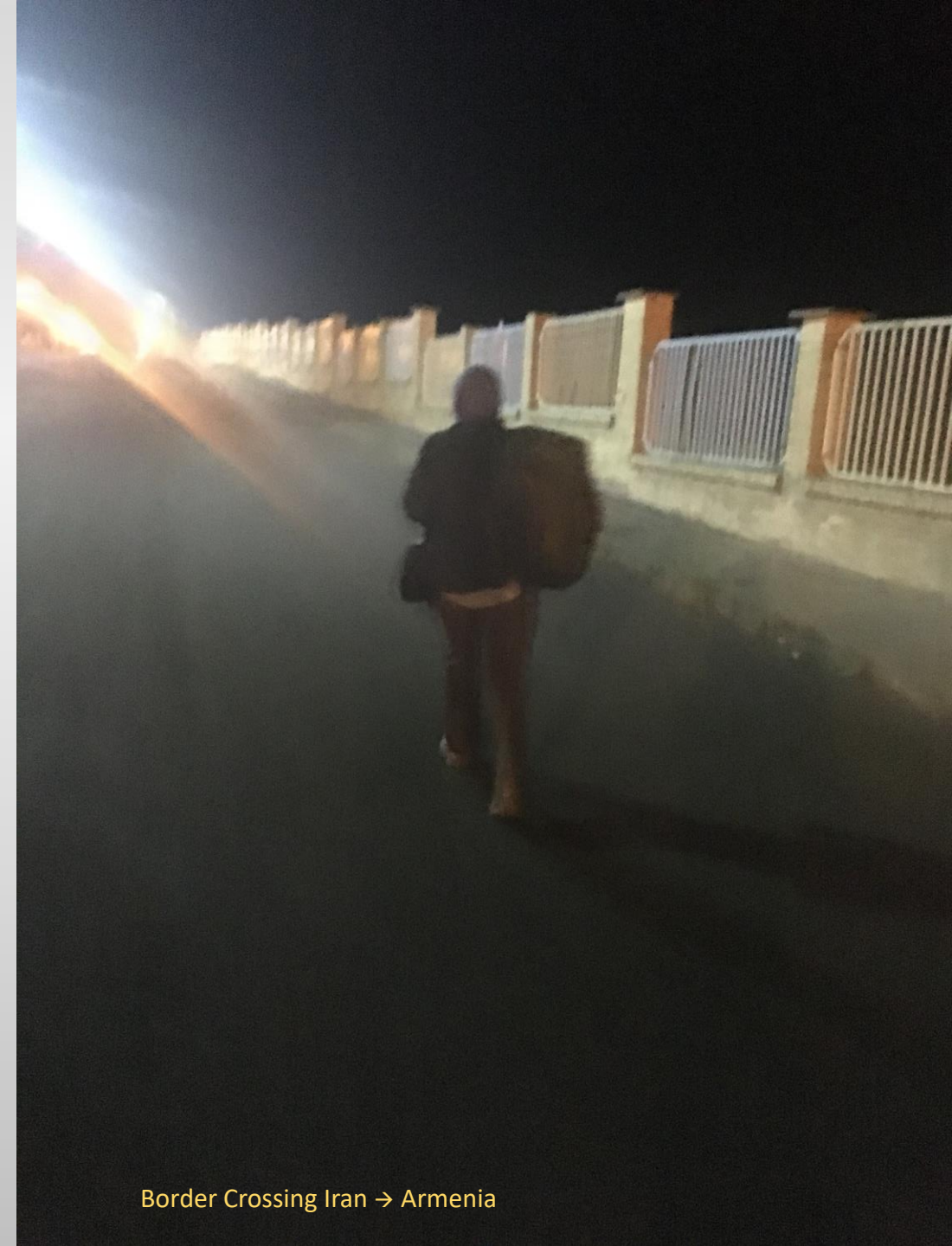


1I Hands On Modelling – Operating Costs

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





Near Karjaran, southern Armenia – on road from Tabriz in Iran

Spend only a few seconds on each page

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

This module has personal opinions!

The purpose of this module is explore **Cashstream #3: Operating Costs**

Level 3: Decision making

Level 2: Evaluating the business/project

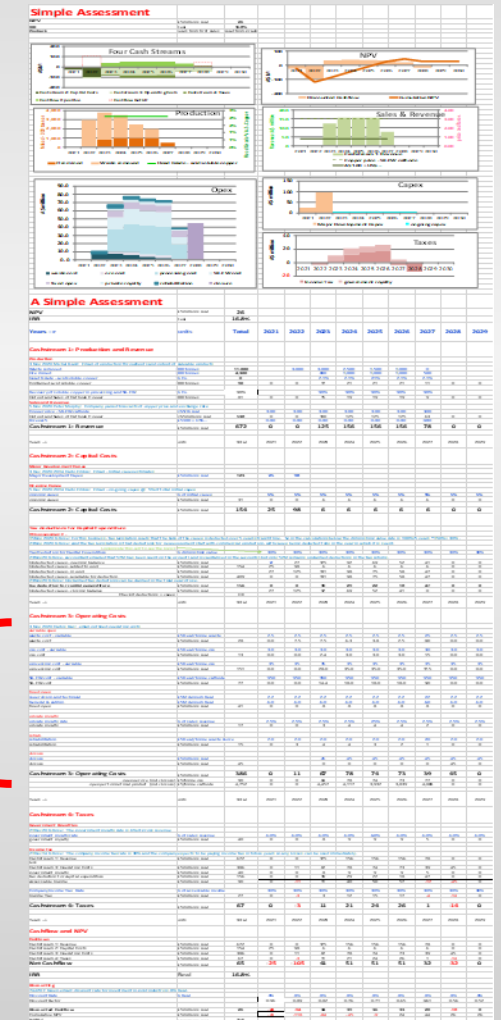
Level 1: Hands-on economic modelling

#1: Revenue

#2: Capex

#4: Taxes

Cashflow
(incl NPV)



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This module is about:

- Operating costs **in cash terms** - Accounting will use accrual
- Operating expenses = operating costs = ‘opex’
- Cafes, hospitals, factories, mining, farms, energy, ...



Making a mess of operating costs: -

Too few people do competent modelling of opex.

Too many people make a mess!

At one extreme are the opex sections that are terribly elaborate, terribly convoluted and use lots of advanced Excel/Google. Anyone trying to understand, can spend many, many hours trying to untangle long algorithms that track through multiple worksheets. All the time these people are thinking “Why is this opex made so awfully complex and messy?”

The person creating the model might be very good at Excel/Google but is no good at understanding and explaining the fundamentals of the business. The rest of the Team think of this person: **“Too much time in front of a computer and too little out in the business.”**

At the other extreme are the opex sections that try to short-cut the forces underlying the business.

For example, rather than using the multiple processing stages and varying quantities of materials and resources needed in a complex manufacturing process, the modeller uses the cost per unit-of-finished-product as the driving force. Far too crude!

This “top down” or “looking backwards” might make the modeller feel clever and knowledgeable but can be very wrong.

Both extremes are well meaning but misguided.

We will look at both these extremes later.



Kapan, southern Armenia

Doing it correctly: -:-

The operating costs must originate from knowing the business intimately and modelling the key driving forces inside the operations.

To model opex correctly, you must know the production sequence right through from taking orders, sourcing the inputs, production stages, working stocks and delivery to the customer. You must know the dynamics of each stage - from the bottom-up.

If you are not already familiar with the operations at every stage you will need to get your 'hands dirty' by at least spending time in each area. **Get away from the office, from the computer & Excel and out into the action of the business.**

Possibly hardest of all is judging how much detail and content is needed for each stage. Like Goldilocks and the Three Bears "Not too much and not too little."



Matching the opex to the task: -

In **concept studies** and **preliminary assessments** the opex usually can be coarse.

- sufficient to make a decision to abandon or assess more deeply

To assess **operating alternatives** and in **prefeasibility studies** the opex usually should be moderate

- good enough to compare cases

In **final feasibility, M&A and major operational studies** the opex may need to be long, detailed and complex.

- But focus on the key costs and perhaps aggregate minor costs

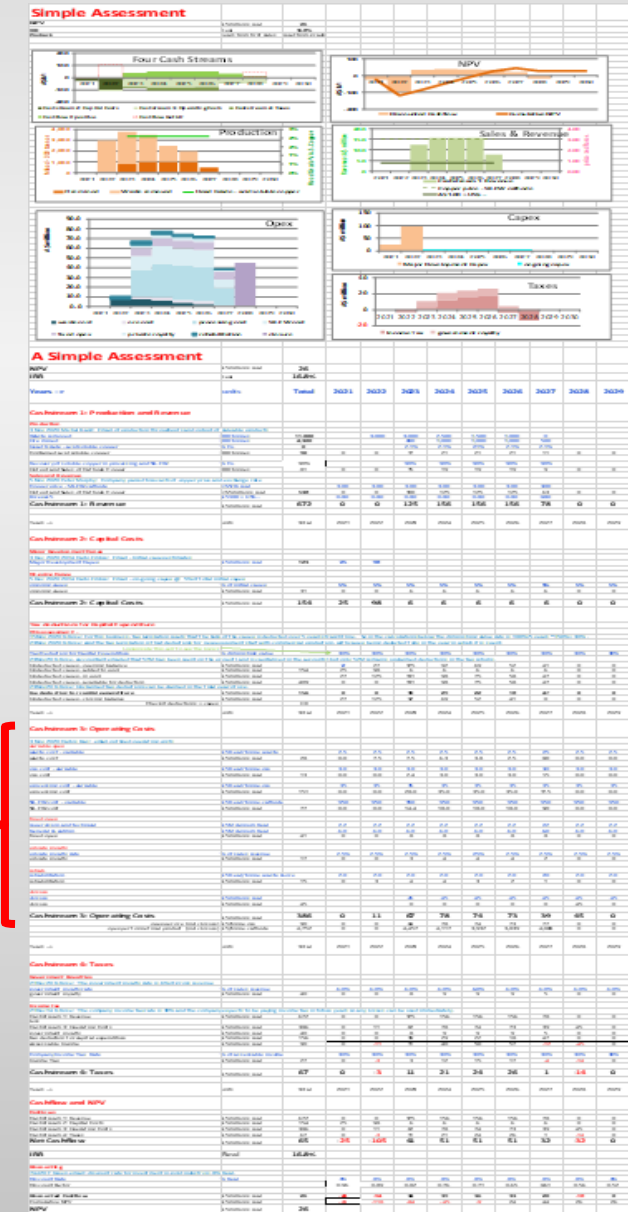


In Concept Studies and Preliminary Assessments: -

As always, begin the model as simply as practical

Do not get lured into building-in extra rows of computations ‘in case they may be needed later’

This example of a complete evaluation model leads to net cashflow & NPV in less than 100 rows.
The opex is just 19 rows.



You should be able to use a preliminary model like this to decide either to abandon or to evaluate further in a more detailed model.

When Comparing Alternatives

This example is a worksheet of operating costs only. It is not the whole evaluation model

- Sales and production quantities are referenced from the operation/revenue worksheet
- These are used to compute feed materials and working stocks
- Variable costs are inputted and computed here
- Fixed costs – people
- Fixed costs – general
- Sub-totals and costs per unit
- Working capital needed in operations
 - Creditors
- Cashstream #3: Operating Costs

- As always ...
- Operating costs are contained within one obvious work block: -
- with bold headings and bold subheadings,
 - Column A is for unambiguous descriptors
 - Column B is for units
 - Column C is for totals (not hidden away in Column Z)
 - rows of results are obvious..
 - any data referenced from an another worksheet is in green font.
 - fresh data inputs are in blue font
 - Algorithms are in black font
 - And every algorithm in this worksheet use cells that have already exposed in this same worksheet
 - It does not directly reference data in other worksheet or have fresh data hidden inside a cell.

→ Easy understanding and errors are made obvious

Years -->	Total	2021	2022	2023	2024	2025	2026	2027
Cashstream 3: Operating Costs								
3a. Purchases of ABC units ex -factory								
<i>Sales of ABC units</i>								
From the 'Sales&Revenue' worksheet								
Product A Sold	units	400,091	20,000	21,000	23,100	27,720	36,036	46,847
Product B sold	units	261,523	15,000	15,700	17,325	20,790	26,958	32,931
Product C sold	units	73,911	5,000	5,500	6,050	6,655	7,321	8,455
Total ABC units sold	units	735,565	40,000	42,200	46,475	55,165	68,305	86,837
<i>Working Stocks of ABC units</i>								
1 Aug 2020: email from M Ali detailing the working stocks of ABC units								
1 Aug 2020 P Card: Working stocks will be consumed in the first year.								
working stocks of ABC's ex-factory to installed on farms	days		30	30	30	30	30	30
working stocks Product A - closing	units	28,046	1,664	1,776	1,899	2,078	2,300	2,438
increase/(decrease) in working stocks - Product A	units		1,664	82	173	380	684	889
working stocks Product B - closing	units	18,537	1,233	1,295	1,424	1,709	2,051	2,461
increase/(decrease) in working stocks - Product B	units		1,233	62	129	285	342	410
working stocks Product C - closing	units	5,319	411	452	497	547	602	662
increase/(decrease) in working stocks - Product B	units		411	41	45	50	55	60
<i>Purchases of ABC units</i>								
purchases from factory - Product A	units	400,091	21,644	21,882	23,273	28,100	36,720	47,735
purchases from factory - Product B	units	261,523	16,293	16,812	17,454	21,075	26,290	33,348
purchases from factory - Product C	units	73,911	5,411	5,541	6,095	6,705	7,375	8,113
total purchases from factory of ABC's	units	735,565	43,348	44,235	46,822	55,879	69,384	86,196
<i>Working stocks of ABC's - closing</i>								
purchases from factory - Product A	units	457	30	30	33	39	49	63
purchases from factory - Product B	units	472	35	36	38	45	55	67
purchases from factory - Product C	units	15	15	17	18	20	21	23
Working stocks of ABC's - closing	units	1,114	80	83	89	103	123	148
3b. Variable Costs								
3b i. Variable Costs - Purchase Cost of ABC units ex-factory								
<i>Purchase price decreases in real terms</i>								
1 Aug 2020 M Ali: Social Enterprise ABC report on "Purchasing A,B & C Units" page 7 details prices in REAL terms with decrease price decreases over time.								
Product A - purchase cost - decrease	in real terms	0%	2%	2%	2%	2%	2%	2%
Sales of units outside the country as a percentage of sales in real terms	0%	2%	2%	2%	2%	2%	2%	2%
Sales outside the country	in real terms	0%	2%	2%	2%	2%	2%	2%
<i>Purchase prices in real terms not VAT</i>								
Product A - purchase cost	units	18.00	18.00	17.64	17.29	16.94	16.60	16.25
Product B - purchase cost	units	28.00	28.00	27.64	26.89	26.35	25.83	25.31
Product C - purchase cost	units	38.00	38.00	37.24	36.50	35.77	35.05	34.35
<i>Cost of purchases of ABC units in real terms not vat</i>								
Product A - purchase cost	units	6,454	390	372	402	476	610	777
Product B - purchase cost	units	6,951	455	449	480	585	768	993
Product C - purchase cost	units	2,545	205	205	222	240	259	279
3a i. Cost of purchasing ABC units ex-factory	units	15,950	1,050	1,012	1,094	1,271	1,521	1,977
3b ii. Variable Costs - Freight ABC units from factory to ABC Depot								
<i>Debtors - sales inside the country</i>								
2020 07 20 F Widihi: email that buyers inside the country	units	735,565	43,288	42,435	46,822	55,879	69,384	86,196
freight and handling from factory	units	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Debtors at end of year - In-country sales	units	3,310	195	191	211	251	312	388
3b iii. Variable Costs - Freight ABC units to customers								
<i>1 Aug 2020: email from M Ali detailing the cost of freight and handling from ABC depot to customers. A generalized estimate is used.</i>								
Total ABC units sold	units	735,565	40,000	42,200	46,475	55,165	68,305	86,837
freight and handling to customers from ABC depot	units	4,400	4,400	4,400	4,400	4,400	4,400	4,400
3b iii. Freight & Handling of ABC units to customers	units	3,420	186	186	216	257	318	394
3b. Variable Costs								
	units	22,321	1,431	1,400	1,521	1,779	2,151	2,606
3c. Fixed Costs								
3c i. Fixed Costs - People								
<i>1 Aug 2020: email from Lee Chang detailing the likely total cost of the Team</i>								
<i>Customer</i>								
* Regional Sales Manager #1	units	180	15	15	15	15	15	15
* Regional Sales Manager #2	units	137	13	13	13	13	13	13
* Production/Distribution Manager	units	144	12	12	12	12	12	12
* Customer contact	units	120	10	10	10	10	10	10
* Logistics and Warehouse Coordinator	units	96	8	8	8	8	8	8
<i>Development and Technical</i>								
* Development Leader	units	300	25	25	25	25	25	25
* Development specialist	units	240	20	20	20	20	20	20
<i>General & Admin</i>								
* Clerk	units	413	34	34	34	34	34	34
* Accountant	units	216	18	18	18	18	18	18
* Office assistant	units	124	10	10	10	10	10	10
* other	units	0	0	0	0	0	0	0
3c i. Fixed Costs - People	units	1,722	153	153	166	179	179	179
3c ii. Fixed Costs - general (non-people)								
<i>1 Aug 2020: email from Lee Chang detailing the likely total cost of the non-people costs of ABC</i>								
<i>depot: warehouse & office</i>								
rent	units	624	52	52	52	52	52	52
Utilities - electricity, gas, water	units	120	10	10	10	10	10	10
Internet provider and phones	units	144	12	12	12	12	12	12
office	units	60	5	5	5	5	5	5
vehicles	units	130	10	10	10	10	10	10
<i>professional services</i>								
insurance & legal	units	180	15	15	15	15	15	15
audit costs & consultants	units	108	9	9	9	9	9	9
<i>activities</i>								
travel	units	240	20	20	20	20	20	20
heating events	units	72	6	6	6	6	6	6
<i>Other fixed</i>								
other fixed #1	units	2	0	0	0	0	0	0
other fixed #2	units	0	0	0	0	0	0	0
other fixed #3	units	0	0	0	0	0	0	0
3c ii. Fixed Costs - general (non-people)	units	1,392	139	139	139	139	139	139
3c. Fixed Costs								
	units	3,114	292	292	305	318	318	318
3c. Total Operating 'Expenses'								
3a i. Cost of purchasing ABC units ex-factory	units	15,950	1,050	1,012	1,094	1,271	1,521	1,977
3b ii. Freight & Handling of ABC units to customers from ABC depot	units	3,420	186	186	216	257	318	394
3c i. Fixed Costs - People	units	1,722	153	153	166	179	179	179
3c ii. Fixed Costs - general (non-people)	units	1,392	139	139	139	139	139	139
3c. Total Operating 'Expenses'	units	25,435	1,722	1,691	1,826	2,097	2,469	2,924
4. Project Working Capital								
<i>2020 07 01 Ben James email: Talks of "£150k reserve working capital" to allow the project to survive through monthly ups and downs but this needs checking</i>								
Working Capital - level needed	units	150	150	150	150	150	150	150
Project Working Capital - closing	units	150	150	150	150	150	150	150
Project Working Capital - change	units	0	150	0	0	0	0	0
5. Creditors (Accounts Payable)								
<i>6 Aug 2020 P Carter: telecon - interim estimate of creditors in average 30 days</i>								
days from invoice to paying cash	days		30	30	30	30	30	30
Total creditors - at end of year	units	142	139	139	139	139	139	139
Total (increase)/decrease in creditors at end of year	units	0	-142	3	-11	-22	-31	-37
<i>CHECK: creditors sum to zero</i>								
Cashstream 3: Operating Costs								
CHECK: operating costs = operating 'expenses'	units	OK						

When creating a long, detailed and complex model for Final Feasibility, Major Evaluations, M&A's

‘Cashstream #3: Opex’ may need multiple worksheets.

Focus on key cost areas and consider aggregating natural groups of lesser costs

If you have multiple opex worksheets then collate the key results into one obvious master worksheet of operating expenses.

Take a few extra minutes when creating the master opex worksheet to have each component area appearing distinctly. (see example below.)

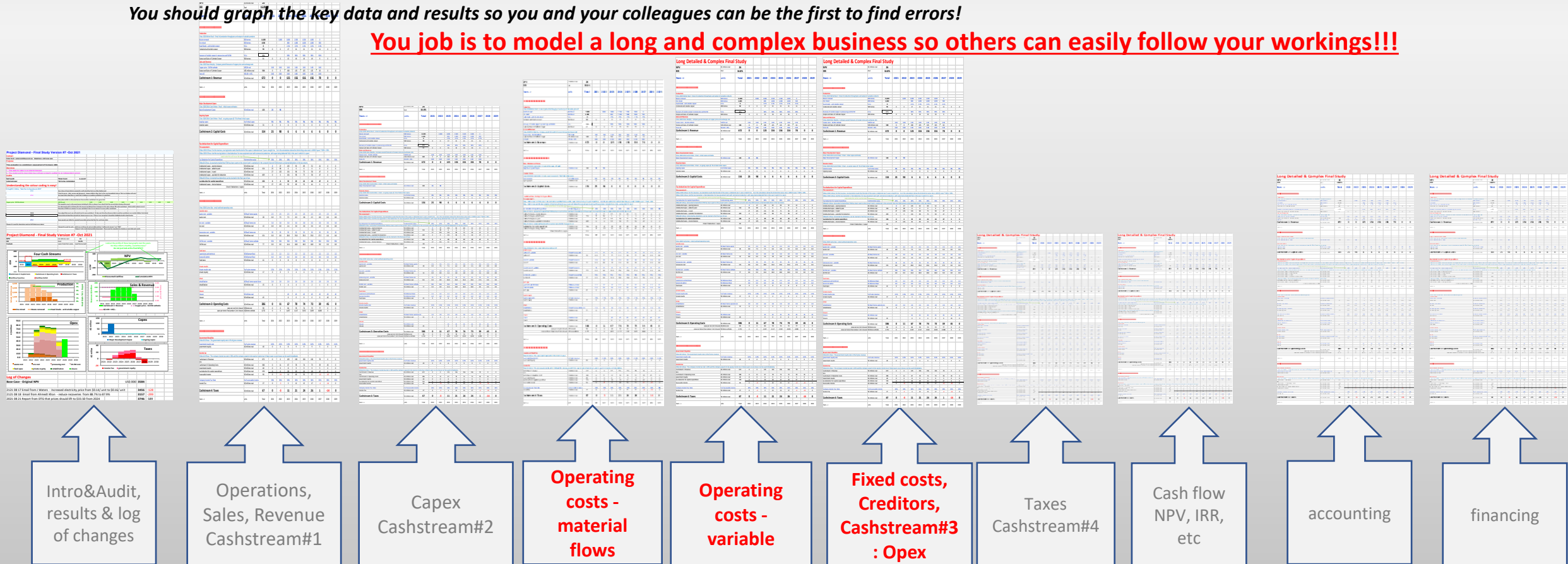
Other people must readily see that every component has been included and none are double counted.

I learned a big lesson when one of my dedicated and overstretched team was under pressure on a big M&A. He took a ‘short cut’ by creating sophisticated algorithms but failed to have obvious work blocks and ended up double counting a big cost area.

This was a disaster for him personally and for the project.

You should graph the key data and results so you and your colleagues can be the first to find errors!

You job is to model a long and complex business so others can easily follow your workings!!!



Back to 'Making a mess of opex': -

The two extremes of 'too much detail' or 'too little detail' are too common in evaluation models.

Too much detail

Most of us love to combine our intimate knowledge of how a business works with our skills in Excel. But too often we get lured into creating: -

- Opex computations that cover huge expanses.
- Calculations that start from minute detail and build up over hundreds of calculations.
- Long and complex algorithms.
- Advanced Excel functions like Lookup, Transpose, Choose, Index.

We love to create an intricate calculating machine that cleverly solves a major puzzle— especially if you love hiding away in an office doing complex Excel . We go home at night feeling super proud of our intellectual masterpiece. But we must desist and think of others who will use and audit this model.

We can make this even worse if: -

1. Algorithms directly reference cells in other worksheets. So trying to track them requires laboriously moving from worksheet to worksheet – without forgetting where you started. Dreadful workmanship!!!
2. Algorithms have fresh input data hidden inside that is not first exposed in a row of blue font.
3. Rows and columns lack totals to check against the sources of data.

All this makes auditing painful and tedious.

No-one wants to waste their time wading chest-deep through the quagmire of algorithms.

Yes, too often we get lured into elaborate detail and in advanced Excel functions.

Too little detail

A few models are at the other extreme and try to use shortcuts for opex.

The classic error is to model operating costs using costs-per-unit-of-output – whether a physical output or a service industry output.

In a café this it would be misleading to use cost per coffee or cost per meal as the way of computing operating expenses as sales went up and down.

In a hospital it would seem inappropriate to compute total operating expenses using cost-per-patient regardless of their symptoms and likely treatment

In factory or mine it would be incorrect to ignore the complexity of the production stages, the logistics and overheads

Using costs-per-unit-of-output fails to recognise that in most businesses : -

- there is a mix of variable costs and fixed costs.
- The variable costs usually relate to the varying stages underlying the production process or the service delivery
- Their failing is that they work upside-down to predetermine the opex.

In mining for example, using an operating cost of US\$/lb copper produced or of US\$/oz gold produced normally is bad.

Being \$/lb or \$/oz they cannot cope with fixed charges like general & administration and with corporate overheads.

They are too crude and hence dangerous. Frequently they are wrong and misleading.

I was involved in an acquisition of a major base metals mine where the head commercial 'expert' did his own valuation of the mine, smugly in secret using \$/lb and \$/oz. The mine was purchased using his valuation. I was brought in later in a small team when it was realised that the acquisition was a disaster. After the fateful purchase, the acquired company was trying to devise an operating plan to become cash positive and the sellers were laughing at the arrogance of our head commercial 'expert'.



Yerevan, Armenia

Activity or Functional Costs?

In a pizza shop the operating costs could be split as:

Activities:

Purchasing, kitchen, shop counter, taking & delivering orders, administration

or as

Functions:

Labour, energy, food, communications, premises, vehicles.

Either way can work in an evaluation but ...

- Accountants seem to prefer functions because they are easier to track and record
- Operators and Management usually prefer activities because that's how the business works and how they usually think & manage.

So if you have the choice use 'activities' as your preferred method because more people will understand and contribute: -

In mining for example it would be better to use Activities → mining, processing, chemical reactor, logistics, G&A, Corporate, etc rather than Functions → manning, fuel, electricity, reagents, maintenance, ...



Repeating from the Capex module → Is it capex or an operating expense?

Firstly it is essential to realise that a business model does not use Accounting definitions. **Instead it uses the Tax Office's definitions of capex and operating expenses.** Much will be the same but some important items might be opposites.

For example: In Australia the Tax Office classifies 'pre-stripping of a mine' (which may be a huge upfront cost) as an operating expense so it is immediately deductible against income. By contrast the Accountants will correctly treat it as 'capital' in the Accounts to be deducted over many years (by some rational method).

When creating your business model you are not making an accounting statement and you are not doing a tax return. It does not matter if an item is put into capex or operating costs in your model – if that helps others to recognise your input data – providing it is clearly visible to everyone and **providing it is treated correctly in the tax deductions – but then probably only if it is a significant amount.**

In Mining:-

- Examples are tailing pond expansions, underground mining development and the replacement of equipment may be included in either capex or opex in the Estimators' lists of expenses. Research the tax office website to work out how each is to be claimed for tax.
- 'Closure costs' are better included in the operating costs but some prefer them in 'capex' – check with the local income tax rules how closure costs are to be treated. In some countries they can be stranded at end of mine life with no ability to deduct them from revenue when computing tax. (In Accounting closure costs are brought forward before the cash is spent and allocated against sales/output from Day1.)
- Underground mining's routine development costs may be included in the capex by people wanting to make the cost per ounce of gold or lb of metal appear lower but this is now difficult with company reporting standards. (All in Sustaining Cost of production makes cheating harder)



Repeating from the Capex module → “Capitalise it!”

Some operations and technical people have a strange idea that if you “capitalise” a major cost that will improve the **business case**. The project leader may suggest that you do this. But don’t because it is untrue: -

- Inside your company, **Accountants** follow strict world-wide accounting rules that determine if an item is ‘capital’ or an ‘operating expense’. An Accountant cannot simply “capitalise” an operating expense if it is not capital according to global accounting rules.
- Inside your company, your **Business Model** will compute income tax in the ‘Tax’ section according to the tax laws of that country. There is no discretion to reclassify an item. (Tax rules may differ from Accounting rules.)
- As already explained: When doing a **Business Model**, you can put a capex item into the ‘opex’ worksheet or an opex item into the ‘capex’ worksheet – if that helps others to recognise your input data. But you must make it clearly displayed and you must give it the correct treatment further down the model when computing income tax. If the item is relatively minor then you probably do not need to do all the extra computations in the tax worksheet if its impact on NPV is insignificant.
- **The biggest fallacy of ‘Capitalise it!’** is that while it might improve the accounting profit, it would actually decrease the business case and its NPV. An item classified by tax laws as ‘capital’ is deducted from revenue over some years. By contrast an operating expense is deducted in its year of expenditure. The overall numeric tax deduction/benefit over the years would be the same in both cases (in Nominal Terms). The difference is that if it is an operating expense that tax benefit is realised in the year of expenditure, the income tax is lower and so the net cashflow is higher in that year. But if it is a capital deduction then that tax benefit is spread over a number of years so the cashflow benefit is not upfront but spread over ensuing years. “Capitalising it” makes the NPV lower for two reasons: firstly the tax benefit is later and secondly because the tax benefit is eroded by inflation in Real Terms. “Capitalise it” backfires!
- **Why would they say that?** In the Company Accounts the rules have the reverse effect and it would make the accounting profit look better in that first year but worse in ensuing years! ‘Capitalising it’ would mean that that the expenditure in cash on a capital item is not recognised in full in its year of expenditure but spread in some logical way over ensuing years. (Of course, a business model is about cashflow so it has to recognise the cash when it is spent)



Abandoned factories, Yerevan

Creditors

In most preliminary evaluations and in many comparative evaluations the creditors will be of low relative importance and can be omitted from the operating costs. Only when the exact detail of cash flows is required or when there are extraordinary creditors are they needed.

Like debtors in the Revenue Cashstream, the creditors may be approximated in all but the final detailed model.

Interest

Just as 'interest charges during construction' should be excluded from the capital costs, any interest charges should be excluded from the operating costs.

An economic evaluation model is about cash being put in and cash being generated. It does not include any financing.

Interest, debt, equity, etc should be included in the separate 'financial model' that is fed from your economic evaluation model - but the financial model must not feed back to your economic model.



Closure Costs

Closure costs can be inputted in capex but usually are better in the operating costs.
Either way it is essential that they are treated correctly in the tax computations.

Costs: In large factories and mines, the closure costs often are grossly underestimated. This is particularly so if the facilities have legacy pollution of soil, dumps and plant.

A classical error is to pretend that the closure costs will be equalled by the benefits of salvaging the plant and equipment.

Real estate may be different if it can be subdivided.

Some arrogant senior managers work through closure plans ignoring the requirements of local community and even of their own company until forced upon them.

For mines and smelters the closure costs need experts to estimate what is required and how much it will cost. These can cost billions in vast, long-history base metal operations. Capping and sealing waste rock dumps, tailings dams and rubbish dumps can be very onerous, expensive and slow. Then there may be years of expensive monitoring after closure. Several mines and smelters have been 'sold off' in the final years or after closure where the 'buyer' was given a large compensation payment by the 'seller' to take the mine/smelter

Timings: Closure costs may start being incurred in a small way in the years before actual cessation of operations but usually the main costs will be incurred afterwards. Closure costs may peak in the years immediately after cessation and taper off over some years. Mining, processing and chemical plants may take some years to be closed and then have a decade or more of monitoring and occasional activity

Tax: The treatment of closure costs in the income tax computations needs careful research.

The tax laws of some countries allow the closure costs to be claimed against revenue in the years before closure.

But many countries will only allow the closure costs to be deducted as they are spent. This is okay if there are other operations within the company against which these closure costs can be deducted. But if this operation is ring-fenced, or the only operation inside that country then the deductions for closure will never be used.



Think: The model is a workhorse.

Do not turn it's opex section into a trophy of your Excel/Google prowess.
Instead get up from your computer and get out amongst the operations
and sales!



Your enjoyment of modelling operating costs will come from becoming a valued part of the business!

Not from being an isolated and scorned expert in advanced Excel/Google.



The Cascade overlooking Yerevan and Mt Ararat