360 AMQ International's STRATEGIC ASSET MANAGEMENT

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Optimism Bias and Cost Overruns

As a species, humans have a tendency to be optimistic, we overestimate good things in our life, and underestimate bad things. For example, we overestimate our longevity or career prospects and underestimate our likelihood of being in a car accident or getting cancer. We are more optimistic than realistic and even when we know the general statistics on car accidents or cancer, we do not materially change our own assessments, according to studies by neuroscientist Tali Sharot (The Optimism Bias). This optimism bias is generally good for us. It makes us more resilient as well as happier, healthier and more successful.

Unfortunately, when it comes to social and public infrastructure decision making, or really any complex decision making, optimism bias also leads us to underestimate the project costs and completion dates, and to overestimate potential demand and benefits. If the bias was trivial we could afford to ignore it, but it is not.

Daniel Kahneman won the Nobel Prize for Economics in 2002 for his work in not only analyzing Optimism Bias in decision-making ***but in finding ways to counteract it.*** He didn't put his theory into practice but others have done so. The London Olympics used Kahneman's approach to get better cost estimates, the UK Transport Department is using it, the American Planning Association has endorsed it, which all suggests that it is worth considering. You can do so here in just 6 short pages (including the related cost overrun issue of strategic misrepresentation) - with follow up reading for those who want to take their cost estimations seriously.

ALSO - on pages 9 and 10, we look at two more possible scenarios for the future of asset management - AM as a technology or tool box, where the focus is not on decision making or outcomes but rather on the technical processes. Again we present a 'strong' and a 'weak' or 'negative' view. *How likely do you think it is that either of these scenarios is to come about? All comments welcome*

Please consider - and enjoy! ***Penny***

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BUDGET INACCURACIES

It may seem strange that budgets are notoriously inaccurate when the one (and very imperfect!) measure that we do have for project performance is 'did it come in on time and within budget?' but they are.

IT IS NOT BECAUSE OF POOR DATA OR FORECASTING MODELS

In the past we have argued that inaccurate cost predictions are the result of (a) poor quality data or (b) poor forecasting models. After studying hundreds of budget to actual cost variations over decades, Brent Flyvbjerg (2008) argues that this cannot be the reason. If it were then, given all the effort that has been put into improving data and forecasting models over the last 30 years, then we should be seeing an improvement in accuracy over this period - and we aren't! He also argues that if it were just a matter of data or modelling inaccuracies then the mean of the variations should be zero, in other words we should be seeing just as many cost projections that are too high, as those that are too low - and, again, we don't.

INACCURACIES IN BOTH COSTS AND BENEFITS IS SIGNIFICANT

Consider the following two tables from Flyvbjerg (2008)

Table 1. Inaccuracy in cost forecasts for rail, bridges, tunnels, and roads, respectively (construction costs, constant prices). For all project types inaccuracy is different from zero with extremely high significance

Type of project	Average inaccuracy (%)	Standard deviation (SD)	Level of significance, *p*
Rail	44.7	38.4	<0.001
Bridges and tunnels	33.8	62.4	0.004
Road	20.4	29.9	<0.001

Source: Flyvbjerg database on large-scale infrastructure projects.

Table 2. Inaccuracy in forecasts of rail passenger and road vehicle traffic

	Rail	Road
Average inaccuracy (%)	−51.4 (SD = 28.1)	9.5 (SD = 44.3)
Percentage of projects with inaccuracies larger than ±20%	84	50
Percentage of projects with inaccuracies larger than ±40%	72	25
Percentage of projects with inaccuracies larger than ±60%	40	13

Source: Flyvbjerg database on large-scale infrastructure projects.

WHY SUCH INACCURACY?

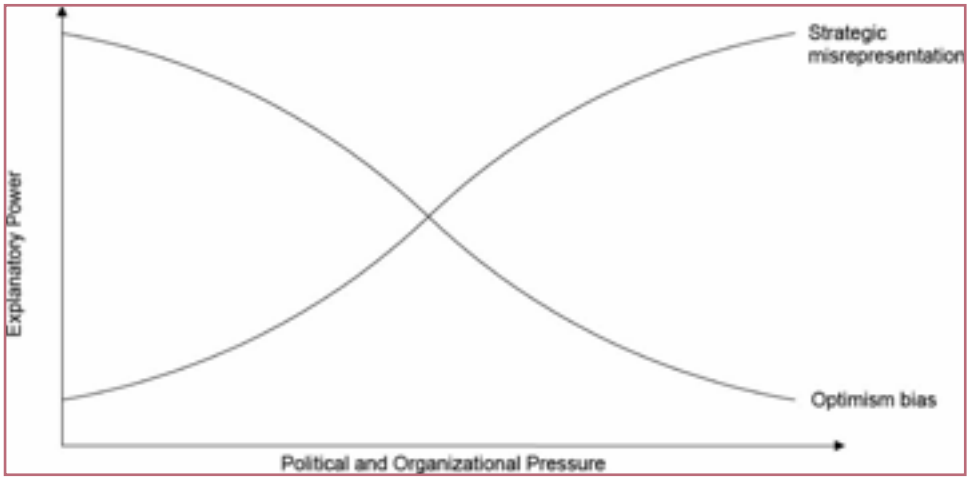
There are two main causes of inaccuracies:

(1) Optimism Bias
(2) Strategic Misrepresentation

OPTIMISM BIAS AND STRATEGIC MISREPRESENTATION *HAVE DIFFERENT CAUSES*

Optimism bias is *involuntary,* affected by psychological factors. Political and economic factors, however, best explain strategic misrepresentation. This occurs when planners or project proposers *deliberately and strategically* underestimate costs and completion times and overestimate benefits to increase the likelihood of their project being accepted above those of their competitors (which may be other departments within an organisation, or by other organisations seeking funds from Treasury.)

The greater the political and organisational pressure, the greater the explanatory power of strategic misrepresentation whereas strategic misrepresentation is less important where such pressure does not exist. This is illustrated in the following diagram from Flyvbjerg (2008)



BUT THE SAME SOLUTION!

Whilst optimism bias and strategic misrepresentation are different (and have different cures), the way to avoid both of them is the same. It is to adjust the final business case cost and benefit calculation by a percentage determined by looking at the experience of many other similar projects - similar in the sense of construction and regulation requirements and similar in their statistical distribution, called a **'reference class'**. In other words, instead of relying only on planners' budget estimates (what Flyvbjerg and Kahneman refer to as *'the inside view*', they should incorporate knowledge from historical outcomes: *'the outside view'.*

(This is what the London Olympics did - much to the dismay of the BBC's Friday Night Comedy Show which bemoaned the fact that coming in on time and budget gave them no scope for merriment at all!)

REFERENCE CLASS FORECASTING

What is a 'reference class'?

It might seem that each project is 'unique' and so a reference project is an impossibility. This is not so. "In fact, ventures are typically more similar than actors assume, even ventures that on the surface of things may appear entirely different. For instance, planners may consider building a subway and building an opera house to be completely different undertakings with little to gain from each other. In fact the two may be—and often are—quite similar in statistical terms, for example as regards the size of cost overruns. And the lessons from one can be pooled with other similar projects and used as distributional information to statistically predict the outcome of the other." (Flyberg (2008), p.8)

Analysis of the statistical properties of project variation distributions showed that, for example, motorways, trunk roads, local roads, bicycle facilities, pedestrian facilities, park and ride and bus lane schemes could all be considered together because their properties were much the same. Moreover, the same holds true for developed countries generally, where construction and regulation are similar. Developing countries and Japan (for reasons I don't understand) are considered to be strategically different and are not included. However, by this means large databases covering many decades, many countries and many individual projects can be assembled as a 'reference class'.

Once the project reference class has been determined it may be analysed to determine the appropriate 'uplift' (i.e. percentage cost increase) to apply, depending on the level of risk that the organisation is prepared to accept. (See "How much risk are you willing to accept?" on page 6 of this issue)

Using Reference Group Forecasts to improve Forecasting Accuracy

In the British Department for Transport Study "Procedures for dealing with optimism bias n transport planning" prepared by Brent Flyvbjerg, the department considers the following actions could be taken to embed the benefits of reference group forecasting into forecasting processes:

- "Emphasis on establishing realistic budgeting as an ideal and de-legitimise over-optimistic budgeting as a routine
- Introduction of fiscal incentives against cost overruns e.g. through requiring local co-financing of project cost escalation where possible
- Formalised requirements for high quality cost and risk assessment at the business case stage
- Introduction of independent appraisal supported by necessary enforcement measures"

WHAT IF WE JUST MADE ESTIMATORS AWARE OF OPTIMISM BIAS?

Study after study (Kahneman, Flyvbjerg, Talot) have shown that even when presented with the facts, optimism bias is resistant to change. Flyvbjerg cites the following story, told by Kahneman, about curriculum planning to illustrate why reference class forecasting is needed - and simply making planners aware of their optimism bias won't cure it.

Some years ago, Kahneman was involved in a project to develop a curriculum for a new subject area for high schools in Israel. The project was carried out by a team of academics and teachers. In time, the team began to discuss how long the project would take to complete. Everyone on the team was asked to write on a slip of paper the number of months needed to finish and report the project. The estimates ranged from 18 to 30 months. One of the team members—a distinguished expert in curriculum development—was then posed a challenge by another team member to recall as many projects similar to theirs as possible and to think of these projects as they were in a stage comparable to their project. "How long did it take them at that point to reach completion?", the expert was asked.

After a while he answered, with some discomfort, that not all the comparable teams he could think of ever did complete their task. About 40% of them eventually gave up. Of those remaining, the expert could not think of any that completed their task in less than 7 years, nor of any that took more than 10. The expert was then asked if he had reason to believe that the present team was more skilled in curriculum development than the earlier ones had been. The expert said no, he did not see any relevant factor that distinguished this team favourably from the teams he had been thinking about. His impression was that the present team was slightly below average in terms of resources and potential.

The wise decision at this point would probably have been for the team to break up, according to Kahneman. Instead, the members ignored the pessimistic information and proceeded with the project. They finally completed the project 8 years later, and their efforts went largely wasted—the resulting curriculum was rarely used.

In this example, the curriculum expert made two forecasts for the same problem and arrived at very different answers. The first forecast was the inside view; the second was the outside view, or the reference class forecast. The inside view is the one that the expert and the other team members adopted. They made forecasts by focusing tightly on the project at hand, considering its objective, the resources they brought to it, and the obstacles to its completion. They constructed in their minds scenarios of their coming progress and extrapolated current trends into the future. The resulting forecasts, even the most conservative ones, were overly optimistic. The outside view is the one provoked by the question to the curriculum expert. It completely ignored the details of the project at hand, and it involved no attempt at forecasting the events that would influence the project's future course. Instead, it examined the experiences of a class of similar projects, laid out a rough distribution of outcomes for this reference class, and then positioned the current project in that distribution. The resulting forecast, as it turned out, was much more accurate.

HOW MUCH RISK ARE YOU WILLING TO ACCEPT?

Not only does the use of 'reference class forecasting' overcome both optimism bias and strategic misrepresentation in budget estimates, it enables the organisation to decide how much risk of overrun it is prepared to take - and thus the amount by which it needs to adjust its budget estimates.

"For roads, for example, a class of 172 completed and comparable projects was used to establish the probability distribution of cost overruns shown in figure 2. The share of projects with a given maximum cost overrun is also shown in figure 2. For instance, 40% of projects have a maximum cost overrun of 10%; 80% of projects have a maximum cost overrun of 32%, etc." (p.13) The cost overrun pattern is higher for bridges and tunnels, and higher again for rail. (see Flyvbjerg (2008) for details)

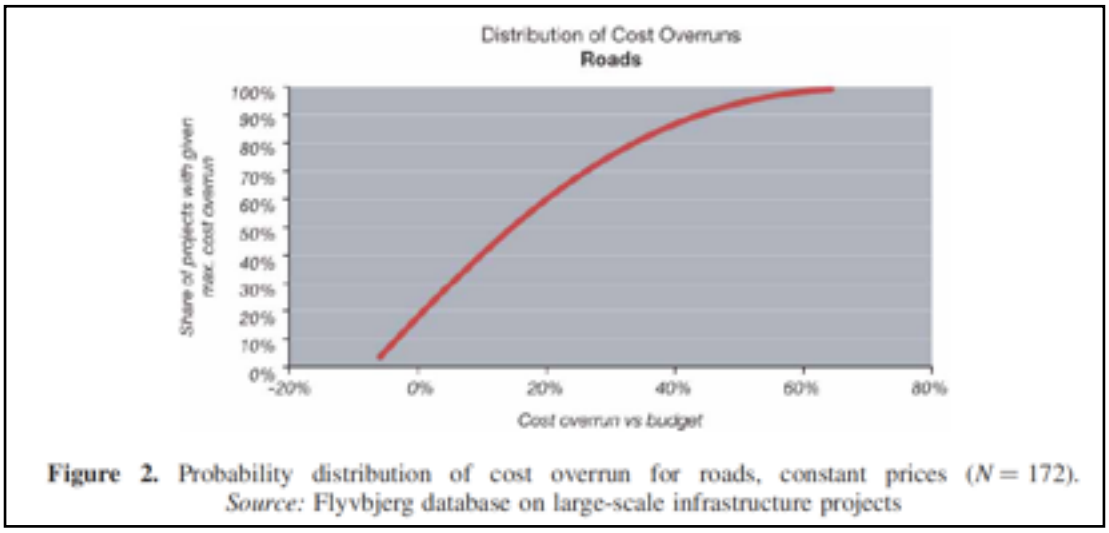
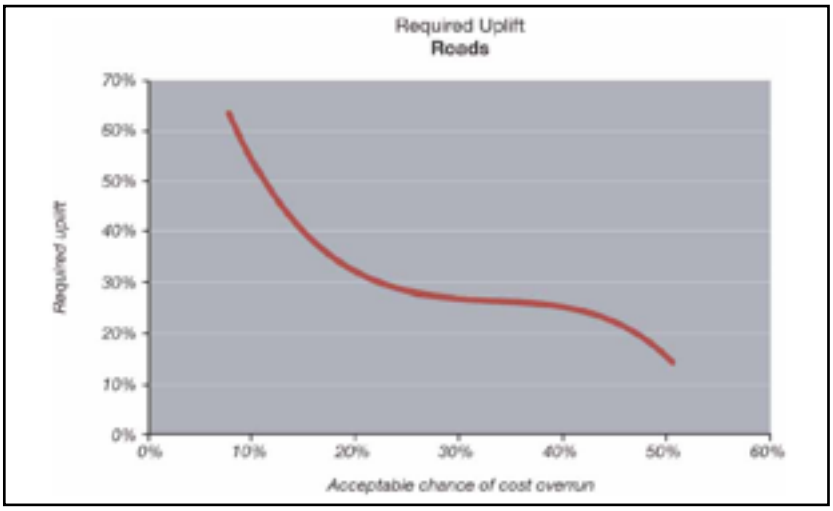


Figure 2. Probability distribution of cost overrun for roads, constant prices ($N = 172$). *Source:* Flyvbjerg database on large-scale infrastructure projects



From these distributions can be calculated the required uplift to reduce the risk of cost overruns.

"For instance, with a willingness to accept a 50% for a cost overrun in a road project, the required uplift for this project would be 15%. If the investor were willing to accept only a 10% risk for cost overrun, then the required uplift would be 45%. " (Flyvbjerg (2008) p.12) (The percentages are higher for the riskier bridges and tunnels and rail.)

The UK Dept of Transport is prepared to accept a 20% chance of overrun.

WHAT CAN GO WRONG?

Reference Class Forecasting can overcome any type of human bias - optimism bias and strategic misrepresentation, but the willingness of planners and estimators to adopt it will depend on what type of bias is most prevalent. Those honestly wanting to get a more accurate estimate are more likely to incorporate the 'outside view' than those who are using strategic misrepresentation. The latter, indeed, are likely to actively oppose it.

> "Biased forecasts serve strategic purposes that dominate the commitment to accuracy and truth. Consider, for example, planners with responsibility for estimating costs and benefits of urban rail projects. Here, the assumption of innocence regarding outcomes typically cannot be upheld. Cities compete fiercely for approval and for scarce national funds for such projects, and pressures are strong to present projects as favourably as possible, that is, with low costs and high benefits, in order to beat the competition. There is no incentive for the individual city to debias its forecasts, but quite the opposite. Unless all other cities also debias, the individual city would lose out in the competition for funds. Planners are on record confirming that this is a common situation" (Flyvbjerg (2008) p.19)

> "In order to lower barriers, and thus create room for reference class forecasting, incentives must be aligned to reward accurate forecasts and punish inaccurate ones. A simple measure would be for national government to cap grants for local projects at the estimated cost at the time of decision to build (the final business case) and pass the full risk of cost overrun and benefit shortfall to local taxpayers. An even better measure may be block grants to local authorities, which would ensure that one dollar spent on one type of local infrastructure would not be available for other types. Governments and banks, furthermore, may have to make reference class forecasting mandatory and make funding contingent on the application of this particular method, as was done in the UK. Finally, promoters' forecasts should be made subject to due diligence by other parties, including banks and independent bodies such as national auditors or independent analysts. Such bodies would need reference class forecasting or similar methodology to do their work. Projects that were shown to have inflated benefit-cost ratios should be stopped or placed on hold. The higher the stakes, and the higher the level of political and organizational pressures, the more pronounced will be the need for such measures. (Flyvbjerg (2008) p.19)

Optimism bias and strategic misrepresentation can occur together. So both need to be addressed.

It could be argued that setting larger reserves aside for a project as a result of risk 'uplifts' could itself lead to risks of inefficiency and overspending, with the money being spent simply because it is there. The use of reference class forecasting and risk uplifts must therefore be combined with tight contracts, incentives for good risk assessment and prudent procurement and project implementation controls - but shouldn't we be aiming for these in any case? (How this may be done, incidentally, is described in Flyvbjerg and Cowi (2004).

A SHORT - BUT INTERESTING - READING LIST
(those asterisked can be found on the internet)

*** Flyvbjerg, Brent, (2008)** 'Curbing optimism bias and strategic misrepresentation in planning: reference class forecasting in practice' European Planning Studies, vol 16, no 1, January

*** Flyvbjerg, B. & Cowi, (2004)** Procedures for Dealing with Optimism Bias in Transport Planning: Guidance Document (London: UK Department for Transport).

*** HM Treasury. (2003?) Supplementary Green Book Guidance - Optimism Bias**

This provides a step by step approach to the use of reference class data. The basic approach is to start with the upper bound (the average percentage cost overrun) and reduce it according to documented and verified mitigation processes. The guidance figures in the Green book were prepared from advice provided by Mott MacDonald (2002) Review of Large Public Procurement in the UK, available at www.hm-treasury.gov.uk/greenbook.

Kahneman, Daniel (2011) Thinking fast and slow

Kahneman won his Nobel Prize in Economics for earlier work in this area, called 'Prospect Theory'. You can read the original Kahneman and Tversky (1979) article in Econometrica, Vol. 47, No. 2. (Mar), pp. 263-292. but Kahneman's 2011 book is much more accessible - and more entertaining.

*** Sharot Tali (2012) The Optimism Bias - TED Talk**

This is a more general look at optimism bias, especially as it applies to marketing. There is an excellent short TED talk by Tali Sharot which is worth watching. She refers to the underestimation of costs in social and public infrastructure projects and to the use of the reference group forecasting work by the London Olympics.

THE FUTURE OF ASSET MANAGEMENT - PART TWO

In the last issue we looked at two scenarios, or possible futures, for Asset Management, developing the theme of a world where regulation dominates asset management develops as a set of regulated procedures and regulation.

Here we consider two more options around the possibility that AM develops as a technology, a collection of tools that collectively 'define' asset management, and asset managers are those that master these tools.

SCENARIO 3.

A WORLD WHERE ASSET MANAGEMENT DEVELOPS AS A TECHNOLOGY, A TOOL BOX - THE POSITIVE STORY

Major characteristics: A focus on tools and technical processes; innovation in technology;

1.SENIOR MANAGEMENT VIEW, SERVICE LEVELS, INNOVATION

Senior management view asset management as essential for both management of existing assets and for decisions on portfolio change. The Board is knowledgeable and receive regular updates on asset management issues. Life cycle costing is used in future asset acquisition decisions. Innovation in engineering tools and technologies is strong and highly regarded but there is little advance in non-engineering areas such as developing customer related service levels, which require non-engineering inputs.

2. ASSET MANAGEMENT PLANS, LEAD DISCIPLINES

Asset Management Plans are seen as an operational tool. The lead discipline is engineering / technical. In terms of organisational structure, asset management is seen as important, but it reports to Engineering rather than to Top Management.

3. AUTOMATION, IT AND RISK/UNCERTAINTY

In this scenario the role of IT and automation is extremely strong. IT is seen as integral to asset management, in the provision and analysis of major data bases. Full automation is seen as the holy grail. The goal is always to be pro-active, never reactive. Risk Management is the main objective. What is uncertain is often treated as if it were a risk on which numbers can be put. Other uncertainties are often ignored because they are difficult to manage.

4. TEACHING, RESEARCH AND PUBLICATION

Asset management courses flourish in engineering faculties and centres of excellence are established focused on the development of asset management tools and models. Engineering journals produce scholarly articles on issues related to operations and maintenance.

SCENARIO 4.

A WORLD WHERE ASSET MANAGEMENT DEVELOPS AS A TECHNOLOGY, A TOOL BOX - THE NOT-SO-POSITIVE STORY

Major characteristics: lack of understanding, failure to communicate, asset management becomes mechanical

1. SENIOR MANAGEMENT VIEW, SERVICE LEVELS, INNOVATION

Senior decision makers do not understand asset management. The asset management tools and technologies that the staff are so interested in are regarded as 'toys for the boys' and expensive. Staff have to fight to get funding, they feel neglected and frustrated. Through necessity, cost saving innovations are made, but are not disseminated. Service is defined in technical terms.

2. ASSET MANAGEMENT PLANS, LEAD DISCIPLINES

Asset management plans are a combination of operational tool and funding proposals - and sometimes tend towards a 'wish list' of desirable projects. Management fails to clearly communicate organisational goals and staff are left, by default, to invent their own goals, few of which are documented. Asset management is seen as a subset of engineering and there is little or no multi-disciplinary involvement and very little communication between asset management and other areas of the organisation.

3. AUTOMATION, IT AND RISK/UNCERTAINTY

New models and approaches are eagerly seized on, and just as rapidly discarded in favour of newer models. Risk Management is highly regarded by staff, but uncertainty is either treated as if a risk, or not treated at all.

4. TEACHING, RESEARCH AND PUBLICATION

More emphasis is placed on teaching than research. There is little publication in the academic journals and such publication as there is tends to be in association and trade journals and often focussing on only one group of assets rather than assets in general, and to be more operational in nature.