Incremental Cash Flow Analysis

Here is a common challenge…

You oversee the company's manufacturing operations.

You want to purchase a new, fully automated 5-axis CNC machining center.

Based on your analysis, you project that such a machine could reduce labor hours for setup and operation, and thereby reduce the costs of the finished component.

The new machine costs $250,000.

Anticipated Annual O&M Costs: $40,000.

Time of Use: 5 years

Salvage Value: $50,000

Company Discount Rate: 16%

Is this a worthwhile project?

Here is a common challenge…

Your Spreadsheet with NPV and IRR

	A	B	C	D	E	F	G
1	**A Cost-Only Example**						
2							
3	**Initial Investment:**	**$250,000**					
4	**Annual Operating Expenses:**	**$40,000**					
5	**Time (years):**	**5**					
6	**Salvage Value:**	**$50,000**					
7	**Discount Rate:**	**16%**					
8							
9		**End of Year Cash Flows**					
10	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
11	**Cash Flow**	-$250,000	-$40,000	-$40,000	-$40,000	-$40,000	$10,000
12							
13	PV (Yr 1-5):	-$107,166	*=NPV(B7, C11:G11)*				
14	Initial Investment:	$250,000	*=B3*				
15	**Net Present Value, NPV:**	**-$357,166**	*=B13-B14*				
16							
17	**Internal Rate of Return, IRR:**	**#NUM!**	*=IRR(B10:G10)*				

There are no "benefits", only costs.

In cost-only projects, NPV will always be less than zero.

IRR is undefined (Excel's #NUM!), as there is no rate of return for a project with no benefits!

This project shows a negative NPV of -$357,166.

And an IRR of #NUM!

A Cost Reduction Project

When proposing cost reduction projects…

Step 1: Determine the “As-Is” case: costs based on the current process, and project these into the future as though you “do nothing” different. (This is sometimes called the “Base Case”).

Step 2: Determine the “To-Be” case: future costs based on the new project.

Step 3: Compare the “To-Be” costs relative to the “As-Is” costs:

Cash Flows (To-Be) – Cash Flows (As-Is)

Step 4: Conduct a discounted cash flow analysis on the “incremental cash flows”.

Incremental Cash Flow Analysis

A Cost Reduction Project

	A	B	C	D	E	F	G
1	**Incremental Cash Flow Example**						
2							
3	**As-Is Case:**						
4	**Annual Operating Expenses:**	**$150,000**					
5							
6	**To Be-Case:**						
7	**Initial Investment:**	**$250,000**					
8	**Annual Operating Expenses:**	**$40,000**					
9	**Time (years):**	**5**					
10	**Salvage Value:**	**$50,000**					
11	**Discount Rate:**	**16%**					
12							
13		**End of Year Cash Flows**					
14	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
15	As-Is Case	$0	-$150,000	-$150,000	-$150,000	-$150,000	-$150,000
16	To Be Case	-$250,000	-$40,000	-$40,000	-$40,000	-$40,000	$10,000
17	**Incremental Cash Flow**	**-$250,000**	**$110,000**	**$110,000**	**$110,000**	**$110,000**	**$160,000**
18							
19	PV (Yr 1-5):	$383,978	*=NPV(B11, C17:G17)*				
20	Initial Investment:	$250,000	*=B7*				
21	**Net Present Value, NPV:**	**$133,978**	*=B19-B20*				
22							
23	**Internal Rate of Return, IRR:**	**36%**	*=IRR(B17:G17)*				

Set up a spreadsheet that shows:

- The “As-Is” Cash Flows
- The “To-Be” Cash Flows
- The Incremental Cash Flows, (To-Be)–(As-Is)
- Determine the NPV & IRR from the Incremental Cash Flows

A Cost Reduction Project

	A	B	C	D	E	F	G
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2							
3	**As-Is Case:**						
4	**Annual Operating Expenses:**	**$150,000**					
5							
6	**To Be-Case:**						
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9	**Time (years):**	**5**					
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12							
13		**End of Year Cash Flows**					
14	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
15	As-Is Case	$0	-$150,000	-$150,000	-$150,000	-$150,000	-$150,000
16	To Be Case	-$250,000	-$40,000	-$40,000	-$40,000	-$40,000	$10,000
17	**Incremental Cash Flow**	**-$250,000**	**$110,000**	**$110,000**	**$110,000**	**$110,000**	**$160,000**
18							
19	PV (Yr 1-5):	$383,978	*=NPV(B11, C17:G17)*				
20	Initial Investment:	$250,000	*=B7*				
21	**Net Present Value, NPV:**	**$133,978**	*=B19-B20*				
22							
23	**Internal Rate of Return, IRR:**	**36%**	*=IRR(B17:G17)*				

The As-Is Cash Flows: these would occur if you “do nothing”.

Note there is no investment required to keep doing what you’re already doing!

A Cost Reduction Project

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14	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
15	As-Is Case	$0	-$150,000	-$150,000	-$150,000	-$150,000	-$150,000
16	To Be Case	-$250,000	-$40,000	-$40,000	-$40,000	-$40,000	$10,000
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18							
19	PV (Yr 1-5):	$383,978	*=NPV(B11, C17:G17)*				
20	Initial Investment:	$250,000	*=B7*				
21	**Net Present Value, NPV:**	**$133,978**	*=B19-B20*				
22							
23	**Internal Rate of Return, IRR:**	**36%**	*=IRR(B17:G17)*				

Then you lay out the “To-Be” cash flows as you normally would for a new project.

A Cost Reduction Project

	A	B	C	D	E	F	G
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3	**As-Is Case:**						
4	**Annual Operating Expenses:**	**$150,000**					
5							
6	**To Be-Case:**						
7	**Initial Investment:**	**$250,000**					
8	**Annual Operating Expenses:**	**$40,000**					
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10	**Salvage Value:**	**$50,000**					
11	**Discount Rate:**	**16%**					
12							
13		**End of Year Cash Flows**					
14	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
15	As-Is Case	$0	-$150,000	-$150,000	-$150,000	-$150,000	-$150,000
16	To Be Case	-$250,000	-$40,000	-$40,000	-$40,000	-$40,000	$10,000
17	**Incremental Cash Flow**	**-$250,000**	**$110,000**	**$110,000**	**$110,000**	**$110,000**	**$160,000**
18							
19	PV (Yr 1-5):	$383,978	*=NPV(B11, C17:G17)*				
20	Initial Investment:	$250,000	*=B7*				
21	**Net Present Value, NPV:**	**$133,978**	*=B19-B20*				
22							
23	**Internal Rate of Return, IRR:**	**36%**	*=IRR(B17:G17)*				

Then determine the NPV and IRR based on the Incremental Cash Flows: (To-Be) – (As-Is)

A Cost Reduction Project

	A	B	C	D	E	F	G
1	**Incremental Cash Flow Example**						
2							
3	**As-Is Case:**						
4	**Annual Operating Expenses:**	**$150,000**					
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6	**To Be-Case:**						
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		End of Year Cash Flows					
14	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
15	As-Is Case	$0	-$150,000	-$150,000	-$150,000	-$150,000	-$150,000
16	To Be Case	-$250,000	-$40,000	-$40,000	-$40,000	-$40,000	$10,000
17	**Incremental Cash Flow**	**-$250,000**	**$110,000**	**$110,000**	**$110,000**	**$110,000**	**$160,000**

18			
19	PV (Yr 1-5):	$383,978	*=NPV(B11, C17:G1*
20	Initial Investment:	$250,000	*=B7*
21	**Net Present Value, NPV:**	**$133,978**	*=B19-B20*
22			
23	**Internal Rate of Return, IRR:**	**36%**	*=IRR(B17:G17)*

With cost reduction projects, the "benefits" are the cost savings from doing the project.

An incremental cash flow analysis allows you to show the financial value of the proposed project in terms everyone understands, the NPV and IRR.

For the Project: NPV = $133,978 and the IRR = 36%

This is a very worthwhile project. The cost savings more than offset the initial investment in the new machining center.

Cost-Only Projects…

Sometimes projects are “cost-only” projects, where there are no defined financial benefits.

What happens in this case?

Example. You need to purchase a new pollution control system for your facility to comply with local emission regulations. The equipment has a life of 5 years. Your company has a discount rate of 14%.

You identified 3 products that will work, with the following costs:

	Pollution Control System #1	Pollution Control System #2	Pollution Control System #3
Initial Cost ($)	$575,000	$500,000	$600,000
Annual O&M ($)	$80,000	$100,000	$60,000

Cost-Only Projects…

There are two ways to select the lowest cost alternative…

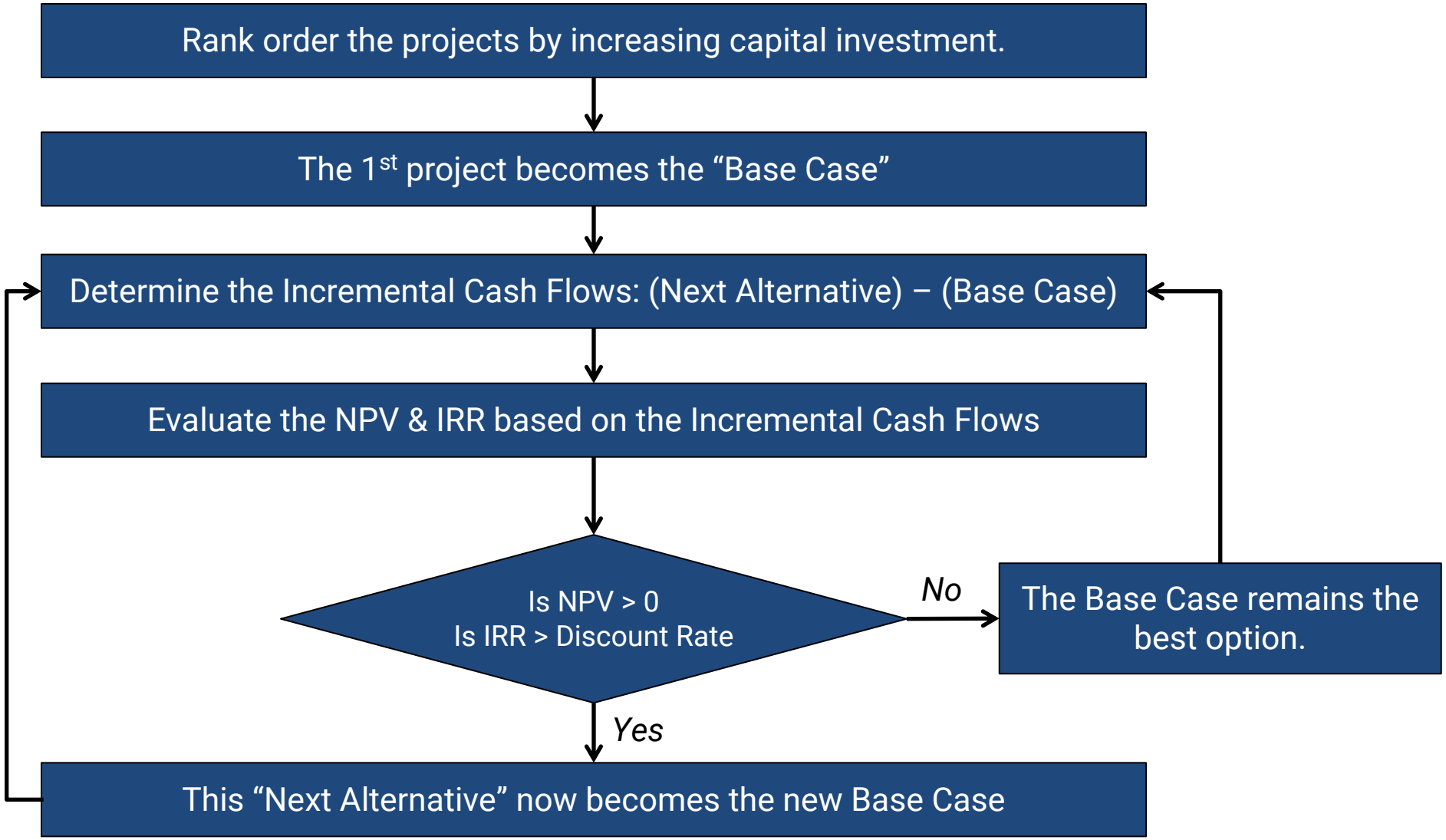
1) Calculate the NPV for each alternative and select the one with the largest NPV
   (Note: as a cost-only project, the NPV's will all be negative. Yet we still select the project with the highest NPV, representing the lowest cost alternative.)

	Pollution Control System #1	Pollution Control System #2	Pollution Control System #3
Initial Cost ($)	$575,000	$500,000	$600,000
Annual O&M ($)	$80,000	$100,000	$60,000
NPV ($)	**-$849,646**	**-$843,308**	**-$805,985**

Recognizing this is an all-cost project, the lowest cost option is the one with the highest NPV (even though it is negative): Pollution Control System #3.

Cost-Only Projects…The Incremental Approach

2) Use Incremental Cash Flow Method to identify the lowest cost alternative.



Cost-Only Projects…The Incremental Approach

Example. You need to purchase a new pollution control system for your facility to comply with local emission regulations. The equipment has a life of 5 years. Your company has a discount rate of 14%.

You identified 3 products that will work, with the following costs:

Step 1: Rank Order the Projects by Initial Investment, from Lowest to Highest; The 1st project becomes the Base Case.

	Base Case	Next Alternative	
	Pollution Control System #2	**Pollution Control System #1**	**Pollution Control System #3**
Initial Cost ($)	$500,000	$575,000	$600,000
Annual O&M ($)	$100,000	$80,000	$60,000

Cost-Only Projects…The Incremental Approach

Step 2: Determine the incremental cash flows between the Next Alternative (PC1) and the Base Case (PC2): $CF_{PC1} - CF_{PC2}$.

	End of Year Cash Flows					
Project	**0**	**1**	**2**	**3**	**4**	**5**
PC2	-$500,000	-$100,000	-$100,000	-$100,000	-$100,000	-$100,000
PC1	-$575,000	-$80,000	-$80,000	-$80,000	-$80,000	-$80,000
Incremental Cash Flow	**-$75,000**	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$20,000**

Step 3: Evaluate the NPV and IRR based on the incremental cash flows.

PV (Yr 1-5):	$68,662
Incremental Investment:	$75,000
Net Present Value, NPV:	**-$6,338**
Internal Rate of Return, IRR:	**10%**

The NPV is negative, and the IRR is less than the discount rate (14%).

=> The additional investment in PC1 is not worth the lower O&M costs, relative to PC2.

Reject PC1, PC2 remains as the Base Case.

Cost-Only Projects…The Incremental Approach

Step 2: Determine the new incremental cash flows between the Next Alternative (PC3) and the new Base Case (PC2): $CF_{PC3} - CF_{PC2}$.

	End of Year Cash Flows					
Project	**0**	**1**	**2**	**3**	**4**	**5**
PC2	-$500,000	-$100,000	-$100,000	-$100,000	-$100,000	-$100,000
PC3	-$600,000	-$60,000	-$60,000	-$60,000	-$60,000	-$60,000
Incremental Cash Flow	**-$100,000**	**$40,000**	**$40,000**	**$40,000**	**$40,000**	**$40,000**

Step 3: Evaluate the NPV and IRR based on the new incremental cash flows.

PV (Yr 1-5):	$200,000
Incremental Investment:	$100,000
Net Present Value, NPV:	**$100,000**
Internal Rate of Return, IRR:	**29%**

The NPV is now positive, and the IRR is more than the discount rate (14%).

=> The additional investment in PC3 is worth the lower O&M costs, relative to PC2.

Reject PC2, **PC3 is selected as the project!**

Main Takeaways…

The incremental cash flow method is very useful when looking at cost-only projects (no benefits), typical of many cost reduction initiatives.

To decide whether a cost reduction project is financially worthwhile, determine the incremental cash flows from the To-Be case and the As-Is case. Cost savings are now benefits, and the NPV and IRR can be readily determined.

When comparing several projects,

- ✓ Rank order the projects by initial investment; establish the Base Case
- ✓ Compare the incremental cash flows from the first two projects (2^{nd} – Base Case)
- ✓ If NPV > 0 & IRR > the Discount Rate, keep the 2^{nd} project; if not, keep the Base Case
- ✓ Now compare the winner to the next project
- ✓ Repeat until you have the answer!

When comparing projects, the incremental cash flow method always selects the best project.

It is ideal with cost-only projects - but works well with any type of project!

Next Time…

Depreciation, Taxes & Inflation

Credits & References

Slide 1: Incremental cash-flow written on the keyboard button by AliFuat, Adobe Stock (273075230.jpeg).

Slide 2: The abstract scene of 5-axis CNC machine and the NC code-data background by Pixel_B, Adobe Stock (277070887.jpeg).

Slide 17: Financial analyst analysis business financial report on digital tablet during discussion at meeting of corporate showing the results of their successful teamwork by crizzystudio, Adobe Stock (502970152.jpeg).