**Teach yourself how to build a Business Case for any industry** including mining

# 1f Hands On Modelling – Calculations & Algorithms


Mutinondo Wilderness Reserve, Zambia

**Spend only a few seconds/minutes on each page**

This website may contain errors so always check your own work and have it audited by a competent person

Mutinondo Wilderness, Zambia

Around 1 billion years ago, magmatic intrusions into the Irumide Belt led to the formation of a series of plutonic rocks which crystallised below the surface. Some of these rocks now outcrop as large granitic inselbergs, following erosion and subsidence of the surrounding country rock.

The purpose of this module is to work through the **calculations and algorithms** used to construct a business model.

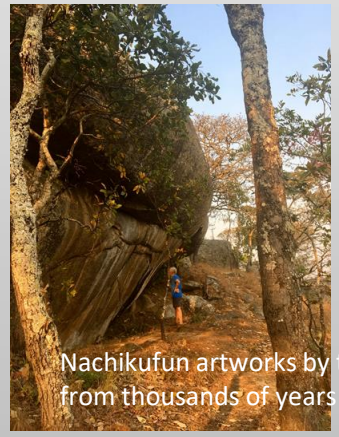
Level 3: Decision making

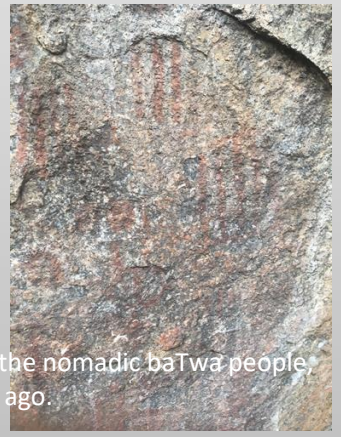
Level 2: Evaluating the business/project

**Level 1: Hands-on economic modelling**

Mutinondo Wilderness Campsite, Zambia

www.economicevaluation.com.au





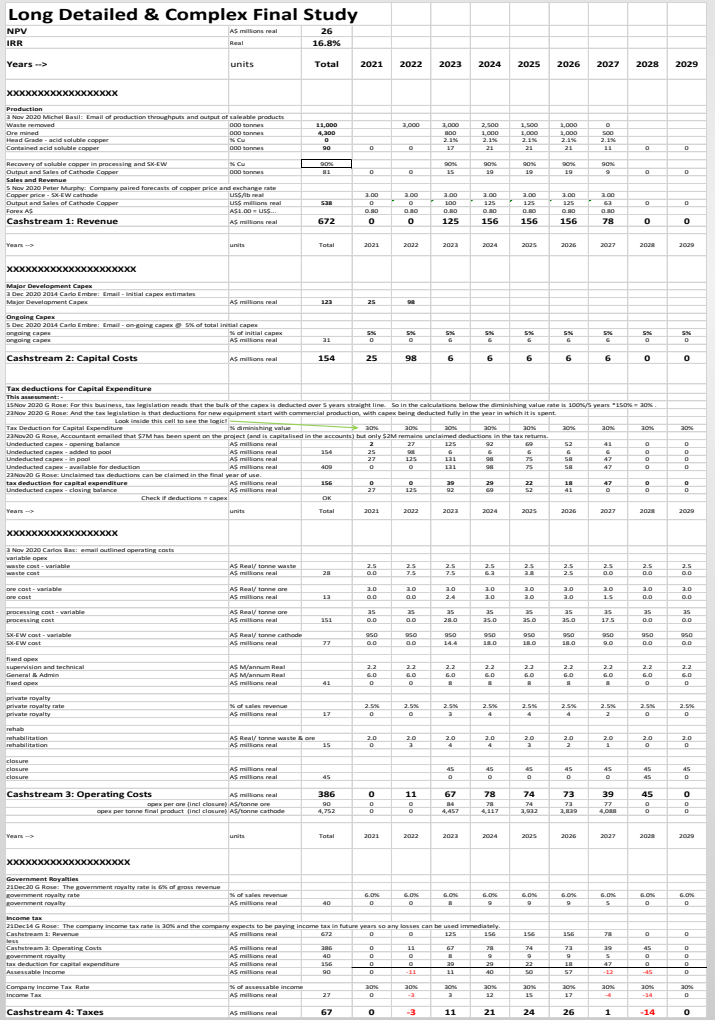
Nachikufun artworks by the nomadic baTwa people, from thousands of years ago.

Jogging to avoid being lost in the night

# The challenge of controlling your impulses inside Excel: -

Most of us who work on economic evaluations go through the phase of feeling so powerful inside Excel. We love using our prowess in modelling.

- We are able to combine multiple computations into one complex algorithm.
- We are capable of using the sophisticated Excel functions that do quite amazing sorting, calculating, arranging, comparing, seeking, draw-down menus, linking, etc.
- Our workbooks can become intellectual masterpieces that only a handful of specialists could build.
- We go home thinking of the workings inside our “trophy” model.
- We feel proud of our achievement.



| Long Detailed & Complex Final Study | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NPV | A$ millions real | 26 | | | | | | | | | |
| IRR | Real | 16.8% | | | | | | | | | |
| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
| xxxxxxxxxxxxxxxxxx | | | | | | | | | | | |
| Production | | | | | | | | | | | |
| 3 Nov 2020 Michel Basil: Email of production throughputs and output of saleable products | | | | | | | | | | | |
| Waste removed | 000 tonnes | 11,000 | | 3,000 | 3,000 | 2,500 | 1,500 | 1,000 | 0 | | |
| Ore mined | 000 tonnes | 4,300 | | | 800 | 1,000 | 1,000 | 1,000 | 500 | | |
| Head Grade - acid soluble copper | % Cu | 8 | | | 2.1% | 2.1% | 2.1% | 2.1% | 2.1% | | |
| Contained acid soluble copper | 000 tonnes | 90 | 0 | 0 | 17 | 21 | 21 | 21 | 11 | 0 | 0 |
| Recovery of soluble copper in processing and SX-EW | % Cu | 90% | | | 90% | 90% | 90% | 90% | 90% | | |
| Output and Sales of Cathode Copper | 000 tonnes | 81 | 0 | 0 | 15 | 19 | 19 | 19 | 9 | 0 | 0 |
| Sales and Revenue | | | | | | | | | | | |
| 5 Nov 2020 Peter Murphy: Company paired forecasts of copper price and exchange rate | | | | | | | | | | | |
| Copper price - SX-EW cathode | US$/lb real | | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | | |
| Output and Sales of Cathode Copper | US$ millions real | 538 | 0 | 0 | 100 | 125 | 125 | 125 | 63 | 0 | 0 |
| Forex A$ | A$1.00 = US$... | | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | | |
| **Cashstream 1: Revenue** | A$ millions real | 672 | 0 | 0 | 125 | 156 | 156 | 156 | 78 | 0 | 0 |
| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
| xxxxxxxxxxxxxxxxxxxxx | | | | | | | | | | | |
| Major Development Capex | | | | | | | | | | | |
| 3 Dec 2020 2014 Carlo Embre: Email - Initial capex estimates | | | | | | | | | | | |
| Major Development Capex | A$ millions real | 123 | 25 | 98 | | | | | | | |
| Ongoing Capex | | | | | | | | | | | |
| 5 Dec 2020 2014 Carlo Embre: Email - on-going capex @ 5% of total initial capex | | | | | | | | | | | |
| ongoing capex | % of initial capex | | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| ongoing capex | A$ millions real | 31 | 0 | 0 | 6 | 6 | 6 | 6 | 6 | 0 | 0 |
| **Cashstream 2: Capital Costs** | A$ millions real | 154 | 25 | 98 | 6 | 6 | 6 | 6 | 6 | 0 | 0 |
| Tax deductions for Capital Expenditure | | | | | | | | | | | |
| This assessment: - | | | | | | | | | | | |
| 15Nov 2020 G Rose: For this business, tax legislation reads that the bulk of the capex is deducted over 5 years straight line. So in the calculations below the diminishing value rate is 100%/5 years *150% = 30% . | | | | | | | | | | | |
| 23Nov 2020 G Rose: And the tax legislation is that deductions for new equipment start with commercial production, with capex being deducted fully in the year in which it is spent. | | | | | | | | | | | |
| Look inside this cell to see the logic! | | | | | | | | | | | |
| Tax Deduction for Capital Expenditure | % diminishing value | | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| 23Nov20 G Rose, Accountant emailed that $7M has been spent on the project (and is capitalised in the accounts) but only $2M remains unclaimed deductions in the tax returns. | | | | | | | | | | | |
| Undeducted capex - opening balance | A$ millions real | | 2 | 27 | 125 | 92 | 69 | 52 | 41 | 0 | 0 |
| Undeducted capex - added to pool | A$ millions real | 154 | 25 | 98 | 6 | 6 | 6 | 6 | 6 | 0 | 0 |
| Undeducted capex - in pool | A$ millions real | | 27 | 125 | 131 | 98 | 75 | 58 | 47 | 0 | 0 |
| Undeducted capex - available for deduction | A$ millions real | 409 | 0 | 0 | 131 | 98 | 75 | 58 | 47 | 0 | 0 |
| 23Nov20 G Rose: Unclaimed tax deductions can be claimed in the final year of use. | | | | | | | | | | | |
| **tax deduction for capital expenditure** | A$ millions real | 156 | 0 | 0 | 39 | 29 | 22 | 18 | 47 | 0 | 0 |
| Undeducted capex - closing balance | A$ millions real | | 27 | 125 | 92 | 69 | 52 | 41 | 0 | 0 | 0 |
| Check if deductions = capex | | OK | | | | | | | | | |
| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
| xxxxxxxxxxxxxxxxxxx | | | | | | | | | | | |
| 3 Nov 2020 Carlos Bas: email outlined operating costs | | | | | | | | | | | |
| variable opex | | | | | | | | | | | |
| waste cost - variable | A$ Real/ tonne waste | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| waste cost | A$ millions real | 28 | 0.0 | 7.5 | 7.5 | 6.3 | 3.8 | 2.5 | 0.0 | 0.0 | 0.0 |
| ore cost - variable | A$ Real/ tonne ore | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| ore cost | A$ millions real | 13 | 0.0 | 0.0 | 2.4 | 3.0 | 3.0 | 3.0 | 1.5 | 0.0 | 0.0 |
| processing cost - variable | A$ Real/ tonne ore | | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| processing cost | A$ millions real | 151 | 0.0 | 0.0 | 28.0 | 35.0 | 35.0 | 35.0 | 17.5 | 0.0 | 0.0 |
| SX-EW cost - variable | A$ Real/ tonne cathode | | 950 | 950 | 950 | 950 | 950 | 950 | 950 | 950 | 950 |
| SX-EW cost | A$ millions real | 77 | 0.0 | 0.0 | 14.4 | 18.0 | 18.0 | 18.0 | 9.0 | 0.0 | 0.0 |
| fixed opex | | | | | | | | | | | |
| supervision and technical | A$ M/annum Real | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| General & Admin | A$ M/annum Real | | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| fixed opex | A$ millions real | 41 | 0 | 0 | 8 | 8 | 8 | 8 | 8 | 0 | 0 |
| private royalty | | | | | | | | | | | |
| private royalty rate | % of sales revenue | | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
| private royalty | A$ millions real | 17 | 0 | 0 | 3 | 4 | 4 | 4 | 2 | 0 | 0 |
| rehab | | | | | | | | | | | |
| rehabilitation | A$ Real/ tonne waste & ore | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| rehabilitation | A$ millions real | 15 | 0 | 3 | 4 | 4 | 3 | 2 | 1 | 0 | 0 |
| closure | | | | | | | | | | | |
| closure | A$ millions real | | | | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| closure | A$ millions real | 45 | | | 0 | 0 | 0 | 0 | 0 | 45 | 0 |
| **Cashstream 3: Operating Costs** | A$ millions real | 386 | 0 | 11 | 67 | 78 | 74 | 73 | 39 | 45 | 0 |
| opex per ore (incl closure) | A$/tonne ore | 90 | 0 | 0 | 84 | 78 | 74 | 73 | 77 | 0 | 0 |
| opex per tonne final product (incl closure) | A$/tonne cathode | 4,752 | 0 | 0 | 4,457 | 4,117 | 3,932 | 3,839 | 4,088 | 0 | 0 |
| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
| xxxxxxxxxxxxxxxxxxxx | | | | | | | | | | | |
| Government Royalties | | | | | | | | | | | |
| 21Dec20 G Rose: The government royalty rate is 6% of gross revenue | | | | | | | | | | | |
| government royalty rate | % of sales revenue | | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| government royalty | A$ millions real | 40 | 0 | 0 | 8 | 9 | 9 | 9 | 5 | 0 | 0 |
| Income tax | | | | | | | | | | | |
| 21Dec14 G Rose: The company income tax rate is 30% and the company expects to be paying income tax in future years so any losses can be used immediately. | | | | | | | | | | | |
| Cashstream 1: Revenue | A$ millions real | 672 | 0 | 0 | 125 | 156 | 156 | 156 | 78 | 0 | 0 |
| less | | | | | | | | | | | |
| Cashstream 3: Operating Costs | A$ millions real | 386 | 0 | 11 | 67 | 78 | 74 | 73 | 39 | 45 | 0 |
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| tax deduction for capital expenditure | A$ millions real | 156 | 0 | 0 | 39 | 29 | 22 | 18 | 47 | 0 | 0 |
| Assessable Income | A$ millions real | 90 | 0 | -11 | 11 | 40 | 50 | 57 | -12 | -45 | 0 |
| Company Income Tax Rate | % of assessable income | | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| Income Tax | A$ millions real | 27 | 0 | -3 | 3 | 12 | 15 | 17 | -4 | -14 | 0 |
| **Cashstream 4: Taxes** | A$ millions real | 67 | 0 | -3 | 11 | 21 | 24 | 26 | 1 | -14 | 0 |

# The challenge of controlling your impulses inside Excel

This sort of modelling is fine for expert engineers and scientists working in their own specialist niches, but it is totally inappropriate for economic evaluations; especially in a team.

These ‘sophisticated’ models become the ‘private domain’ of its creator and perhaps a couple other specialists in Excel.

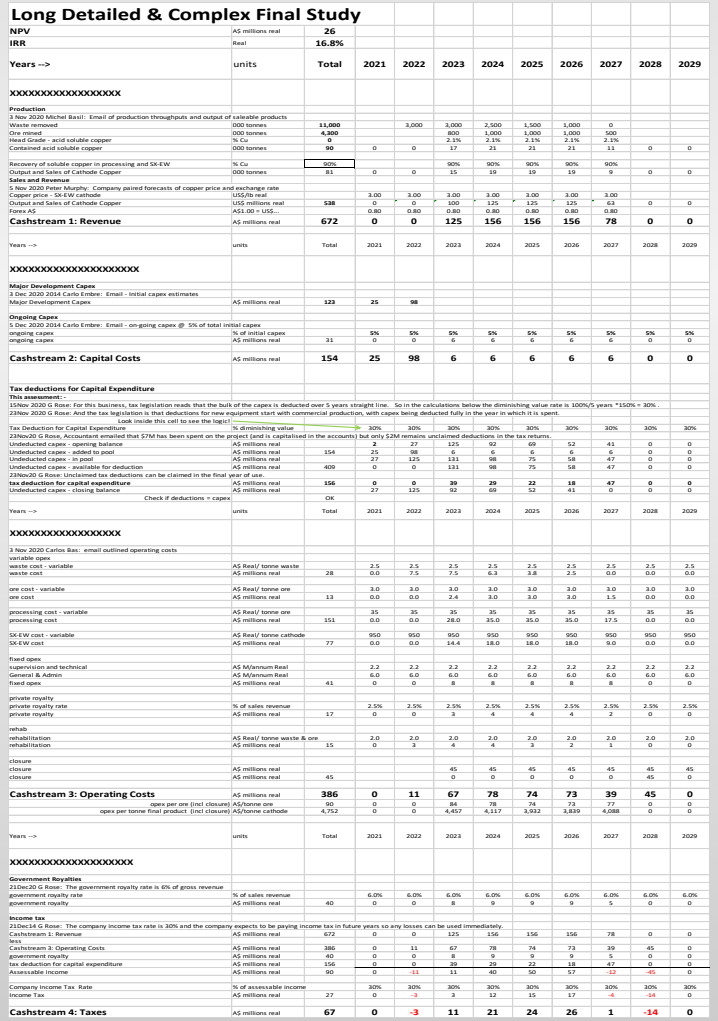
But they are too tedious for colleagues to plough through the complex algorithms and functions.

Imposing that sort of modelling on your colleagues is arrogant.

History proves that lots of mistakes lie dormant in ‘sophisticated’ models until the model is painstakingly audited or worse, the business/project goes bad and the model is to blame. (I am familiar with several major studies and major projects that failed this way.)

> Occasionally, a horribly ‘sophisticated’ model has been audited by professionals from a respected accounting company who verify the mechanics. But they do not have the expertise to audit the practicality and usability of the model. The boss says “Yes it has been properly audited!” and thence a poorly constructed evaluation model is inflicted on the Team. People work with the model hoping all is OK but they become alienated and apathetic.

If you want to create “sophisticated trophy” models then stop reading!



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| Ore mined | 000 tonnes | 4,300 | | | 800 | 1,000 | 1,000 | 1,000 | 500 | | |
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| **Cashstream 2: Capital Costs** | A$ millions real | 154 | 25 | 98 | 6 | 6 | 6 | 6 | 6 | 0 | 0 |
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| processing cost - variable | A$ Real/ tonne ore | | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| processing cost | A$ millions real | 151 | 0.0 | 0.0 | 28.0 | 35.0 | 35.0 | 35.0 | 17.5 | 0.0 | 0.0 |
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| fixed opex | | | | | | | | | | | |
| supervision and technical | A$ M/annum Real | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| General & Admin | A$ M/annum Real | | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
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| private royalty | | | | | | | | | | | |
| private royalty rate | % of sales revenue | | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
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| rehabilitation | A$ millions real | 15 | 0 | 3 | 4 | 4 | 3 | 2 | 1 | 0 | 0 |
| closure | | | | | | | | | | | |
| closure | A$ millions real | | | | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| closure | A$ millions real | 45 | | | 0 | 0 | 0 | 0 | 0 | 45 | 0 |
| **Cashstream 3: Operating Costs** | A$ millions real | 386 | 0 | 11 | 67 | 78 | 74 | 73 | 39 | 45 | 0 |
| opex per ore (incl closure) | A$/tonne ore | 90 | 0 | 0 | 84 | 78 | 74 | 73 | 77 | 0 | 0 |
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| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
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| government royalty rate | % of sales revenue | | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| government royalty | A$ millions real | 40 | 0 | 0 | 8 | 9 | 9 | 9 | 5 | 0 | 0 |
| Income tax | | | | | | | | | | | |
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| Cashstream 1: Revenue | A$ millions real | 672 | 0 | 0 | 125 | 156 | 156 | 156 | 78 | 0 | 0 |
| less | | | | | | | | | | | |
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| government royalty | A$ millions real | 40 | 0 | 0 | 8 | 9 | 9 | 9 | 5 | 0 | 0 |
| tax deduction for capital expenditure | A$ millions real | 156 | 0 | 0 | 39 | 29 | 22 | 18 | 47 | 0 | 0 |
| Assessable income | A$ millions real | 90 | 0 | -11 | 11 | 40 | 50 | 57 | -12 | -45 | 0 |
| Company Income Tax Rate | % of assessable income | | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| Income Tax | A$ millions real | 27 | 0 | -3 | 3 | 12 | 15 | 17 | -4 | -14 | 0 |
| **Cashstream 4: Taxes** | A$ millions real | 67 | 0 | -3 | 11 | 21 | 24 | 26 | 1 | -14 | 0 |


Mutinondo Wilderness Campsite, Zambia

**Your task is to make your economic evaluation intuitive to others: -**

1. Use lots of small steps to make calculations visually obvious – not big jumps that need to be tediously investigated.
2. Use simple algorithms – not 'terribly clever' sophisticated algorithms that are so painstaking for others to untangle.
3. Begin as simply as possible – Don't build in computations in case they are needed later, but add complexity and detail only when it is needed.
4. Make any changes look very obvious – don't just overwrite and expect everyone else to somehow know a change has been made.

# Making your workings intuitive:

**#1. Use small steps to make calculations visually obvious.**

I. Bold headings

II. Discrete block of calculations

III. Obvious sub-totals at the bottom of each block

IV. Totals for each row should be visible at the left of the computations not hidden off the screen in Column Z

| Years --> | units | Total | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|---|
| **Cashstream 1: Sales & Revenue** | | | | | | | |
| **1. Sales of A, B & C units** | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 15 | | | | | | | |
| Units Sold | | | | | | | |
| Product A Sold | units | 400,091 | 20,000 | 21,000 | 23,10 | | 36,036 |
| Product B sold | units | 261,523 | 15,000 | 15,750 | 17,32 | | 24,948 |
| Product C sold | units | 73,951 | 5,000 | 5,500 | 6,0 | | 7,321 |
| Total ABC units sold | units | 735,565 | 40,000 | 42,250 | 46,475 | 55,165 | 68,305 |
| **2. Selling Prices of ABC units** | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 22 | | | | | | | |
| Product A' - selling price | US$ Real/ unit | | 38 | 37 | 36 | 36 | 35 |
| Product B' - selling price | US$ Real/ unit | | 48 | 47 | 46 | 45 | 44 |
| Product C' - selling price | US$ Real/ unit | | 58 | 57 | 56 | 55 | 53 |
| **3. Revenue from ABC units** | | | | | | | |
| Product A revenue | US$ 000 Real | 13,606 | 760 | 782 | 843 | | 1,263 |
| Product B revenue | US$ 000 Real | 11,283 | 720 | 741 | 799 | | 1,105 |
| Product C revenue | US$ 000 Real | 3,879 | 290 | 313 | | | |
| Revenue from ABC units | US$ 000 Real | 28,767 | 1,770 | 1,836 | 1,979 | 2,254 | 2,759 |
| Years --> | units | Total | 2024 | 2025 | 2026 | 2027 | 2028 |
| **4. Value added Tax on Sales** | | | | | | | |
| 2022 06 17 Central Government Tax Office website VAT rates are 10% except on exports | | | | | | | |
| Revenue from ABC units | US$ 000 Real | 0 | 1,770 | 1,836 | 1,979 | | 2,759 |
| VAT on Sales of units | | | 10% | 10% | 10% | | |
| Vat on Sales Revenue | US$ 000 Real | 2,877 | 177 | 184 | 198 | 225 | 276 |

Work block

Work block

Work block

A single page in Excel is called a 'worksheet'.

An assembly of 'worksheets' is called a 'workbook'

# Making your workings intuitive:

## #2. Use simple algorithms

I. ‘Magical’, complex, all-embracing algorithms in advanced Excel might make you feel proud, but they only alienate everyone else.

II. Instead aim to create algorithms that can be rapidly understood.

III. Other people should be able to work down any column and across any row with speed and confidence.

*98% of your algorithms should be short and easy to follow.*
*Yes, some advanced Excel Functions are very economical with rows and are intellectually rewarding but your colleagues will not easily follow/audit them.*
*Complexity will be a ‘trust me’ section of your model that will destroy other’s confidence in your model.*
*Instead use several, simpler algorithms to visually display the logic*
.

| Years --> | units | Total | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|---|
| **Cashstream 1: Sales & Revenue** | | | | | | | |
| **1. Sales of A, B & C units** | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 15 | | | | | | | |
| **Units Sold** | | | | | | | |
| **Product A Sold** | units | **400,091** | 20,000 | 21,000 | 23,100 | 27,720 | 36,036 |
| **Product B sold** | units | **261,523** | 15,000 | 15,750 | 17,325 | 20,790 | 24,948 |
| **Product C sold** | units | **73,951** | 5,000 | 5,500 | 6,050 | 6,655 | 7,321 |
| **Total ABC units sold** | units | **735,565** | 40,000 | 42,250 | 46,475 | 55,165 | 68,305 |
| **2. Selling Prices of ABC units** | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 22 | | | | | | | |
| **Product A' - selling price** | US$ Real/ unit | | 38 | 37 | 36 | 36 | 35 |
| **Product B' - selling price** | US$ Real/ unit | | 48 | 47 | 46 | 45 | 44 |
| **Product C' - selling price** | US$ Real/ unit | | 58 | 57 | 56 | 55 | 53 |
| **3. Revenue from ABC units** | | | | | | | |
| Product A revenue | US$ 000 Real | **13,606** | 760 | 782 | 843 | 991 | 1,263 |
| Product B revenue | US$ 000 Real | **11,283** | 720 | 741 | 799 | 939 | 1,105 |
| Product C revenue | US$ 000 Real | **3,879** | 290 | 313 | 337 | 363 | 392 |
| **Revenue from ABC units** | US$ 000 Real | **28,767** | 1,770 | 1,836 | 1,979 | 2,294 | 2,759 |
| **Years -->** | **units** | **Total** | **2024** | **2025** | **2026** | **2027** | **2028** |
| **4. Value added Tax on Sales** | | | | | | | |
| 2022 06 17 Central Government Tax Office website VAT rates are 10% except on exports | | | | | | | |
| Revenue from ABC units | US$ 000 Real | **0** | 1,770 | 1,836 | 1,979 | 2,294 | 2,759 |
| **VAT on Sales of units** | | | 10% | 10% | 10% | 10% | 10% |
| **Vat on Sales Revenue** | US$ 000 Real | **2,877** | 177 | 184 | 198 | 229 | 276 |

# Making your workings intuitive:

## #2. Use simple algorithms: -

IV. Any algorithm should refer to cells ***ONLY on the same worksheet***. It never should directly reference a cell in another worksheet in that workbook.

V. This means that if you click on to any algorithm and trace its precedents then it will show arrows only to cells in the same worksheet. For example =K41*K23

VI. It never would show arrows to another worksheet, or worse show 'Links' to another workbook. For example it would not show = 'Worksheet2!F13*K23

VII. This means you first have to ***reference*** the whole row across from Worksheet2 and position it above where you need to use it in the algorithm. This is illustrated on the right, where the three complete referenced rows are shown in green font. These three are used to compute the three rows of revenue immediately underneath.

| Years --> | units | Total | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|---|
| **Cashstream 1: Sales & Revenue** | | | | | | | |
| **1. Sales of A, B & C units** | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 15 | | | | | | | |
| Units Sold | | | | | | | |
| Product A Sold | units | 400,091 | 20,000 | 21,000 | 23,100 | 27,720 | 36,036 |
| Product B sold | units | 261,523 | 15,000 | 15,750 | 17,325 | 20,790 | 24,948 |
| Product C sold | units | 73,951 | 5,000 | 5,500 | 6,050 | 6,655 | 7,321 |
| Total ABC units sold | units | 735,565 | 40,000 | 42,250 | 46,475 | 55,165 | 68,305 |
| **2. Selling Prices of ABC units** | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 22 | | | | | | | |
| Product A' - selling price | US$ Real/ unit | | 38 | 37 | 36 | 36 | 35 |
| Product B' - selling price | US$ Real/ unit | | 48 | 47 | 46 | 45 | 44 |
| Product C' - selling price | US$ Real/ unit | | 58 | 57 | 56 | 55 | 53 |
| **3. Revenue from ABC units** | | | | | | | |
| Product A revenue | US$ 000 Real | 13,606 | 760 | 782 | 843 | 991 | 1,263 |
| Product B revenue | US$ 000 Real | 11,283 | 720 | 741 | 799 | 939 | 1,105 |
| Product C revenue | US$ 000 Real | 3,879 | 290 | 313 | 337 | 363 | 392 |
| Revenue from ABC units | US$ 000 Real | 28,767 | 1,770 | 1,836 | 1,979 | 2,294 | 2,759 |
| Years --> | units | Total | 2024 | 2025 | 2026 | 2027 | 2028 |
| **4. Value added Tax on Sales** | | | | | | | |
| 2022 06 17 Central Government Tax Office website VAT rates are 10% except on exports | | | | | | | |
| Revenue from ABC units | US$ 000 Real | 0 | 1,770 | 1,836 | 1,979 | 2,294 | 2,759 |
| VAT on Sales of units | | | 10% | 10% | 10% | 10% | 10% |
| Vat on Sales Revenue | US$ 000 Real | 2,877 | 177 | 184 | 198 | 229 | 276 |

The algorithm must not directly reference a cell in another worksheet

# Making your workings intuitive:

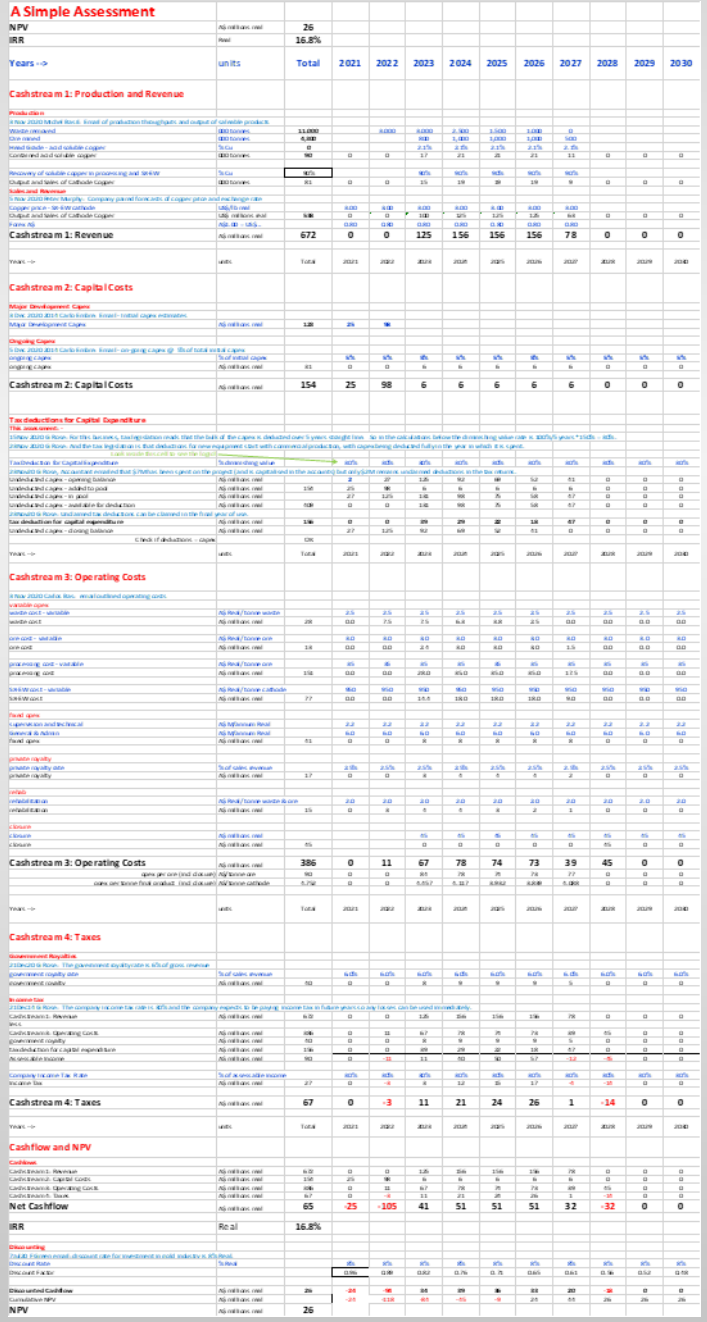
## #3. Begin the model as simply as practical

I. For example, this is a complete cash flow model in 125 rows →

II. Its size would be appropriate for preliminary assessments and concept studies

III. This model should allow you to make a decision; either to abandon an idea or to evaluate it further in a more advanced evaluation.

IV. When you start a model do not build in extra rows of computations "in case they will be needed in the near future". (This is very tempting; especially when you have lots of knowledge in your brain and you feel you should incorporate it.)



| A Simple Assessment | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NPV | A$ million, real | 26 | | | | | | | | | | |
| IRR | Real | 16.8% | | | | | | | | | | |
| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| Cashstream 1: Production and Revenue | | | | | | | | | | | | |
| Cashstream 1: Revenue | A$ million, real | 672 | 0 | 0 | 125 | 156 | 156 | 156 | 78 | 0 | 0 | 0 |
| Cashstream 2: Capital Costs | | | | | | | | | | | | |
| Cashstream 2: Capital Costs | A$ million, real | 154 | 25 | 98 | 6 | 6 | 6 | 6 | 6 | 0 | 0 | 0 |
| Cashstream 3: Operating Costs | | | | | | | | | | | | |
| Cashstream 3: Operating Costs | A$ million, real | 386 | 0 | 11 | 67 | 78 | 74 | 73 | 39 | 45 | 0 | 0 |
| Cashstream 4: Taxes | | | | | | | | | | | | |
| Cashstream 4: Taxes | A$ million, real | 67 | 0 | -3 | 11 | 21 | 24 | 26 | 1 | -14 | 0 | 0 |
| Cashflow and NPV | | | | | | | | | | | | |
| Net Cashflow | A$ million, real | 65 | -25 | -105 | 41 | 51 | 51 | 51 | 32 | -32 | 0 | 0 |
| IRR | Real | 16.8% | | | | | | | | | | |
| Discounted Cashflow | A$ million, real | 26 | -25 | -98 | 34 | 39 | 36 | 33 | 20 | -18 | 0 | 0 |
| Cumulative NPV | A$ million, real | | -25 | -123 | -89 | -51 | -14 | 19 | 39 | 21 | 21 | 21 |
| NPV | A$ million, real | 26 | | | | | | | | | | |

# Making your workings intuitive:

## #4. Make any changes look obvious

I. When I make changes to an existing model I usually colour the cells in bright yellow. Then when I send it out again everyone instantly can see where the changes have been made.

II. I modify its file name slightly, so others do not get confused as to the latest version.

*III.* *BE AWARE:* Do not change a cell that has been referenced across from another worksheet (green font). Instead, it is important that you go to the worksheet where this data is originally inputted and change it there. Otherwise, you may find that your change does not flow through the entire model and the results are erroneous.

| Years --> | units | Total | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Ye |
|---|---|---|---|---|---|---|---|---|
| **Cashstream 1: Sales & Revenue** | | | | | | | | |
| **1. Sales of A, B & C units** | | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 15 | | | | | | | | |
| Units Sold | | | | | | | | |
| Product A Sold | units | 346,514 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25, |
| Product B sold | units | 261,523 | 15,000 | 15,750 | 17,325 | 20,790 | 24,948 | 29, |
| Product C sold | units | 73,951 | 5,000 | 5,500 | 6,050 | 6,655 | 7,321 | 8,( |
| Total ABC units sold | units | 681,989 | 45,000 | 46,250 | 48,375 | 52,445 | 57,269 | 62, |
| **2. Selling Prices of ABC units** | | | | | | | | |
| 1 Aug 2022: Enterprise ABC Marketing Report: page 22 | | | | | | | | |
| Product A' - selling price | US$ Real/ unit | | 30 | 30 | 30 | 30 | 30 | 3 |
| Product B' - selling price | US$ Real/ unit | | 48 | 47 | 46 | 45 | 44 | 4 |
| Product C' - selling price | US$ Real/ unit | | 58 | 57 | 56 | 55 | 53 | 5 |
| **3. Revenue from ABC units** | | | | | | | | |
| Product A revenue | US$ 000 Real | 10,793 | 750 | 750 | 750 | 750 | 750 | 7 |
| Product B revenue | US$ 000 Real | 11,283 | 720 | 741 | 799 | 939 | 1,105 | 1,2 |
| Product C revenue | US$ 000 Real | 3,879 | 290 | 313 | 337 | 363 | 392 | 4 |
| Revenue from ABC units | US$ 000 Real | 25,955 | 1,760 | 1,804 | 1,886 | 2,053 | 2,246 | 2,4 |
| Years --> | units | Total | 2024 | 2025 | 2026 | 2027 | 2028 | 20 |
| **4. Value added Tax on Sales** | | | | | | | | |
| 2022 06 17 Central Government Tax Office website VAT rates are 10% except on exports | | | | | | | | |
| Revenue from ABC units | US$ 000 Real | 0 | 1,760 | 1,804 | 1,886 | 2,053 | 2,246 | 2,4 |
| VAT on Sales of units | | | 10% | 10% | 10% | 10% | 10% | 10 |
| Vat on Sales Revenue | US$ 000 Real | 2,596 | 176 | 180 | 189 | 205 | 225 | 2 |

# Good and Bad Modelling:

**NPV:** Excel has several functions to compute NPV, but they should not be used for two reasons. Firstly, too often the wrong NPV timing has been used and secondly, they alienate people unskilled in NPV methodology. Although it will take a couple of extra rows, it is far, far better to do a 'long hand manual' computation. Many people confess they do not understand what NPV exactly means, so the long-hand computation in a few rows makes it very clear. Again, it is you taking care of others.

**IRR:** The Excel Function for 'IRR' must be used.

**Do not inflict 'sophisticated' algorithms on others:** Here is an example of a terrible algorithm of which its creator told me he was very proud. He should have been absolutely ashamed: -

=IF(K14=0,0,IF(K244<Max($H$241:$A$241)*$D75,IF(OR(SUM($H13:M13)=0,SUM(S15:$A15)=0),K244/MAX($G$244:$A$244),1)1)

No-one creating evaluation models should expect anyone else to waste their time trying to unravel this type of monstrosity.

**Resist using draw-down menus:** They work well but are too hard to backtrack and audit.
They are another "Trust me because I know what I am doing!"
They look clever but take your model away from being easily understood by others.

**The 'Index Function' alienates other users** – Why should others put up with your inability to express yourself in a straight-forward sequence? Anyone asked to do an audit should refuse! (explaining "My life is too short to waste it on Index Functions!")

**Links:** Most experienced evaluation specialists refuse to use the Excel function "Links" - where an algorithm references data in another workbook. (ie not in another worksheet in the same workbook.) Firstly, the model is not self-contained and secondly, as people have found out with disastrous consequences, the exterior model can get altered without the specialist knowing and instantly the model is corrupted.


Mutinondo Wilderness, Zambia

# More ideas on creating intuitive models …

Mutinondo Wilderness, Zambia - stone-age artwork from the earliest known Zambians, the baTwa people.

# Making your workings intuitive:

**The sequence of little steps of calculation needs to be *visually* in logical order down the worksheet.**

Rarely should an algorithm refer to a cell in a row underneath.

For example:
If you saw the following three rows in a model you would think they are in a logical sequence: -

| | | | | |
|---|---|---|---|---|
| Cost of processing | US$ | 10 | 11 | 12 |
| Exchange rate | A$1 = US$.... | 0.75 | 0.76 | 0.77 |
| Cost of processing | A$ | 13.33 | 14.47 | 15.58 |

But when you look inside the cells at the algorithms you find that the cost of processing in A$ is computed first and then converted into US$ two rows above. This is bad modelling because the visual presentation is upside down. It of course should have been …

| | | | | |
|---|---|---|---|---|
| Cost of processing | A$ | 13.33 | 14.47 | 15.58 |
| Exchange rate | A$1 = US$.... | 0.75 | 0.76 | 0.77 |
| Cost of processing | US$ | 10 | 11 | 12 |


Mutinondo Wilderness Zambia

# Making your workings intuitive: -

## Beginning the model as simply as practical

In this model for a concept study the operating costs are simply:

two lots of variable costs

one lot of fixed costs

If the business evaluation progresses through prefeasibility and feasibility level stages, then these operating costs will be greatly expanded in sophistication/detail. But they always will be in little, easy-to-follow steps so the model remains intuitive.

| Years --> | units | Total | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cashstream 3: Operating Costs** | | | | | | | | | | | |
| 3 Nov 2020 Carlos Bas: email outlined operating costs | | | | | | | | | | | |
| variable opex | | | | | | | | | | | |
| energy cost - variable | A$ Real/ unit | | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| energy cost | A$ millions real | 28 | 0.0 | 7.5 | 7.5 | 6.3 | 3.8 | 2.5 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | |
| materials cost - variable | A$ Real/ unit | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| materials cost | A$ millions real | 13 | 0.0 | 0.0 | 2.4 | 3.0 | 3.0 | 3.0 | 1.5 | 0.0 | 0.0 |
| | | | | | | | | | | | |
| fixed opex | | | | | | | | | | | |
| supervision and technical | A$ M/annum Real | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| General & Admin | A$ M/annum Real | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| fixed opex | A$ millions real | 16 | 0.0 | 0.0 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 0.0 | 0.0 |
| | | | | | | | | | | | |
| **Cashstream 3: Operating Cos** | A$ millions real | 56 | 0.0 | 7.5 | 13.1 | 12.5 | 10.0 | 8.7 | 4.7 | 0.0 | 0.0 |
| opex per unit | A$/unit | 13 | 0 | 0 | 16 | 12 | 10 | 9 | 9 | 0 | 0 |
| | | | | | | | | | | | |
| Years --> | units | Total | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |

# *Take control …*

Create models that are easy to follow, *even when they need to be long, detailed and complex*. Give everyone a 'helicopter view' of the business.

A. Control your impulses: don't inflict advanced Excel on others.

B. Make your workings intuitive: -
   1. Use small steps to make calculations visually obvious.
   2. Use simple algorithms.
   3. Begin as simply as practical
   4. Make obvious each of your progressive changes to the model

***"If you do not quickly understand my model, you have not got a problem, but I have!"***

**END**