



How should governments  
prioritize infrastructure  
stimulus investments?

Why governments must look  
beyond cost-benefit analysis

# Introduction

As countries seek to recover from the ongoing COVID-19 pandemic, infrastructure spending is seen as a solution for stimulating economies worldwide. Infrastructure is often called the “backbone” of a healthy economy. Done right, infrastructure stimulus investments can not only hasten economic recovery from the effects of COVID-19, but can also accelerate progress in addressing other issues, such as social needs and the effects of climate change.

As public debt levels have increased dramatically through the COVID-19 crisis, governments must stretch stimulus investments as far as possible. Historically, cost-benefit analysis (CBA) has been used as a basis for sound project appraisal and project prioritization. However, in a best-case scenario, CBA provides only a limited view on the potential outcome of investments—and in a worst-case scenario, it can be downright misleading.

The inaccuracies associated with CBA have recently been the focal point of discussion and research in both academic and industry sectors. Most of the lesser criticisms of CBA emphasize that such tools are limited as they typically include only easily measurable costs and benefits, while ignoring the wider social impacts of infrastructure solutions, which we believe should feature heavily in infrastructure prioritization.

Other criticisms are more severe and call for reform while arguing that current CBA is inaccurate since it fails to consider variability and systematic biases that affect project outcomes. The inaccuracy of CBA was recently highlighted by Flyvbjerg and Bester (2022)<sup>1</sup>, who argue that cost and benefit estimates are inaccurate and biased and thus cannot be used to provide evidence around the worth of project investments. Table 1 shows the inaccuracies of base estimates by comparing the actual costs and benefits of various infrastructure investment types to their initial estimates:

**Table 1: Actual costs vs. initial investments of various types of infrastructure investment**

Investment type	Cost overrun		Benefit underrun	
	Number	Average	Number	Average
Dams	243	96%	84	11%
Bus rapid transit	6	41%	4	58%
Rail	264	40%	74	34%
Tunnels	48	36%	23	19%
Power plants	100	36%	23	6%
Buildings	24	36%	20	1%
Bridges	49	32%	26	4%
Roads	869	24%	532	4%
<b>Total</b>	<b>1603</b>	<b>39%/43%<sup>††</sup></b>	<b>786</b>	<b>6%/17%<sup>††</sup></b>

††) Weighted and unweighted average, respectively.

Source: Flyvbjerg & Bester (2022)

<sup>1</sup> Flyvbjerg, Bent and Dirk W. Bester, 2022, "How (In)Accurate Is CBA? Data, Explanations, and Suggestions for Reform," in José A. Gómez-Ibáñez and Zhi Liu, eds., Infrastructure Economics and Policy: International Perspectives (Cambridge, MA: Lincoln Institute of Land Policy), pp. 174-196, url: <https://cup.columbia.edu/book/infrastructure-economics-and-policy/9781558444188>.



As these numbers show, depending on investment type, cost-benefit ratios are overestimated by approximately 50% to 200%. Additionally, Flyvbjerg and Bester note that this estimate is likely conservative, as there is generally a selection bias in the reported costs and benefits—meaning that the forecast and actual figures are more likely to be reported if the projects perform better than similar projects, not worse. Hence, the actual performance of CBAs is 50% to 200% wrong at best. As a result, CBAs are providing a false sense of accuracy and misleading decision-makers.

Unfortunately, these problems are universal. Regardless of the investment type, location, or project timing, significant inaccuracy in CBA is prevalent, with minimal variation. This led Flyvbjerg and Bester to coin the expression 'cost-benefit fallacy' to reflect the phenomenon that "individuals behave as if cost-benefit estimates are largely accurate and unbiased, when in fact they are highly inaccurate and biased."<sup>2</sup>

Incorrect forecasting of infrastructure utilization can even change the CBA from positive to negative.<sup>3</sup> The risk of inaccurate CBAs is exacerbated when there are multiple projects managed by an organization, as is often the case for infrastructure projects (which typically have government oversight). Over-optimistic CBAs in

portfolios compound the risk exposure from underestimating costs and overestimating benefits.

A further limitation of CBA is that it does not take variation into account. Forecasting infrastructure projects involves estimating the future, which is inherently uncertain. Picking one specific number as the likely cost, schedule, or benefit from a project does not reflect this uncertainty. Likewise, forecasting with highly precise figures is also unrealistic. It would be difficult to reasonably justify why a road would cost \$19,846,394.65 as opposed to \$19,846,394.89. This is why it is often better to provide a range of potential outcomes. Given the level of foreknowledge at the planning stage, it is difficult to imagine a scenario where it is not more in line to say there is a 30% likelihood that the project will cost \$18 million to \$24 million. This level of variation also allows organizations to take account of the risk profile of the project. After all, a lower cost project may also carry higher risk and while this uncertainty lurks under the surface in a spot estimate, it can have major impacts.

To overcome the weaknesses associated with CBA, this paper explores current approaches to project prioritization and proposes several alternative strategies organizations can use to enhance the effectiveness of their infrastructure investments.

<sup>2</sup> Flyvbjerg, Bent and Dirk W. Bester, 2022, "How (In)Accurate Is Cost-Benefit Analysis? Data, Explanations, and Suggestions for Reform," in José A. Gómez-Ibáñez and Zhi Liu, eds., *Infrastructure Economics and Policy: International Perspectives* (Cambridge, MA: Lincoln Institute of Land Policy), pp. 174-196, url: <https://cup.columbia.edu/book/infrastructure-economics-and-policy/9781558444188>.

<sup>3</sup> Flyvbjerg, Bent, 2009, "Survival of the unfittest: why the worst infrastructure gets built – and what we can do about it", *Oxford Review of Economic Policy*, 25 (3), pp.344-367. Flyvbjerg, Bent, 2018, "Planning Fallacy or Hiding Hand: Which is the Better Explanation?", *World Development*, 103, pp. 383-386.



# Current approaches to prioritization

Project selection implies grappling with the relative exigency, efficiency, and effectiveness of investments. Several steps are needed to reach decisions that match policy guidance with project appraisal and subsequent investment.

## Project comparison based on CBA/Social CBA

CBA and Social CBA – a form of CBA based on taking account of wider social impacts, are used extensively in the United States, Chile, England, Ireland, New Zealand, Australia, Singapore, and many other countries to assess and prioritize alternative infrastructure projects, particularly those that demand significant investments. But in the past five years, the United Kingdom, Australia, and many US states have also published notes and guidance on the application of multicriteria decision analysis (MCDA), expanding the ‘Value for Money’ discourse to suggest structured ways of employing MCDA to incorporate key policy criteria. Some countries, such as Ireland, have imposed thresholds to guide when the government should apply Social CBA, multicriteria analysis, or more simple assessments, depending on the size of the proposed investment.

Appraisal and prioritization processes outside of the Organization for Economic Co-operation and Development (OECD) are largely undocumented, but evidence suggests that prioritization is often based on politics, loose qualitative assessments, or professional judgment, without clear principles underpinning selection.<sup>4</sup>

A study of 245 large dams<sup>5</sup> across the globe found that the cost-benefit ratios for these projects were often anticipated to be 1.4—meaning they were expected to deliver 40% more benefits than they cost to deliver. The result was a far cry from this. Almost half of the dams actually had a cost overrun of 40% or more. This held for the majority of dams, with three in every four dam projects experiencing a cost overrun. In fact, the mean cost overrun was 96%—almost double the forecasted cost. This inaccurate forecasting would certainly eat into that 1.4 cost-benefit ratio, leaving a net negative benefit.

<sup>4</sup>Petrie, Murray, 2002, A Framework for Public Sector Performance Contracting, OECD, <https://www.oecd.org/gov/budgeting/43514084.pdf>

<sup>5</sup>Ansar, Atif, Flyvbjerg, Bent Budzier, Alexander, Lunn, Daniel, 2014, "Should we build more large dams? The actual costs of hydropower megaproject development", Energy Policy, 69 pp. 433-56.

Amid increasing financial inequality, socio-economic changes, and movements for greater social justice, some governments are working to address systemic disadvantages and discrimination. One way they are doing this is through social procurement. New York has a target to award 30% of contracts by value to minority-owned businesses. They hold trade shows where original equipment manufacturers can meet with minority-owned businesses and secure suppliers.

Sustainability is another important business consideration being affected through procurement. There is widespread acknowledgement of the need for serious changes, as captured by the UN Sustainable Goal of Climate Action and the UN Paris Agreement that is legally binding on 193 countries and the EU as a signatory. Countries, cities, and international businesses are taking action to address climate change and meet net-zero emissions by 2050. For instance, Vodafone has committed to reaching net-zero carbon footprint for the activities of the company and its supply chain by 2040.<sup>6</sup> Sweden has made a legally binding commitment to meet net-zero emissions by 2045.<sup>7</sup> Toronto has a CAD\$11.2 billion budget for infrastructure, committing a substantial CAD\$4 billion of this specifically to green infrastructure. Additionally, they require that all new builds are net-zero.

While social procurement often has admirable aims, it can be challenging to execute them effectively. Efforts to prioritize women owned business (WOB) in Canada led to the formation of membership networks for WOB. These were paid for both by the WOB and the client organizations that sought to access the list. This created unnecessary barriers for both parties and made the purchase process less efficient.



<sup>6</sup><https://www.vodafone.com/sustainable-business/our-purpose-pillars/planet/net-zero-by-2040>

<sup>7</sup><https://www.government.se/articles/2021/03/swedens-climate-policy-framework/>



# Effective infrastructure prioritization

## Identify your stakeholders

Who is the true judge of project success? This is a more nuanced question than it initially appears. Infrastructure projects generally have clear definitions of 'what' and 'by who', but 'for whom' has many different answers. These stakeholders must be considered when shaping the 'what' and are fundamental to formulating the 'why' of a project: its purpose.

One school of thought consider a project successful if it delivers the specification to the planned time and cost. Another acknowledges that, whether or not these criteria are met, a project is not successful unless its purpose is fulfilled, and this is judged by a myriad of stakeholders. There is a difference between 'project success' (the project fulfills its purpose according to those for whom it has been delivered) and 'project management success' (the project delivers within specification, time, and budget), which has been explored by de Wit (1988) and Cooke-Davies (2002).<sup>8</sup> Typically, concerns related to project management success consider a shorter time frame than those for overall project success. The Channel Tunnel connecting France and England is a project that failed abysmally from a financial perspective (with an 80% project cost overrun and financing costs 140% higher than planned<sup>9</sup>), but is viewed well by users and could be seen as fulfilling the purpose of connecting the United Kingdom and mainland Europe.

Prioritizing infrastructure investments requires balancing the needs of different stakeholders: both the 'by who' of project delivery partners on behalf of governments, and the 'for whom' comprising residents,

visitors, commuters, families, groups, individuals, the disabled, children, voters, taxpayers, tourists, as well as people from different socioeconomic backgrounds, varying degrees of privilege and disadvantages, vulnerable parties and more. Each has a range of needs and requirements. Project delivery partners have a vested interest in project management success, but so too do societal stakeholders who, for taxpayers and residents, will have contributed to the cost and may have been inconvenienced by its delivery. Public opinion needs to be accounted for, as the public is an important stakeholder (and often the ultimate arbiter of whether a project has delivered value) both to the project in action and the project outcomes.

## Start early to capture the voice of the user

Incorporating changes earlier in the process is far cheaper than waiting until later, which is why it's so important to capture the voice of the user as early as possible. Meaningful public consultation must take place at an early enough stage for changes to be incorporated. If consultation simply intends to inform the community of what is taking place, it merely pays lip service to the process and raises the likelihood of substantial objection and public outcry. Projects should take pains to incorporate broad swathes of society in a meaningful way. Community engagement efforts often cater primarily to those with ample spare time, and this tends to limit feedback opportunities for less privileged people. Consider how best to engage others too. Rather than consulting on the specifics of an established project only, make consultation part of project selection. Use portfolio and project level stage gates before greenlighting projects and incorporate the community at earlier stages.

<sup>8</sup> De Wit Anton, 1988, Measurement of project success. International Journal of Project Management; 6. Cooke-Davies, Terry, 2002, The "real" success factors on projects, International Journal of Project Management; pp. 185-190.

<sup>9</sup> Flyvbjerg, B., Bruzelius, N. and Rothengatter, W., 2003. Megaprojects and Risk: an Anatomy of Ambition. Cambridge: Cambridge University Press.



### Thwart the cost benefit-fallacy

While most cost-benefit analyses are limited and inaccurate, CBA remains a good tool for analyzing investment outcomes when combined with tools that examine other financial aspects of an investment, such as the affordability of the project under different scenarios, the variability of outcomes to ensure the project portfolio properly balances high-risk and low-risk projects, and the dispersion of risks (e.g., whether the project's exposure to specific risks is too homogeneous to the risk exposure of the total project portfolio).

However, for CBA to provide any relevant insight for public investment policy and planning, it needs to be more accurate. Because cost-benefit estimates are prone to bias, they must be de-biased before they can reliably be used for prioritization purposes; otherwise, the prioritization itself will be biased. Bias affects any kind of behavioral forecast, and the only way to truly de-bias is by switching from "inside view" bottom-up estimating to "outside view" top-down estimating that uses historical data to develop estimates. One example of this is "reference class forecasting", a method to systematically take the outside view by implementing distributional information about actual estimation errors in previous investments to precisely assess the extent to which cost-benefit estimates for a planned venture must be adjusted before they can be considered de-biased. A recent study by J. Park (2021)<sup>10</sup> showed the practical relevance of using historical project performance data through reference class forecasting when making infrastructure investment decisions. Here, a before-and-after comparison of 107 major projects in the United Kingdom revealed that the average cost overrun declined from 38% to 5% following the introduction of reference class forecasting for business case estimation. The study

concluded that implementing this kind of forecasting method "can be used to reduce substantial financial risks for the government as well as social and economic welfare losses for society".<sup>11</sup> Another way to implement external data is through high-level benchmarking in early project stages, which can present quick evidence that can motivate and guide further research and investigation into project performance and performance drivers.

### Incorporate social impacts in prioritization

Infrastructure investments form a substantial part of most government budgets. The financial and socioeconomic power required to deliver infrastructure projects can be used to promote equality and access for the disadvantaged. To be effective, however, social considerations should be embedded in the CBA and project appraisal as integral elements rather than afterthoughts or add-ons.

Governments typically have multiple stages of review for infrastructure projects. One way to consider social impacts is by using community representatives in the appraisal process. This should be done before projects are approved and requires substantive input and considerations of different stakeholder groups. When addressing historically disadvantaged groups in particular, it is important for the chosen representatives to both act in and seen to be acting in the interests of that community, rather than solely for themselves. To avoid this perception and possibility, aim to work with leaders who originated from grassroots and community-led organizations, where possible.

<sup>10</sup>Park, Jung Eun (2021). "Curbing cost overruns in infrastructure investment: Has reference class forecasting delivered its promised success?" *European Journal of Transport and Infrastructure Research* 21(2):120-136

<sup>11</sup>Ibid



The case study below highlights how Canada has sought to use government procurement targets to encourage working with Indigenous peoples.



## Case Study: Indigenous People in Canada

In Canada, there has been a Procurement Strategy for Aboriginal Business (PSAB) since 1996, however its effect was not as significant as expected. In fact, in 2019 the Canadian Council for Aboriginal Business found that only 0.32% of government procurement by value had gone to indigenous businesses.<sup>12</sup> To remedy this situation, they called for a target of 5% procurement being granted to indigenous-led businesses. Later in 2019, the Canadian government further committed that 5% of procurement (by value) from its own projects would go to indigenous owned and controlled businesses<sup>13</sup> and that CAD\$35.2 million would be invested in

PSAB over five years. This was later reinforced by Prime Minister Justin Trudeau following his reelection in 2021.<sup>14</sup>

The full outcome of these targets is yet to be determined. One of the challenges Canada faces is that the government has a limited perspective on the full supply chain. While they can determine if a first-tier supplier is indigenous owned, they lack sight into secondary and tertiary suppliers. This supply chain blindness is not unique to Canada.

In the United States, the Small Business Administration supports small businesses and disadvantaged businesses. They offer registration as a small, disadvantaged business (SDB), women-owned small business (WOSB), veteran-owned small business (VOSB) and more. The federal government aims to award at least 5% of federal contracts by value to SDBs and 5% to WOSBs. However, one challenge of making a meaningful effort to incorporate social impacts in government procurement is that unscrupulous actors can try to fraudulently take advantage of these provisions. In fact, the FBI has been involved in the successful prosecution of several cases of fraudulent claims of acting as a minority and women-owned business enterprise (MWOBE). As such, accreditation as a MWOBE business is required. While the process varies from state to state and at the federal level, it is typically lengthy. The FBI also created a Procurement Collusion Strike Force in 2019. Its Director, Daniel Glad, announced in October 2021 that addressing 'set-aside fraud' (ineligible parties accessing procurement opportunities set aside for disadvantaged communities) is a top priority<sup>15</sup>. This task force's work has led to charges for wire fraud and conspiracy to defraud the government. To protect against fraudulent bad actors, some level of accreditation is required as a first defense, along with government enforced ramifications for fraudulent claims.



<sup>12</sup> Canadian Council for Aboriginal Business, 2019. Industry and Inclusion: An Analysis of Indigenous Potential in Federal Supply Chains. [online] Available at: <[https://www.ccab.com/wp-content/uploads/2019/05/CCAB\\_Research-Report\\_web.pdf](https://www.ccab.com/wp-content/uploads/2019/05/CCAB_Research-Report_web.pdf)>

<sup>13</sup> <https://pm.gc.ca/en/mandate-letters/2019/12/13/archived-minister-public-services-and-procurement-mandate-letter> <https://www.canada.ca/en/public-services-procurement/news/2021/08/government-of-canada-announces-federal-wide-measures-to-increase-opportunities-for-indigenous-businesses.html>

<sup>14</sup> <https://pm.gc.ca/en/mandate-letters/2021/12/16/minister-public-services-and-procurement-mandate-letter>

<sup>15</sup> <https://www.justice.gov/opa/speech/director-procurement-collusion-strike-force-daniel-glad-delivers-remarks-aba-section>

# Conclusion

Government infrastructure investments are significant, but governments often fall prey to prioritizing in a flawed manner. This prevents infrastructure from achieving its maximum potential impact, resulting in lost opportunities for the communities these projects are designed to serve. This negative impact is compounded by the opportunity loss of better options that do not proceed or which are allocated fewer resources. To effectively prioritize infrastructure projects, it's consequently important to apply the following principles:



## **Engage the community.**

Take meaningful action to incorporate the views of the wider community (and not just the most vocal or privileged) at an early enough stage to shape the project. In addition to mitigating against community action, this will allow project recipients to access the infrastructure that serves them best.



## **Thwart the cost-benefit fallacy.**

Don't rely solely on CBA. Get more robust estimates by using data-driven methods, such as reference class forecasting. Similarly, forecast communications should reflect an appropriate level of uncertainty and potential variation (e.g., there is a 40% to 60% chance that this bridge will cost \$35-\$50 million, rather than saying 'this bridge will cost \$35,131,879'). Combining these measures provides a more realistic forecast against which different infrastructure projects can be compared.



## **Embed social impacts and considerations throughout the project lifecycle.**

These should not be tacked on as an afterthought but weaved throughout the project, from inception at the portfolio level to the ultimate day-to-day operations. Use the infrastructure project to effect social good and change, as well as physical transformation.

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While there is a way to go before all infrastructure investments are properly prioritized, adopting these strategies can position governments to make less biased, more informed resource allocation decisions.

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