Teach Yourself:
Economic Evaluation:

Cost Reduction Studies
(Trade Off Studies)

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The purpose of this module is to …

Level 3: Decision ma

Use your model to assess cost reduction ideas

Level 2: Evaluating the business/project

Level 1: Hands-on economic modelling

There is a worked example of a cost reduction model in Excel on this website

Spend only a few seconds on most slides.

Cost reduction/ trade off studies …

Cost reduction (Trade-off) studies should be faster than classical investment evaluations because they have no change in revenue

- normally!

Typically they involve comparing the existing business with an alternative or two which have: -

- No change in output of products, sales and prices
- A change in the opex and capex configuration
  - For example, 'Should we invest a little capex to lower the operating costs?'
- A consequential change in income tax (in the opposite direction)

Some cost reduction studies examine whether to: -

- Change the production profile but still output the same volumes of saleable products.
  - For example, should we process larger volumes of lower grade feed to output the same products? (or process smaller volumes of higher grade feed). These in turn will change the operating costs, capex and therefore the income tax.

Your evaluation model …

Your evaluation model typically might comprise: -

1. An 'Introduction/Audit' worksheet,
2. A worksheet of the 'Existing Business'
3. A worksheet of 'Alternative A' For example, that produces the same product tonnes for sale but has a different capex, opex and hence tax profile.

And if needed

1. A worksheet of 'Alternative B' For example it may have another opex/capex configuration or it may change the production strategy. …
2. etc

Comparing cases…

Unlike the basket of metrics needed to assess a businesses or a revenue generating project, a cost reduction study can focus on NPV.

- If the cost reduction alternative involves development, operations or technology that is not well established then you may wish to risk weight the NPVs.

Rather than comparing final NPVs it is essential to compare the graphs of cumulative NPV over the study period.

Alternative B may have the highest NPV but it may be a poor choice.

The journey to get to its highest NPV may too long and risky.

For example it may require a large capital investment, in a yet to be proven technology, and then take 4 years before its cumulative NPV equals that of the existing case.

Then its final NPV after 6years may be only marginally better than the existing case.

Decision makers should be fully informed when they make their decision 'with eyes wide open'

They may well decide Alternative B with the highest NPV is not a wise choice!

The 'existing case' is not the 'status quo'!

The **existing case** may be called the '**base case**' or another term. It is how the business should evolve and be shaped/developed on its present course. The business inside this 'existing case' or 'base case' should be optimised. It should include all the progressive gradual improvements and the organic growth that could be achieved by operating and managing the business effectively, efficiently and creatively.

It should not be the **'status quo'** case. This case is frozen at the present time. The status quo is a non-thinking case that does not include the improvements that the business should be able to achieve over the next years. It does not include the increases in production, sales and revenue that the business should reasonably achieve by good management. Status quo fails to include normal increasing efficiency and improving technology within the business. It does not include the improvements in costs that should be achieved by effective management over these years.

If revenue does change …

If the output of products, sales and revenue **does** change in one of the alternatives then you must be very, very careful.

As you would know, production/revenue is the dominant cash stream. If one of the alternatives has even a small change in revenue then its impact on NPV is likely to be very influential. In many businesses a small increase or decrease in saleable product/revenue will swamp any underlying changes in capex and opex.

So if one of your alternatives involves a change in revenue you need to think through whether the opex/capex changes are causing the change in NPV or whether the production/revenue is the main cause.

If it is the production/revenue cash stream then you need to discuss with colleagues how else you could get this same change in production/revenue. Perhaps there is an even better configuration of production, revenue, capex and opex.

Normal worksheet structure …

1. Use the normal four cash streams leading to the table of net cash flow and NPV (IRR probably will be redundant)
2. Model only the changes in each cash stream if you are confident you can capture the underlying impacts (as in the worked example on this website)
3. Or model the four complete business cash streams in full if the interactions in the Alternatives are complex.
4. Start with as simple a model as is sensible, to initially test the ideas, then add extra detail as warranted.
   - It is likely that the production sequence (ie processing steps) and operating costs might need more and more detail if the initial coarse assessment justifies deeper studies.
   - You need to go to as much detail and complexity as is needed to be confident that you have correctly characterised and valued each alternative against the existing case.
5. Create the graphs. First to find your own mistakes and then for others to quickly grasp the fundamentals of each case.

Cash Stream #1: Production & Revenue

In straight forward cost reduction studies you may not need any production, sales and revenue information, because all the alternatives you are studying will process the same feed and output the same products for sale. All that might be needed is one row showing the "Cash Stream 1- **Changes** in Revenue" as zero in each year.

In the next level of study you may need to show the key material flows in the production sequence so that you can compute the variable operating costs below. Then the revenue would be as above - one row showing the "Cash Stream 1- **Changes** in Revenue" as zero in each year. (as in the worked example on this website.)

In complex cost reduction studies you may need to model the complete production, sales and revenue sequence (not just the changes in revenue) - as in a classical evaluation model.

Cash Stream #2: Capex

In straight forward cost reduction studies you may be able to show just a few rows that sum to "Cash Stream 2- Changes in Capex"

In complex cost reduction studies you may need to model the complete capex profile – as in a classical evaluation model.

Each of these would lead to the usual computation of tax deductions for capex – either the changes in tax deductions or the complete tax deductions.

Always check as you go that your total tax deductions for capex equal your capex plus opening balance of unclaimed tax deductions: whether you work more coarsely in real terms only or whether you decide it is prudent to do the tax deductions for capex in nominal terms so as to include the erosion caused by inflation.

Cash Stream #3: Opex

In straight forward cost reduction studies you may be able to show just a few rows that sum to "Cash Stream 3- Changes in Opex"

In the next level of study you may need to compute the changes in opex as a sequence of fixed and variable costs. This sequence would mimic and reference the process steps in the Production sequence in Cash Stream #1 above. (as in the worked example on this website.)

In complex cost reduction studies you may need to model the complete opex profile – as in a classical evaluation model.

In any model: -

- Match the detail of the operating costs with their materiality. Start as simply as sensible and add detail as is justified/needed. Usually operating costs can be sorted into natural groups of variable costs and fixed costs.
- Be very wary of operating costs that are based on the final quantities of product, rather than on the quantities being processed through each stage.
- Your model may become long and detailed , but always use simple, obvious steps where anyone can readily follow the calculations. Do not use 'half smart' algorithms that do multiple steps in one row - they are too tedious for others to untangle!

Cash Stream #4: Tax

Income tax: In both straight forward cost reduction studies and complex studies the tax computation would be the same straight forward format as in a full evaluation model. In many studies this could be only a few rows.

If you are modelling changes in costs without revenue then the tax change will be in the opposite direction. For example if an alternative has lower costs then its income tax will increase. (as in the worked example)

Royalties: If there is no change in sales revenue then there is no need to model government royalties and other charges that are based on revenue.

Net Cash Flow and NPV

Net cashflow and NPV should be straight forward as in a full evaluation model.

Cumulative NPV: It is essential that you graph the cumulative NPV. When you compare alternatives with the existing case you will need to compare these graphs – much more important than just comparing 'final NPVs'.

IRR: Unless there is a capex investment that causes a reversal in net cash flow in an early year there will not be an IRR.

‘Alternative A’

My method of generating a worksheet for Alternative A is:

1. Make a copy of the ‘Existing Case’ and relabel it ‘Alternative A’ (or a name like ‘high capex case’) in its tab.
2. Do a find and replace down Column A of ‘Existing Case’ by ‘Alternative A’.
3. Change the graph titles manually one at a time – is there a better method?
4. Every row that is to be kept the same as the ‘Existing Case’ (for example income tax rate and discount rate) is converted to a ‘reference’ of the same row in the ‘Existing Case’ (=‘Existing Case:F6’) and is coloured green font on green background. So if this parameter is changed in the Existing Case it will automatically change in Alternative A. (as in the worked example)
5. Delete redundant rows of blue text above each of those referenced rows or convert its cell in Column A to referencing the ‘Existing Case”. (as in the worked example)
6. Methodically work down the worksheet changing the fresh input parameters (blue font on blue background) in each of the four cash streams to make it ‘Alternative A’. Insert where you sourced each parameter in the row above; date, who, what – in blue font.
7. Change the logic where needed. Delete and add rows as needed.
8. Check the new cash flows and NPV
9. Audit the whole worksheet – especially the graphs.

‘Alternative B’

My method of generating a worksheet for Alternative B is:

1. Make a copy of ‘Alternative A’ and relabel it ‘Alternative B’ (or a name like ‘low grade feed case’) in its tab.
2. Do a find and replace down Column A of ‘Alternative A’ by ‘Alternative B’.
3. Change the graph titles, one at a time
4. The parameters that are to be kept the same as in ‘Existing Case’ will already be referenced and show as green font on green.
5. Continue as in Alternative A

Results

After having your colleagues audit each worksheet, compare the cumulative NPV's and the four cash streams of all cases

As for any assessment –

Get up and away from your computer to get amongst your colleagues

Find out what managers and colleagues want from the study

Teach yourself the drivers and intricacies of this business

Share your progress - to get others on-side

Check your evaluation inputs and results with colleagues

Get them to audit their sections/worksheets of your model

Discuss, review and realign your evaluation work

You can become a key person in cost reduction

End