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

1f Hands On Modelling – Calculations & Algorithms

Mutinondo Wilderness Reserve, Zambia

st important practices

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, Zambi

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. ome of these rocks now outcrop as large granitic inselbergs, following erosion and subsidence of the surrounding country rock

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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





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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.

NPV	AS millions real	26	1								
IBB	Real	16.8%	-								
Years>	units	Total	2021	2022	2023	2024	2025	2026	2027	2028	202

Production											
3 Nov 2020 Michel Basil: Email of production throughputs and output o Waste removed	000 tonnes	11,000	-	3,000	3,000	2,500	1,500	1,000	0		
Ore mined Head Grade - acid soluble cooper	000 tonnes % Cu	4,300			800	1,000	1,000	1,000	500 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 Sales and Revenue	000 tonnes	81	0	0	15	19	19	19	9	0	0
5 Nov 2020 Peter Murphy: Company paired forecasts of copper price an Copper price - SX-EW cathode	d exchange rate US\$/Ib 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 80	0.50	100	125	125	125	63	0	0
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	202

Major Development Capex 3 Dec 2020 2014 Carlo Embre: Email - Initial capex estimates											
Major Development Capex	A\$ millions real	123	25	98							
5 Dec 2020 2014 Carlo Embre: Email - on-going capex @ 5% of total in	itial capex										
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 bul	k of the capex is deducte	d over 5 years	straight line.	So in the cal	culations bel	ow the dimir	ishing value	rate is 100%,	'S years *150	9% = 30% .	
23Nov 2020 G Rose: And the tax legislation is that deductions for new e Look inside this cell to see the logic	quipment start with com	mercial produc	tion, with cap	ex being ded	ucted fully in	the year in v	which it is spe	ent.			
Tax Deduction for Capital Expenditure 23/iox20 G Rose Accountant emailed that 52M has been spent on the r	% diminishing value	t in the account	> 30%	30%	30%	30%	30%	30%	30%	30%	30%
Undeducted capex - opening balance	A\$ millions real		2	27	125	92	69	52	41	0	0
Undeducted capex - added to pool Undeducted capex - in pool	A\$ millions real	154	25	125	131	98	75	58	47	0	0
Undeducted capex - available for deduction 23Nov20 G Rose: Unclaimed tax deductions can be claimed in the final	A\$ millions real year of use.	409	0	0	131	98	75	58	47	0	0
tax deduction for capital expenditure Undeducted capex - closing balance	A\$ millions real A\$ millions real	156	27	0	39 92	29 69	22 52	18	47	0	0
Check if deductions = capes		OK									
Years>	units	Total	2021	2022	2023	2024	2025	2026	2027	2028	2029

3 Nov 2020 Carlos Bas: email outlined operating costs											
vanabe 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 ore cost	A\$ Real/ tonne ore A\$ millions real	13	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
processing cost - variable	AS Real/ tonne ore		35	25	35	35	25	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
58-6 W COST	As millions real		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 fixed opex	A\$ M/annum Real A\$ millions real	41	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
nivete musity											
private royalty rate	% of sales revenue	17	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
private royarty	AS millions real	1/	0	0	1	1	1	•	- 1	0	0
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	AS 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	AS millions real	386	0	11	67	78	74	73	39	45	0
opex per ore (incl closure) opex per tonne final product (incl closure)	A\$/tonne ore A\$/tonne cathode	90 4,752	0	0	84 4,457	78 4,117	74 3,932	73 3,839	77 4,088	0	0
Years>	units	Total	2021	2022	2023	2024	2025	2026	2027	2028	2029
~~~~~~											
Government Royalties											-
21Dec20 G Rose: The government royalty rate is 6% of gross revenue	% 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%	0	8	9	9	9	5	0	0
income tax											
21Dec14 G Rose: The company income tax rate is 30% and the compan Cashstream 1: Revenue	y expects to be paying in A\$ millions real	come tax in fut 672	ure years so a	ny losses ca	n be used im 125	mediately. 156	156	156	78	0	0
less Cashstream 3: Operating Costs	A\$ millions real	386	0	11	67	78	74	73	39	45	0
government royalty	A\$ millions real	40	0	0	8	9	9	9	5	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

#### 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!

	Af william and	26									
NPV	A\$ millions real	26	-								
IRR	Real	16.8%									
Years>	units	Total	2021	2022	2023	2024	2025	2026	2027	2028	2029
****											
Production a Nov 2020 Michel Basil: Email of production throughouts and output of	saleable products										
Waste removed	000 tonnes	11,000		3,000	3,000	2,500	1,500	1,000	0		
Ore mined Head Grade - acid soluble copper	% Cu	4,300			800	1,000	2.1%	1,000	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
5 Nov 2020 Peter Murphy: Company paired forecasts of copper price an	d exchange rate										
Copper price - SX-EW cathode	US\$/Ib real	<b>C</b> 24	3.00	3.00	3.00	3.00	3.00	3.00	3.00	0	0
Forex A\$	A\$1.00 = U\$\$		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
****											
Major Development Capex 3 Dec 2020 2014 Carlo Embre: Email - Initial capex estimates											
Major Development Capex	A\$ millions real	123	25	98							
Drgoing Capex 5 Dec 2020 2014 Carlo Embre: Email - on-going capex # 5% of total in	tial capex		-								
ongoing capex	% of initial capes	31	5%	5%	5%	5%	5%	5%	5%	5%	5%
Cashstream 2: Canital Costs	AS millions real	154	25	98	6	6	6	6	6	0	0
	C) IIIIIAIS IVAI	134		50							
Tax deductions for Capital Expenditure											
This assessment: -											
23Nov 2020 G Rose: For this business, tax registration reads that the buil 23Nov 2020 G Rose: And the tax legislation is that deductions for new e	quipment start with com	d over 5 years mercial produc	tion, with cap	ex being ded	ucted fully in	the year in w	hich it is sp	nate is 100%, int.	is years -150	ns = 40% .	
Look inside this cell to see the logic Tax Deduction for Canital Expenditure	% diminishing value		30%	30%	30%	30%	30%	30%	30%	30%	30%
23Nov20 G Rose, Accountant emailed that \$7M has been spent on the p	roject (and is capitalised	in the account	s) but only \$2	M remains u	nclaimed dec	fuctions in th	e tax returns		30/4	30/4	3074
Undeducted capex - opening balance	A\$ millions real	154	2	27	125	92	69	52	41	0	0
Undeducted capex - added to pool Undeducted capex - in pool	A\$ millions real	154	25	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
tax deduction for capital expenditure	A\$ millions real	156	0	0	39	29	22	18	47	0	0
Undeducted capex - closing balance Check if deductions = capes	A\$ millions real	ОК	27	125	92	69	52	41	0	0	0
Years>	unite	Total	2021	2022	2023	2024	2025	2026	2027	2028	2029
Tears ->	units	Total	2021	2002	202.8	2021	202.3	2020	2027	2028	2029
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX											
3 Nov 2020 Carlos Bas: email outlined operating costs											
variable opex											
waste cost - variable waste cost	A\$ Real/ tonne waste A\$ millions real	28	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
ore cost - variable ore cost	A\$ Real/ tonne ore A\$ millions real	13	3.0	3.0	3.0	3.0	3.0	3.0	1.5	3.0	3.0
processing cost - variable	A\$ millions real	151	0.0	45	28.0	35.0	35.0	35.0	17.5	45	0.0
TV Fill and undable	Af David Immer with ode		050	070	010	070	010	050	070	050	050
SX-EW cost - variable SX-EW cost	A\$ millions real	77	0.0	950	14.4	18.0	18.0	18.0	9.0	0.0	0.0
			-								
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
IIAPLE Speck	og millions real	41	U	0						0	0
private royalty	% of value reserver.		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.59
private royalty	A\$ millions real	17	0	0	3	4	4	4	2.5%	0	0
rahah			-								
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	Ap 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) opex per tonne final product (incl closure)	A\$/tonne ore A\$/tonne cathode	90 4,752	0	0	84 4,457	78 4,117	74 3,932	73	4,088	0	0
		Testal	2021	2022	2022	2024	2026	2026	2017	2028	2020
AAAAAAAAAAXXXXXXXXXXXXXXXXXXXXXXXXXXXX											
21Dec20 G Rose: The government royalty rate is 6% of gross revenue											
government royalty rate	% of sales revenue AS millions real	40	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
*4	a production for an	40			-						
Income tax 21Dec14 G Rose: The company income tax rate is 30% and the company	expects to be paving in	come tax in fue	ure years no r	rry losses ca	n be used im	mediately					
Cashstream 1: Revenue	A\$ millions real	672	0	0	125	156	156	156	78	0	0
Jess Cashstream 3: Operating Costs	A\$ millions real	386	0	11	67	78	74	73	39	45	0
government royalty	A\$ millions real	40	0	0	8	9	9	9	5	0	0
tax deduction for capital expenditure Assessable Income	A\$ millions real A\$ millions real	156	0	-11	39	29	22	18	47	-45	0
											-
Lompany income Tax Rate	>> or assessable income A\$ millions real	27	30%	-3	30%	30%	30%	30%	30%	-14	30%
					-						
				-							



#### 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.

#### **#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

A single page in Excel is called a 'worksheet'. An assembly of 'worksheets' is called a 'workbook'

Years>	units	Total	Year 1	Year 2	Year 3	Year 4	Year !
Cashstream 1: Sales	& Revenue						
1. Sales of A, B & C unit	S						
1 Aug 2022: Enterprise ABC Marketi	ing Report: page 15						
Units Sold							
Product A Sold	units	400,091	20,000	21,000	23,10	Work	36,03
Product B sold	units	261,523	15,000	15,750	17,32	VVOIK	24,94
Product C sold	units	73,951	5,000	5,500	0,00	block	7,321
Total ABC units sold	units	735,565	40,000	42,250	46,475	55,165	68,30
2. Selling Prices of ABC	units						
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price Product C' - selling price 3. Revenue from ABC u Product A revenue Product B revenue	units ng Report: page 22 US\$ Real/ unit US\$ 000 Real US\$ 000 Real US\$ 000 Real US\$ 000 Real	13,606 11,283	38 48 58 760 720	37 47 57 782 741	36 46 56 843 799	36 45 55 Work	35 44 53 1,263 1,105
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price      3. Revenue from ABC u Product A revenue Product B revenue Product C revenue Revenue from ABC units	Units ING Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real	13,606 11,283 3,879 28,767	38 48 58 760 720 290 <b>1,770</b>	37 47 57 782 741 313 <b>1,836</b>	36 46 56 843 799 <b>1,979</b>	36 45 55 Work block 2,=34	35 44 53 1,263 1,105 <b>7</b> <b>2,75</b>
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price 3. Revenue from ABC u Product A revenue Product A revenue Product C revenue Revenue from ABC units Years>	units Ing Report: page 22 US\$ Real/ unit US\$ 000 Real	13,606 11,283 3,879 28,767 Total	38 48 58 760 720 290 1,770 2024	37 47 57 782 741 313 <b>1,836</b> <b>2025</b>	36 46 56 843 799 1,979 2026	36 45 55 Work block 2,≃54 2027	35 44 53 1,263 1,105 <b>2,75</b> 202
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price 3. Revenue from ABC u Product A revenue Product B revenue Product C revenue Revenue from ABC units Years> 4. Value added Tax on S	units Ing Report: page 22 US\$ Real/ unit US\$ 000 Real Seales	13,606 11,283 3,879 28,767 Total	760 720 290 1,770	37 47 57 782 741 313 <b>1,836</b> <b>2025</b>	36 46 56 843 799 1,979 2026	36 45 55 Work block 2,=54 2027	35 44 53 1,265 1,105 2,75 2023
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price <b>3. Revenue from ABC u</b> Product A revenue Product A revenue Product B revenue Product C revenue Revenue from ABC units Years> 4. Value added Tax on S 2022 06 17 Central Government Tax	units  Ing Report: page 22 US\$ Real/ unit US\$ 000 Real CS 000	13,606 11,283 3,879 28,767 Total	760 720 290 <b>1,770</b> <b>2024</b>	37 47 57 782 741 313 <b>1,836</b> <b>2025</b>	36 46 56 843 799 3 1,979 2026	36 45 55 Work block 2,=54 2027	35 44 53 1,263 1,105 2,75 2023
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price Product C' - selling price 3. Revenue from ABC u Product A revenue Product B revenue Product C revenue Revenue from ABC units Years> 4. Value added Tax on S 2022 06 17 Central Government Tax Revenue from ABC units	units Ing Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real Contemportation Contemp	13,606 11,283 3,879 28,767 Total	760 720 290 1,770 2024	37 47 57 782 741 313 <b>1,836</b> <b>2025</b>	36 46 56 843 799 3 1,979 2026	36 45 55 Work block 2,=54 2027 Work	35 44 53 1,263 1,105 2,759 2021
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Marketi Product A' - selling price Product B' - selling price Product C' - selling price 3. Revenue from ABC u Product A revenue Product B revenue Product C revenue Revenue from ABC units Years> 4. Value added Tax on S 2022 06 17 Central Government Tax Revenue from ABC units VAT on Sales of units	units Ing Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real US\$ 000 Real US\$ 000 Real US\$ 000 Real CSales Coffice website VAT re US\$ 000 Real	13,606 11,283 3,879 28,767 Total	760 720 290 1,770 2024	37 47 57 782 741 313 <b>1,836</b> 2025	36 46 56 843 799 1,979 2026	36 45 55 Work block 2,=34 2027 Work block	35 44 53 1,263 1,105 2,755 2028

#### **#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 unit	s						
1 Aug 2022: Enterprise ABC Market	ing Report: page 15						
Units Sold							
Product A Sold	units	400,091	20,000	21 00	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 Market	ing Report: page 22						
Product A' - selling price	US\$ Real/ unit		38	37	36	36	35
Product B' - selling price	US\$ Real/ unit		48		46	45	44
Product C' - selling price	US\$ Real/ unit		58	17	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	j.1	799	939	1,105
Product C revenue	US\$000 Real	3,879	290	318	337	363	392
Revenue from ABC units	US\$000 Real	28,767	1,77u	1, '30	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 Ta	x Office website VAT r	ates are 10% exce	ept 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%	1.%	10%	10%	10%
Vat on Sales Revenue	US\$000 Real	2,877	177	4	198	229	276
				•			

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#### #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 work<u>book</u>. For example it would not show = 'Worksheet2!F13*K23
- VII. This means you <u>first</u> 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 <u>complete</u> 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 8	& Revenue						
1. Sales of A, B & C units	5						
1 Aug 2022: Enterprise ABC Marketin	ng 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	5,000	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						
Product A' - selling price	US\$ Real / unit		38	37	36	36	350
Product B' - selling price	US\$ Real/ unit		48	47	46	45	, eA4
Product C' - selling price	US\$ Real/ unit		58	57	56	55	e 53
3. Revenue from ABC u	nits					directive	
Product A revenue	US\$000 Real	13,606	760	782	843	991	1,263
Product B revenue	US\$000 Real	11,283	720	741	399	939	1,105
Product C revenue	US\$000 Real	3,879	290	313	3370	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 S	ales		3	ell			
2022 06 17 Central Government Tax	Office website VAT	ates are 10% exce	ept 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

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

- I. For example, this is a complete cash flow model in 125 rows  $\rightarrow$
- 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§ millions mel	26										
IRR	Real	16.8%										
Years>	units	Total	2021	202.2	2023	2024	2025	2026	2027	2028	2029	2030
Cashstream 1: Production and Revenue												
Production												
a Nov 2020 Michael Novik, small of probability throughputs and output of Wildle involved	dia tonnes	11.000		8.000	8,000	2.900	1.500	1.000	0			
con mond mond limite - and soluble coger	State	0			2.1%	2.25	2.1%	2.1%	2.25			
Conterned as a constant copper	data torrans.	963			1/	21		21	- 11	0	-	-
Receiving of salable capper in processing and St-EW Dulput and Sales of Cathode Copper	dia tonnes	92% 81	0	0	15	90%	9135	19	9075	0	0	0
Soles and Revenue Is now attain linear templay. Company paired forecasts, of copper pitce as	id exchange rate											
Copper picca - St-EW cathode Chaput and Sales of Cathode Copper	LAS, TO real LAS reliances	58	0	- 0	100	8.00 105	8.00 125	1.5	68	0	0	0
Cashstream 1: Revenue	Nácotitors cert	672	0	0	125	156	156	156	78	0	0	0
Years ->-	unes.	Total	2023	2022	30.23	2028	2005	2026	2027	30.28	2029	2010
Cashstream 2: Canital Costs												
Maper Development Capita R Dec 2020 2014 Carlo Enders Errari-Initial capes estimates												
Migar Development Capes	As millions mul	1.21	25									
Chegolog Capita 5 Dec 2020 2014 Carlo Federa Ferrari- co-gross capita @ Thad total in	that capes											
ongerig Capex ongerig Capex	Scof within capies A§ millions ceal	¥1	0	0	<b>6</b>	- <del>6</del>	6	6 6	6	0	0	0
Cashstrea m 2: Capital Costs	Ni mili que cont	154	25	98	6	6	6	6	6	0	0	0
						_		-	-	-		
Tax deductions for Cadital Extenditure												
The associated. ISono 2010 6 Rose, for this because, taxing educes much that the ful-	it of the cases is defined	ed over 5 varies	coude in-	So in the cal	California Pad	ow the duran	shore with	OR 8 2010	5 years + 16	da - infa		
2000 or 2010 G Rose. And the tax ing start or 1.5 that default one for taxing starts for the tax ing start on 1.5 that default one for taxing starts for call to present the tax.	spapment start with can	mercal produc	ta, with cap	eathering ded	a and fully to	the year is a	that an up	ve				
TaxDeduction for Capital Expenditure	Sudmanustring value	den the set out	+ atris	infla	arts.	atris .	it fu	80%	80%	ith	atris.	at/s
landedicated capes - opening balance landedicated capes - opening balance landedicated capes - added to cool	As onthins one As onthings and	19	2	27	125	92	-	52	61	0	0	0
landed and capes - in pro-	Als calls and call		27	125	18	98	- X	58	67	0	0	8
persense end capes - available to clock chain 20 mouth 6 Rose- und arrend tak deductions can be classed in the final tax deduction for call bit control on control to con-	year of use.		0	0			~	19	47	0		0
tanded and capes - doing balance	A§ calls as ceel		27	125	92	69	- 2	01	0	0	0	0
E Teck If declaritions - cape	unts.	Treat	2023	2002	2022	2014	2015	2026	2022	200	2029	2040
					AUN					aun		2000
Cashstream 3: Operating Costs												
A Year 2020 Carlos Ros. emailcuttined operating cores.												
warden open	Ağ Real/tonne warde		2.5	2.5	25	2.5	25	25	25	2.5	2.5	25
	Ap millions met	208	0.0	75	25	h.i	N.N.	25	0.0	0.0	0.0	0.0
ore cot - vetate ore cot	Aș Real/tonne ore Aș militars nel	18	0.0	0.0	24	80	80	80	8D 1.5	0.0	0.0	80
processing cost - vanishine	A§ Real/tonne ore		- 25	-	- 25	- 85	- 16	- 25	- 25	- 25	- 25	- 25
burkend mg	Aý cultors cui	154	0.0	0.0	28.0	850	85.0	850	125	0.0	0.0	0.0
SHEW COLL - MILLION SHEW COLL	A§ Real/tonne cathode A§ millions mel	22	960	950	10.0	180	950 180	18.0	950	950	97D 0.0	950
fixed opex												
caperation and technical General & Identic	AS Mannum Real AS Mannum Real		2.2 6.0	3.2	32	2.2	2.2	22	2.2	2.2	2.2	3.3
fixed gets	A§ millions coul	61	0	0	8	8	8	8	8	0	0	0
provide registry	To of calles, mumore		2.0	25%	25%	2.05	2.5%	25%	2.55	2.5%	25%	25%
preate repairy	Ağ militans mel	17	0	0	×	4	4	4	2	0	0	0
with a	Al Red Doors where a		*0		20	20		20	20	*0	**	
which it as as	Ný militans mel	15	0	8	8	8	8	2	1	0	0	0
clourn												
c losare	Ný millions mel	45			0	0	0	0	0	- 65 - 65	0	0
Cashstream 3: Operating Costs	Ni calitane cani	386	0	11	67	78	74	73	39	45	0	0
apex per are (ind datum	No/ some are	90 6,202	0	0	84	28	20	28 8,930	22	0	0	0
tops are sent in the solution of the cost of	and all the second								- marki			
YANG ->-	units.	Total	2021	2022	30.23	2028	2005	2026	2027	2028	2029	2010
Cashstrea m 4: Taxes												
Government Royaltics. District G Rose: The government constructes a little aper measure												
government copility and	Staf siles evenue No attage and	-	605	60%	60%	6ds	60%	60%	6.ds	60%	60%	60%
R CONTRA TAX	Contractor of the			a		-	-					a
a start to Rose. The company income tax rate is Afficiand the company	y expects to be paying a	ncome tax in fut	ure years co	w lases a	n be used in	conductedy.	16		-			
umen a melti 2: Mayinaan Mr. C	ing millions rivel	6.2		0	1.6	26	156	256	78		0	0
powerserverse operating case.	As calls as cost	106	0	0	8	9	8	9	5		0	0
An service alon har cligable expenditione As services all e traceme	As call as call	196	0	-11	19	29	- 22 - 30	18	-12		0	0
Company Income Tax Rute	Staf a sexual e man	•	80%	atts.	80	80%	sta	80%	80%	8254	80%	80%
na drie tak	reș nată ans neel	27	0	-8	8	12	25	17	4	-38	0	0
Cashstrea m 4: Taxes	Aş militarıs mel	67	0	-3	11	21	24	26	1	-14	0	0
Year>	units.	Total	2021	2022	3023	2028	2005	2026	2027	2028	2029	2020
Cashflow and NPV												
Caddows.												
Cardistreams. Reveale	A§ millions, mill A§ millions, mill	62	25	98	125	256 6	156 6	196	78	0	0	0
Cardistreamit: Operating Cock.	As millions and As millions and	806	0	11	67	28	2	28	29	45	0	0
Net Cashflow	A§ cull ans coul	65	-25	-105	41	51	51	51	32	-32	0	0
IRR	Real	16.8%										
Planuation												
2010) Element coult, discount care for meetiment in cold indexity is if Day out finite	In Renal			-				-				-
Discourt Factor			0.96	0.99	0.82	0.76	0.75	0.65	0.61	0.56	0.52	0.48
Discounted Cadd ow	Ağ militans mel	25	-24		84	29		88	20	-	0	

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#### **#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 unit	ts							
1 Aug 2022: Enterprise ABC Market	ting 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	401.523	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 Colling Drices of ADC	- unite							
2. Selling Prices of ABC	Cunits							
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Market	<b>Cunits</b> ting Report: page 22							
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Market Product A' - selling price	ting Report: page 22 US\$ Real/ unit		30	30	30	30	30	
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Market Product A' - selling price Product B' - selling price	ting Report: page 22 US\$ Real/ unit US\$ Real/ unit		<b>30</b> 48	30 47	30 46	30 45	30 44	
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Market Product A' - selling price Product B' - selling price Product C' - selling price	ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit		30 48 58	<mark>30</mark> 47 57	30 46 56	30 45 55	30 44 53	
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Market Product A' - selling price Product B' - selling price Product C' - selling price	Lunits ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit	-	30 48 58	30 47 57	30 46 56	30 45 55	30 44 53	
<ol> <li>Selling Prices of ABC</li> <li>Aug 2022: Enterprise ABC Market</li> <li>Product A' - selling price</li> <li>Product B' - selling price</li> <li>Product C' - selling price</li> <li>Revenue from ABC to</li> </ol>	c units ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit		30 48 58	30 47 57	30 46 56	30 45 55	30 44 53	
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market     Product A' - selling price     Product B' - selling price     Product C' - selling price     3. Revenue from ABC to     Product A revenue	Cunits ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit	10,793	30 48 58 750	30 47 57 750	30 46 56 750	30 45 55 750	30 44 53 750	7
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market     Product A' - selling price     Product B' - selling price     Product C' - selling price     3. Revenue from ABC I     Product A revenue     Product B revenue	Cunits ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real US\$ 000 Real	10,793 11,283	30 48 58 750 720	30 47 57 750 741	30 46 56 750 799	30 45 55 750 939	30 44 53 750 1,105	7
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market     Product A' - selling price     Product B' - selling price     Product C' - selling price     3. Revenue from ABC u      Product A revenue     Product B revenue     Product B revenue     Product C revenue	Cunits US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real US\$ 000 Real US\$ 000 Real	10,793 11,283 3,879	30 48 58 750 720 290	30 47 57 750 741 313	30 46 56 750 799 337	30 45 55 750 939 363	30 44 53 750 1,105 392	
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market     Product A' - selling price     Product B' - selling price     Product C' - selling price     3. Revenue from ABC u Product A revenue     Product B revenue     Product C revenue     Revenue from ABC units	Cunits ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real US\$ 000 Real US\$ 000 Real US\$ 000 Real US\$ 000 Real	10,793 11,283 3,879 25,955	30 48 58 750 720 290 <b>1,760</b>	30 47 57 750 741 313 <b>1,804</b>	30 46 56 750 799 337 <b>1,886</b>	30 45 55 750 939 363 <b>2,053</b>	30 44 53 750 1,105 392 <b>2,246</b>	7 1, 4 <b>2,</b>
2. Selling Prices of ABC 1 Aug 2022: Enterprise ABC Market Product A' - selling price Product B' - selling price Product C' - selling price 3. Revenue from ABC units Product C revenue Product C revenue Revenue from ABC units Years>	Cunits US\$ Real/ unit US\$ 000 Real	10,793 11,283 3,879 25,955 Total	30 48 58 750 720 290 <b>1,760</b> 2024	30 47 57 750 741 313 <b>1,804</b> 2025	30 46 56 750 799 337 <b>1,886</b> 2026	30 45 55 750 939 363 2,053 2027	30 44 53 750 1,105 392 2,246 2028	7 1, 4 2,
<ul> <li>2. Selling Prices of ABC</li> <li>1 Aug 2022: Enterprise ABC Market</li> <li>Product A' - selling price</li> <li>Product B' - selling price</li> <li>3. Revenue from ABC I</li> <li>Product B revenue</li> <li>Product C revenue</li> <li>Revenue from ABC units</li> <li>Years&gt;</li> <li>4. Value added Tax on S</li> </ul>	Cunits US\$ Real/ unit US\$ 000 Real Solution US\$ 000 Real US\$ 000 Real	10,793 11,283 3,879 25,955 Total	30 48 58 750 720 290 <b>1,760</b> 2024	30 47 57 750 741 313 <b>1,804</b> 2025	30 46 56 750 799 337 <b>1,886</b> <b>2026</b>	30 45 55 750 939 363 <b>2,053</b> <b>2027</b>	30 44 53 750 1,105 392 2,246 2028	7 1, 2, 2(
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market     Product A' - selling price     Product B' - selling price     Product C' - selling price     3. Revenue from ABC u  Product B revenue Product B revenue Product C revenue Revenue from ABC units     Years> 4. Value added Tax on 1 2022 06 17 Central Government Ta	C units Ling Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real S\$ 000 Real S\$ 000 Real CS\$ 000 R	10,793 11,283 3,879 25,955 Total	30 48 58 750 720 290 <b>1,760</b> <b>2024</b>	30 47 57 750 741 313 <b>1,804</b> <b>2025</b>	30 46 56 750 799 337 <b>1,886</b> <b>2026</b>	30 45 55 750 939 363 <b>2,053</b> <b>2027</b>	30 44 53 750 1,105 392 2,246 2028	
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market     Product A' - selling price     Product B' - selling price     Product C' - selling price     3. Revenue from ABC u  Product B revenue Product B revenue Product C revenue Revenue from ABC units     Years> 4. Value added Tax on S 2022 06 17 Central Government Ta Revenue from ABC units	Cunits ting Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real CS 000 Real	10,793 11,283 3,879 25,955 Total	30 48 58 750 720 290 <b>1,760</b> <b>2024</b> ton exports 1,760	30 47 57 750 741 313 <b>1,804</b> <b>2025</b>	30 46 56 750 799 337 <b>1,886</b> <b>2026</b>	30 45 55 750 939 363 <b>2,053</b> <b>2027</b>	30 44 53 750 1,105 392 2,246 2028	2, 2,
2. Selling Prices of ABC     1 Aug 2022: Enterprise ABC Market Product A' - selling price Product B' - selling price Product C' - selling price      3. Revenue from ABC u Product B revenue Product B revenue Revenue from ABC units      Years>      4. Value added Tax on S     2022 06 17 Central Government Ta     Revenue from ABC units	Cunits Ling Report: page 22 US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ Real/ unit US\$ 000 Real	10,793 11,283 3,879 25,955 Total	30 48 58 750 720 290 <b>1,760</b> <b>2024</b> t on exports 1,760 10%	30 47 57 750 741 313 <b>1,804</b> 2025	30 46 56 750 799 337 <b>1,886</b> 2026	30 45 55 750 939 363 <b>2,053</b> <b>2027</b> 2,053 10%	30 44 53 750 1,105 392 <b>2,246</b> 2028	77 1, 4 2, 2( 2, 1

## **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 work<u>book</u>. (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.



12



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

# 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



#### 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 Co	sts										
3 Nov 2020 Carlos Bas: email outlined op	erating 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 Co	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, <u>even when they need to be long</u>, <u>detailed and complex</u>. 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