

GLISSANDO 20 SL WHOLE SLIDE SCANNER CAPEX REPORT

Financial Marketing and Planning
MSc International Innovation Management

Module code = ACPA7002

Supervisor = Howard Davies

Assignment 1 – Capital Project Appraisal
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John Ford (Student No. = 2115200)
(2115200@student.uwtsd.ac.uk)

Glissando 20 SL Whole Slide Scanner CAPEX report for.

CAPEX to support thin section scanning and automated porosity extraction – A new service.

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1 Introduction

Observing, recording and/or calculating accurate porosity values is a critical process in de-risking subsurface, geological assets. Traditionally, this dataset would be employed on exploration of oil or gas fields. Today, this dataset is becoming increasingly sought after in the emerging energy transition sector, particularly CCS (Carbon Capture and Storage), which is a key sector in the UK Government's Net Zero target (UK Gov, 2021).

Today, porosity data is extracted manually from thin slices of rock (AKA 'thin sections', approx. 30µm in thickness). These thin sections are produced in our laboratory and analysed within our Reservoir Geology department, where the analytical process is labour intensive, and prone to potential user bias and error. Using modern advances in scanning technology and image analysis, this analytical process can be automated, resulting in development of new revenue streams, as well as cost saving based on efficiency. This CAPEX report focuses on this new automated system.

1.1 CAPEX report Premise

This report proposes we build an automated process for scanning petrographic thin sections and automatically extract porosity data.

This represents both a new workflow and a **new service** whereby scanned thin section images and extracted porosity data are served to clients (and internally to PetroStrat staff) online, accessed via a free-to-use internet browser (such as MS Edge, or Google Chrome). This will **generate a new revenue stream**.

To achieve this, this report requests:

- Purchase of a whole thin section scanner,
- Purchase of a dedicated image server,
- Purchase of dedicated image analysis software.

These technologies will form a 'Tech stack' that will deliver this new workflow and service, building a completely new revenue stream.

2 Financial proposal

2.1 Investment

Total CAPEX investment in this proposal is **£75.6k**, representing the total cost of the required 'Tech stack' to implement and deliver the proposed automated workflow. This is broken down into:

Whole thin section scanner

Equipment	Manufacturer	Gross Cost	VAT (at 20%)	Total Cost
Glissando 20 SL Whole Slide Scanner	Objective Imaging	£45k	£9k	£54K

The Glissando 20 SL Whole Slide Scanner from Objective imaging (Objective Imaging 1) has been selected as it provides excellent image resolution at a rapid scan rate. It will scan a full thin section in 8 minutes at a resolution of 0.25µm per pixel; equivalent of x20 microscope magnification. Equivalent

scanners have been reviewed with quotes significantly higher; e.g., ZEISS Axioscan 7 which was quoted at £165k.

Image Server (RAID configuration)

Equipment	Manufacturer	Gross Cost	VAT (at 20%)	Total Cost
Glissando ImageShare	Objective Imaging	£16k	£3.2k	£19.2K

This stand-alone server has an internal storage capacity of 60TB, allowing it to handle significant volumes of data (Objective Imaging 2). It is a key part of this new service in that it also allows data to be served online to our clients in near real-time.

Image analysis software

Equipment	Manufacturer	Gross Cost	VAT (at 20%)	Total Cost
IPSDK smart image processing	Reactiv'IP	£2k	£0.4k	£2.4K

This is an off-the-shelf software solution that uses modern advances in Machine Learning to perform more efficient and more complicated image analysis processes (Reactiv'IP 1). Using an off-the-shelf solution is preferred, compared to an in-house build, as it is significantly cheaper and is ready to be deployed instantly. Minor training costs will be incurred in learning how to use the software, but these costs will be put against our central training budget. Annual software maintenance costs will also be put against our IT department.

2.2 Financial Modelling

To understand the financial implications of this 'Tech Stack' investment, three 'options' have been financially modelled. These are listed below:

Option 1 (Appendix 1): New service priced to clients at £100 per slide

Internal costs = slide preparation, laboratory staff time (loading samples), Res Geo. Staff time (image processing samples)

Option 2 (Appendix 2): New service priced to clients at £110 per slide (10% increase relative to option 1)

Internal costs = slide preparation, laboratory staff time (loading samples), Res Geo. Staff time (image processing samples)

Option 3 (Appendix 3): New service priced to clients at £100 per slide

Internal costs = Res Geo. Staff time (image processing samples). No Laboratory costs attributed to scanning.

2.3 Assumptions

These financial models make the following assumptions:

- 400 thin sections will be analysed per year (this is based on an average of all thin sections produced over the last 5 years)
- WACC (future depreciation of capital) set at 10%. This allows us to model based on a less certain economy

3 Findings and recommendations

3.1 Increased production rate

Use of scanning technology will provide a significant increase in productivity, as shown on Figure 1. In summary, 6 thin sections per hour can be scanned and porosity data extracted compared to 2 per hour using present-day methods (i.e., manually). This represents a **300% increase in productivity** per hour. This also assumes a 6 hour day, accounting for any technical or other issues that might occur.

3.1 Financial modelling summary

Table 1 shows the breakdown of cost and profit per thin section based on Options 1 – 3. Profit per slide ranges from £44.42 – £90.84. These profit values have been used in the financial modelling of options 1 - 3.

The table below provides a summary of the financial modelling:

Financial metric	Option 1	Option 2	Option 3
WACC	10%	10%	10%
Payback period	4 yrs, 3 mths	3 yrs 5.7 mths	2 yrs, 0.9 mths
NPV	(8,250)	6,913	62, 145
IRR	5.63%	13.52%	38.70%
PI	0.89	1.09	1.82
BCR	-0.11	0.09	0.82
Recommendation	Reject	Reject	Approve

3.2 Financial recommendation:

The report suggests that **OPTION 3** should be taken forward. This option states that a CAPEX investment of £75.6k will be paid back in ~2 years, meeting our internal payback threshold. Furthermore, this option provides a 39% RRI (against a WACC of 10%), with a PI of 1.82. This indicates thin section production costs should be charged to the client separately.

These values also indicate that **OPTION 3** is profitable at our current production rate of 400 slides per year (avg.). By employing the automated system that is delivered by Option 3, the capacity to analyse more samples per year will increase significantly. In this case, payback will be much quicker and this option becomes more financially attractive.

3.3 Strategic recommendations

Strategically, investment in scanning and image analysis technology is strongly recommended. A recent survey conducted by Hundred Brands on our (PetroStrat) behalf indicated that our clients expect this technology to be included in our workflows today. Consequently, we need to be 'seen' to be embracing new technology and provide 21st century results.

From a competition analysis standpoint, close competitors such as CGG and APT are already engaging in this technology and presenting to the wider scientific community, either through publication or through social media such as LinkedIn (see here for an example from APT: LinkedIn 1). To retain our

market share and compete, we must also engage with this technology, making CAPEX investment in this automated system a strategic consideration as well as financial one.

Finally, investing in this automated system will allow us to develop new revenue streams that, currently, we cannot develop. For example:

- the BGS (British Geological Survey) holds 193,000 thin sections (BGS, 2022) in their UK archive.
- Using this workflow, it would be possible to digitise this archive through high-resolution thin section scans, as well as extracting porosity volumes (where appropriate) where appropriate.

If we employed this system on 10% of their archive, at £100 per slide, we would generate £1.93million over 2.2 years, with a **profit of £857.3k** (See appendix 4 for assumptions). Currently, without investment, this type of workflow and associated revenue is outside our capability.

Lab and Res Geo unit cost = hourly rate (internal)

All options assume 6 slides analysed per hour

Option 1

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample		total cost	£55.58
	Scanner turnover		£100.00
	Scanner profit		£44.42

Avg. no samples per year	400
Scanner profit	£44.42
Yearly profit	£17,766.67

← Per sample

Option 2

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample		total cost	£55.58
	Scanner turnover		£110.00
	Scanner profit		£54.42

Avg. no samples per year	400
Scanner profit	£54.42
Yearly profit	£21,766.67

← Per sample

Option 3

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	0	£0.00
Lab prep	£20.95	0	£0.00
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample		total cost	£9.16
	Scanner turnover		£100.00
	Scanner profit		£90.84

Avg. no samples per year	400
Scanner profit	£90.84
Yearly profit	£36,336.67

← Per sample

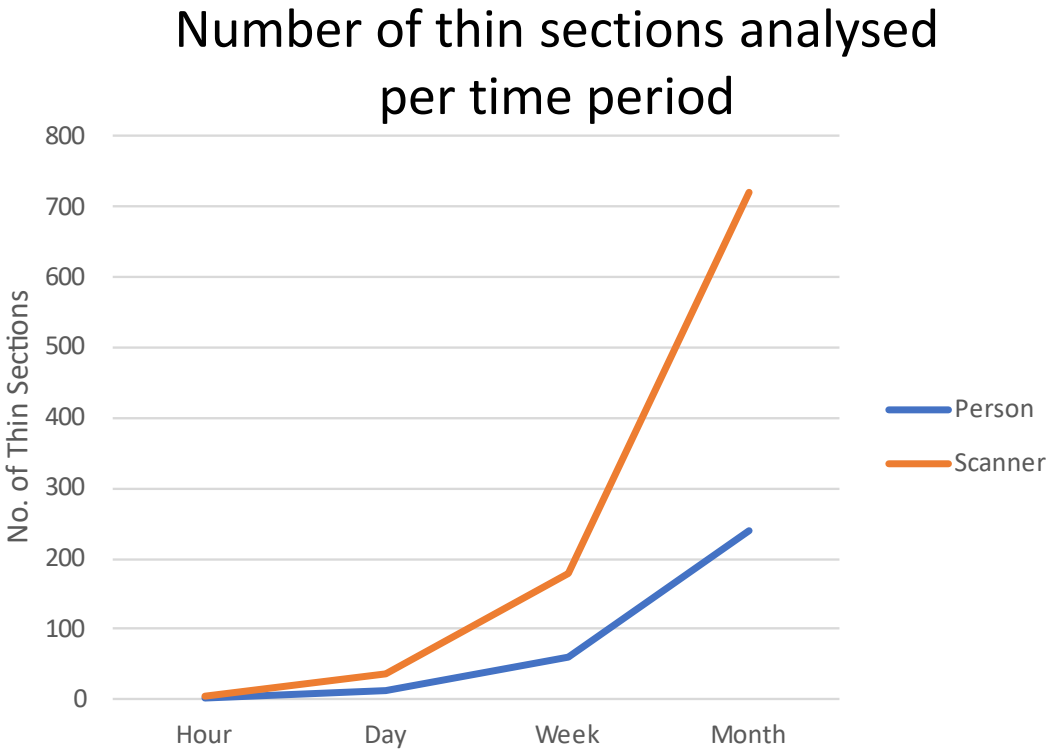
Table 1: Breakdown of thin section costs, per option

- Sample scanned and porosity volume automatically extracted – new service
- Sample preparation costs and processing timing included in costing

Profit per thin section:

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample		total cost	£55.58
		Scanner turnover	£100.00
		Scanner profit	£44.42

Value charged to clients for this new service (per sample). Charge is based on present-day grain size charge



	Hour	Day	Week	Month
Person	2	12	60	240
Scanner	6	36	180	720
Difference	4	24	120	480
Scanner Revenue	£266.50	£1,599.00	£7,995.00	£31,980.00

Value based on:
total number of scanned thin sections x profit per sample

Figure 1: Production efficiency based on use of scanning technology

7 References

BGS 2001, Petrology Collections. [Online]: <https://www.bgs.ac.uk/geological-data/national-geological-repository/petrology-collections> [accessed 02/10/22]

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Yearly profit value invested in Option 1

Avg. no samples per year	400
Scanner profit	£44.42
Yearly profit	£17,766.67

Payback schedule

	Investment	Year				
		1	2	3	4	5
Present Value	(75,600)	£17,766.67	£17,766.67	£17,766.67	£17,766.67	£17,766.67
Cumulative		£17,766.67	£35,533.33	£53,300.00	£71,066.67	£88,833.33
Payback	4 Yrs 3 mths	Manually Calculated				

Net Present Value (NPV)

NPV	(8,250)					
Discount Rate (WACC)	10.00%					
		From Present Value Table				
Denominator	1.00	0.909	0.826	0.751	0.683	0.621
Investment		1	2	3	4	5
Future Value	(75,600)	16,151.52	14,683.20	13,348.36	12,134.87	11,031.70

Profitable Index (PI) and Benefit Cost Ration (BCR)

PI	0.89
BCR	-0.11

PI > 1 represents a net positive investment

BCR > 1 represents a net positive benefit to the investment

For live excel files please email 2115200@student.uwtsd.ac.uk

Yearly profit value invested in Option 1

Avg. no samples per year	400
Scanner profit	£54.42
Yearly profit	£21,766.67

Payback schedule

	Investment	Year				
		1	2	3	4	5
Present Value	(75,600)	£21,766.67	£21,766.67	£21,766.67	£21,766.67	£21,766.67
	Cumulative	£21,766.67	£43,533.33	£65,300.00	£87,066.67	£108,833.33
Payback	3 yrs 5.7 mths	Manually Calculated				

Net Present Value (NPV)

NPV	6,913
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Discount Rate (WACC)	10.00%
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		From Present Value Table				
Denominator	1.00	0.909	0.826	0.751	0.683	0.621
	Investment	1	2	3	4	5
Future Value	(75,600)	19,787.88	17,988.98	16,353.62	14,866.93	13,515.39

Profitable Index (PI) and Benefit Cost Ration (BCR)

PI	1.09
BCR	0.09

PI > 1 represents a net positive investment

BCR > 1 represents a net positive benefit to the investment

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Yearly profit value invested in Option 1

Avg. no samples per year	400
Scanner profit	£90.84
Yearly profit	£36,336.67

Payback schedule

	Investment	Year				
		1	2	3	4	5
Present Value	(75,600)	£36,336.67	£36,336.67	£36,336.67	£36,336.67	£36,336.67
	Cumulative	£36,336.67	£72,673.33	£109,010.00	£145,346.67	£181,683.33
Payback	2 yrs 0.9 mths	Manually Calculated				

Net Present Value (NPV)

NPV	62,145					
Discount Rate (WACC)	10.00%					
		From Present Value Table				
Denominator	1.00	0.909	0.826	0.751	0.683	0.621
	Investment	1	2	3	4	5
Future Value	(75,600)	33,033.33	30,030.30	27,300.28	24,818.43	22,562.21

Profitable Index (PI) and Benefit Cost Ration (BCR)

PI	1.82
BCR	0.82

PI > 1 represents a net positive investment

BCR > 1 represents a net positive benefit to the investment

For live excel files please email 2115200@student.uwtsd.ac.uk

Standard cost per thin section

T/S cost	Unit cost	multiplie	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample		<u>total cost</u>	<u>£55.58</u>
		<u>Scanner turnover</u>	<u>£100.00</u>
		<u>Scanner profit</u>	<u>£44.42</u>

← Per sample

BGS total number of archived petrological thin sections

- 193,000 thin sections

10% of BGS archived petrological slides:

- $193,000 \times 0.1 = \mathbf{19,300 \text{ thin sections}}$

Revenue calculation

19,300 thin sections x revenue per thin section/sample

19,300 thin sections x £100 =

- £1.93 million

Profit

$19,300 \times \mathbf{£44.42} =$

£857,306 profit

APPENDIX 5

Authors:

John Ford (2115200)

Date:

11:45 – 13:15 30/09/22

**Case for automated porosity
extraction from thin section
scanning technology**

Board Presentation

Contents



Project Premise



Introduction to Whole Slide Scanners + review of techstack



Sunk costs and present timings



Payback schedule, NPV and IRR comparison between 3 options



Conclusions

Project



Project premise

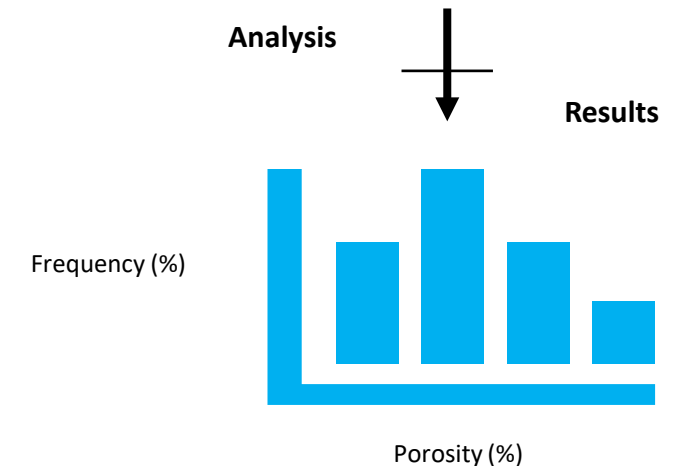
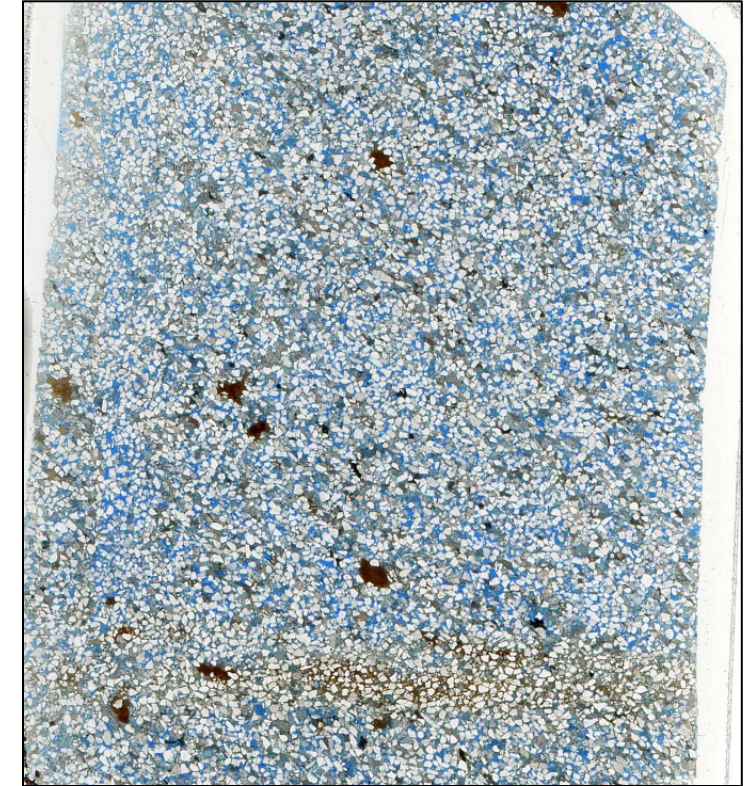
Current methods for extracting porosity volume:

- Labour intensive
- Potentially biased/non-representative

Strategic considerations

New method:

- Pass results of whole thin section scanner through image analysis software; automatically extract porosity value



Introduction – Whole thin section slide scanners

Glissando 20 SL WSI (whole slide imaging)



Images from
https://www.objectiveimaging.com/Glissando/Glissando_20SL.php

Specification

-  Multi-slide magazine. Up to 20 slides can be loaded at once
-  Auto-sample designation based on QR code reader
-  0.25µm per pixel resolution, with 0.75 aperture. Provides x20 magnification scan in 8 minutes



Images from
https://www.objectiveimaging.com/Glissando/Glissando_20SL.php

Techstack – total costs

1.



Gross = £45k
VAT = £9k (at 20%)

Total = £54k

2



Gross = £16k
VAT = £3.2k (at 20%)

Total = £19.2k

3



Gross = £2k
VAT = £400 (at 20%)

Total = £2.4k

Total cost of full techstack = £75.6k

Sunk costs and present timings

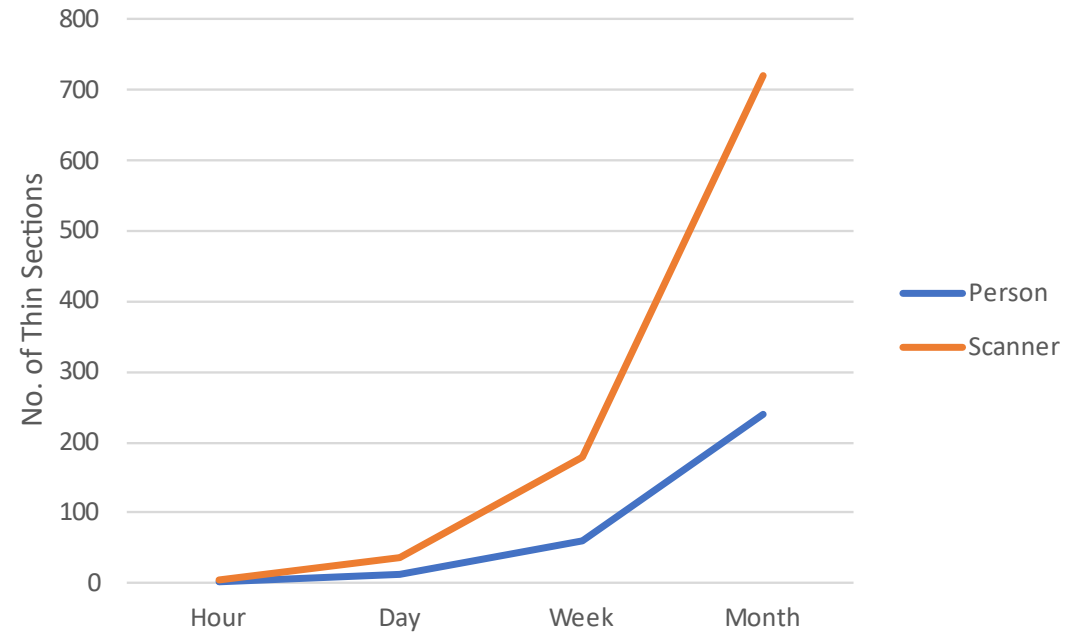
Sample scanned and porosity volume automatically extracted – new service

Sample preparation costs and processing timing included in costing

Profit per slide:

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample	total cost		£55.58
	Scanner turnover		£100.00
	Scanner profit		£44.42

Number of thin sections analysed per time period



	Hour	Day	Week	Month
Person	2	12	60	240
Scanner	6	36	180	720
<i>Difference</i>	4	24	120	480
Scanner Revenue	£266.50	£1,599.00	£7,995.00	£31,980.00

Option costs

Option A

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample	total cost		£55.58
	Scanner turnover		£100.00
	Scanner profit		£44.42

samples per year	400
Scanner profit	£44.42
yearly profit	£17,766.67

Option B

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	1	£15.00
Lab prep	£20.95	1.5	£31.43
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample	total cost		£55.58
	Scanner turnover		£110.00
	Scanner profit		£54.42

samples per year	400
Scanner profit	£54.42
yearly profit	£21,766.67

Option C

T/S cost	Unit cost	multiplier	Total cost
consumable	£15.00	0	£0.00
Lab prep	£20.95	0	£0.00
Sample loading	Unit cost	division	Total cost
Lab time	£20.95	6	£3.49
Image processing	Unit cost	division	Total cost
Res. Geo time	£34.00	6	£5.67
Per Sample	total cost		£9.16
	Scanner turnover		£100.00
	Scanner profit		£90.84

samples per year	400
Scanner profit	£90.84
yearly profit	£36,336.67

Payback schedules

Payback period of initial investment



Average number of slides per year = 400

Option A

Option A

		Year				
Investment		1	2	3	4	5
Present Value	(75,600)	£17,766.67	£17,766.67	£17,766.67	£17,766.67	£17,766.67
Cumulative		£17,766.67	£35,533.33	£53,300.00	£71,066.67	£88,833.33

Profit = £44.42 per slide, with a £100 client charge

= Payback: 4 yrs, 3 mths

Option B

Option B

		Year				
Investment		1	2	3	4	5
Present Value	(75,600)	£21,766.67	£21,766.67	£21,766.67	£21,766.67	£21,766.67
Cumulative		£21,766.67	£43,533.33	£65,300.00	£87,066.67	£108,833.33

Profit = £54.42 per slide, with a £110 client charge

= Payback: 3 yrs, 5.7 mths

Lab processing costs removed

Option C

removed

Profit = £90.84 per slide, with a £100 client

Option C

		Year				
Investment		1	2	3	4	5
Present Value	(75,600)	£36,336.67	£36,336.67	£36,336.67	£36,336.67	£36,336.67
Cumulative		£36,336.67	£72,673.33	£109,010.00	£145,346.67	£181,683.33

Profit = £90.84 per slide, with a £100 client charge

= Payback: 2 yrs, 0.9 mths

NPV and IRR: comparison

Option A

Discount Rate (WACC)	10.00%					
		From Present Value Table				
Denominator	1.00	0.909	0.826	0.751	0.683	0.621
Investment		1	2	3	4	5
Future Value	(75,600)	16,151.52	14,683.20	13,348.36	12,134.87	11,031.70

NPV	(8,250)
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IRR (Excel Calculated)	5.63%
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This project is not commercially viable over a 5 year period

Option B

Discount Rate (WACC)	10.00%					
		From Present Value Table				
Denominator	1.00	0.909	0.826	0.751	0.683	0.621
Investment		1	2	3	4	5
Future Value	(75,600)	19,787.88	17,988.98	16,353.62	14,866.93	13,515.39

NPV	6,913
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IRR (Excel Calculated)	13.52%
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This project is commercially viable over a 5 year period

Option C

Discount Rate (WACC)	10.00%					
		From Present Value Table				
Denominator	1.00	0.909	0.826	0.751	0.683	0.621
Investment		1	2	3	4	5
Future Value	(75,600)	33,033.33	30,030.30	27,300.28	24,818.43	22,562.21

NPV	62,145
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IRR (Excel Calculated)	38.70%
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This project is commercially viable over a 5 year period. This project represents greatest rate of return

Conclusions

-  Utilising scanning technology increases analytical efficiency. More samples are processed in the same time period and results are more repeatable
-  When lab preparation costs are included within the cost of analysing each sample:
 - Payback period is over 3 years
 - IRR is relatively low at 13% (option B - £110 per sample charge to clients)
-  When lab preparation costs are removed from the cost of analysing each sample:
 - Payback period is over ~2 years
 - IRR is high at ~39%. This IRR is achieved at a client price of £100 per sample, which is equivalent to rates today

Strategic considerations

-  Client expectation is that we include scanning technology within our workflows
-  Competitor analysis indicates use of scanner technology in their workflows and products
-  **This technology will also allow us to generate additional products. Correct to invest from a strategic viewpoint.**