VISION

Less than one per cent of megaprojects
deliver the promised benefits
on time and on budget.

We explain why they go wrong, how
you can fix them and why the fix works.

We also show how these lessons can
be applied to all capital projects of scale.

HOW TO FIX
MEGAPROJECTS
(and all capital projects that matter)

What is a megaproject?

Megaprojects are defined as capital projects costing $1bn or more. But there is a lot more to them than a price tag. We explore their other characteristics, why they're essential to our communities and how the lessons that we learn from them can be applied to all capital projects.

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How to fix megaprojects

We will take you through our proven four-step process for delivering all significant capital projects on time, on budget and with all the promised benefits. This encompasses transformational leadership, transformational governance, the sharing of risks and rewards, and commitment-based management.

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Why the fix works

Leading a megaproject successfully is like running a small town. Our fix works because it recognises the complexity of megaprojects, the importance of community building, and the reality that traditional management styles simply don't cut it when it comes to capital projects of scale.

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Willie Brown wasn't happy.

Faced with reports that his Transbay Terminal development was millions of dollars over budget, the former mayor of San Francisco, had a blunt message.

"News that the Transbay Terminal is something like $300 million over budget should not come as a shock to anyone," he wrote in a letter to his constituents. "We always knew the initial estimate was way under the real cost. Just like we never had a real cost for the Central Subway or the 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."[1]

Willie Brown was right about costs and cost expectations. Around 99% of megaprojects fail to deliver their promised benefits on time and on budget. But the big question is whether we should simply "get off it".

> "Around 99% of megaprojects fail to deliver their promised benefits on time and on budget"

At VISION and Relevate, we say no – we shouldn't get off it. Our teams have expertly guided several megaprojects (and many other significant capital projects) to completion on budget, on time and with all the promised benefits. An example of our work includes helping Intel shave 30% off the cost of building semiconductor fabrication facilities, enabling them to stay in a key sector they were in danger of being priced out of. We'll explore how we did it in a little more detail later.

Also, one another point before we get properly started: even if you're not involved in megaprojects, we think you'll find this paper useful. The learnings and best practice that we share here apply equally to capital delivery projects with budgets under $1 billion – particularly if they are of significant scale to you and your organization.

"The original cost estimate for the Boston Central Artery Tunnel Project (the Big Dig) was **$2.56 billion.**

In 1992, estimators revised the cost to $7.74 billion; then in 1994 to **$10.4 billion.**

When completed in 2007, the cost came in at **$15 billion.**

That is nearly **six times** the original budget.

That requires a hefty amount of 'getting off it', **especially if you're footing the bill.**"

What is a megaproject?

Megaprojects are large-scale capital projects typically costing $1 billion and beyond. While the cost bestows the 'mega' label, other defining factors include longer timescales, a multitude of active stakeholders, a significant impact on public and private enterprise finance, the project's future in markets, and the community it serves.

The size of scale, risk, and impact relative to the budget holder's enterprise value is clearly visible, and achieving the project's benefits becomes the central focus for the budget holder. As the project encounters unplanned difficulties, sacrifices are made, one on top of another, in pursuit of the benefit. Budget holders break agreements, collaborators become enemies, suppliers reduce quality, everyone accepts longer timelines, and costs spiral higher.

The number of megaprojects has regularly increased over the last 90 years – the period over which Bent Flyvbjerg, the Danish economic geographer, has been diligently tracking them. And it's not just the number that's gone up, it's the cost. The Joint Strike Fighter program is projected to be the first megaproject to come in at a cost of more than $1.1 trillion[2]. Megaprojects in the $50-$100 billion range, such as US and UK high-speed rail projects, are becoming common.[3] Global spend on megaprojects is now running at $6-9 trillion per year, or 8% of the global gross domestic product.[4]

And here is the shocker. At best, according to Flyvbjerg, only eight out of 1,000 (0.8%) deliver the promised benefit at the promised cost and on time.[5] Our investigations have shown a slightly higher success rate but, in either case, would you invest if you were told that you had only a 1% chance of hitting a sensible return?

Take the Boston Central Artery/Tunnel Project (the Big Dig). The original cost estimate was $2.56 billion. In 1992, estimators revised the cost to $7.74 billion; then in 1994 to $10.4 billion. When completed in 2007, the cost came in at $15 billion. That is nearly six times the original budget. That requires a hefty amount of "getting off it", especially if you're footing the bill.

"Sacrifices are made, one on top of another, in pursuit of the benefit"

Many people blame the estimators for the problem. Most theorists write about the overconfidence bias, the optimism bias, the planning fallacy (where planners do not adequately assess risks.) There is also 'strategic misrepresentation' - otherwise known as lying - which is sometimes excused by the so-called 'hiding hand' thesis of Hirschman.[6] Hirschman's theory is that, while we are over-optimistic about what we can do, we are also overly skeptical about how creative we can be in overcoming things that go wrong.[7]

Flyvbjerg debunks Hirschman, but Flyvbjerg's solution is no better than Hirschman's magical handwaving. According to Flyvbjerg, we should debias planners and estimators.[8] Welcome to your summer re-education camp.

Hearts and souls

Of course, there could be another solution to ending the mismanagement of megaproject budgets – simply get rid of megaprojects altogether. Could we not cap the scale of projects? Could we not build thousands of smaller, cheaper single-purpose fighter planes, rather than create a multi-purpose joint strike fighter? Businesses kept going when the earthquake damaged the San Francisco-Oakland Bay Bridge. Ferries, BART and other bridges carried people over the water. Why make such risky megaproject bets in the first place?

The main answer to this question is that we build these projects, even high-tech fabs, as testimony to the heritage and greatness of our community or organization. These are projects that demonstrate technological wonder by doing something never done before. They are often projects of aesthetic greatness and iconic beauty. They create economic impact in their marshalling of resources and their payments to all the workers involved. They establish monuments that will last for decades, even centuries, and it is very hard to put a value on such greatness.

"You don't have to blow your megaproject budget — not if you know what you're doing"

How much are the Egyptian pyramids worth? How much the Parthenon? How much the palaces of Venice? How much would we charge someone who wanted to tear them down? These testimonies to our greatness are essential to our hearts and souls.

But while megaprojects may be important to our communities, does that mean we should take Willie Brown's advice and "get off it" when it comes to their hefty price tags? We say that's nonsense. We know that you don't have to blow your megaproject budget – not if you know what you're doing, and we do. Our track record proves it. You can deliver the full benefits of your megaproject on time and on budget, and you can win hearts and souls. This may require changes in leadership, governance, commercial terms and culture, but we can help you do it.

Intel and BAA

Our favorite megaproject is one we worked on with Intel to build semiconductor fabrication facilities (fabs). About 10 years ago, Intel was facing a crisis. With chip technology developing according to Moore's Law (the observation that the number of transistors in a dense integrated circuit doubles about every two years), chip manufacturing had to develop even faster. 10 years ago, upgrading a fab would cost about $1 billion (including the tools installed). Today, a complete new fab costs in the range of $7-10 billion. At the rate that fab costs were increasing, Intel had to contemplate leaving the chip-making business altogether, and had already given up one major contract.

However, using a version of our Integrated Project Delivery and Commitment-Based Management™, we helped Intel and its

> "BAA invested in experts outside a traditional construction project team"

suppliers cut the cost of its fabs by 30%, and complete plants at the scheduled time, and to the specified safety standards.

A similar approach has been taken with several other megaprojects, such as BAA's construction of Heathrow's Terminal 5. This took place between two of the busiest runways in the world, near the busiest roadway in Europe, and was subject to intense environmental management conditions. Early modeling revealed that a truck needed to make a delivery every 10 seconds onto one of the highest security sites in the world. BAA, the owner of the project, took a long-term view of these conditions and invested in experts outside a traditional construction project team to develop a logistics strategy that could meet the unique challenges of the project. Unlike the Big Dig, the project was an overwhelming success, as was the investment in logistics infrastructure. Logistic costs on Terminal 5 were estimated at 7% of the total cost of work versus industry benchmarks of 12%.[9]

How to fix megaprojects

So how do you do it? How do you deliver your megaproject's full benefits on time and on schedule?

There are four key ingredients to making this work: transformational leadership, transformational governance, the sharing of risk and rewards, and commitment-based management.

1 Transformational leadership

The budget holder must take on the role of a strong, heroic leader fighting to change the way megaproject work is achieved, and developing leadership skills in partners. They will make it clear to all that they are willing to make significant sacrifices to work in a new way that makes the project come in on time and on budget with all the promised benefits. At Intel, leaders put their careers on the line.

Megaprojects require mega-leadership. This first means being willing to take moral risks, then share authority and build each other up, sometimes even competitors, for the sake of the project. In simple terms, here are the steps required:

- The leader assembles the suppliers for approximately seven weeks of program development, including setting out the goals of the program, a date for the completion of negotiations for the Integrated Project Delivery Contract, a date for the completion of the initial plan and schedule, and milestones for agreements on costs.

- During the seven weeks, the leader and their associates lead workshops on the new way of working and negotiate the activities, deliverables and costs in light of the new way of working. The budget holder's accountants work with the suppliers' accountants to develop an understanding that what both parties agree fairly represents the real costs.

- In these working sessions, the leader and their associates stand fiercely against the patronizing, policing behaviors of their own budget-holding organization and against any petty gameplaying among suppliers. To achieve this stance, the leader will surround themselves with highly experienced financial experts (former CFOs, for instance) and at

least one senior, experienced culture change expert. As a wake-up measure, the culture change expert delivers forceful criticisms of both the budget holder and the suppliers.

- The leader listens carefully to all the complaints about past behavior on similar projects, and takes on the smaller complaints seriously: problems with water at breaks, cleaning the restrooms, parking, scheduling lunch etc. Instead of solving these, the leader puts the suppliers together in small teams and gives them authority to come up with the solutions. Thus, the suppliers, often competitors, begin to learn to take each other seriously as colleagues and take ownership as co-leaders. There are many wake-up moments when coaches call out gameplaying and people have to take their authority seriously, like early common-law jurors realizing that they are deciding on the life and death of their neighbors. As these teams work through small problems, more come their way, and they get better at forming consensus and taking their authority seriously.

- As competence in working together grows, so does frustration over not solving the bigger problems. About seven weeks in, the leader declares a breakdown (usually because the negotiations over the Integrated Project Delivery Agreement have not come to completion), sets a deadline for completion and steps away to give the suppliers the opportunity to work it out among themselves.

- Once the suppliers pass this test, they are ready for a new style of governance and execution.

2 Transformational governance

This begins by establishing a policy organization, modeled on a board of directors. At least half of its membership should consist of people outside the project execution teams. Include likely antagonists. Any compensation this group receives should be directly tied to the project hitting its goals.

Then establish a top-level, longest time-horizon meeting with the most senior decision makers from the budget holder and all relevant suppliers who lay out the major moves of the project in six-month segments over its full length.

Next, create a second-level, monthly time-horizon meeting with project managers from the budget holder and all relevant suppliers and departmental discipline specialists (like finance, real estate, engineering design, procurement, and so forth) to lay out the project over a six-month to monthly timeframe.

And then, you also need a third-level, weekly time-horizon meeting with area managers from the budget holder and all relevant suppliers and their reports to focus on weekly commitments.

> "At least half of its membership should consist of people outside the project execution teams"

Except for escalation, govern these meetings identically:

● **Make decisions by consensus**

If participants of one of the lower level meetings cannot come to agreement, they can escalate. Participants at the top level establish a rule that they must come to agreement in a certain amount of time and, if they do not, a resolution principle comes into play: 'decision by majority, senior budget holder, or arbitrator'. Note, in our experience, this final principle is a mere technicality. We have never seen it invoked. There is too much of a premium on making things work.

● **Do things faster, cheaper or with added benefits**

At each meeting, find a way to do things faster or cheaper or with a better-than-expected benefit at current costs and times. Simple progress is not good enough. Each participant looks for ways in which their teams could:

> "Simple progress is not good enough"

- Do something in parallel with others.
- Do work ahead of others (for instance, surveyors doing a technical piece of work as they conduct the survey).
- Do work for multiple others (as in getting permits for all the work that can be done over a certain period of time).
- Do work that another team is nominally responsible for but where that other team is, for one reason or another, unavailable.

We have used this kind of coordination to cut cycle times by 50% and more, and costs by 10% and more.

● **Obtain approval for everything**
Secure approval on every plan or change in plan, budget and change in budget from the group at the next smaller time horizon. We call this the rolling planning or the last-actor planning system[10]. It prevents overly optimistic estimates and ensures buy-in to plans, which otherwise often go ignored.

● **Rotate the chair at each meeting**
This keeps discussions freshened up.

● **Coach for insights**
Members of the higher-level bodies should coach members of lower-level bodies on how to succeed. Coached properly, they will provide considerable insight (as opposed to oversight).

3 The sharing of risks and rewards
The key points here are as follows:

- Award contracts to suppliers on the basis of experience and skill, not on the basis of projected cost.

- Only engage in agreeing contractual terms once the accountants on the budget holder and supplier sides believe they are seeing genuinely open costs and books.

- Use legal experts with experience in these kinds of agreements. We recommend the Integrated (multi-party) Frame of Agreement or the Vested Contracting model developed at the University of Tennessee.

- Align all the parties to a common structure of goals such that all profits come out of savings made on the project as a whole, not individual parts.

- Create healthy incentives to reduce costs and innovate without jeopardizing shared rewards.

- Get real about managing risk. Accept that, in one way or another, the budget holder will pay when things go wrong. Set up the agreement so that suppliers make profits when things do not go wrong or when they make up for losses with savings elsewhere.

The point of these agreements is to undo all the rent-seeking, freeloading, hoarding, and similar behaviors that get in the way of work and to ensure that all available resources are used optimally: no waiting around. There is a premium on getting people to exercise their skills and talents. In practice, some participants might not earn as much revenue as they expected but, generally, all will earn higher profits.

4 Commitment-based management
Commitment-based management is modeled on the way agile, entrepreneurial start-up teams work:[11]

- All work is performed on the basis of a commitment of a performer to an internal or external customer, not individual professional judgements.

- All members of teams make commitments to each other for results for which the members are then responsible. In addition, all take on the additional commitment of supporting each other by picking up the ball if it is dropped.

- All team members listen for difference in what others say; they are trained against listening to hear what they expect.

- Each commitment is specific: requests are specific; negotiations clarify; questions are asked during execution; feedback is regularly given; clarifying insights never end as planning and work proceed. Each commitment has a precise standard of quality, time, and cost.

- Everyone on the project understands the local, global, and historical importance of the work being done and makes even small commitments in that light.

- Team members always decline requests that they cannot fulfill. They negotiate promises they can fulfill. There are no merely hopeful commitments.

- Operations meetings are focused on surprises that people encounter in trying to fulfill commitments. If there are no surprises, the work is not getting done.

- When some members of a team encounter unhappy surprises, they say so. They make adjustments as a team where other members try to make up for the surprise. Use the team to buffer against downsides.

- Everyone manages his or her own mood and identifies others who have fallen into bad moods, coaching them out of it. The common bad moods to watch out for are resentment, arrogance, fear, and most importantly resignation, which happens when people feel overwhelmed. These moods are early warning indicators of deeper problems that must be met as a team.

Why the fix works

When we take our clients to visit Intel, one thing they regularly say is: "I had to keep pinching myself to remember that I was talking to Intel and a group of its suppliers and not one team from one single company." And this happened months after we, Intel, and their suppliers had completed the work. How could there still be this solidarity?

Megaprojects put us in a very different world from other projects, where achieving and working with clear causal chains and role definitions usually solves problems. They require a completely different approach from conventional project and factory management.

Our approach, combining integrated project delivery with commitment-based management, draws on the way we act as members of a community, and the way that communities manage complexity and role integration. But this is not what we're used to doing in business.

Our predecessors created amazing institutions: highly-disciplined military organizations (think of Napoleon's armies or the Prussian military), hospitals, prisons, factories, grade schools and scientific laboratories.[12] In these institutions, people had narrow roles and were drilled in narrow skill sets. Managers observed and corrected relentlessly. People were classified by their propensity to learn certain skills and then by their competence. Managers kept records. These organizations were amazing because, by design, they functioned according to causal chains. Indeed, one of the founding ideas was to keep causal chains as independent as possible. That was obviously essential for scientific experimentation. But it is also critical for maximizing the benefits of division of labor.

On the assembly line, you want the person who puts the top on the bottle to be brilliant at that and the person who washes the bottle to be brilliant at that and you do not want one person trying to do it all. With such independent causal chains, it becomes possible to identify root causes when something goes wrong and then to make repairs.

> "On the assembly line, you want the person who puts the top on the bottle to be brilliant at that"
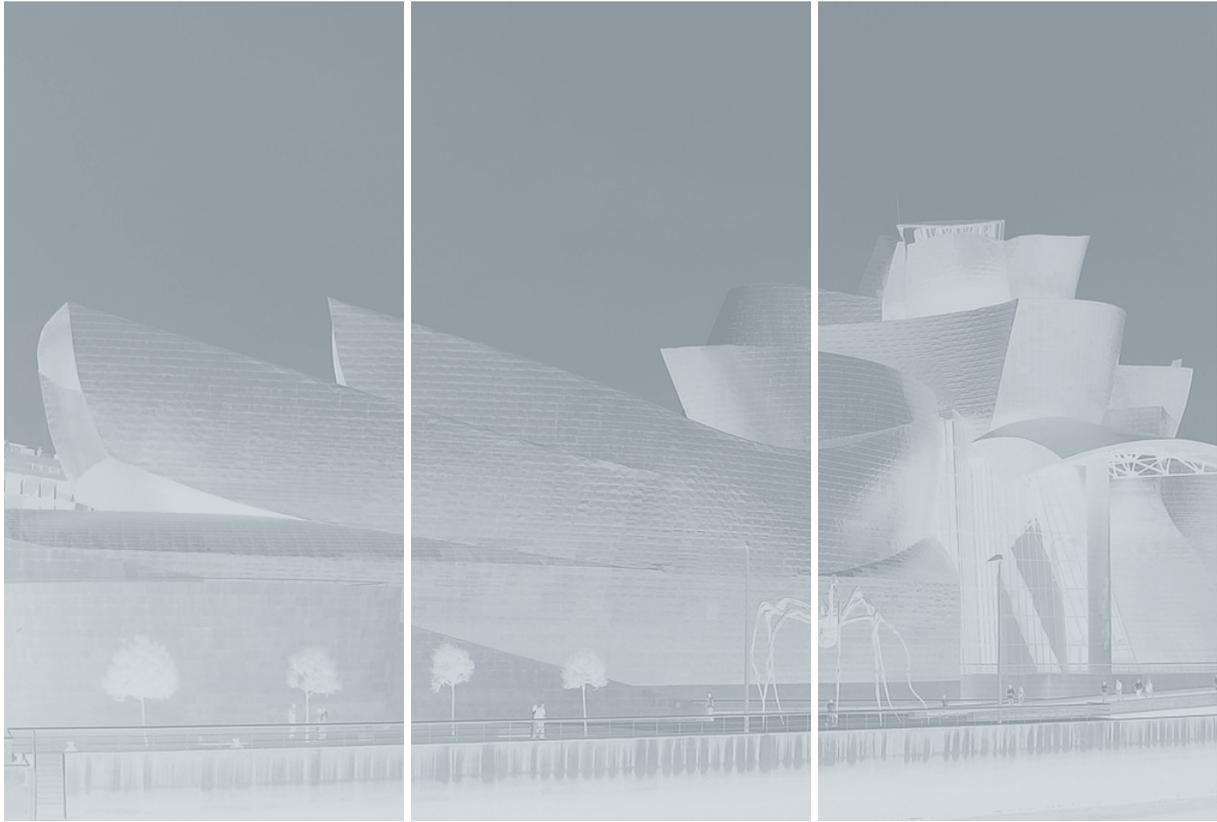
Communities not individuals

The French philosopher Michel Foucault describes how we came to think that many of our institutions were of this sort, and if they were not, that we should try to shape them up to function that way. The mistake that the world has made with megaprojects is to run them like these institutions. And the mistake that people working in megaprojects have made is to think of their role as the role of the individual, rather than being part of a community. Individuals make over-optimistic predictions of outcomes. They make autocratic decisions that prove defective. They give in to people on the ground, relax performance standards and miss deadlines. They lose their legitimacy. They create winners and losers. The way to resolve this is to think as a community rather than as an individual. That's what commitment-based management delivers.

It's this thinking that allows us to build successful megaprojects. We've named the Intel fabs and Heathrow's Terminal 5 but other famous successes, such as the Bilbao redevelopment project, the Guggenheim Museum Bilbao and the metro extensions in Madrid,[13] created communities too. Think too of the communities we had in the US during World War II and just after. Note that the Manhattan, Atlas and Polaris projects came in on time, within cost assumptions and with the expected benefits.[14]

To continue to build these glorious monuments without mega-heartbreaks, delays, cost overruns and reduced benefits, we have to build (and can build) glorious communities. That is what integrated project delivery with commitment-based management offers. You might have to pinch yourself to believe it, but it's true.

| "Think as a community rather than as an individual"

If you're involved in a megaproject or a capital project that is of significant scale to you, your organization or your community, we can help. Drop us an email at **capitalprojects@vision.com** or visit **www.vision.com/capital** where you can access more information about megaprojects, including our podcast series.

Written by Billy Glennon, Connor Butler, Chauncey Bell and Dr Charles Spinosa.

VISION is an international organization that helps businesses transform their operational practices, leadership, and culture for the long term – a combination that is essential for organisations managing capital projects of significant scale.

For capital projects, VISION also collaborates closely with Relevate (www.relevatewith.us), a skilled management consultancy with expertise in Lean Construction Strategy and program management, specializes in high-technology, complex projects, and has offices in the US and Europe.

Together, our portfolio includes capital delivery projects across high technology, infrastructure, utilities, commercial, retail and healthcare.

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Notes

1   Flyvbjerg, B. (2017). Did megaproject research pioneer behavioral economics? The case of Albert O. Hirschman. In B. Flyvbjerg (ed.) The Oxford Handbook of Megaproject Management, pp. 155-193). Oxford, UK: Oxford University Press, p. 155.

2   Flyvbjerg, B. (2017). Introduction. In B. Flyvbjerg (ed.) The Oxford Handbook of Megaproject Management, pp. 1-18). Oxford, UK: Oxford University Press, p. 5

3   Flyvbjerg, 2017, Introduction, p. 4.

4   Flyvbjerg, 2017, Introduction, p. 5.

5   Flyvbjerg, 2017, Introduction, p. 12.

6   Flyvberg, pp. 159 & 185.

7   Flyvbjerg, pp. 157-158.

8   Flyvbjerg, p. 185.

9   We recommend applying new tools such as Touchplan to integrate the delivery of construction on a scale impossible with traditional critical path approaches. This technology allows decision makers at the point of work to understand their impact on each other in real time and also allows project management teams to monitor real progress, not guesses and updates in GANTT charts.

10   Glenn Ballard is the lead creator of the Last Planner System. We learned it from Glenn Ballard, Greg Howell, Iris Tommelein, and Hal Macomber. See Ballard, H. G. (2000). The Last Planner System of Production Control [unpublished doctoral dissertation]. University of Birmingham.

11   See Sull, D. & Spinosa, C. (2007). Promise-based Management: The Essence of Execution. Harvard Business Review; Winograd, T. & Flores, F. (1987). Understanding Computers and Cognition: A New Foundation for Design. New York, NY: Addison-Wesley.

12   Michel Foucault wrote the contemporary classic. Foucault, M. (1979). Discipline and Punish. New York, NY: Vintage is the contemporary classic. Of course, Max Weber preceded Foucault with the basic picture. See Weber, M. (2019). Economy and Society. Cambridge, MA: Harvard University Press.

13   Flyvbjerg, p. 12.

14   Lenfle, S. & Loch, C. (2017). p. 24.

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