A critique of the PMI
Practice Standard for Estimating
and the idea that 'bottom up'
estimating always equals
improved accuracy,
excessive detail does not help!

Presentation Outline

- What is an ‘estimate’
- The problem with excessive detail
- Why range estimates matter
- Estimate what you know
- Conclusion

What is an ‘estimate’

- PMI: *‘The act of creating a quantitative assessment of the likely amount or outcome’*
  - Duration estimates
  - Cost estimates
- Estimates are focused on something that HAS NOT occurred
- The future is always uncertain

The problem

- Prediction is very difficult, especially about the future.
  (Niels Bohr)
- But when the 'future' happens there will be a defined fact

See: **Scheduling in the Age of Complexity**
https://mosaicprojects.com.au/PDF_Papers/P089_Schduling_in_the_Age_of_Complexity.pdf

The problem

- The problem is we don't know for sure what we know and don't know about the future
- The uncertainty is in our knowledge of the future!
- As every casino operator knows

The problem

- Uncertainty about the future changes:
  - The uncertainty increases the further out you have to estimate
    - The rest of today?
    - This week? / This month?
    - This year / 5 years time?
  - The uncertainty decreases if you know exactly who else is involved
  - The uncertainty decreases if you know exactly what has to be accomplished

The problem

As Douglas Hubbard points out in his book the ***Failure of Risk Management***:

"He saw no fundamental irony in his position: Because he believed he did not have enough data to estimate a range, he had to estimate a point".

The problem

- Someone asks you what a meal costs in your favourite restaurant?
  Possible valid answers:
  - Precisely $83.56
  - Usually between $70 and $100 depending on what you select
  - Around $85
- Which option is most useful?

The problem

- Precisely $83.56?
  - This has a 1 in 3000 chance of being correct (assuming a $30 range)
- Around $85?
  - More useful but how much cash is actually needed?
- Usually between $70 and $100
  - Most useful – we have a range and a likely maximum (ie, the amount of cash to take…)

The problem

- Precisely wrong detail
  - Creates false expectations
  - Ignores variability and uncertainty
  - Generates a false sense of security
  - Increases the risk of failure

Variability In Estimates

- The cost of reducing variability -v- the value of contingencies
- Consider the value of converting a 'budget estimate' to a 'detailed estimate' for a $500,000 project:
  - Budget +25% / -10%
  - Detailed +10% / -5%
  - 80% certainty required by management

Variability In Estimates

The 'Budget Estimate':

Optimistic cost = $500,000 - 10% = $450,000

Most Likely cost = $500,000

Pessimistic cost = $500,000 + 25% = $625,000

Therefore the expected Mean (50% probability of being achieved) = (a + 4b + c)/6 = ($450,000 + 4 * $500,000 + $625,000)/6 = $512,500

The Standard Deviation for the set = (c - a)/6 = ($625,000 - $450,000)/6 = $29,167

And an 84.13% probability of the project completing at or below a planned cost is achieved by adding one standard deviation to the Mean =

$512,500 + $29,167 = $541,667

Variability In Estimates

The 'Detailed Estimate':

Optimistic cost = $500,000 - 5% = $475,000

Most Likely cost = $500,000

Pessimistic cost = $500,000 + 10% = $550,000

Therefore the expected Mean (50% probability of being achieved) = (a + 4b + c)/6 = ($475,000 + 4 * $500,000 + $550,000)/6 = $504,167

The Standard Deviation for the set = (c - a)/6 = ($550,000 - $475,000)/6 = $12,500

And an 84.13% probability of the project completing at or below a planned cost is achieved by adding one standard deviation to the Mean =

$504,167 + $12,500 = $516,667

Variability In Estimates

- Required Contingency =
  - Budget Est. $541,667 - $500,000 = $41,667
  - Detailed Est.$516,667 - $500,000 = $16,667
- Reduction in Contingency = $25,000
- **But what if doing the detailed estimate was going to cost $30,000?**

The PMI Approach

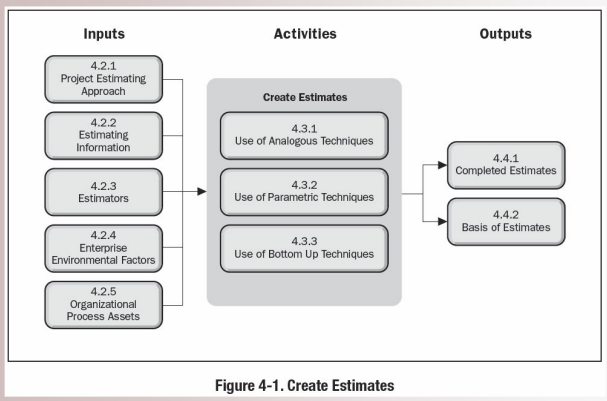


Figure 4-1. Create Estimates

Practice Standard for Project Estimating

The PMI Approach

- PMI assumes
  - Analogous is least accurate
  - Detailed is most accurate
  - Requires every person working on the project to be:
    - Defined with a known cost rate
    - The hours of effort known
    - Calculations applied to produce an accurate result

The PMI Approach

- PMI ignores 'Vendor bid analysis' in the Estimating Practice Standard
- Has no way of dealing with projects longer then a few weeks where:
  - You don't know who will be doing the work and their specific cost rates
  - You have limited information on how the work will be done

Using 'Production Rates'

- Based on 'Scientific Management' theories (1940's and 50's)
  - Supported by work study
  - Successful in manufacturing
- But projects are unique (variable)
- Therefore production rates vary!
  - For every project

Using 'Production Rates'

- Production rates for block laying*
  - Slow = 7.0m^2/per day
  - Average = 12.0m^2/per day
  - Fast = 17.5m^2/per day
- How do you decide which rate to use?
  - Or an intermediate rate – "a bit quicker than average" (13m^2/per day ?)

* Source Planning Planet – www.planningplanet.com

Using 'Production Rates'

- For 100m^2 of block work
  - Slow = 14.285 days of effort
  - Fast = 5.714 days of effort
  - Note the overall variability (nearly a factor of 3)
- Problems assuming 'slow':
  - Round up or down? (15 or 14 days of effort)
  - If the 'crew' is 4 people does the actual duration become 4 days or 3? (a 25% error)

Using 'Production Rates'

- Appear to be objective calculations
  - Based on data and arithmetic
- Are in fact subjective
  - Based on opinions and personal assessments
  - Heavily influenced by 'crew size'

Using 'Production Rates'

- There is an optimum 'crew size' for every class of work and every task
- Using the optimum crew creates efficiencies and the best 'production'
- Changing the size increases costs
  - The 'J-Curve' factor

Using 'Production Rates'

The Cost / Efficiency Curve

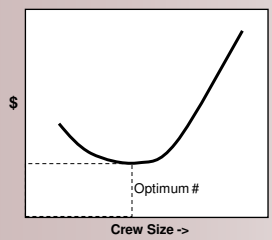


Fig. 1: Typical J-Curve

The Duration Curve

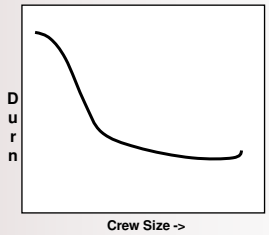


Fig. 2: Crew size -v- Duration

See: **The Cost of Time - or who's duration is it anyway?**
https://mosaicprojects.com.au/PDF_Papers/P009_The_Cost_of_Time.pdf

Using ‘Production Rates’

- Unavoidable if the people doing the work are not currently available
- But are less accurate than asking the person involved ‘how long’ (or how much)

Range estimates matter

- They introduce uncertainty
- They encourage risk management and innovation
- False expectations are not created
- They prevent unnecessary failure…

Range estimates matter

- Estimated total cost of project $10,988, 547.55 is no more valid than an estimate stated in more realistic terms!
- $11million +10% -5%
- The precisely wrong number will raise expectations leading to 'perceived failure' when they are not realised!

Range estimates matter

- $10,988, 547.55
- Plus a cost increase of $2000 (an estimating error of 0.02%)
- Means your project has 'failed' because the costs have 'blown out' to over $11 million
- Detailed time estimates have exactly the same effect!

A Practical Example

- Early in my career I had to estimate the time needed to plant 35,000 plants on a rocky hillside for the Argyle Diamond Mine accommodation village:


29 Estimating Fallacies mosaic

A Practical Example

- With a labour rate of $60 per hour, every minute spent planting a plant added $35,000 to the project cost
- And with an expected crew of 15, the task duration changed by 5 days
- Detail estimating failed (after several days of trying)

30 Estimating Fallacies mosaic

A Practical Example

- The best result was achieved by:
  - focusing on understanding how long similar jobs had taken
  - How the work-crews were organised
- An analogous approach produced a more accurate and stable estimate

The Solution

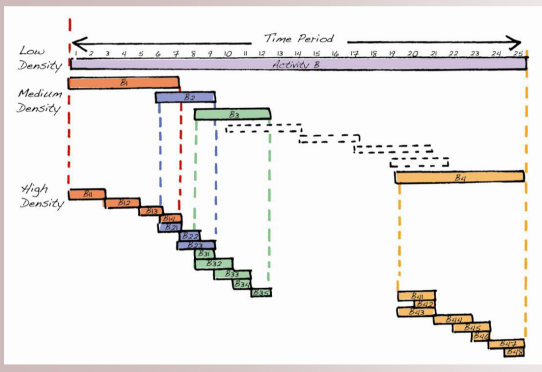
- Plan what you know!
  - Base your estimates on realistic levels of detail
- Schedule Density is one option:

Schedule Density

- Schedule Density
  - Overall framework is essential for Time Management….. But
  - Detail planning requires the people doing the work to be involved
  - Therefore, add detail when appropriate

Schedule Density

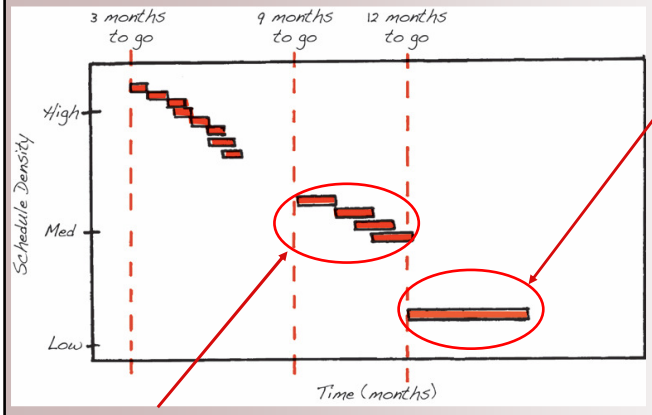
Figures © Guide to Good Practice in the Management of Time in Complex Projects



Activities are progressively expanded to greater levels of 'density' as more information becomes available

Unless the work is designed in its entirety and all subcontractors and specialists appointed before any work commences, it is impossible to plan the work in its entirety, in detail at the beginning of a project.

Schedule Density

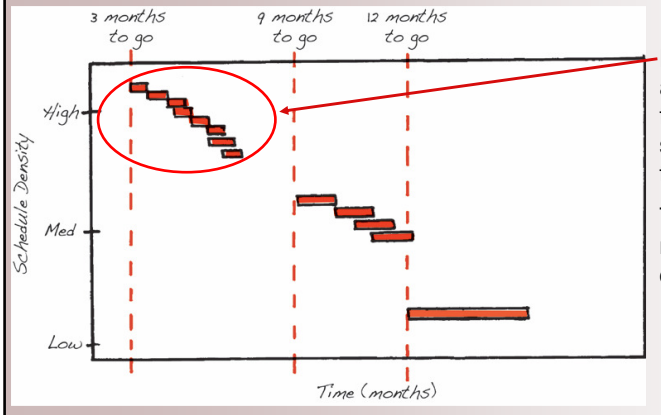


Low-density is appropriate for work, which is intended to take place 12 months, or more in the future.

Tasks may be several months in duration

Medium density is appropriate for work, which is intended to take place between 3 and 9 months after the schedule date. At this stage the work should be designed in sufficient detail to be allocated to contractors, or subcontractors. Task durations should not exceed 2 months.

Schedule Density



High-density scheduling is an essential prerequisite for undertaking work. The schedule is prepared with the people doing the work.

Task durations should be no more than the update cycle

As the density is increased, adjustments to the plan take into account actual performance to date, resources, work content, and other factors necessary to achieve the overall schedule objectives.

Conclusion

- If you don't have a model, you don't have a plan (all plans are models) and if you don't have a plan you are totally lost!
- Useful models are reasonably accurate and we use them every day ranging from street directories and GPS Sat-Nav systems through to project schedules.

Conclusion

- Ignoring the advantages of modelling because the process is not 100% perfect is the act of an idiot (unfortunately there are plenty of those around)
- The only thing more dangerous and stupid is believing a model is 100% correct and not checking regularly for incorrect assumptions and innate errors.

Conclusion

- The one of the primary causes of the GFC (that ranks alongside the criminal frauds that occurred) was the banking systems world-wide believing their almost identical risk models were infallible until it was too late

Conclusion

- One of the mathematicians that developed many of the risk modelling theorems we still use, Gottfried Leibniz wrote in a letter to Bernoulli in 1703 that:

  "Nature has established patterns originating in the return of events, but only for the most part"

Conclusion

- Models are always based on what has happened and are used to predict what should reasonably be expected to happen (not what will happen)
- Sensible estimating recognises this!
- The results are for the guidance of wise men and the blind obedience of fools
- ***All models are wrong, some are useful!***

Conclusion

- Now all we need to do is convince the lawyers……
- The CIOB Complex Projects Contract and GAO have both started along this path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