

Teach Yourself: Economic Evaluation:

Step 3 of Evaluating the Business / Project

**2h: Uncertainty, Risk,
Optionality**

The purpose of this module is to ...

Level 3: Dec

take an overview of uncertainty, risk
and optionality when

Level 2: Evaluating the business/project

Level 1: Hands-on economic modelling

Spend only a few seconds on most slides.

Level 2: Evaluating the business/project

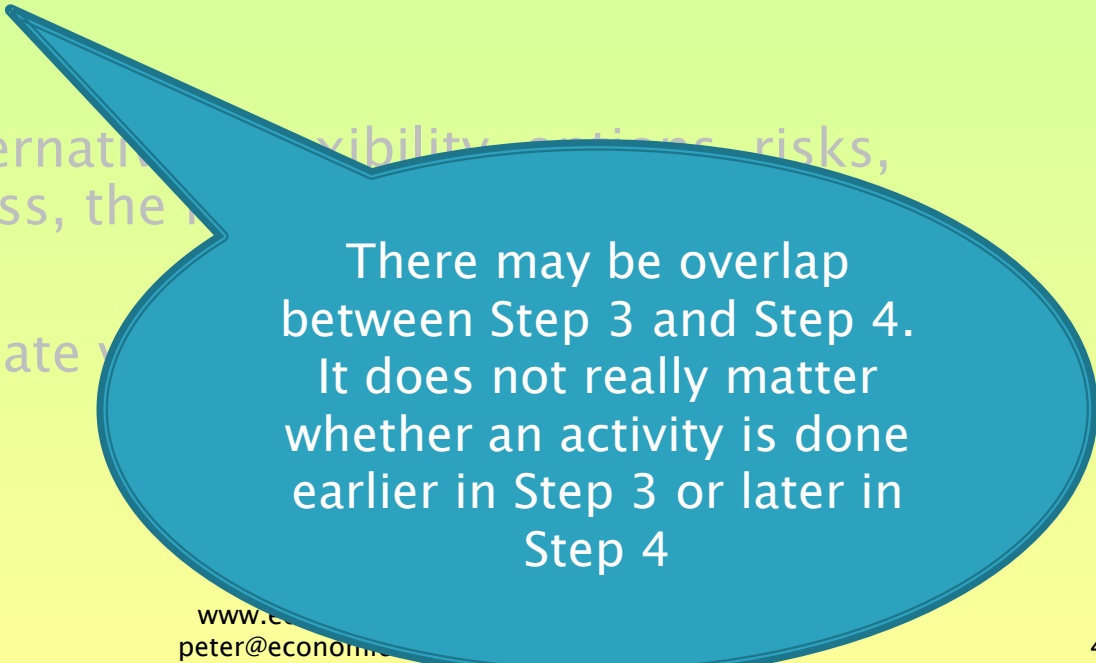
Step 1: Find out what is required

Step 2: Create the hands-on model

Step 3: Compute the basket of powerful economic measures: NPV, IRR, Payback, four cash streams, key drivers, break-evens, **uncertainty, risk, optionality**

Step 4: Assess alternative flexibility options, risks, the business, the market

Step 5: Communicate your findings



There may be overlap between Step 3 and Step 4. It does not really matter whether an activity is done earlier in Step 3 or later in Step 4

In simple terms I understand that ...

Uncertainty

Is by how much experts forecast that a parameter might vary.

As an illustration they may estimate:

Maximum recovery = 96%

High recovery = 94%

Mid recovery = 90%

Low recovery = 82%

Minimum recovery is 60%

The key role of uncertainty is already discussed above in NPV and IRR, etc

Risk

Is whether an event may happen or not happen.

As an illustration there is a 75% likelihood of getting the mining licence

And so a 25% risk of not getting the mining licence to proceed.

Optionality

If one thing happens then another thing may or may not follow

If we build the first mine then its infrastructure means that we should have an 80% likelihood of being able to develop the satellite deposit nearby.

Absolutely essential computations ...

These three are likely to be absolutely essential processes in understanding and computing the full range of values of a business/project.

As an illustration you may compute the following sets of valuations: –

- Value mid
- Values adjusted for uncertainty – minimum, low, mid, high, maximum
- A probability weighted valuation of minimum, low, mid, high, maximum
- Above values adjusted for risk (positive and negative)
- Above values adjusted for optionality (positive and negative)
- Where valid, values generated from probabilistic software

Everyone should be aware of

1. all results and of
2. the assumptions (opinions) underlying each

Decisions must be made with eyes wide open!

The mathematics ...

In these three areas there are many people specialising in running workshops, doing computations and co-ordinating to a result.

As everywhere some are good and some are mediocre, some are reasonably priced and some are overpriced, some are great at self promotion and some are modest.

Paying lots for a self confident showman may not be as beneficial as hiring a modest, competent, hard worker.

I feel a lot of this sort of work can be done in-house by the business/project team or by an in-house colleague once they get understanding of what is required.

Watch out for a workshop co-ordinator who inadvertently starts leading the discussion.

This person should facilitate, perhaps get people to stretch their thinking but never help set values for uncertainty, risk or optionality. Can be difficult.

I believe results only if I truly understand how they were generated and if I understand the key assumptions upon which they are based.

I no longer feel intimidated by mathematicians and seasoned 'experts' who expect me to accept their results at face value. Their job is to convince me!

Only opinions expressed mathematically

Just like NPV, IRR, four cash streams the results of work in uncertainty, risk and optionality are assemblies of expert opinions. Any results are only as valid and trustworthy as the data going in and of the processing mathematics.

Be wary of managers and colleagues who start thinking the results are true and objective.

Be more aware of probabilistic software dealers who smooth over the limitations of the interactions between key parameters like price/ forex/ cut-off grade/ throughput/ capex/etc.

Uncertainty

As already illustrated, I would consider the following sequence to compute an assembly of NPV's, IRRs, four cashflows, breakeven, etc adjusted for uncertainty.

1. **Mid Scenario**
 - Create the mid scenario and generate its NPV and IRR.
2. **Minimum, Low, High, Maximum scenarios**
 - Generate the low and high scenarios using colleagues' consensus
 - If sensible create the minimum and maximum scenarios
3. **Probability weight the NPV's**
 - of the above three (or five) scenarios to get a probability weighted NPV
4. **Probabilistic Software Scenarios**
 - If applicable and warranted get an uncertainty specialist to co-ordinate the team through a probabilistic workshop.
 - Make sure that specialist does not lead the decision making process but remains neutral.
 - Rate the software results by how well the software can integrate the changes in key parameters. One common failing is that iterations that vary price do not recompute the mine plan with different cut-off grades to give a better matching production schedule, and then recompute capital costs for the new production schedule.

Risk and Optionality

Source methodologies for risks and for optionality from the Internet.
Methodologies are well described in many publications and sources on the Internet.

One common way to handle risks and optionality seems to be via separate decision trees

This might involve working from your base case NPV/IRR (mid case or probability weighted) and adding the first prime risk. As an illustration there may be a 25% likelihood that community groups will prevent your project from proceeding after you have spent cash on studies and government processes. Multiple the NPV of these lost costs by 25%, and the base case NPV by 75%. Repeat across a decision tree.

Do similarly for optionality – as an illustration if we build the mine then we estimate there is a 80% likelihood of being able to re-open the old mine which would bring an extra \$45 million NPV.

Your job is to actively search for ways to exploit risk and optionality to create a better business.

“Unlocking hidden value” ...

Flowing out of risk and optionality there is a tiny, growing industry that claims to unlock ‘hidden value’.

This is fine if the project was healthy anyway and this recognises extra ways of reaping value over its life.

But if your project needs it to get over the line, then warning bells should start ringing. My first reaction is that if a business/project cannot be justified by normal NPV computations and needs ‘hidden value’ to be unlocked by mathematics to reach a satisfactory NPV then I have big reservations. (I worked alongside a major project that kept itself alive with this hope, only to fall over when reality struck.)

Despite this I would keep an open mind, look for its positive opportunities and would go through the computations. Again I would add it to the assembly of NPVs and if the computation method seemed sound then give it appropriate weighting.

Personal experiences ...

In major resource companies I have worked alongside:

1. A uncertainty expert who led/steered a project team through an extensive series of uncertainty workshop to conclude that our major project had a 98% likelihood of positive NPV. It was constructed and it was a disaster.
2. A humble but very bright guy who was advising the company on discount rate theory, optionality and probabilistic evaluation – all whilst doing his normal job. He could explain and discuss each of these very challenging areas in easy-to-understand terms. Never were the underlying theories too hard for the common man to grasp and he was never ‘trust me’ because the mathematics are too complex.

He towers above anyone else in his ability to explain in easy-to-follow concepts the inputs, mathematics and outputs of discount rate theory, optionality and probabilistic evaluation. He was exceptional in his ability to make me feel confident in understanding the results and the limitations of the results.

Basket of metrics ...

As always I would add these three sets of results to my basket which would include:

- ▶ NPVs
- ▶ IRRs
- ▶ Paybacks
- ▶ Four cash streams
- ▶ Breakeven analysis
- ▶ The driver tree

And as discussed in Step 4: –

- ▶ The industry forecast
- ▶ The competitor forecast.

END