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Special Costing Issue: -

**Why does it cost
- HOW much?**

How much – or *Why* much?

Cost estimators focus on how much assets and projects cost. They seldom ask themselves why they should cost what they do. Edward B Dean*, Technical Resources Manager at the NASA Langley Research Centre, does.

Much of the cost lies in the acquisition process

He argues that the cost is not so much in the asset itself – but more so in the way in which we procure the asset, if you like *the management of the acquisition process*.

The good news is that management of the acquisition process is more or less under our control.

*The title of this issue and the inspiration for the ideas within it come from an article by Dean which you may find on my web site. However Dean speaks of 'systems', 'systems to genopersitate systems' and 'genopersistational recursion', so you may find SAM easier to understand!

*Researched and written by Dr Penny Burns, AMQ International.
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We Bring Costs Upon Ourselves

How does Cost Estimation Work?

Some cost estimates are based on cost estimating relationships derived from data, for example, the use of unit rates. Others are based on analogy, expert opinion, or just plain guesses. All cost estimates are *just estimates*.

"Most cost estimates have little or no relationship to the asset or project that is eventually delivered."

"Many cost estimates have little or no relationship to the final cost."

Why? There are several reasons:

1. We don't get what we cost
2. Our efforts to contain costs can be self-defeating
3. Costs can be self generating

1. *What we are costing is NOT what we get*

The end product or asset generally looks very different from the one that was originally conceived – and costed. We are all familiar with the scope and value changes that take place during the construction of an asset, and not only for political reasons. But there are steps that we can take to ensure that we don't start off wanting a rubber tyre swing in a tree and end up with an entire gymnasium. (see p 140)

The cost estimates themselves can change the nature of the product or asset. Such as when we systematically under-cost so that, in the end, something needs to be left out, - or put back in again later at the greater expense of retro-fitting. Or we may accidentally under-cost, with the same result.

Or we over-cost and then strive to justify our original estimates by adding something on. These behavioural reactions to costs may explain the Freiman Curve on the next page.

2. *Costs are often of our own making*

Dean points out that the requirements and specifications that we build into our purchase requests may be viewed as constraints. Basically what we are trying to do is to minimise the cost of an asset subject, say, to the requirement that it be able to do x, y and z.

Constraints may be active - that is they have an impact on the outcomes, or non-active.

Now if the constraint is non active then the minimum cost is not affected by that constraint – however, *we have incurred an acquisition process cost* merely by the fact that we have had to manage this constraint. For example we may specify a condition x and all available models have condition x so that our ultimate choice does not end up being affected by this constraint and nor does the asset cost. However, simply by the fact that we have had to check all of the models for x we have incurred a processing cost.

If a constraint is binding, or active, then the constrained minimal cost is higher than it would have been if we did not have to take the constraint into account. For example, if your specification demands a higher standard than is normally provided in the 'off the shelf' models, or if it requires you to go to the top of the range of standard models.

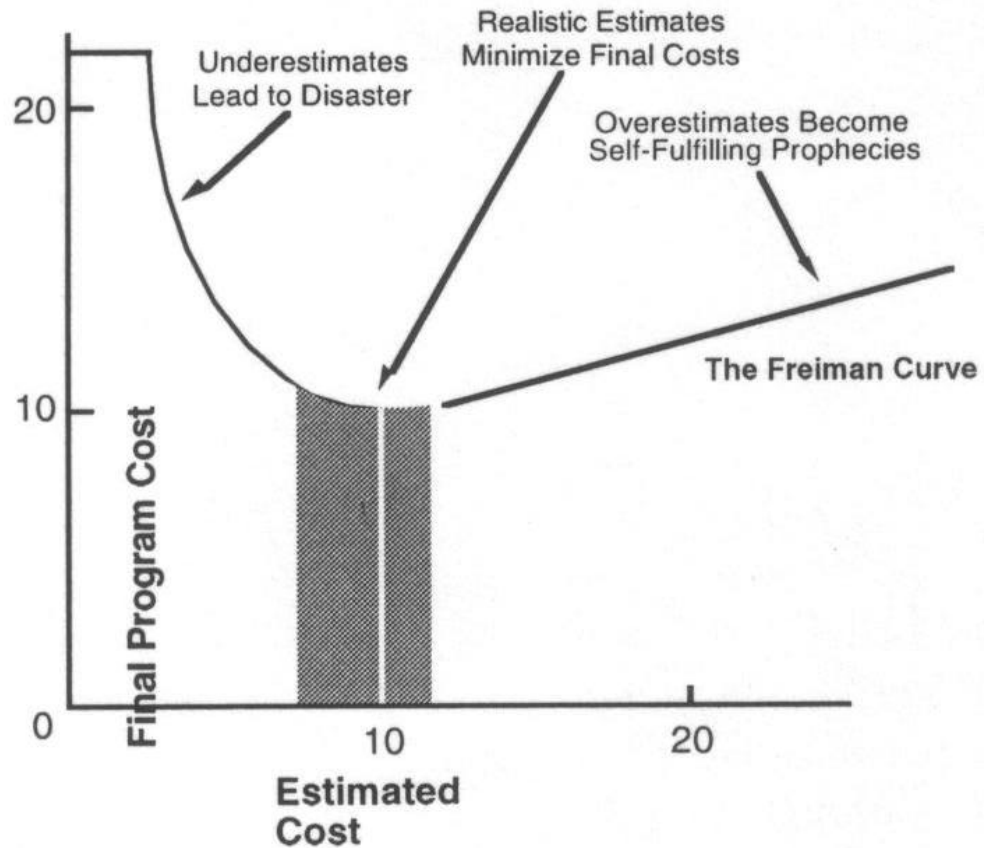
The conclusion is that **all constraints increase costs**. Eliminating all constraints is unrealistic, the aim is rather to work towards a minimal core of constraints for that will minimise your costs.

We often think that 'you get what you pay for' and this may be true, but equally true is

'you pay what you ASK for'

- whether you need it or not!

The Freiman Curve



From Freiman, F (1983) "The *Fast Cost Estimating Models*", Transactions of the 27th Annual Meeting of the American Association of Cost Engineers, Philadelphia, PA, 26-29 June.

Uncertainty Costs

When we commence a new project there are many uncertainties. How we deal with these will be one of the factors in the ultimate cost.

The use of contingency allowances is a standard way of addressing uncertainties. Over the page are some hints on establishing and, once established, on managing contingencies.

It doesn't take an Einstein to figure out that once a budget allocation has been made there is a tendency to 'spend up to' it. The more generous the contingency the more the project is likely to end up costing.

(For a study I did some years ago for the South Australian Audit Commission of five large capital projects, one of the projects actually came in below budget, not all of the contingency allowance having been spent. When queried, the project manager said, quite frankly "That was a mistake, we should have spent it!")

Establishing and Managing Contingencies

Establishing Contingencies

On the establishing of contingencies, **Mark Neasbey** of the ACVM writes:

“For any ‘construction’ project there will be a need to establish contingency in the budget which is commensurate with the degree of uncertainty that is evident.

This will be potentially significantly different depending on the industry to which the project relates, the complexity of the project, the time-frame that it will occur within, the market/industry environment that the project will proceed in, the proposed procurement method, the final scope and so on.

Rule-of-thumb for Contingencies

Mark suggests that the ‘rule-of-thumb’ seems to be

- At initial concept expect to allow at least 30% contingency.
- At the time of validating the concept it should be down to around 20%.
- At detailed design it should be possible to have it narrowed to around 10%.
- At time of entering into the procurement contract it should be about 5%.

These will vary from industry to industry in accordance with the variations in key areas of uncertainty. For example, a commercial building project vs a steel plant vs a marine jetty vs a major teaching hospital.

Normally one would expect that refurbishment would have a higher level of uncertainty than a ‘greenfield’ project.

If a project is going into contract with a contingency greater than about 5% then you’d have to be concerned that they are not clear about what it is they want (i.e. a poorly defined or specified brief) or that they remain un-

certain as to the effectiveness of the method of procurement (ie unpredictable resource needs or external risks such as the weather) or that they have failed to adequately scope the intended works (i.e. expected high rate of variations). Or it could mean that they have recognised some risk factors that cannot be accurately scoped and that if they arise will be expected to have significant cost impacts.”

Note that all of the elements discussed above, viz

1. We don’t get what we cost (defining the brief)
2. Our efforts to contain costs can be self-defeating (prescription)
3. Costs can be self generating (contingencies)

are elements in the **acquisition process** not in the asset itself!

All of these can be managed. And must be managed if you are to control costs. So let’s see how we can do this.

Managing Contingencies

1. Be sure you know what the contingency element is. The following scenario is not uncommon – design builds in a 10% contingency factor, production takes this figure, adds on its own production costs, plus a contingency of 10% (on the total!) then distribution does the same and now marketing. Before you know it you have contingency piled on contingency. [Make sure you isolate the contingency factor.](#) If you don’t, you can’t control it.
2. [Keep your options open.](#) Don’t foreclose until you have to. This gives you the maximum scope to refine your scope, costs, and contingencies. Focus on outcomes (see below)
3. [Get your incentives right!](#) (see page 142)

Getting Your Incentives Right

Jeff Roorda, Jeff Roorda & Associates

This Works!

Jeff Roorda (Jeff Roorda & Associates) will be well known to readers of *SAM*. He personally attests to the effectiveness of the following approach, having used it himself on a number of occasions.

It is a case study on cost and the contingency element. He stresses that it is not partnering—a badly misused term and now out of favour. One project using this approach, while experiencing constant political and administrative interference, still came in 10% under budget with much higher quality for life cycle cost reasons and 20% ahead of schedule!

Avoiding Unnecessary Variation in the Brief

To obtain the minimum core of requirements requires a client brief that does not change after the estimate is made. There are scenarios where the cost estimate is subject to so many uncertainties that accurate advance estimates are almost impossible.

Examples are projects subject to political and/or administrative input during construction or maintenance / renewal contracts where not much is known about the long term work and material input required.

Experience shows that for these type of projects, saying “you agreed to the plans and specifications, we will not change them because of cost penalties”, is not a satisfactory option because the client will not be satisfied. The plans and specifications must represent the clients needs, but in these examples the client is unable to define details, or does not really understand the documentation that reflects a client brief.

It is not until the client sees the outcome of the specification that the knowledge of what is actually required is gained.

The result is variations to the contract and cost and time overruns that can more than double the initial estimate. *The original estimate was correct, but based on the wrong specification.*

A Method for Controlling Changes

One possible mechanism that recognises the principle in the Freiman Curve but still allows either client or contractor to make changes to improve the end result has been proven on a number of contracts where high levels of flexibility are required (eg Civic Centre and Hospital Expansion Projects).

The method relies on a high level of understanding and cooperation between the main parties i.e. the client, the designer specifying the work, the cost estimator and controller, and the service provider / contractor.

The arrangement is based on the following:

1. The designer and cost estimator work as a team to interpret client requirements
2. The contractor becomes part of the team of 4 once documentation and estimates have progressed to 80% documentation. All 4 parties have the shared responsibility of achieving the best possible result for the client at minimum cost within time constraints. There will need to be constant judgements about relative importance of time / quality and cost. The contractor is part of decisions about optimum construction methods and materials rather than an adversarial party.
3. There is a guaranteed maximum price (or rate) that is tendered by the contractor / Business Unit.

4. The contractor's profit and preliminaries are disclosed in a separate lump sum price within the guaranteed maximum price.
5. There is some form of pre-agreed contractor incentive based on performance e.g. savings to the Guaranteed Maximum Price (GMP) are shared eg 50/50 between contractor and client. The GMP contains a number of contingencies (to a maximum of 5%), most shared if unspent. This method recognizes that under the Freeman principle, the GMP would always become self fulfilling prophecy unless there is an incentive for the contractor and client to recover at least 50%.
6. The client is able to make changes up to a pre defined limit with the agreement of all 4 project team members. These changes are within a separate contingency within the GMP but returnable to the client if unspent.
7. The agreements with any external designers or maintenance system administrators recognize
 - that % fees be converted to lump sum fees when contracts are signed, and

- that the project control group will formulate continual improvements throughout the contract which may require re-documentation.

This needs to be allowed for in the contract budget.

This method is a form of non adversarial contract that relies on total commitment by all 4 parties to the end result and on the principle "fair and reasonable". All project decisions must be unanimous or the relationships quickly break down.

Quickpoint 1: Shifting Contingencies

It is possible to reduce your own contingency by including it within the contractor's price but that doesn't mean it will necessarily cost any the less, in fact the reverse is likely to be true, since 'once given, it is hard to take away'. Jeff Roorda's approach above seems a safer way to go!

Avoiding "Cost Creep" by Specifying Outcomes rather than Processes **Ami Sudjiman, Strategic Facility Services PL**

What we are costing is not what we get

This is because the scope of work may not have been sufficiently described, leading to 'preliminary cost estimates', which will need to be refined later, upon confirmation of details.

The preliminary cost estimates are often based on general assumptions and allowances for projected details. When the details arrive, the cost estimates often become way out of the ballparks, as details become very specific and, in some instances 'unique'. Architects are often the worst offenders in these instances, as the 'simple line on the drawing' which originally

thought as a feature brick design, turned out to be a custom made sun dial that needs to be imported from Europe.

Costs are often our own making

In trying to be more realistic in preparing cost estimates, we usually try to be as specific as we can, or at least provide some definite constraints to the scope of work. Yet we often are not able to do that in the early stages of planning, due to many unconfirmed details.

Suggestion—> (see over page)

Specifying Outcomes

For many instances, we may be able to prepare a minimal core of requirements, by specifying the required **outcomes**.

Although we often are not yet in a position to describe exactly what we require, we usually do know the *kind of functions or performance that we require for our assets*. If we can concentrate on the outcomes, the cost estimators will need to do a bit more research into the type of materials or equipment to produce the outcomes described, and possibly come up with a suggestion of the most economical solution to our required outcomes.

Example: Road Access

For instance, we may know that we will require a land access from two locations, to connect a new suburb from an existing one. Yet we cannot be specific whether this will be a 6 lane highway or a bicycle track or a simple dirt road, until we know further on the most likely type of activities and industry that the new suburb may have.

So, for the moment, we may be able to specify, that the land access will:

- follow the general contour of the land at the shortest distance between the two locations;
- be capable of taking ordinary road traffic up to certain volumes per day;
- be safely accessible through all weather;
- be used by both pedestrians, bicycles and cars up to certain weight;
- will not have any residential housing alongside it;
- require minimum upgrades and maintenance;
- will be built by local contractors only;
- will be supported with additional land access after 5 years etc.

It will be up to the cost estimators' discretion to decide whether this means that the above land access will be a sealed road with appropriate stormwater drainage, line markings, street lightings etc. or not.

Through the above process of specifying the required outcomes, we will be able to practically 'delegate' that

research and basic design role to the cost estimator, whilst we are trying to finalise our plan. The possibility of the introduction of new technology or materials into the market can also be adequately covered through this process, as nothing was specified about a particular technology or material.

More targeted role for the cost estimator

Through good communication and understanding between the parties, the cost estimator will also be able to contribute more to the planning process, by coming up with suggestions that will provide economical benefits to our mutual plan.

Specifying Outcomes in Maintenance

The above process of specifying the required outcomes has been used for a while in the maintenance industry. In these instances, the customer stays in control, and only needs to specify the performance outcomes that the plant and equipment need to meet eg air temperature in the office needs to be 21 degrees with +/-2 degrees variation. The customer does not need to specify that the various equipment controlling the temperature within the room needs to be maintained every week or monthly etc.

Retaining your client control

The latter process tends to give control to the maintenance contractor, and the customer needs to be very conversant with its air conditioning systems to be able to control their contractor.

"Incidents occur regularly where the customer complains that the room temperature is not cool enough, and yet the contractor has been maintaining the equipment exactly as specified. In many cases, the customer is then required to pay for additional services due to the change in details of the maintenance specifications."

(cont. over the page)

(cont from page 143)

It may not be possible to use required outcomes to provide minimal core of requirements and specifications in all instances. However, it is a useful way of finding the lowest ultimate costs without putting too much constraint, which may still deprive us from obtaining the most economical solutions to our plans. By concentrating on the required outcomes, we are not constraining ourselves to certain unit rates or known available technology or material; instead, we have the opportunity of highlighting our true core requirements and all the internal and external factors that may influence the outcomes of those core requirements.

Quickpoint 2
Improve your Unit Costing

Organisations with large asset portfolios of a similar nature (eg water mains,roads) can take advantage of systems to capture unit costs at an appropriate level after completion of a construction project.

Aneurin Hughes, Cardno-MBK advises that we should pass on using bills of quantities for this purpose. Most of the information in bills of quantities is usually far too detailed and costs associated with an asset are distributed right through the documents. These documents do not usually include overheads and contract variations which can be significant. It can take some time to identify the cost of an asset.

Quickpoint 3:
Getting Better Estimates through Unit Rates

Why not follow the lead of the South Australian country council that is getting on top of their cost estimation by improving their use of unit rates? Whereas once they used to use one unit rate for road seals, they now break this up into individual variable elements. They now have a unit rate for

- materials
- contract labour, and
- in- house labour

Now when their actual costs do not tally with their estimates they first check whether they sealed the length of road in the estimation. Then they look at whether the materials cost was right, whether they caught an upturn or a downturn in the labour market and whether their in-house labour efficiencies were as estimated.

As a result they improve their understanding of why costs are what they are—and improve their ability to estimate next time round.

Quickpoint 4
Take advantage of market fluctuations

Aneurin Hughes reminds us that costs fluctuate and we are now in a good position to take advantage of a coming lull in the market—post the pre-GST land development/building boom and post the Sydney Olympics boom. There are potential savings if asset managers invest in a building recession rather than during a boom

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