require inter company transactions due to timings of the investment. As Tubex is a seasonable business project work has to be implemented when the lines are quiet but this is also the time when the company makes the least amount of profit. Given this there is a chance that the Capital will be moved inter- company from a Berry Division that is making more profit at that time.

Project considerations.

Ethics, disruption and conclusion

An automation project such as this is generally seen as something that replaces labour and leads to redundancies. In this instance with the churn of bringing temporary labour being 4-1 ratio the focus is on permanent staff and robots working in collaboration so temporary labour would no longer be needed. Down time and disruption would be able to be kept to a minimum with the install being carried out in the quiet season so the plant wouldn't be sold out and at around only 60% capacity. When the line is started up and during commissioning I would envisage efficiency to be down for a few weeks but and not matching the 98+% we currently see from the manufacturing lines. One of the criteria of the project in the URS would be that the system has to achieve or exceed current KPI's.

The financial metrics and model produced are a good indicator that the project will be approved when presented to the Capital committee and with more justification on sustainability and year on year growth even the payback being just over 3 Years the project will achieve sign off.

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Appendices

Payback Period

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
		-313,688	-141,857	33,411	212,184	394,533
Pay back Yrs	2.81	1	1	0.81		

Payback Period

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
		-329,018	-187,085	-55,459	66,643	179,881
Pay back Yrs	3.17	1	1	1	0.17	

Calculating NPV

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881	-329,018	-187,085	-55,459	66,643	179,881
Pay back	3.17	1	1	1	0.168	
NPV using excel	180,017					

Calculating IRR

Project

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
NPV using excel	180,017					

Project

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC	23.527%					
Denomiator	1.000	0.833	0.694	0.579	0.482	0.402
Future value	-482,150	140,329	119,251	101,480	86,169	73,304
NPV	38,383					
NPV using excel	0					

Profability index

Project A

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
Pay back	3.17					
NPV using excel	180,017					
IRR	23.53%					

$$PI \quad \frac{\text{PV of future cash}}{\text{Investment}} \quad \frac{662{,}031}{482{,}150} \quad 1.37$$

BCR

Project A

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
Pay back	3.17					
NPV using excel	180,017					
IRR	23.53%					

$$BCR \quad \frac{\text{NPV}}{\text{Investment}} \quad \frac{180{,}017}{482{,}150} \quad 0.37$$

ARR - accounting rate of return

	investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present value	-482,150	168,462	171,831	175,268	178,773	182,349
Discount Rate (WACC)	10%					
Denomiator	1.000	0.909	0.826	0.751	0.683	0.621
Future value	-482,150	153,132	141,933	131,626	122,102	113,239
NPV	179,881					
Pay back	3.17					
NPV using excel	180,017					
IRR	23.53%					

Cash in	£	Residual Value
Yr1	168,462	175,337
Yr2	171,831	
Yr3	175,268	
Yr4	178,773	
Yr5	182,349	
Net cash flow	876,683	

701,346

	Total profit	Years	Average
Average annual prof	876,683	10	87,668

	Investment	Residual	Average
Average annual prof	482,150	175,337	328,743

ARR $\frac{87,668}{328,743} \times 100\% = 27\%$

Annual Rate of Return $= \frac{\text{Average Annual Profit}}{(\text{Initial Investment} + \text{Future Residual Value})/2}$