Transportation Solutions Defense and Education Fund

P.O. Box 151439 San Rafael, CA 94915 415-331-1982

August 13, 2015
By E-Mail

Mary Nichols, Chair
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Re: Funding Guidelines for Agencies that Administer California Climate Investments

Dear Ms. Nichols:

The Transportation Solutions Defense and Education Fund, TRANSDEF, is an environmental non-profit advocating for the regional planning of transportation, land use and air quality, with a focus on climate change. As transit advocates, we have a very different perspective than the agencies lining up to receive Cap and Trade funding from the Greenhouse Gas Reduction Fund ("GGRF"). While we are pleased with the draft Funding Guidelines for Agencies that Administer California Climate Investments ("Funding Guidelines"), we believe that they do not address problems that are endemic in American infrastructure projects. **The draft Funding Guidelines and associated Quantification Methodologies are an open invitation to widespread application fraud.** If they are finalized in their current consequence-free form, we expect the on-the-ground outcomes in terms of mode shift, transit ridership increases and GHG emissions reductions to be dismal.

Cost Explosion

There are two related-but-independent problems here: First, it costs far more to build and operate transit in the US than it does in Europe--or than is reasonable. ARB would do well to conduct its own investigation of the factors that lead to higher costs. The attached articles (with key statements highlighted) would be a good place to start. Our state needs to receive maximum value for these precious cap and trade funds.

Project Selection

The other problem is project selection--the worst projects are selected for funding. This too has two elements. The first element is the conversion of the selection of infrastructure projects into a tool for the self-promotion of political leaders, along with associated log-rolling and political horse-trading. (See attached "Case Study: Politics Trumps Outcomes at MTC.") ARB will need to build a strong sense of mission, along with requisite policies and procedures, into the Funding Guidelines, to enable granting agencies to resist inevitable political pressures to fund projects with inferior outcomes.

The other element is the exaggeration of project benefits and the underestimation of costs by consultants. Professor Bent Flyvbjerg discussed the mechanisms of optimism bias and strategic misrepresentation (i.e., outright lying) in detail in his classic work *Megaprojects and Risk*. An article title of his says it best: "Survival of the Unfittest: Why the worst infrastructure gets built." (See attached abstract.) In short, the projects that get funded are the ones that lowball their costs and over-promise benefits. These two elements are frequently combined, where consultants massage politically driven projects to make them appear deserving of public funds. This harms the public, because more cost-effective (i.e., net beneficial) projects are pushed aside and left unfunded.

> ... for rail projects, an average cost overrun of 44.7% combines with an average demand shortfall of 51.4%...
>
> ... The problem is not that projects worth undertaking do not exist or cannot be built on time and on budget. The problem is that the dubious and widespread practices of underesti-mating costs and overestimating benefits used by many megaproject promoters, planners, and managers to promote their pet project create a distorted hall-of-mirrors in which it is extremely difficult to decide which projects deserve undertaking and which do not.
>
> ... It is not the best projects that get implemented in this manner, but the projects that look best on paper, and the projects that look best on paper are the projects with the largest cost underestimates and benefit overestimates, other things being equal. (Flyvbjerg, "What You Should Know About Megaprojects and Why," attached.)

The draft Funding Guidelines and associated Quantification Methodologies open the door to consequence-free widespread application fraud. To be able to generate maximum GGRF outcomes, TRANSDEF thinks ARB needs to undertake a determined program to change the culture of consulting. Congress provides a useful model: It responded to an epidemic of accounting fraud by adopting the certification requirements of Sarbanes-Oxley. ARB could do something similar.

Like accounting fraud, transportation consultant misrepresentation creates real-world harms. Relying on inflated project evaluations leads to a less-than-optimal capital allocation, thereby achieving fewer benefits for the climate. While we see parallels to prosecutable accounting fraud in transportation, TRANSDEF recognizes that current attitudes do not support the criminal prosecution of transportation professionals.

Deterring the temptation to game the Funding Guidelines is relatively simple: Consultants need to be more afraid of ARB than they are of their clients. The incentives need to support honest work and discourage cheating, so that the public gets the emissions reductions and congestion relief it pays for.

We urge ARB to require all consultant work to be signed off by the firm's CEO, with the ARB-equivalent of a Sarbanes-Oxley statement. The CEO should declare under penalty of perjury that the firm has not knowingly altered, destroyed, mutilated, concealed, covered up, falsified, or made a false entry in any record, document, or tangible object with the intent to impede, obstruct, or influence the project selection process.

Firms need to know that if they are found to have artificially enhanced the merits of a project, they face debarment from submitting work to any GGRF program for a period of years. (For example, see Gov. Code Section 14105(g).) It will take that level of threat to enable consultants to stand up to client pressure to pump up the transit ridership, or otherwise make a project more attractive. ARB needs to take explicit steps to counteract the pattern of known industry falsification and "everyone's doing it" excuses.

Due to the complexity of starting a new program like this, including the possible need for debarment legislation, it may not be possible to include a detailed description in the Final Funding Guidelines. However, announcing the development of debarment and certification processes will send a needed strong message to the consulting community.

Reference Class Forecasting

Reference class forecasting is an innovation that directly tackles the dual challenges of optimism bias and strategic misrepresentation. Even though every project tends to consider itself unique and without peers, there are commonalities between megaprojects. Useful comparisons become possible when a project is placed in a class of peers. This process is now a requirement for all British government projects. ARB should acquire the ability to perform this analysis on all projects submitted.

Maintenance of Effort

The Funding Guidelines need to set a bright line test to differentiate between the support of existing expansion programs and additional cap and trade capital investments that will increase ridership and decrease GHG emissions. Agencies will be tempted to shift their capital funds to system maintenance as cap and trade funds pick up the load. While system maintenance tends to get shortchanged, and needs a comprehensive funding strategy, GGRF should not backfill past deferred maintenance.

Embedded Energy

GHG analysis should use a life-cycle approach, so that all emissions are captured. Otherwise it is easy to miss inputs like cement, which may generate very large emissions, thus negating project benefits.

Scope Changes

A very serious problem arises when project scopes are changed but project selection is not revisited. A cautionary tale: The BART Oakland Airport Connector final cost was roughly 5 times its estimate. The project was downscoped prior to the start of construction, removing all the benefits to the local community. The net benefits of the finished project are a tiny fraction of what was initially promised. The funding agency refused to reevaluate the project, despite a large outpouring of public criticism about the "bait and switch." ARB must put muscular procedures in place to prevent such outcomes.

In discussing the issue of cost overruns with construction industry professionals, the issue of scope changes and design changes kept coming up. The advice we received and pass on to ARB is:

- The best way to minimize costs is for grantees to enter into Design-Build contracts and At-Risk contracts at the 30% design stage.
- Strong disincentives are needed to discourage changes after that point.

Track the GGRF Outcomes

While agencies like MTC make a point of not looking back to evaluate outcomes, ARB must be accountable for the use of cap and trade funds. It should compile reports that track actual project outcomes, juxtaposed with the estimates that were submitted in the respective applications.

Conclusion

TRANSDEF recognizes that investing the GGRF to achieve optimal outcomes is difficult, as it requires resisting pressure from powerful political and economic forces. ARB's science-based culture offers the best possible foundation for that daunting task. The rest of the world is watching what you do. As Flyvbjerg wrote, "Never has it been more important to choose the most fitting projects and get their economic, social, and environmental impacts right." (*Id.*)

We appreciate this opportunity to comment on the draft Funding Guidelines. We would be pleased to assist in the implementation of these ideas.

Sincerely,

/s/ DAVID SCHONBRUNN

David Schonbrunn,
President
David@Schonbrunn.org

Attachments

Reforms Key to Controlling Costs on Public Works Megaprojects, Say Experts
Why is it so expensive to build a bridge in America?
American transit activists need to speak up about exorbitant construction costs
Survival of the unfittest: why the worst infrastructure gets built
—and what we can do about it (abstract)
What You Should Know About Megaprojects and Why: An Overview
Case Study (for the State Transportation Agency): Politics Trumps Outcomes at MTC

CA: Reforms Key to Controlling Costs on Public Works Megaprojects, Say Experts

LISA VORDERBRUEGGEN
SOURCE: CONTRA COSTA TIMES
CREATED: NOVEMBER 14, 2013

Forget the $1 billion megaproject. It's all about the $10-billion-and-counting gigaproject now.

Forget the $1 billion megaproject. It's all about the $10-billion-and-counting gigaproject now.

Experts coined the expanded term to keep pace with the vastly more expensive bridges and other huge infrastructure projects on the drawing boards around the world, such as California's $68 billion high-speed rail plan.

But as megaprojects of yesterday proved, controlling costs and keeping schedules on track will remain unattainable without reforms in how agencies manage increasingly complex and expensive public works projects, experts from England to Berkeley testified Wednesday at a state Senate Transportation Committee hearing.

"Good luck," U.C. Berkeley civil and environmental engineering professor William Ibbs offered wryly at the close of the nearly 2 1/2 hour session in Sacramento.

Ibbs was one of four experts committee Chairman Mark DeSaulnier, D-Concord, invited to testify at the first of three hearings on why the new $6.4 billion Bay Bridge was a decade late and cost nearly five times more than engineers estimated.

The state senator said he will use the information next year to help craft legislation aimed at averting a costly repeat of the Bay Bridge, the most expensive public works project in the state's history.

"The Bay Bridge is a beautiful and spectacular bridge, fitting in its setting, but I do wonder if it was worth the cost and the delays," said DeSaulnier in his opening comments. "Now, we have high-speed rail in California and if you believe ... in the research around what happens with rail projects, Californians might be paying $300 billion or $350 billion instead of $68 billion."

Whether it is high-speed rail or California's proposed $22 billion water diversion tunnels through the Delta, overruns and delays are more likely than not, Oxford University megaprojects researcher Alexander Budzier told the senator.

In an Oxford study of 157 bridges and tunnel projects built in 1919-2001, costs rose on average 34 percent and estimates were low in nine out of 10 cases. High-speed rail and dams fared worse, he said.

Researchers blamed the phenomenon on project bias, described as excessive optimism and "strategic misrepresentation or, put simply, lying," Budzier said.

"People think they can do a project faster and so the cost estimates are that much less," Budzier said. " ... And project proponents are the most likely to intentionally misrepresent the risks just to get a project going because once it gets started, it is almost always finished no matter how big the overruns."

One of the keys to reversing this trend is sharing the risks — extra costs, delays and blame — more equitably between the public agencies, designers and contractors, said former Boston "Big Dig" manager Virginia Greiman, currently a professor of law at Kennedy School of Government and Law School at Harvard.

The "Big Dig," a series of tunnels beneath Boston that replaced a deteriorating elevated freeway system, started at $2.5 billion and ultimately cost $15 billion.

"Many states require balanced budgets but we never seem to require projects to do the same," Greiman said. And when those massive projects are completed, the state should follow France's example and mandate publications of an easy-to-understand report on how the endeavor scored on cost, schedule and other factors, suggested Louis Thompson, chairman of the California High Speed Rail peer review group.

"There is no way to get rid of (cost and timeline bias) unless the people making the estimates have something at stake," Thompson said. "Unless they know that at the end, 'Here is where you failed and here are the consequences,' nothing will change."

Among the experts' other recommendations:

- Commission outside people with no financial stake in the project to conduct mandatory cost-benefit analyses on every big project.
- Hire top-notch project managers with the skills to bring together the public agency, designers and contractors.
- "Mega-communicate" with the public and media.
- Use specialized computer systems that scour designs and project plans for conflicts or errors that could cost time and money.
- Convene citizen and technical oversight committees.

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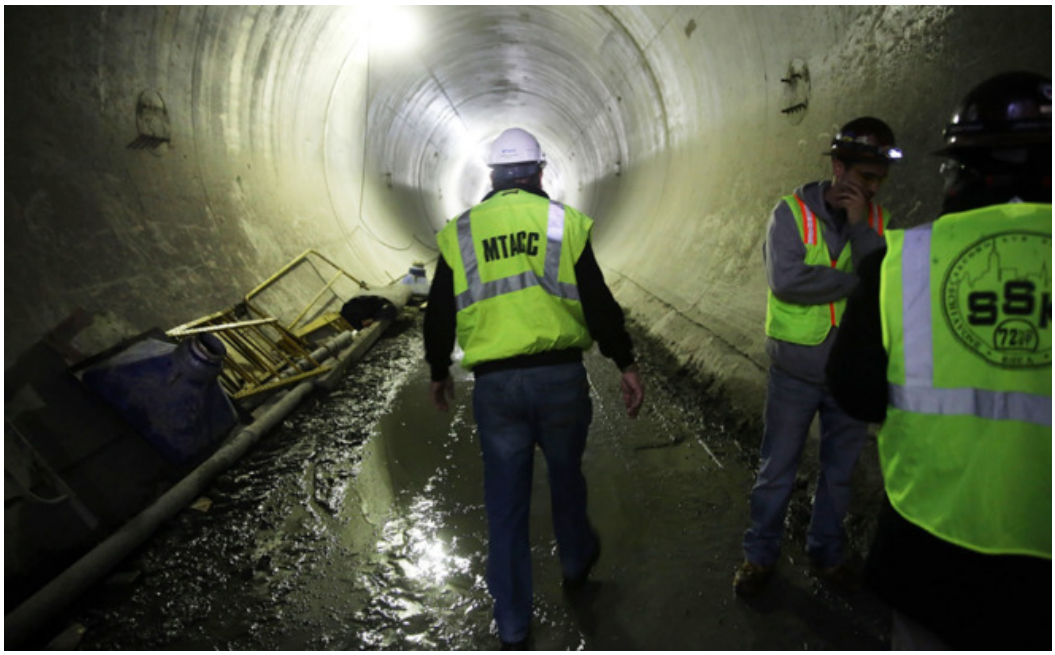
Why is it so expensive to build a bridge in America?

The answer: Our greedy and undemocratic political culture

By Ryan Cooper | March 10, 2014



Good luck keeping costs down. (Spencer Platt/Getty Images)

It's become commonplace to note that U.S. infrastructure costs are very high. What is less appreciated is the staggering *scale* of the difference between American infrastructure costs and those of other nations. Like our health care, U.S. infrastructure isn't just a tad higher than the next most expensive country — we pay something like twice as much as our closest peer (usually the U.K., which is itself a very expensive place). And when you compare America to, say, Spain, we're talking order-of-magnitude differences.

In other words, Spain, a developed market democracy, gets *10 to 20 times* as much infrastructure for its money as America does, and it is of much higher quality to boot. Why is this?

People who have looked into the question have collected a range of fairly convincing explanations — though they come up short in a fundamental way. Let's quickly go through the major factors researchers have identified, in no particular order:

1. Expensive labor. From the top brass at New York's Metropolitan Transportation Authority: "The MTA is required to overstaff projects so that the same [tunnel boring machine] work, for instance, that can be done in Spain with nine workers must be done in [New York City] with 25 workers."

2. Out-of-control private contractors. From Stephen Smith at *Bloomberg*: "Agencies can't keep their private contractors in check. Starved of funds and expertise for in-house planning, officials contract out the

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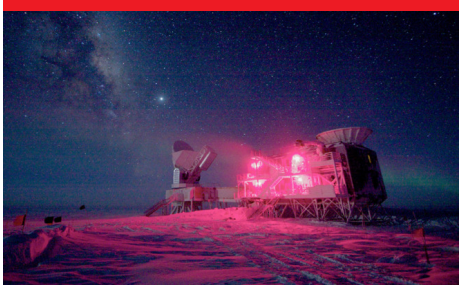


CARTOONS

project management and early design concepts to private companies that have little incentive to keep costs down and quality up."

3. A crap procurement process. The classic American way to pay for a big project is to round up about half of the funding (or even less), start construction, and then use a sunk-cost-fallacy to get the rest. This, obviously, is not conducive to efficient or speedy projects. (Looking at you, California high-speed rail.)

There are probably a lot more, but as Alon Levy points out, it would be a mistake to focus too much on particular techniques or failures. The reality is that when it comes to cost and quality, America is doing basically everything wrong. Again, we're not just a bit behind the curve — we're ridiculously, embarrassingly behind the curve.

The fact that both left- and right-aligned institutions (public employee unions and private contractors, respectively) are implicated here is evidence that this isn't a typical left-right situation. And if we look internationally, both Singapore (very free-markety) and Sweden (unembarrassedly socialist) manage *much* cheaper building costs than America.

This is basically about our greedy and opaque political culture.

Every American infrastructure project features a scramble on the part of all parties to skim as much for themselves as possible. This leads to a self-defeating cycle in which voters are reluctant to pay for new stuff, so elites try to fund new projects in a duplicitous way, which only leads to more cost overruns.

The U.S. is a low-trust society, by developed-world standards, and our infrastructure institutions are usually a complex, stunningly corrupt hodgepodge. It's nearly impossible to get transparently funded projects through our janky political institutions, so instead of doing the slow and patient work of building democratic support for a new project and explicitly voting for the needed spending, which can then be completed without fear of backlash, we try to hide it through "independent" authorities, or the tax code, or duplicitous ballot initiatives.

The classic example of the American style of infrastructure is Robert Moses' New York empire. Never elected to any office, he used political maneuvering and legal chicanery to install himself as the de facto emperor of New York City. He was by far the most important power broker in the city for 44 years, and controlled all infrastructure spending during that time. (Naturally, he nearly wrecked the place with highways.)

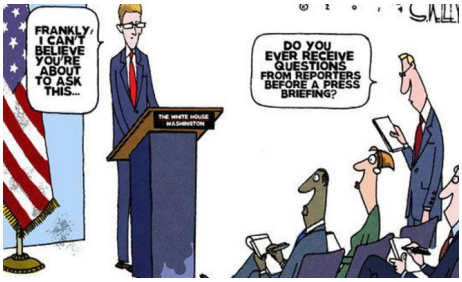
For a more recent example, look at the Port Authority, the supposedly independent transit agency that, as the Bridgegate scandal has revealed, is in fact a mess of patronage and corruption and always has been.

So when there's a new pot of money available for some infrastructure spending, nobody much considers value for the taxpayer or trying to do a good job for its own sake. They just try to grab what they can, because they can't trust anyone else not to do the same. Why should transit unions, for example, worry about economizing on labor when any worker givebacks would probably be devoured by agency executives or private contractors? And because these things are typically carried out through bizarre and complex legal machinery, the public can't figure out whom to hold responsible. Hence, they figure that infrastructure spending is just a bad deal.

The toxic nature of the process deep-sixes obvious win-win bargains, like cutting back on overstaffing to win more projects.

One might look at all this and despair, concluding that America is fundamentally incompetent and will never have nice things. But there are some reasons for optimism — and they start with getting our politics sorted out. An emergency, for example, can magically snap layers of corruption, and even lumbering monstrosities like the MTA are capable of awesome feats of efficiency. Just look at what happened after Hurricane Sandy:

> It has been less than two weeks since the most devastating storm in the New



York City subway system's 108-year history. Seven tunnels beneath the East River flooded. Entire platforms were submerged. Underground equipment, some of it decades old, was destroyed....

Less than three days after the storm hit, partial subway service was restored. Most major lines were back within a week. Repairs came so quickly in some cases that the authority was ready before Consolidated Edison had restored power.

"Some of what they're doing borders on the edge of magic," said Gene Russianoff, the staff lawyer for the Straphangers Campaign, a rider advocacy group that is frequently critical of the authority. [*New York Times*]

Public agencies managed even more stupendous feats back in World War II.

Now, it's a tall and rather vague order to demand that all political institutions be fixed. But when we have the option, we ought to think about abandoning the authority model and folding our infrastructure institutions into more democratically responsible structures. And we should definitely vote for political candidates who advocate such changes.

Ryan Cooper Follow @ryanlcooper

Ryan Cooper is a national correspondent at *TheWeek.com*. His work has appeared in the *Washington Monthly*, *The New Republic*, and the *Washington Post*.

EDITORS' PICKS

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American transit activists need to speak up about exorbitant construction costs

Updated by Matthew Yglesias on December 17, 2014, 3:04 p.m. ET

@mattyglesias *matt@vox.com*

The City of Alexandria in the Washington suburbs would like to build a new Metro station alongside existing Blue/Yellow Line tracks somewhere near the Potomac Yard (http://www.mypotomacyard.com/) development and between the

existing Reagan National Airport and Braddock Road Metro stations.

The Metro runs above ground in this area. Above-ground construction is cheaper than underground construction, and adding infill stations is cheaper than building whole new Metro lines. The project is already two years behind schedule, no definitive location has been selected, the costs at the four sites under consideration range from $209 million to $493 million, and "the project, after two decades of planning, is halfway through a required federal review." (http://m.washingtonpost.com/local/trafficandcommuting/alexandria-sights-a-2018-opening-of-metro-station-at-growing-potomac-yard/2014/05/24/c573c5dc-dba4-11e3-b745-87d39690c5c0_story.html)

About five years ago, Berlin built a new 1.8 kilometer underground Metro line (http://www.railwaygazette.com/news/single-view/view/berlin-u55-metro-line-opens.html) with three new stations for about $436 million in total — less than the high-cost estimate of a single station in Alexandria.

It's not just mass transit. Somehow Indiana and Kentucky are spending $2.6 billion to make a bridge wider (http://usa.streetsblog.org/2012/06/25/indianas-big-dig-raises-bar-on-absurdly-wasteful-highway-boondoggles/), there's a $1.7 billion highway interchange in Wisconsin (http://usa.streetsblog.org/2012/08/17/wisdot-faces-civil-rights-suit-over-1-7-billion-zoo-interchange/), and in New York the Tappan Zee Bridge upgrade project is getting so expensive that people worry the tolls needed to pay for it will deter drivers from actually using the bridge (http://www.nytimes.com/2014/03/26/nyregion/new-tappan-zee-bridge-rises-amid-unanswered-questions-over-funding.html).

But the problem hits transit the hardest because the basic fact of the matter is that political and economic elites don't rely on mass transit.

The clearest case is the growing popularity of mixed-traffic streetcar (http://www.vox.com/cards/us-streetcar-trend-public-transportation) projects. These are much cheaper than grade-separated light- or heavy-rail, but still far more expensive than a conventional bus without actually moving people any faster. In terms of offering a transportation service, spending money on a streetcar is much worse than spending the same amount of money on multiple new bus routes or upgrades to existing ones.

Soon this bus will have a streetcar in its way | Elvert Barnes/Flickr

Streetcars appeal, however, because those high costs create construction jobs and because the aura of classiness around them appeals to real estate developers (http://www.nytimes.com/2014/04/16/business/washington-retail-districts-future-rides-on-streetcars.html) and other would-be drivers of gentrification. So cities across America are opening stub streetcar lines rather than investing in improving the transit experience of bus riders.

Shanghai has opened six new Metro lines in the past five years (http://en.wikipedia.org/wiki/Shanghai_Metro#Lines). In 2004,

Shenzhen had no Metro system. Today (http://www.szmc.net/page/index.html) it has more stations and track than Washington's Metro or Boston's T. Of course DC is building the Silver Line, but Shenzhen has three new lines under construction.

The Second Avenue Subway in New York has been under construction since 2007 (http://en.wikipedia.org/wiki/Second_Avenue_Subway#Current_developn (or 1939 if you want to be ungenerous) and "Phase 1" — a two-mile tunnel — is still a year and a half from completion. It will cost $4.5 billion.

The Malmö City Tunnel (http://en.wikipedia.org/wiki/City_Tunnel_(Malm%C3%B6)) in Sweden — not exactly a land of weak unions or cheap labor — is 3.7 miles and cost about $1.4 billion.

Train station in Malmö, Sweden | News Oresund/Flickr

Because transportation networks are *networks*, each over-priced project we build is less valuable than it would be if we actually built more projects. Developing more cost-effective means of undertaking transit construction projects, would mean not just more infrastructure

but *more useful* infrastructure.

Identifying the causes of this cost crisis and feasible ways of addressing it ought to be a top priority for mass transit advocates. Yet the American Public Transit Association appears to have zero publicly available research (http://www.apta.com/resources/statistics/Pages/Surveys.aspx) on the matter — they prefer a posture of boosterism that emphasizes the benefits of transit spending and the case for doing more. The case for doing more is in fact strong. But it would be much stronger if the United States knew how to undertake cost-effective projects. In some transit circles it's considered bad manners or worse to talk about this. Or it's said to be a smear to focus on transit construction costs without talking about the fact that many US highway projects are also exorbitantly expensive.

But this is backwards. If you want the United States to move away from suburbanism and automobile dependency, then highway cost overruns aren't necessarily a huge problem. On the one hand, yes, it's a waste of money. On the other hand, were the money spent more efficiently we'd just have even more highways. If you care about transit, you ought to care about reducing project bloat in the transit space because more efficient transit spending would mean more and better transit projects. It's time to break the silence and start caring.

Oxford Review of Economic Policy
oxrep.oxfordjournals.org

Oxf Rev Econ Policy (2009) 25 (3): 344-367. doi: 10.1093/oxrep/grp024
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Survival of the unfittest: why the worst infrastructure gets built—and what we can do about it

Bent Flyvbjerg*
+ Author Affiliations

Abstract

The article first describes characteristics of major infrastructure projects. Second, it documents a much neglected topic in economics: that *ex ante* estimates of costs and benefits are often very different from actual *ex post* costs and benefits. For large infrastructure projects the consequences are cost overruns, benefit shortfalls, and the systematic underestimation of risks. Third, implications for cost–benefit analysis are described, including that such analysis is not to be trusted for major infrastructure projects. Fourth, the article uncovers the causes of this state of affairs in terms of perverse incentives that encourage promoters to underestimate costs and overestimate benefits in the business cases for their projects. But the projects that are made to look best on paper are the projects that amass the highest cost overruns and benefit shortfalls in reality. The article depicts this situation as 'survival of the unfittest'. Fifth, the article sets out to explain how the problem may be solved, with a view to arriving at more efficient and more democratic projects, and avoiding the scandals that often accompany major infrastructure investments. Finally, the article identifies current trends in major infrastructure development. It is argued that a rapid increase in stimulus spending, combined with more investments in emerging economies, combined with more spending on information technology is catapulting infrastructure investment from the frying pan into the fire.

Key words infrastructure • cost overruns • benefit shortfalls • cost–benefit analysis • optimism bias • agency issues • reference class forecasting

JEL codes H43 • H54 • R42

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Understanding and researching complexity with Qualitative Comparative Analysis: Evaluating transportation infrastructure projects

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The Trade-Offs of Transferring Demand Risk on Urban Transit Public-Private Partnerships
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» Abstract » Full Text (PDF)

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OXF REV ECON POLICY (2009) 25 (3): 307-326
» Abstract » Full Text (HTML) » Full Text (PDF)

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PAPERS

What You Should Know About Megaprojects and Why: An Overview

Bent Flyvbjerg, *Saïd Business School, Oxford University, Oxford, United Kingdom*

ABSTRACT

This paper takes stock of megaproject management, an emerging and hugely costly field of study, by first answering the question of how large megaprojects are by measuring them in the units of mega, giga, and tera, and concluding with how we are presently entering a new "tera era" of trillion-dollar projects. Second, total global megaproject spending is assessed, at US$6 to US$9 trillion annually, or 8% of the total global gross domestic product (GDP), which denotes the biggest investment boom in human history. Third, four "sublimes"—political, technological, economic, and aesthetic—are identified and used to explain the increased size and frequency of megaprojects. Fourth, the "iron law of megaprojects" is laid out and documented: Over budget, over time, over and over again. Moreover, the "break–fix model" of megaproject management is introduced as an explanation of the iron law. Fifth, Albert O. Hirschman's theory of the "Hiding Hand" is revisited and critiqued as unfounded and corrupting for megaproject thinking in both the academy and policy. Sixth, it is shown how megaprojects are systematically subject to "survival of the unfittest," which explains why the worst projects get built rather than the best. Finally, it is argued that the conventional way of managing megaprojects has reached a "tension point," in which tradition is being challenged and reform is emerging.

KEYWORDS: megaproject management; scale; four sublimes; iron law of megaprojects; break–fix model of megaprojects; Hirschman's Principle of the Hiding Hand; survival of the unfittest; tension points

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Mega, Giga, Tera: How Big Are Megaprojects?

Megaprojects are large-scale, complex ventures that typically cost US$1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people.[1] Hirschman (1995, vii, xi) calls such projects "privileged particles of the development process" and points out that often they are "trait making"; in other words, they are designed to ambitiously change the structure of society, as opposed to smaller and more conventional projects that are "trait taking," that is, they fit into pre-existing structures and do not attempt to modify these. Megaprojects, therefore, are not just magnified versions of smaller projects. Megaprojects are a completely different breed of project in terms of their level of aspiration, lead times, complexity, and stakeholder involvement. Consequently, they are also a very different type of project to manage. A colleague of mine likes to say that if managers of conventional projects need the equivalent of a driver's license to do what they do, then managers of megaprojects need the equivalent of a pilot's jumbo jet license.[2] And, just like you wouldn't want someone with just a driver's license to fly a jumbo jet, you wouldn't want conventional project managers to manage megaprojects.

Megaprojects are increasingly used as the preferred delivery model for goods and services across a range of businesses and sectors, including infrastructure, water and energy, information technology, industrial processing plants, mining, supply chains, enterprise systems, strategic corporate initiatives and change programs, mergers and acquisitions, government administrative systems, banking, defense, intelligence, air and space exploration, big science, urban regeneration, and major events. Examples of megaprojects are high-speed rail lines, airports, seaports, motorways, hospitals, national health or pension information and communication technology (ICT) systems, national broadband, the Olympics, large-scale signature architecture, dams, wind farms, offshore oil and gas extraction, aluminum smelters, the development of new aircraft, the largest container and cruise ships, high-energy particle accelerators, and the logistics systems used to run large supply chain–based companies like Amazon and Maersk. Below, we will see just how big megaprojects and the megaprojects business are. We will also try to understand what drives scale.

To illustrate just how big megaprojects are, consider one of the largest dollar figures in public economic debate in recent years—the size of the U.S. debt to China. This debt is approximately US$1 trillion and is considered so large it may destabilize the world economy if the debt is not managed prudently. With this supersize measuring rod, now consider the fact that the combined cost of just two of the world's largest megaprojects—the Joint Strike Fighter aircraft program and China's high-speed rail project—is more than one half of this figure, US$700 billion (Figure 1). The cost of a mere handful of the largest

[1] As a general rule of thumb, "megaprojects" are measured in billions of dollars, "major projects" in hundreds of millions, and "projects" in millions and tens of millions. Megaprojects are sometimes also called "major programs."

[2] The colleague is Dr. Patrick O'Connell, Practitioner Director of Major Programme Management at Oxford University's Saïd Business School.

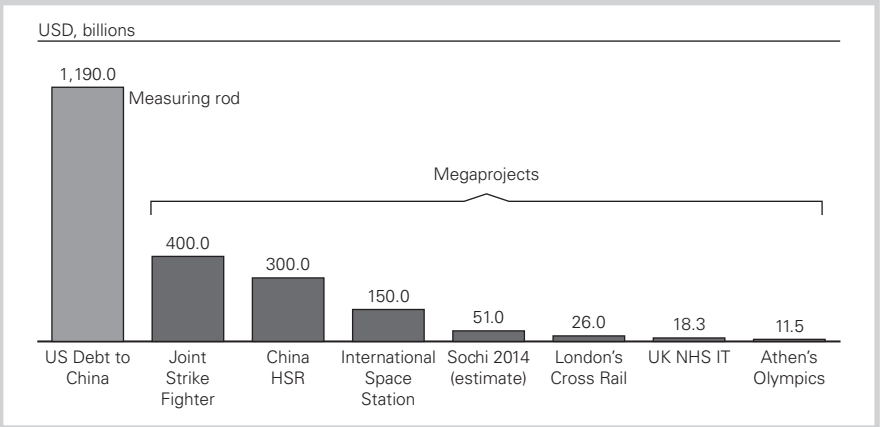

Figure 1: Size of selected megaprojects, measured against one of the largest dollar-figures in the world, the accumulated U.S. debt to China.

megaprojects in the world will dwarf almost any other economic figure and certainly any investment figure.

Not only are megaprojects large, however, they are constantly growing ever larger in a long historical trend with no end in sight. When New York's Chrysler Building opened in 1930 at 319 meters, it was the tallest building in the world. The record has since been surpassed seven times and from 1998, the world record for height has significantly been held by emerging economies, with Dubai's Burj Khalifa presently holding the record at 828 meters. This is a 160% increase in building height over 80 years. Similarly, the longest bridge span has grown even faster, by 260% over approximately the same period. Measured by value, the size of infrastructure projects has grown by 1.5% to 2.5% annually in real terms over the past century, which is equivalent to a doubling in project size two to three times per century (author's megaprojects database). The size of ICT projects, the new kid on the block, has grown much faster, as illustrated by a 16-fold increase between 1993 and 2009 in lines of code in Microsoft Windows, from 5 to 80 million lines. Other types of megaprojects, ranging from the Olympics to industrial projects, have seen similar developments. Coping with increased scale is therefore a constant and pressing issue in megaproject management.

"Mega" comes from the Greek word "megas" and means great, large, vast, big, high, tall, mighty, and important. As a scientific and technical unit of measurement, "mega" specifically means one million. If we were to use this unit of measurement in economic terms, then strictly speaking, megaprojects would be million-dollar (or euro, pound, etc.) projects; indeed, for more than one hundred years, the largest projects in the world were measured mostly in the millions. This changed with World War II, the Cold War, and the Space Race. Project costs had now escalated to the billions, led by the Manhattan Project (1939–1946), a research and development program that produced the first atomic bomb, and later the Apollo program (1961–1972), which landed the first humans on the moon (Morris, 1994; Flyvbjerg, 2014). According to *Merriam-Webster Dictionary*, the first known use of the term "megaproject" was in 1976; but before that, from 1968, "mega" was used in "megacity"; and later, from 1982, as a standalone adjective, indicating "very large."

Thus, the term "megaproject" caught on just as the largest projects were technically no longer megaprojects but, to be more accurate, were evolving into "gigaprojects"—"giga" being the unit of measurement meaning one billion. However, the term "gigaproject" never really caught on. A Google search reveals that the word "megaproject" is used 27 times more frequently on the Web than the term "gigaproject." For the largest of this type of project, a price tag of US$50 to US$100 billion is now common (e.g., the California and UK high-speed rail projects), and a price above US$100 billion is not uncommon (e.g., the International Space Station and the Joint Strike Fighter). If these were nations, projects of such size would rank among the world's top 100 countries measured by gross domestic product, larger than the economies of, for example, Kenya or Guatemala. When projects of such size go wrong, entire companies and national economies suffer.

"Tera" is the next unit up, and is the measurement for one trillion (one thousand billion). Recent developments in the sizes of the very largest projects and programs indicate we may presently be entering the "tera era" of large-scale project management. If we consider as projects the stimulus packages launched by the United States, Europe, and China to mitigate the effects of the 2008 financial and economic crises, then we can speak in terms of trillion-dollar projects and thus of "teraprojects." Similarly, if the major acquisition program portfolio of the United States Department of Defense (valued at US$1.6 trillion in 2013) is considered a large-scale project, then this, again, would be a teraproject (United States Government Accountability Office [GAO], 2013). Projects of this size compare with the GDPs of the world's top 20 nations, similar in size to the national economies of, for example, Australia or Canada. There is no indication that the relentless drive to scale is abating in megaproject development. Quite the opposite—scale seems to be accelerating.

How Big Is the Megaprojects Business?

Megaprojects are not only large and growing constantly larger, however, they

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Type of Sublime	Characteristic
Technological	The excitement engineers and technologists get in pushing the envelope for what is possible in "longest-tallest-fastest" types of projects
Political	The rapture politicians get from building monuments to themselves and for their causes, and from the visibility this generates with the public and media
Economic	The delight business people and trade unions get from making lots of money and jobs off megaprojects, including money made for contractors, workers in construction and transportation, consultants, bankers, investors, landowners, lawyers, and developers
Aesthetic	The pleasure designers and people who love good design get from building and using something very large that is also iconic and beautiful, such as the Golden Gate Bridge

Table 1: The "four sublimes" that drive megaproject development.

are also being built in ever greater numbers, at ever greater value. The McKinsey Global Institute (2013) estimates global infrastructure spending will be US$3.4 trillion per year between 2013 and 2030, or approximately 4% of the total global gross domestic product, mainly delivered as large-scale projects. *The Economist* (2008) similarly estimated infrastructure spending in emerging economies at US$2.2 trillion annually for the period between 2009 and 2018.

To illustrate the accelerated pace at which spending is taking place, consider that in the five years between 2004 and 2008, China spent more on infrastructure in real terms than during the entire 20th century, which is an increase in spending rate of a factor of 20. Similarly, between 2005 and 2008, China built as many kilometers of high-speed rail as Europe did in two decades; Europe was extraordinarily busy building this type of infrastructure during this period as well. Not at any time in the history of mankind has infrastructure spending been this high, measured as a share of world GDP, according to *The Economist,* (2008), who calls it "the biggest investment boom in history." And that's just for infrastructure.

If we include the many other fields in which megaprojects are a main delivery model—oil and gas, mining, aerospace, defense, ICT, supply chains, mega events, and so forth—then a conservative estimate for the global megaproject market is between US$6 and US$9 trillion per year, or approximately 8% of the total global gross domestic product. To put this into perspective, consider this is the equivalent of spending five to eight times the accumulated U.S. debt to China, *every year.* That's big business by any definition of the term.

Moreover, megaprojects have proved remarkably recession proof. In fact, the downturn from 2008 has helped the megaprojects business grow further by showering stimulus spending on everything from transportation infrastructure to ICT. From being a fringe activity—albeit a spectacular one—mainly reserved for rich, developed nations, megaprojects have recently transformed into a global multi-trillion-dollar business that affects all aspects of our lives, from our electricity bill to how we shop, what we do on the Internet to how we commute.

With so many resources tied up in ever-larger and ever-more megaprojects, at no time has the management of such projects therefore been more important. The potential benefits of building the right projects in the right manner are enormous and are only matched by the potential waste from building the wrong projects, or building projects erroneously. Never has it been more important to choose the most fitting projects and get their economic, social, and environmental impacts right (Flyvbjerg, Bruzelius, & Rothengatter, 2003). Never has systematic and valid knowledge about megaprojects therefore been more important to inform policy, practice, and public debate in this highly costly area of business and government.

The Four Sublimes

What drives the megaproject boom described above? Why are megaprojects so attractive to decision makers? The answer may be found in the so-called "four sublimes" of megaproject management (see Table 1). The first of these, the "technological sublime," is a term variously attributed to Miller (1965) and Marx (1967) to describe the positive historical reception of technology in American culture during the nineteenth and early twentieth centuries. Frick (2008) introduced the term to the study of megaprojects and here described the technological sublime as the rapture engineers and technologists get from building large and innovative projects, with their rich opportunities for pushing the boundaries for what technology can do, such as building the tallest building, the longest bridge, the fastest aircraft, the largest wind turbine, or the first of *anything.* Frick applied the concept in a case study of the multi-billion-dollar New San Francisco–Oakland Bay Bridge, concluding "the technological sublime dramatically influenced bridge design, project outcomes, public debate, and the lack of accountability for its [the bridge's] excessive cost overruns" (p. 239).

Flyvbjerg (2012; 2014) proposed three additional sublimes, beginning with the "political sublime," which here is understood to be the rapture politicians get from building monuments to themselves and for their causes. Megaprojects are manifest, garner attention, and lend an air of pro-activeness to

their promoters; moreover, they are media magnets, which appeals to politicians who seem to enjoy few things better than the visibility they get from starting megaprojects, except, perhaps, the ceremonious ribbon-cutting during the opening of one in the company of royals or presidents, who are likely to be present, lured by the unique monumentality and historical import of many megaprojects. This is the type of public exposure that helps get politicians reelected; so, therefore, they actively seek it out.

Next, there is the "economic sublime," which is the delight business people and trade unions get from making lots of money and jobs from megaprojects. Given the enormous budgets for megaprojects, there are ample funds to go around for all, including contractors, engineers, architects, consultants, construction and transportation workers, bankers, investors, landowners, lawyers, and developers. Finally, the "aesthetic sublime" is the pleasure designers and people who appreciate good design get from building, using, and looking at something very large that is also iconically beautiful (e.g., San Francisco's Golden Gate Bridge or Sydney's Opera House).

All four sublimes are important drivers of the scale and frequency of megaprojects described above. Taken together they ensure that strong coalitions exist of stakeholders who benefit from megaprojects and who will therefore work for more such projects.

For policymakers, investing in infrastructure megaprojects seems particularly coveted because, if done right, such investing:

- Creates and sustains employment;
- Contains a large element of domestic inputs relative to imports;
- Improves productivity and competitiveness by lowering production costs;
- Benefits consumers through higher-quality services; and
- Improves the environment when infrastructures that are environmentally sound replace infrastructures that aren't (Helm, 2008, p. 1).

There is a big "if" here, however, as in "*if* done right." Only if this is disregarded—as it often is by promoters and decision makers for megaprojects—can megaprojects be seen as an effective way to deliver infrastructure. In fact, conventional megaproject delivery, infrastructure and other, is highly problematic, with a dismal performance record in terms of actual costs and benefits, as we will see below. The following characteristics of megaprojects are typically overlooked or glossed over when the four sublimes are at play and the megaproject format is chosen for the delivery of large-scale ventures:

1. Megaprojects are inherently risky due to long planning horizons and complex interfaces (Flyvbjerg, 2006).
2. Often, projects are led by planners and managers without deep domain experience who keep changing throughout the long project cycles that apply to megaprojects, leaving leadership weak.
3. Decision making, planning, and management are typically multi-actor processes involving multiple stakeholders, both public and private, with conflicting interests (Aaltonen & Kujala, 2010).
4. Technology and designs are often non-standard, leading to "uniqueness bias" among planners and managers, who tend to see their projects as singular, which impedes learning from other projects.[3]
5. Frequently there is overcommitment to a certain project concept at an early stage, resulting in "lock-in" or "capture," leaving analyses of alternatives weak or absent, and leading to escalated commitment in later stages. "Fail fast" does not apply; "fail slow" does (Cantarelli, Flyvbjerg, & Rothengatter, 2010; Ross & Staw, 1993; Drummond, 1998).
6. Due to the large sums of money involved, principal-agent problems and rent-seeking behavior are common, as is optimism bias (Eisenhardt, 1989; Stiglitz, 1989; Flyvbjerg, Garbuio, & Lovallo, 2009).
7. The project scope or ambition level will typically change significantly over time.
8. Delivery is a high-risk, stochastic activity, with overexposure to so-called "black swans"; i.e., extreme events with massively negative outcomes (Taleb, 2010). Managers tend to ignore this, treating projects as if they exist largely in a deterministic Newtonian world of cause, effect, and control.
9. Statistical evidence shows that such complexity and unplanned events are often unaccounted for, leaving budget and time contingencies inadequate.
10. As a consequence, misinformation about costs, schedules, benefits, and risks is the norm throughout project development and the decision-making process. The result is cost overruns, delays, and benefit shortfalls that undermine project viability during project implementation and operations.

In the next section, we will see just how big and frequent such cost overruns, delays, and benefit shortfalls are.

The Iron Law of Megaprojects

Performance data for megaprojects speak their own language. Nine out of ten such projects have cost overruns; overruns of up to 50% in real terms are common, over 50% are not

[3] "Uniqueness bias" is here defined as the tendency of planners and managers to see their projects as singular. This particular bias stems from the fact that new projects often use non-standard technologies and designs, leading managers to think their project is more different from other projects than it actually is. Uniqueness bias impedes managers' learning, because they think they have nothing to learn from other projects because their own project is unique. This lack of learning may explain why managers who see their projects as unique perform significantly worse than other managers (Budzier & Flyvbjerg, 2013). Project managers who think their project is unique are therefore a liability for their project and organization. For megaprojects this would be a mega-liability.

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Project	Cost Overrun (%)
Suez Canal, Egypt	1,900
Scottish Parliament Building, Scotland	1,600
Sydney Opera House, Australia	1,400
Montreal Summer Olympics, Canada	1,300
Concorde Supersonic Aeroplane, UK, France	1,100
Troy and Greenfield Railroad, USA	900
Excalibur Smart Projectile, USA, Sweden	650
Canadian Firearms Registry, Canada	590
Lake Placid Winter Olympics, USA	560
Medicare transaction system, USA	560
Bank of Norway headquarters, Norway	440
Furka Base Tunnel, Switzerland	300
Verrazano Narrow Bridge, USA	280
Boston's Big Dig Artery/Tunnel project, USA	220
Denver International Airport, USA	200
Panama Canal, Panama	200
Minneapolis Hiawatha light rail line, USA	190
Humber Bridge, UK	180
Dublin Port Tunnel, Ireland	160
Montreal Metro Laval extension, Canada	160
Copenhagen Metro, Denmark	150
Boston–New York–Washington Railway, USA	130
Great Belt Rail Tunnel, Denmark	120
London Limehouse Road Tunnel, UK	110
Brooklyn Bridge, USA	100
Shinkansen Joetsu high-speed rail line, Japan	100
Channel Tunnel, UK, France	80
Karlsruhe–Bretten light rail, Germany	80
London Jubilee Line extension, UK	80
Bangkok Metro, Thailand	70
Mexico City Metroline, Mexico	60
High-speed Rail Line South, The Netherlands	60
Great Belt East Bridge, Denmark	50

Table 2: Large-scale projects have a calamitous history of cost overrun.

uncommon. The cost overrun for the Channel Tunnel, the longest underwater rail tunnel in Europe, connecting the United Kingdom and France, was 80% in real terms. The cost overruns for the Denver International Airport were 200%; for Boston's Big Dig, 220%; and for the Sydney Opera House, 1,400% (see more examples in Table 2). Overrun is a problem in private as well as public sector projects, and things are not improving; overruns have stayed high and constant for the 70-year period for which comparable data exist. Geography doesn't seem to matter either; all countries and continents for which data are available suffer from overruns. Similarly, benefit shortfalls of up to 50% are also common and above 50% not uncommon, again with no signs of improvements over time and geography (Flyvbjerg, Holm, & Buhl, 2002, 2005).

Combine the large cost overruns and benefit shortfalls with the fact that business cases, cost–benefit analyses, and social and environmental impact assessments are typically at the core of planning and decision making for megaprojects and we see that such analyses can generally not be trusted. For example, for rail projects, an average cost overrun of 44.7% combines with an average demand shortfall of 51.4%, and for roads, an average cost overrun of 20.4% combines with a 50-50 risk that demand is also incorrect by more than 20%. With errors and biases of such magnitude in the forecasts that form the basis for business cases, cost–benefit analyses, and social and environmental impact assessments, such analyses will also, with a high degree of certainty, be strongly misleading. (Flyvbjerg, 2009) "Garbage in, garbage out," as the saying goes.

As a case in point, let's consider the Channel Tunnel in more detail. This project was originally promoted as highly beneficial both economically and financially. At the initial public offering, Eurotunnel, the private owner of the tunnel, tempted investors by telling them that 10% "would be a reasonable allowance for the possible impact of unforeseen circumstances on construction costs" (The Economist, 7 October, 1989, 37–38). In fact, costs went 80% over budget for construction, as mentioned above, and 140% over budget for financing. Revenues have been one half of those forecasted. As a consequence, the project has proved non-viable, with an internal rate of return on the investment that is negative, at minus 14.5% with a total loss to the British economy of US$17.8 billion; thus, the Channel Tunnel detracts from the economy instead of adding to it. This is difficult to believe when you use the service, which is fast, convenient, and competitive with alternative modes of travel. But, in fact, each passenger is

heavily subsidized—not by the taxpayer this time, but by the many private investors who lost their money when Eurotunnel went insolvent and was financially restructured. This drives home an important point: A megaproject may well be a technological success, but a financial failure, and many are. An economic and financial ex post evaluation of the Channel Tunnel, which systematically compared actual with forecasted costs and benefits, concluded that "the British Economy would have been better off had the Tunnel never been constructed" (Anguera, 2006, p. 291). Other examples of non-viable megaprojects are Sydney's Lane Cove Tunnel, the high-speed rail connections at the Stockholm and Oslo Airports, the Copenhagen Metro, and Denmark's Great Belt Tunnel, the second-longest underwater rail tunnel in Europe, after the Channel Tunnel.

Large-scale ICT projects are even more risky. One in six such projects becomes a statistical outlier in terms of cost overrun, with an average overrun for outliers of 200% in real terms. This is a 2,000% over incidence of outliers compared with normal and a 200% over incidence compared with large construction projects, which are also plagued by cost outliers (Flyvbjerg & Budzier, 2011). Total annual project waste from failed and underperforming ICT projects for the United States alone has been estimated at US$55 billion by the Standish Group (2009).

Delays are a separate problem for megaprojects and they cause both cost overruns and benefit shortfalls. For example, preliminary results from a study undertaken at Oxford University, based on the largest database of its kind, suggest that delays on dams are 45% on average. Thus, if a dam was planned to take 10 years to execute, from the decision to build until the dam became operational, then it actually took 14.5 years on average. Flyvbjerg, Holm, and Buhl (2004) modeled the relationship between cost overrun and length of implementation phase based on a large data set for major construction projects; they found that, on average, a one-year delay or other extension of the implementation phase correlates with an increase in percentage cost overrun of 4.64 percentage points.

To illustrate, for a project the size of London's US$26 billion Crossrail project, a one-year delay would cost an extra US$1.2 billion, or US$3.3 million per day. The key lesson here is that in order to keep costs down, implementation phases should be kept short and delays small. This should not be seen as an excuse for fast-tracking projects, in other words, rushing them through decision making for early construction start. Front-end planning needs to be thorough before deciding whether to give the green light to a project or stopping it before it starts (Williams & Samset, 2010). But often the situation is the exact opposite. Front-end planning is scant, bad projects are not stopped; implementation phases and delays are long; costs soar, and benefits and revenue realization recedes into the future. For debt-financed projects this is a recipe for disaster, because project debt grows, whereas there is no revenue stream to service interest payments, which are then added to the debt, which increases interest payments, and so on in a vicious cycle. As a result, many projects end up in the so-called "debt trap," where a combination of escalating construction costs, delays, and increasing interest payments makes it impossible for income from a project to cover costs, rendering the project non-viable. That is what happened to the Channel Tunnel and Sydney's Lane Cove Tunnel, among other projects.

This is not to say that there are no projects that were built on budget and on time and delivered the promised benefits. The Guggenheim Museum Bilbao is an example of that rare breed of project. Similarly, recent metro extensions in Madrid were built on time and to budget (Flyvbjerg, 2005), as were a number of industrial projects (Merrow, 2011). It is particularly important to study such projects to understand the causes of success and test whether success may be replicated elsewhere. It is far easier, however, to produce long lists of projects that have failed in terms of cost overruns and benefit shortfalls than it is to produce lists of projects that have succeeded. To illustrate this, as part of ongoing research on success in megaproject management, this author and his associates are trying to establish a sample of successful projects large enough to allow statistically valid answers; but, thus far have failed. Why? Because success is so rare in megaproject management that, at present, it can only be studied as small-sample research; whereas, failure may be studied with large samples of projects.

Success in megaproject management is typically defined as projects being delivered on budget, on time, and with the promised benefits. If, as the evidence indicates, approximately one out of ten megaprojects is on budget, one out of ten is on schedule, and one out of ten delivers the promised benefits, then approximately one in one thousand projects is a success, defined as "on target" for all three. Even if the numbers were wrong by a factor of two—so that two, instead of one out of ten projects were on target for cost, schedule, and benefits, respectively—the success rate would still be dismal, now eight in one thousand. This serves to illustrate what may be called the "iron law of megaprojects": *Over budget, over time, over and over again* (Flyvbjerg, 2011).[4] Best practice is an outlier, average practice a disaster in this interesting and very costly area of management.

The "Break–Fix Model" of Megaproject Management

The above analysis leaves us with a genuine paradox, the so-called "megaprojects paradox," first identified by

[4] The Economist (March 10, 2012, p. 55) describes the near-certainty of large cost overruns and delays in transportation infrastructure projects as "the iron law of infrastructure projects." Our data show the iron law is not limited to infrastructure; it applies to megaprojects in general and covers benefit shortfalls in addition to cost overruns and delays.

Flyvbjerg et al. (2003, pp 1–10). On one side of the paradox, megaprojects as a delivery model for public and private ventures have never been more in demand, and the size and frequency of megaprojects have never been larger. On the other side, performance in megaproject management is strikingly poor and has not improved for the 70-year period for which comparable data are available, at least not when measured in terms of cost overruns, schedule delays, and benefit shortfalls.

Today, megaproject planners and managers are stuck in this paradox because their main delivery method is what has been called the "break–fix model" for megaproject management.[5] Generally, megaproject planners and managers—and their organizations—do not know how to deliver successful megaprojects, or do not have the incentives to do so, and therefore such projects tend to "break" sooner or later, for example, when reality catches up with optimistic, or manipulated, estimates of schedule, costs, or benefits; delays, cost overruns, and benefit shortfalls follow. Projects are then often paused and reorganized—sometimes also refinanced—in an attempt to "fix" problems and deliver some version of the initially planned project with a semblance of success. Typically, lock-in and escalation make it impossible to drop projects altogether, which is why megaprojects have been called the "Vietnams" of policy and management: "easy to begin and difficult and expensive to stop" (White, 2012; Cantarelli et al., 2010; Ross & Staw, 1993; Drummond, 1998). The "fix" often takes place at great and unexpected cost to those stakeholders who were not aware of what was going on and were unable or lacked the foresight to pull out before the break.

The break–fix model is wasteful and leads to misallocation of resources, in both organizations and society, for the simple reason that under this model decisions to go ahead with projects are based on misinformation more than on information. The degree of misinformation varies significantly from project to project, as documented by the large standard deviations that apply to cost overruns and benefit shortfalls (Flyvbjerg et al., 2002; 2005). We may therefore *not* assume, as is often done, that on average all projects are misrepresented by approximately the same degree and, therefore, we are still building the best projects, even if they are not as good as they appear on paper. The truth is, we don't know, and often projects turn out to bring a net loss to the economy, rather than a gain. The cure to the break–fix model is to get projects right from the outset so they don't break, through proper front-end management.

Hirschman's Hiding Hand, Revisited

One may argue, of course, as famously done by Hirschman (1967a, pp 12–13) that if people knew in advance the real costs and challenges involved in delivering a large project, "they probably would never have touched it" and nothing would ever get built; so, it is better not to know, because ignorance helps get projects started, according to this argument. The following excerpt is a recent and particularly candid articulation of the nothing-would-ever-get-built argument, by former California State Assembly Speaker and Mayor of San Francisco, Willie Brown, discussing a large cost overrun on the San Francisco Transbay Terminal megaproject in his *San Francisco Chronicle* column (27 July 2013, with emphasis added):

> "News that the Transbay Terminal is something like $300 million over budget should not come as a shock to anyone. We always knew the initial estimate was way under the real cost. Just like we never had a real cost for the [San Francisco] Central Subway or the [San Francisco–Oakland] Bay Bridge or any other massive construction project. So get off it. In the world of civic projects, the first budget is really just a down payment. *If people knew the real cost from the start, nothing would ever be approved.* The idea is to get going. Start digging a hole and make it so big, there's no alternative to coming up with the money to fill it in."

Rarely has the tactical use by project advocates of cost underestimation, sunk costs, and lock-in to get projects started been expressed by an insider more plainly, if somewhat cynically. It is easy to obtain such statements off the record, but few are willing to officially lend their name to them, for legal and ethical reasons, to which we will return later. Nevertheless, the nothing-would-ever-get-built argument has been influential with both practitioners and academics in megaproject management. The argument is deeply flawed, however, and thus deserves a degree of attention and critique. Hirschman's text contains the classic formulation of the argument and has served widely as its theoretical justification, as has Sawyer (1952), who directly inspired and influenced Hirschman.[6] A recent celebration of Hirschman's thinking on this point may be found in Gladwell (2013).

Hirschman (1967a, pp. 13–14) observed that humans are "tricked" into doing big projects by their own ignorance. He saw this as positive because, just as humans underestimate the difficulties in doing large-scale projects they also underestimate their own creativity in dealing with the difficulties, he believed, and "the only way in which we can bring our creative sources fully into play is by misjudging the nature of the task, by presenting it to ourselves as more routine, simple, undemanding of genuine creativity than it will turn out to be." Hirschman called this the "prin-

[5]The author owes the term "break-fix model" to Dr. Patrick O'Connell, Practitioner Director of Major Programme Management at Oxford University's Saïd Business School.

[6]Two versions of Hirschman's text exist (1967a, 1967b). The version of the text referenced here is the one published in *Development Projects Observed* (Hirschman, 1967a), which is the original text. The differences between the two texts are minor and are mainly due to the editing of Irving Kristol, editor of *The Public Interest* at the time of publication (Adelman, 2013, p. 405).

ciple of the Hiding Hand" and it consists of "some sort of invisible or hidden hand that beneficially hides difficulties for us"—where the error of underestimating difficulties is offset by a "roughly similar" error in underestimating our ability to overcome the difficulties, thus helping "accelerate the rate at which 'mankind' engages successfully in problem-solving."

Sawyer (1952, pp. 199, 203), in a study of early industrial infrastructure projects that he called a work "in praise of folly," similarly identified what he called "creative error" in project development as, first, "miscalculation or sheer ignorance" of the true costs and benefits of projects; second, such miscalculation being "crucial to getting an enterprise launched at all." Sawyer argued that such "creative error" was the key to building a number of large and historically important projects, including the Welland Canal between Lake Erie and Lake Ontario, the Panama Canal, the Middlesex Canal, the Troy and Greenfield Railroad, and early Ohio roads. For these and other projects, Sawyer found that "the error in estimating costs was at least offset by a corresponding error in the estimation of demand" (p. 200). Hirschman (1967a, p. 16) explicitly mentioned Sawyer as an inspiration and his "creative error" as a close "approximation" to the Hiding Hand principle.

It is easy to understand why Hirschman's and Sawyer's theories have become popular, especially with people who benefit from megaprojects. The theories encourage promoters and decision makers, such as Willie Brown quoted above, to just go ahead with projects and not worry too much about the costs or other problems, because the Hiding Hand will take care of them, eventually. And, in any case, who wants to be the killjoy stopping large projects from going ahead by an overdose of truth? Hirschman (1967b) was an immediate hit with practitioners—from Washington's policy establishment to the United Nations, to the World Bank. The head of the World Bank's Economics Department told Hirschman: "You've helped in part to remove the unease that I have had in reflecting on the fact that if our modern project techniques had been used, much of the existing development in the world would never have been undertaken" (Adelman, 2013). Hirschman's thinking also eventually penetrated academia. Teitz and Skaburskis (2003) follow the Hiding Hand logic when they ask of the huge cost overrun on the Sydney Opera House: "Did people really think that the Sydney Opera House would come in on budget? Or did we all agree to accept the deception and engage in wishful thinking in order to make something that we really wanted happen? … [D]o Australians really regret those dramatic sails in the harbour? Or would they have regretted more the decision [not to build] that would most reasonably have been based on a fair prediction of costs?"

The logic is seductive, yet precarious. In retrospect, of course Australians do not regret the Sydney Opera House, given what it has done for Australia though, at first, the building was not called "dramatic sails in the harbour," but "copulating white turtles" and "something that is crawling out of the ocean with nothing good in mind" designed by an architect with "lousy taste" (Reichold & Graf, 2004, p. 168). Non-Australians may feel regret, however; for example, the architect of the Opera House: What's his name? Does anybody know? Only few do, which seems surprising given we are talking about the architect of arguably the most iconic building of the 20th century. And, if anybody knows the architect is the Dane Jørn Utzon, how come they can hardly ever mention another building designed by him? Because the overrun on the Opera House, and the controversy that followed, destroyed Utzon's career and kept him from building more masterpieces. He became that most tragic figure in architecture: the one-building-architect. This is the real regret—and real cost—of the Sydney Opera House, not premier Joe Cahill's deliberate deception about the cost—to get approval in Parliament—and the consequential huge cost overrun (Flyvbjerg, 2005).

In a meeting held in support of Utzon at Sydney Town Hall in March 1966—six weeks before the controversy made Utzon leave Australia and the Opera House, in the middle of construction and never to return—the Vienna-born Australian architect Harry Seidler said, "If Mr. Utzon leaves, a crime will have been committed against future generations of Australians" (Murray, 2004, p. 105). Seidler was more right than he could have imagined, except the crime would not be limited to Australians—it became a crime against lovers of great architecture everywhere. After winning the Pritzker Prize, the Nobel for architecture, in 2003, Utzon again became widely acclaimed, even in Australia, where the Sydney Opera tour guides for years had been forbidden to even mention his name. But it was too late. Utzon was now 85 years old and had not built anything major for decades. So instead of having a whole oeuvre to enjoy, as we have for other architects of his caliber, we have just the one main building. Utzon was 38 when he won the competition for the Opera House. How would other works by the mature master have enriched our lives? We will never know.

As a thought experiment, consider the collected works of architect Frank Gehry, who is in the same league as Utzon; then consider which building you would choose, if you could choose only one, and the rest would have to go. So if you chose, say, the Guggenheim Museum Bilbao, then Los Angeles' Disney Concert Hall, Chicago's Jay Pritzker Pavilion, Prague's Dancing House, and Seattle's Experience Music Project Museum would be eliminated. This illustrates the high price the government of New South Wales has imposed on the world by mismanaging the planning of the Sydney Opera House and deliberately playing the game of cre-

ative error and Hiding Hand. Even if the Opera House is an extreme case, Sydney drives home an important point: managing by creative error is risky and disruptive, sometimes in drastic and unexpected ways, and the Hiding Hand isn't big enough to hide all, or even most, errors.

Hirschman's and Sawyer's theories are also flawed on a more basic level, that of validity. A close look reveals the theories to be based on small samples and biased data. Hirschman studied only 11 projects or a few more if we take into account the subprojects, and Sawyer studied 10 to 15. This important fact is typically ignored when the Hiding Hand principle is discussed. Hirschman (1967a, pp. 7, 14) seemed aware of the weak foundations and limited applicability of the principle when he called it "speculative" and useful only "[u]p to a point." To a colleague he admitted at the time of publication that his book was "an exploration, an experiment"; to another he said he had deliberately biased his analysis "to emphasize unexpected successes" (Adelman, 2013, pp. 404–405). Even so, Hirschman went on to call the Hiding Hand a "general principle of action" and brazenly used a name for it with clear connotations to Adam Smith's famous Invisible (Hidden) Hand. Evidently, the temptation to formulate an "economic law" was too strong, despite the weak and biased data. Sawyer (1952, p. 204) warned the reader up front that his study must be considered a "marginal and distinctly limited note." He admitted the study considers only a "quite special kind of case" and neglects projects that were "failures" in order to focus on projects that were "successful" in the sense that "an original gross miscalculation as to costs ... was happily offset by at least a corresponding underestimation of demand." Sawyer's results, thus, do not describe a general characteristic of large projects, but a characteristic of his biased sample that includes only projects lucky enough to have had large underestimates of costs compensated by similarly large or larger underestimates of demand. Some would call this dubious data fishing, and the only redeeming factor is that Sawyer was disarmingly honest and tongue-in-cheek humoristic about it. He appears to not have expected to be taken wholly seriously, which he unfortunately was by some, including Hirschman.

Today we have much better data and theories on megaproject performance than at the time of Hirschman and Sawyer. We now know that, although there may be elements of truth in these authors' theories for certain types of projects and contexts, their samples and conclusions are not representative of the project population. In particular, their odd asymmetrical assumption that optimism would apply to cost estimates, yet pessimism to estimates of benefits, has been solidly disproved by Kahneman and Tversky (1979a, 1979b) and by behavioral economists building on their work. They found that optimism bias applies to estimates of both costs and benefits. An optimistic cost estimate is low and leads to cost overrun, whereas an optimistic benefit estimate is high and results in benefit shortfalls. Thus, errors of estimation do not cancel each other out, as Hirschman would have it; the exact opposite happens—errors generally reinforce each other.

Megaproject planners and managers would therefore be ill advised to count on Hiding Hands, creative errors, or any other general principle according to which underestimates of costs would be balanced by similar underestimates of benefits. We also now know it would be equally foolhardy to assume that downstream human creativity may be generally counted on to solve problems that planners and managers overlook or underestimate when the decision is made to go ahead with a project. The data show that for too many projects with front-end problems, such creativity never materializes and projects end up seriously impaired or non-viable. Initial problems, if not dealt with up front, tend not to go away. The iron law of megaprojects, described above, trumps Hirschman's Hiding Hand at a high level of statistical significance, and we know why. The Hiding Hand is itself an example of optimism and does therefore not capture the reality of megaproject management. For such capture, and true explanatory power, we must turn to theories of optimism bias, the planning fallacy, strategic misrepresentation, and principal–agent behavior.

Survival of the Unfittest

In sum, one does megaprojects—and megaproject management—a disservice if one claims they can only be done through the Hiding Hand, creative error, or downright deception. It is, undoubtedly, quite common for project promoters and their planners and managers to believe their projects will benefit society and they, therefore, are justified in "cooking" costs and benefits to get projects built (Wachs, 1990; Pickrell, 1992). Such reasoning is faulty, however. Underestimating costs and overestimating benefits for a given project (which is the common pattern, as described above) leads to a falsely high benefit–cost ratio for that project, which in turn leads to two problems. First, the project may be started despite the fact it is not financially and economically viable. Or, second, it may be started instead of another project, which would have shown to yield higher returns than the project started had the real costs and benefits of both projects been known. Both cases result in Pareto inefficiency; that is, the misallocation of resources and, for public projects, waste of taxpayers' money. Thus, for reasons of economic efficiency alone, the argument must be rejected that cost underestimation and benefit overestimation are justified for getting projects started.

But the argument must also be rejected for legal and ethical reasons. In most democracies, for project promoters, planners, and managers to deliberately misinform legislators, administrators, bankers, the public, and the media about costs and benefits

would not only be considered unethical but, in some cases also illegal, for example, where civil servants would intentionally misinform cabinet members, or cabinet members would intentionally misinform parliament. In private corporations, Sarbanes-Oxley-like legislation similarly makes deliberate misrepresentation a crime under many circumstances, which in the United States is punishable by imprisonment of up to 20 years.[7] There is a formal "obligation to truth" built into most democratic constitutions—and now also in legislation for corporate governance—as a means for enforcing accountability. This obligation would be violated by deliberate misrepresentation of costs and benefits, whatever the reasons for such misrepresentation may be. Not only would economic efficiency suffer but also democracy, good governance, and accountability.

A first answer to the skeptics' question of whether enough megaprojects would be undertaken if some form of misrepresentation of costs and benefits was not involved is, therefore, that even if misrepresentation was necessary in order to get projects started, such misrepresentation would typically not be defensible in liberal democracies—and especially not if it was deliberate—for economic, legal, and ethical reasons.

A second answer to the skeptics' question is that misrepresentation is not necessary to undertaking projects, because many projects exist with sufficiently high benefits and low enough costs to justify building them. Even in the field of innovative and complex architecture, which is often singled out as particularly difficult, there is the Basque Abandoibarra urban regeneration project, including the Guggenheim Museum Bilbao, which is as complex, innovative, and iconic as any signature architecture, and was built on time and budget. Complex rail projects, too, including the Paris–Lyon high-speed rail line and the London Docklands light railway extension have been built to budget. The problem is not that projects worth undertaking do not exist or cannot be built on time and on budget. The problem is that the dubious and widespread practices of underestimating costs and overestimating benefits used by many megaproject promoters, planners, and managers to promote *their* pet project create a distorted hall-of-mirrors in which it is extremely difficult to decide which projects deserve undertaking and which do not.

In fact, the situation is even worse than that. The common practice of depending on the Hiding Hand or creative error in estimating costs and benefits, thus "showing the project at its best" as an interviewee put it in a previous study, results in an inverted Darwinism, i.e., the "survival of the unfittest" (Flyvbjerg, 2009). It is not the best projects that get implemented in this manner, but the projects that look best on paper, and the projects that look best on paper are the projects with the largest cost underestimates and benefit overestimates, other things being equal. But the larger the cost underestimate on paper, the greater the cost overrun in practice; and the larger the overestimate of benefits, the greater the benefit shortfall. Therefore, the projects that have been made to look best on paper become the worst, or unfittest, projects in reality, in the sense that they are the very projects that will encounter the most problems during construction and operations in terms of the largest cost overruns, benefit shortfalls, and risks of non-viability. They have been designed like that—as disasters waiting to happen.

The result is, as even the industry's own organization, the Major Projects Association, has stated that "too many projects proceed that should not have done" (Morris & Hough, 1987, p. 214). One might add that projects also exist that do not proceed but should have, had they not lost out, not to better projects but to projects with "better" creative error; that is, "better" manipulated estimates of costs and benefits.

Light at the End of the Tunnel?

Fortunately, signs of improvement in megaproject management have recently appeared. The tacit consensus that misrepresentation is an acceptable business model for project development is under attack. Shortly after taking office, U.S. President Barack Obama openly identified "the costly overruns, the fraud and abuse, the endless excuses" in public procurement for major projects as key policy problems (White House, 2009). The *Washington Post* rightly called this "a dramatic new form of discourse" (Froomkin, 2009). Other countries are seeing similar developments. Before Obama came into office, it was not common in government or business to talk openly about overruns, fraud, and abuse in relation to megaprojects, although they were as widespread then as now. The few who did so were ostracized; however, as emphasized by Wittgenstein (2009), we cannot solve problems we cannot talk about. So talking is the first step.

A more material driver of improvement is the fact that the largest projects are now so big and consequential in relation to individual businesses and agencies that cost overruns, benefit shortfalls, and risks from even a single project may bring down executives and whole corporations. This happened with the Airbus A380 superjumbo jet, when delays, cost overruns, and revenue shortfalls cost the CEO and other top managers their jobs. The CEO of BP was similarly forced to step down and the company lost more than half its value when the Deepwater Horizon offshore oil drilling rig caught fire and caused the world's largest oil spill in

[7] The Sarbanes-Oxley Act of 2002 pioneered this area in the United States, but many other countries have since followed suit with similar legislation. Section 802[a] (18 U.S.C. § 1519) of the original act states that whoever knowingly alters, destroys, mutilates, conceals, covers up, falsifies, or makes a false entry in any record, document, or tangible object with the intent to impede, obstruct, or influence the investigation or proper administration of any matter within the jurisdiction of any department or agency of the United States or any case filed under title 11, or in relation to or contemplation of any such matter or case, shall be fined, imprisoned not more than 20 years, or both.

the Gulf of Mexico in 2010. At Kmart, a large U.S. retailer, the entire company went bankrupt when a new multibillion-dollar ICT enterprise system, which was supposed to make Kmart competitive with Walmart and Target, went off the rails (Flyvbjerg & Budzier, 2011). In China, corruption and related safety issues on the country's US$300 billion high-speed rail program have caused massive reputational damage, and cost the railway minister his political career in 2011. Today, if you are a CEO, minister, permanent secretary, or other top manager and want to be sure to keep your job, you will want to manage your megaprojects properly. Episodes such as these have triggered leaders to begin looking for better megaproject delivery.

Even the wealth of whole cities and nations may be affected by a single megaproject failure. In Hong Kong, months of obstacles during the opening of a new international airport made traffic go elsewhere, resulting in a fall in GNP for the entire city state. For Greece, a contributing factor to the country's 2011 debt default was the 2004 Olympic Games in Athens, for which cost overruns and incurred debt were so large they negatively affected the credit rating of the whole nation, substantially weakening the economy in the years before the 2008 international financial crisis. This resulted in a double dip—and disaster—for Greece, when other nations had only a single dip. Likewise, in Japan in 2011, the nuclear tragedy at Fukushima significantly and negatively impacted the national economy as a whole. It is becoming increasingly clear that when megaprojects go wrong they are like the proverbial bull in the china shop: it takes just one bull to smash up the entire store. It is becoming similarly clear to many involved that something needs to be done about his.

In the United Kingdom, at the beginning of the century, cost underestimation and overrun were rampant in so many projects and in so many ministries that the reliability of national budgets suffered, leading the chancellor to order a Green Book on the problem and how to solve it (HM Treasury, 2003). This move inspired other countries to follow suit. Lawmakers and governments have begun to see that national fiscal distress and unreliable national budgets are too high a price to pay for the conventional way of managing megaprojects. In 2011, the UK Cabinet Office and HM Treasury joined forces to establish a Major Projects Authority, with an enforceable mandate directly from the Prime Minister to oversee and direct the effective management of all large-scale projects that are funded and delivered by central government. In 2012, the Authority established, in collaboration with Oxford University, a Major Projects Leadership Academy—the first of its kind in the world—to train and authorize all UK civil servants in charge of central government major projects.[8]

Outside of government, private finance in megaprojects has been on the rise over the past twenty years, which means that capital funds, pension funds, and banks are increasingly gaining a say in management. Private capital is no panacea for the ills in megaproject management, to be sure; in some cases, private capital may even make things worse (Hodge & Greve, 2009). But private investors place their own funds at risk; therefore, funds and banks can be observed to not automatically accept at face value the cost and revenue forecasts of project managers and promoters. Banks typically bring in their own advisers to do independent forecasts, due diligence, and risk assessments, which are important steps in the right direction (Flyvbjerg, 2013). The false assumption that one forecast or one business case may contain the whole truth about a project is problematized. Instead, project managers and promoters are getting used to the healthy fact that different stakeholders hold different forecasts and that forecasts are not only products of data and mathematical modeling but also of power and negotiation. And why is this healthier? Because it undermines trust in the misleading forecasts often produced by project promoters.

Moreover, democratic governance is generally getting stronger around the world. Corporate scandals, from Enron, WorldCom, and onward have triggered new legislation and a war on corporate deception that is spilling over into government with the same objectives: to curb waste and promote good governance. Although progress is slow, good governance is gaining a foothold even in megaproject management. The main drivers of reform come from outside the agencies and industries conventionally involved in megaprojects and this is good because it increases the likelihood of success. For example, the UK Treasury now requires that all ministries develop and implement procedures for megaprojects that will curb so-called "optimism bias" (Flyvbjerg, 2006). Funding will be unavailable for projects that do not take into account such bias, and methods have been developed for doing this (UK Department for Transport, 2006). Switzerland and Denmark have followed the lead of the United Kingdom (Swiss Association of Road and Transportation Experts, 2006; Danish Ministry for Transport and Energy, 2006, 2008). In Australia, the Parliament of Victoria has conducted an inquiry into how government may arrive at more successful delivery of significant infrastructure projects (Parliament of Victoria, 2012). Similarly, in the Netherlands, the Parliamentary Committee on Infrastructure Projects did extensive public hearings to identify measures that will limit the misinformation about large infrastructure projects presented to the Parliament, public, and media (Dutch Commission on Infrastructure Projects, 2004). In Boston, the government sued to recoup funds from contractor overcharges for the Big Dig

[8]For full disclosure: The author was involved in the planning, start up, and delivery of the UK Major Projects Leadership Academy.

related to cost overruns. More countries and cities are likely to follow the lead of the United Kingdom, Australia, Switzerland, Denmark, the Netherlands, and the United States in coming years.

Finally, research on how to reform megaproject management—examples of which have been referenced above—is beginning to positively impact practice. Such research has recently made great strides in better understanding what causes the many failures in megaproject delivery and how to avoid them. For example, we now understand that optimism bias and strategic misrepresentation are significantly better explanations of megaproject outcomes than previous explanations, including Hirschman's Hiding Hand and Sawyer's creative error discussed above. And with a better understanding of causes a better grasp of cures has followed, from front-end management (Williams & Samset, 2010) to reference class forecasting (Kahneman, 2011, pp 243–254; Flyvbjerg, 2006) to institutional design for better accountability (Scott, 2012; Bruzelius et al., 1998). Moreover, research is beginning to help us understand success and how to replicate it. Perhaps most importantly, researchers have begun to take seriously the task of feeding their research results into the public sphere so they may effectively form part of public deliberation, policy, and practice (Flyvbjerg, 2012; Flyvbjerg et al., 2012).

With these developments, things are moving in the right direction for megaproject management. It is too early to tell whether the reform measures being implemented will ultimately be successful. It seems unlikely, however, that the forces that have triggered the measures will be reversed, and it is those forces that reform-minded individuals and groups need to support and work with in order to improve megaproject management. This is the "tension point," where convention meets reform, power balances change, and new things are happening. In short, it is the place to be as a megaproject planner, manager, scholar, student, owner, or interested citizen.[9]

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[9] See Flyvbjerg et al. (2012) regarding the use of tension points for triggering change in policy and practice, including for megaprojects.

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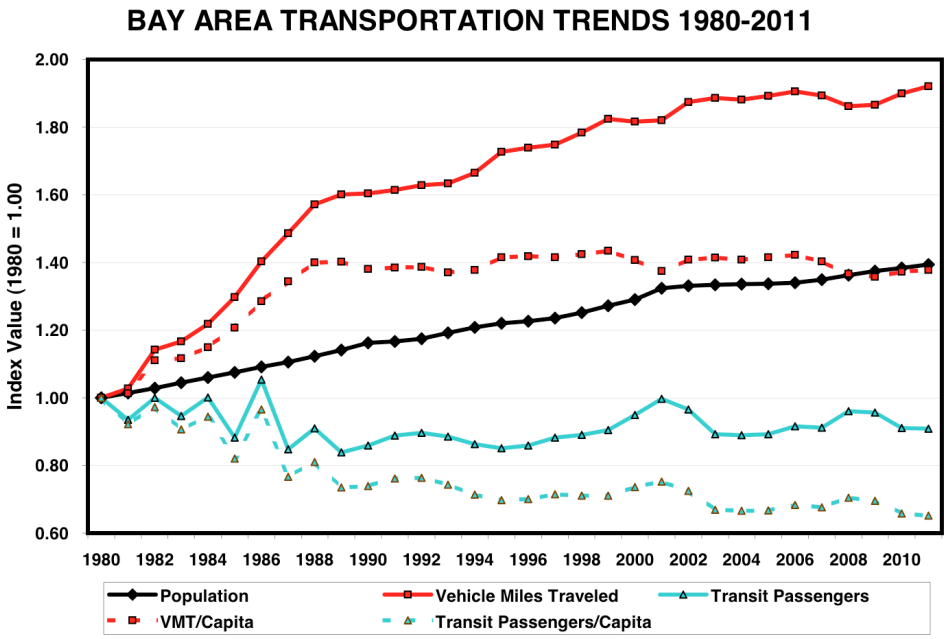
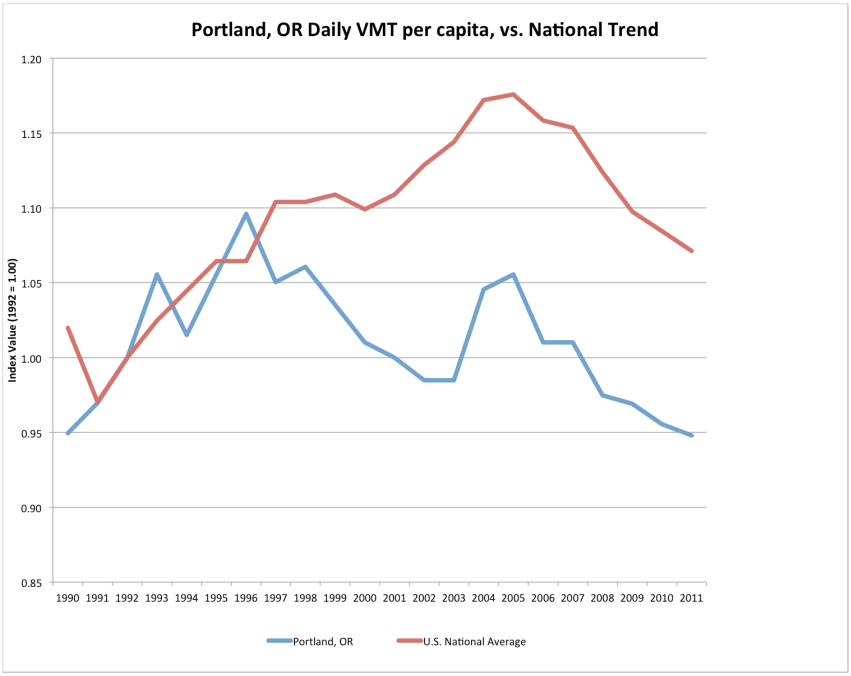
Case Study: Politics Trumps Outcomes at MTC

The Metropolitan Transportation Commission, MTC, serves as the Metropolitan Planning Organization for the Bay Area. Its performance offers a perfect example of what not to do in implementing the Transit and Intercity Rail Capital Program, TIRCP. MTC has poured many billions of dollars into transit, only to see a decline in transit ridership over the past 30 years, both in absolute and per capita terms. The trend for VMT per capita has remained stagnant.



Data from MTC's *Statistical Summary of Bay Area Transit Operators* and *Bay Area Census* reports

In contrast, Portland was able to change its trend, substantially lowering its VMT per capita, presumably by thoughtful capital allocation and successful policies:



(1992 was chosen as the base year for comparison, because the daily VMT per capita was very similar: 19.80 for Portland and 20.20 nationally.) Note that on the chart above, Portland significantly out-performed the national average. Portland introduced policy innovations in the early 1990s, which, together with competent implementation, makes it the successful model STA needs to emulate.

MTC considers itself one of the nation's leading metropolitan planning organizations, and possibly the most advanced of them all. In 2001, despite a 30% population increase since 1982, TRANSDEF noted that Bay Area regional transit ridership had increased less than 1% (which constituted more than a 21% per capita decrease in ridership!). We initiated a lawsuit to enforce the provisions of TCM 2, a federal Clean Air Act commitment MTC had made to increase regional transit ridership by 15% over 1982 levels. We won two excellent trial court decisions and an attorney's fee of $1.1 million, which were unfortunately overturned by a conservative Ninth Circuit panel.

Ten years after the TCM 2 litigation, after a 38% increase in Bay Area population over 1980 levels, transit ridership is now even lower than 1982. After spending many billions of dollars on BART extensions and highway widenings, regional transit ridership is an astonishing 31% lower on a per capita basis. If the point of the TIRCP is to achieve outcomes of increased transit ridership and reduced greenhouse gas emissions, STA would be well advised to not use MTC as a model.

The MTC Project Selection Process

The addition of large projects to the long-range regional plan is typically the result of grandstanding by a political leader, followed by consultant work to ostensibly justify the expenditure. The BART extension to San Jose had been considered out of reach for the area, when San Jose Mayor Gonzales made a name for himself by becoming its champion.

An all-too-familiar example of the MTC project selection process: San Francisco Willie Brown promised a subway to a Chinatown political leader that had helped him in a tough election. Despite Muni's very large capital needs to achieve a State of Good Repair, San Francisco made the Central Subway its top priority. MTC unblinkingly put the project into its long-range plan, and assisted in getting a Full-Funding Grant Agreement for $942 million, with another $62 million in HSR connectivity funds. Ironically, the project will disconnect transit riders on the Third Street line from the Muni Market Street tunnel, forcing a long walk to make the connection. The project underwent a series of scope changes as the cost escalated. Platform lengths were shortened in a penny wise--pound-foolish attempt to reduce costs.

Transit advocates were very opposed to the project. (See SaveMuni.com for details.) They fully agreed that Chinatown needed much better transit. However, they recognized that a surface transit solution would be far more beneficial, with a dramatically lower price tag. The City, however, had no stomach for the political firestorm that would come from reconfiguring parking to make space for bus lanes. Advocates recognized that the deep tunnel approach would require very long escalator rides, which would eliminate any travel time advantage gained by avoiding surface traffic. As project cost estimates doubled, neither MTC nor SFMTA reevaluated the merits of the project.

The BART extension to San Francisco International Airport, which MTC had made the region's top priority, still has not achieved the ridership that was projected for it twenty years ago. Its cost more than doubled, too. MTC is committed to pursuing BART extensions because of their political popularity, no matter how absurd their cost. TRANSDEF views this as a rejection of the basic principles of planning, which call for identifying the problem and serving it in the most cost-effective manner possible. Making matters far worse, the extensions have failed to achieve ridership justifying the many billions of dollars spent.

A striking characteristic of MTC's project selection process is its ratchet-like inflexibility. Once a project has become a "committed project" by being added to the plan, that decision is never revisited, even when project scope changes. (See discussion of Oakland Airport Connector on page 3 of our comment letter.) This is a clear expression of MTC's priorities in project selection: what matters is upholding the political deal. The outcome is secondary--or tertiary.

This is why MTC's performance is so miserable. The agency is not focused on achieving results. This is also why MTC never looks back to evaluate its performance: it frankly isn't interested. It values its performance in political terms, not in transportation terms. While MTC makes a great show of evaluating performance measures, these evaluations are not actually used to screen out low-benefit projects.

Rather than regional planning, MTC sees its primary function as stapling together the wish lists of local jurisdictions and brokering deals. Even at this late date, MTC has still not realized that auto-dominated local priorities do not scale up to make a regional plan that can provide peak hour mobility. The very high auto mode share simply cannot be supported during peak periods. Congestion keeps getting worse, with an obvious trend line: gridlock straight ahead!

This leaves no hope for a better future. MTC refuses to recognize that its solutions, which are highway-oriented, aren't working and can't work in the future. MTC refuses to commit to a transit-first future. MTC's most expensive projects are adding HOT lanes to Bay Area highways, in obvious disregard of the last three items on this list of project selection factors--each of which plays only a minor role, or none at all, at MTC:

- a strategy of regionalism
- cost-effectiveness
- mode-shift
- GHG emissions reductions
- VMT reductions

The Bay Area has already done the experiment with politically driven projects supported by fanciful consultant projections. While we're not saying the agency is corrupt, the public is clearly getting negative value from the funds it entrusts with MTC. Is STA willing to move beyond the status quo to get results? If not, the outcomes are likely to look like MTC's.