

# CHALLENGES AND TOOLS FOR *Determining Public Infrastructure Projects and Priorities*<sup>1</sup>

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*Governments, in their enthusiasm to expand investment in infrastructure, are keen to promote new models for financing public infrastructure. This focus on how to finance an infrastructure project presumes that a decision has already been taken that the investment is the best use of limited resources. We argue that policy makers should in the first instance aim to identify public infrastructure service needs, an appropriate role for government in meeting them, and priorities for public investment. These decisions are far from straightforward. However, given the scale and long-term nature of public infrastructure and the multitude of ways it can affect economic and social activity, there are significant benefits to be realised (and costs to be avoided) from getting these threshold decisions right. The central economic question then becomes how a project can be delivered most efficiently, including which financing mechanisms ought to be used. This paper examines the appropriate role of government in identifying and prioritising infrastructure projects which best meet public infrastructure service needs.*

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## **What is ‘public infrastructure’?**

‘Public infrastructure’ can be defined as infrastructure in which government has the primary role and responsibility for determining whether and how such infrastructure is provided and funded in the interests of the broader community. The economic rationale for government intervention is that socially beneficial infrastructure (that which delivers net social benefits) would otherwise be underprovided by the private sector. This may arise, for example, where services exhibit public good characteristics (i.e. are non-excludable and non-rival in consumption), network effects and/or positive externalities, or where a facility has natural monopoly characteristics. Governments may also become involved to address social or equity objectives (though from an economic efficiency perspective, such interventions should still pass a social net benefit test).

The case for government intervention based on market failure should be properly balanced against risks of government failure. A number of studies have explored the scope for government intervention to create inefficiencies, not least because of an absence of commercial disciplines, and distorted or absent market signals. Indeed, this has become a primary reason for increasing the involvement of the private sector in public infrastructure provision under a variety of different models (Krueger 1990; Winston 2006). All approaches involve efficiency trade-offs that need to be assessed on a case-by-case basis.

## **Challenges in identifying the ‘best’ projects**

Estimates of infrastructure ‘gaps’ or ‘deficits’ are prevalent in the policy discourse on infrastructure (for example, OECD 2006; Dobbs et al. 2013), and might indicate a need for new and continued investments in infrastructure (either private or public). However, such estimates should not substitute for effective processes to ensure that public infrastructure service needs are properly identified, the appropriate role for government determined, and the highest value projects selected for public funding. Poorly chosen projects run the risk of diverting resources from more socially productive activities. Challenges in identifying the best projects include the prevailing institutional and governance arrangements, the lack of a market mechanism to signal demand, the sheer range of options available and the network nature of many infrastructure projects.

The link between infrastructure investment and broader macroeconomic indicators, such as growth and productivity, has been extensively considered and debated in the literature.<sup>3</sup> However, there is widespread agreement that the institutional and governance arrangements applying to public infrastructure influence the quality of decisions about project selection (PC 2014; Woetzel and Pohl 2014). The importance of good process is demonstrated in a recent paper by Gupta et al. (2014). In the paper, project selection and implementation processes were identified as important factors affecting the marginal productivity of both public and private infrastructure.

An ongoing challenge for governments is meeting or striving for 'best practice' institutional and governance arrangements. This policy goal applies whether government is the investment:

- > decision maker (allocating public funding to a publicly owned project)
- > facilitator (setting the overarching policy and regulatory framework), or
- > partner (establishing a public-private partnership).

Poor governance, combined with vested interests, rent seeking, principal-agent problems, and the political process, can result in poor, uncoordinated decisions about project design and selection (Robinson and Torvik 2005; Keefer and Knack 2007; PC 2014). Identifying the best projects is especially challenging for public infrastructure services where there is no market mechanism, such as a commercial price signal or profitability, to signal future needs, consumer willingness to pay, or the need for capacity adjustments (or there are constraints on an operator's ability to vary prices to test these matters). For example, the lack of direct user charging for most roads or cost-reflective pricing for many public transport systems means governments must rely on other tools to judge the case for capacity expansion.

Even when the need for an infrastructure service or its expansion has been identified, there is potentially a wide range of options to address this need in the short or long term, creating challenges for governments in selecting between investment options of different nature, size and scale (Banks 2008). Options might include more efficient use of existing infrastructure or policy/regulatory changes to facilitate efficient private sector investment. For example, overcoming barriers to the adoption of new technologies, such as adjustable lane technologies for roads, has been identified as a way of improving efficiency and extending the life of existing infrastructure assets (Winston 2014). In Australia, the Productivity Commission has observed that pricing policies and regulation have created incentives for underinvestment in the urban water sector and overinvestment in electricity transmission infrastructure (PC 2011, 2013).

Further complicating matters, the network nature of many public infrastructure assets means that investment in one element of the system could have important system-wide impacts. Network externalities need to be considered in the planning process, as do other interdependencies, such as disruptions during construction phases and the competition for scarce construction resources. For larger projects in particular, the effective sequencing of investments might offer economies of scope or avoid higher per unit costs due to capacity constraints.

### **Challenges in prioritising the 'best' projects**

Investments in public infrastructure are typically made in the presence of real resource and funding constraints. Therefore, it is relevant to consider not only the costs of planning, building and operating the infrastructure, but also the opportunity costs of raising taxes or diverting public funds or resources from other uses. This highlights the importance of prioritising the best projects once infrastructure needs have been identified. Challenges in prioritising the best projects include the appropriate use of cost-benefit analysis, avoiding inappropriately favouring large projects, and considering how the scope for user charges might affect prioritisation.

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### **Robust social cost-benefit analysis is not straightforward**

Cost-benefit analysis is used in many countries as an assessment tool to help guide and improve public sector appraisal and prioritisation of public infrastructure projects. However, putting together a rigorous social cost-benefit analysis of all relevant infrastructure investment options is rarely a straightforward exercise. Public infrastructure investments typically involve both positive and negative spillovers that can be difficult to identify or quantify. There is often debate about key inputs to the analysis, such as which costs and benefits should be included (including how wider economic and social benefits should be handled), treatment of risk and uncertainty, and the choice of discount rate. Decision makers are also often confronted with 'optimism bias' in estimates from project proponents (Flyvbjerg 2009).

The quality of, and weight given to, cost-benefit assessments can also vary widely (Ergas and Robson 2010; Mackie 2010; Pickford 2013). Some governments have attempted to address these challenges by establishing 'best practice' standardised frameworks and guidelines for the use of cost-benefit analysis. For example, in Australia, the Department of Finance provides a *Handbook of Cost-Benefit Analysis* (DOFA 2006). Many texts and studies also provide important insights for the application of social cost-benefit analysis assessments to public decision making in general, and the various pitfalls that have befallen assessments in the past (Layard and Glaister 1994; Mishan and Quah 2007; Boardman et al. 2010; PC 2014).

### **Selecting between large and small projects**

There is a risk that in some circumstances decision makers may have incentives to prioritise, or proponents will advocate, larger 'iconic' public infrastructure projects at the expense of smaller projects or the more efficient use of existing infrastructure (Flyvbjerg et al. 2003; Ergas and Robson 2010; PC 2014). However, ensuring that the public gets the best value does not necessarily mean prioritising major public infrastructure projects. For example, Dobbs et al. (2013) cite estimates that the average benefit-cost ratio (BCR) for 'traditional' road capacity is 2.7, while that for the use of intelligent traffic management is 14 and that for optimised traffic signals is 17. Infrastructure Australia's latest *National Infrastructure Priority List* also indicates that 'smaller' projects (by estimated capital value) often have higher forecast BCRs (Infrastructure Australia 2013).

Further, where investments involve considerable risk and uncertainties, it can be beneficial for governments to evaluate the 'option value' of delaying a large and substantially irreversible commitment of capital until more information becomes available and/or making smaller-scale investments in the short term to retain longer term flexibility (Dixit and Pindyck 1994). Where appropriate, these types of options can be evaluated using a 'real options' approach to ex ante investment appraisal, and as an augmentation to a robust cost-benefit analysis (PC 2014).<sup>4</sup>

### **The funding task – gap between user charges and costs**

In the presence of government funding constraints, another relevant issue in thinking about the application of cost-benefit analysis and prioritisation of projects is the size of the 'gap' between user charges and the total costs of a project. For public infrastructure, the larger this gap the greater is the funding task of governments (i.e. from tax revenue). There is an important distinction between the 'funding' and 'financing' of infrastructure. Funding is how the total investment costs, such as capital costs, are repaid over time – either through users, other beneficiaries or taxpayers (IFWG 2012; Maddock 2013). Funding also involves meeting the ongoing operating costs, including maintenance, where there can be a trade-off between investment at the construction phase and costs during operation. Financing is raising money upfront to pay for the capital costs, which usually involves the design, construction and early operational phases of a project, through debt or equity instruments of a public or private nature.

The size of the gap between user charges and total costs of a project might influence project selection and prioritisation. For example, where the government is concerned about debt and long-term budget pressures it could lead to decision makers favouring projects that are largely funded through user charges, that is, choosing low or no gap projects regardless of the overall costs and benefits. On the other hand, there might be limits and challenges to levying direct user charges in some public infrastructure sectors even where they can be justified on economic grounds (such as technical, institutional or policy barriers), or if user charging is in conflict with other government objectives.

## Government tools available to promote high-quality decisions

### Robust and transparent analysis

As discussed, the institutions and planning frameworks through which decisions about public infrastructure are made (including project selection and prioritisation) have an important bearing on the quality of decisions.

Entrenching rigorous and transparent use of cost-benefit analysis in the project appraisal process should improve the quality of, and impose discipline on, public infrastructure investment decisions (Ergas and Robson 2010). A well-constructed social cost-benefit analysis of all viable options for addressing a recognised need is an essential tool for identifying the best option. Transparency of the analysis is critical as this ensures that there is scope for independent audit or testing of the key assumptions underlying the analysis, improves stakeholder engagement, and ultimately should improve the quality of public investment decision making (Freebairn and Cordon 2013; PC 2014).

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### Expert scrutiny and independent advice

A notable development in some countries has been the establishment of specialist institutions to advise on public infrastructure decision making and project delivery. The specific role of these institutions, the extent to which they draw on private sector expertise, and their degree of independence from government varies in each case (Box A). Some (such as Infrastructure Australia) advise on matters relevant to the 'project selection' decision stage. Others focus more on project delivery issues once an investment decision has been made.

The capacity for specialist institutions to improve the quality of decision making has been recognised in some studies (as has their varied nature of success), particularly where they provide an added avenue to ensure independent scrutiny and greater transparency of project selection and prioritisation decisions (Armitt 2013; Freebairn and Cordon 2013).

#### **BOX A: Examples of specialist infrastructure advisory institutions**

Infrastructure Australia (IA) — A statutory body that advises the Australian Government on a range of infrastructure policy issues. As part of its role, IA evaluates nationally significant infrastructure proposals put forward for funding (including through reviewing the associated cost-benefit analysis (Infrastructure Australia 2014).

Infrastructure UK — A unit within the UK Treasury Department. Its main responsibilities are co-ordinating and simplifying the planning and prioritisation of investment in UK infrastructure, and improving UK infrastructure by achieving greater value for money on infrastructure projects and transitions. The unit is made up of civil servants and private sector commercial experts (HM Treasury 2014).

PPP Canada — Established as a federal Crown corporation, with an independent Board of Directors reporting through the Minister of Finance to Parliament. Among other responsibilities, it administers the P3 Canada Fund, which provides funding support to eligible P3 (PPP) public infrastructure projects (PPP Canada 2014).

### **Long-term planning and project ‘pipelines’**

There is widespread agreement on the importance of governments developing and publishing national long-term infrastructure plans, with these plans often forming a core part of internationally accepted principles guiding public infrastructure financing (see OECD 2013 for a recent example). However, the case for whether these plans need to take the form of a list of specific projects with firm timelines (what is often referred to as a ‘project pipeline’) is less clear.

On the positive side, a national plan might assist in the forward planning of resources by identifying long-term priority areas and policy goals for infrastructure investment, and should assist in improving coordination between different levels of government and government agencies. They can also assist in addressing short-termism associated with the political cycle, and providing information to both the public and potential private investors. To achieve these aims, transparency is crucial, and there should be scope for the plan to be updated as infrastructure needs evolve.

On the negative side, focusing on publishing a pipeline of specific projects with defined timelines stretching out beyond the short-term might provide a false sense of certainty to private investors. More problematically, a pipeline might lock governments into projects that no longer provide the best value for money to taxpayers as new information becomes available. Ideally, private parties seeking to be involved in future public infrastructure projects should be able to combine the priorities in a national infrastructure plan with the results of the rigorous and transparent cost-benefit analyses of individual projects to ascertain what might be in ‘the pipeline’ (PC 2014). Such a pipeline would be both flexible and credible.

This high degree of transparency is the ideal. However, in practice, governments take a range of approaches in the level of detail provided on priority national infrastructure projects. This ranges from almost no information in the case of many low income countries, to the UK’s annually updated 100-plus page National Infrastructure Plan (which includes an assessment of infrastructure needs and strategic objectives, a ‘top 40’ list of priority investments and an estimate of the total infrastructure pipeline costs out to beyond 2021 (HM Treasury 2013)).

### **Consideration of cost-reflective pricing where appropriate**

Where there are clear linkages between user benefits and costs, it is generally desirable from an efficiency perspective to link consumer’s willingness to pay with charges for use of the infrastructure. User charges provide signals for efficient use of infrastructure once deployed, can be used to test and signal the need for future capacity adjustments, and minimise (or even eliminate) the need for government funding (PC 2014). In addition, user charges, and the scope providers have to vary prices, can provide incentives for service innovation.

In considering the design and implementation of user charges, decision makers must consider other relevant trade-offs, such as the transaction costs of implementing and administering pricing systems, and other relevant policy, regulatory or legal impediments. Moreover, in some instances structuring user charges based on the full recovery of costs may conflict with other economic and social policy objectives of providing the infrastructure. For example, a rationale often put forward for subsidising public transport networks is as a second-best tool for reducing congestion on roads where user charges are infeasible (Parry and Small 2009; Button 2010).

Where the balance and design of user charges and other funding sources (taxes) affects the efficiency of the project (and measured benefits or costs) this is a relevant factor to feed back into the cost-benefit analysis process.

### **Conclusion**

With a focus on the need for new infrastructure investment, infrastructure financing issues are high on the policy agenda in many countries. However, the merits of any investment should be properly considered before thinking about how to finance it. Further, the source of financing itself does not fundamentally alter the economics of a project. As such, a necessary threshold step is ensuring that public good infrastructure projects — that is, ones that generate the highest net benefits to the community of all available options — are identified and prioritised by governments.

Undoubtedly, governments face a range of challenges in ensuring that the ‘best’ infrastructure projects are selected and prioritised. However, there are some clear best practice tools available to governments to ensure that scarce public resources are channelled towards the right projects at the right time. One of those tools is establishing or moving towards best practice institutional and governance arrangements. Another tool is conducting high-quality cost-benefit analyses that are made available for public scrutiny. These benefit from relevant expertise and independent advice and allow for consistent comparison of project options and projects across different sectors. The use of prices through user charges, where practically possible and economically justified, can also provide valuable signals on future infrastructure needs as well as providing incentives for more efficient use of existing infrastructure.

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These tools do have their own financial and non-financial costs on government, but these should be viewed as an ‘investment in investment’, much like a private firm conducting due diligence before undertaking an investment on behalf of its owners.

## Notes

1. This article draws heavily on Poole, Toohey and Harris (2014), a paper presented at a March 2014 conference on ‘Financial Flows and Infrastructure Financing’ jointly sponsored by the Lowy Institute for International Policy, Productivity Commission and Reserve Bank of Australia.
2. The authors of this paper are Emily Poole, International Department, Reserve Bank of Australia and Carl Toohey, Senior Research Economist, Productivity Commission. Views expressed in this article are those of the authors (Poole and Toohey 2014) and not necessarily those of the Reserve Bank of Australia or Productivity Commission. Use of any results from this article should clearly attribute the work to the authors and not to the Reserve Bank of Australia or Productivity Commission.
3. Literature reviews by Romp and de Haan (2005) and Straub (2008) indicate that although some studies find that infrastructure investment has a high positive impact on growth, others find negative or zero returns, and significant empirical challenges remain (not least the direction of causality). A recent working paper finds only a weak positive association between investment spending and growth, and lagged impacts are not significant (Warner 2014).
4. Brealey et al. (2014) describe options to modify projects — delay, make follow-on investments, abandon or vary output — as ‘real options’ and note that the opportunity to make such decisions adds value whenever project outcomes are uncertain. An extensive literature on the development and use of ‘real options’ analysis in a wide range of contexts has developed over the past 20 to 30 years.

## References

- Armitt, J 2013, *The Armitt Review*, review on long-term infrastructure planning commissioned for the UK Labour Party’s Policy Review, September.
- Banks, G 2008, ‘Riding the third wave: Some challenges in national reform’, presentation to the Melbourne Institute and The Australian Economic and Social Outlook Conference, New Agenda for Prosperity, Melbourne, 27–28 March.
- Boardman, AE, Greenberg, DH, Vining, AR and Weimer, DL 2010, *Cost-Benefit Analysis: Concepts and Practice*, Pearson Series in Economics, 4th Edition, Prentice Hall, Upper Saddle River, NJ.
- Brealey, RA, Myers, SC and Allen, F 2014, *Principles of Corporate Finance*, The McGraw-Hill/Irwin Series in Finance, Insurance and Real Estate, Global Edition, McGraw-Hill/Irwin.
- Brearley, RA, Cooper, IA and Habib, MA 1997, ‘Investment appraisal in the public sector’, *Oxford Review of Economic Policy*, vol. 13, no. 4, pp. 12–28.
- Button, K 2010, *Transport Economics*, 3rd Edition, Edward Elgar Publishing, Cheltenham.
- Department of Finance and Administration (DOFA) 2006, *Handbook of Cost-Benefit Analysis*, Financial Management Reference Material, no. 6, rev. ed., Department of Finance and Administration, Canberra.
- Dixit, A and Pindyck, R 1994, *Investment under Uncertainty*, Princeton University Press, Princeton.
- Dobbs R, Pohl, H, Lin, D-Y, Mischke, J, Garemo, N, Hexter, J, Martzinger, S, Palter, R and Nanavatty, R 2013, *Infrastructure Productivity: How to save \$1 trillion a year*, report from the McKinsey Global Institute, January.
- Ergas, H and Robson A, 2010, ‘Evaluating major infrastructure projects: How robust are our processes’, in *Strengthening Evidence-based Policy in the Australian Federation, Volume 1: Proceedings Roundtable Proceedings*, Productivity Commission, Canberra, pp. 127–67.
- Flyvbjerg, B 2009, ‘Survival of the unfittest: Why the worst infrastructure gets built — and what we can do about it’, *Oxford Review of Economic Policy*, vol. 25, p. 3, pp. 344–67.



- Flyvbjerg, B, Bruzelius, N and Rothengatter, W 2003, *Megaprojects and risk: An anatomy of ambition*, Cambridge University Press, Cambridge.
- Freebairn, J and Cordon, M 2013, 'Vision versus prudence: Government debt financing of investment', *Melbourne Institute Working Paper*, no. 30.
- Gupta, S, Kangur, A, Papageorgiou, C and Wane, A 2014, 'Efficiency-adjusted public capital and growth', *World Development*, vol. 57, pp. 164-78.
- HM Treasury 2014, *Infrastructure UK – About us*, 8 August, available at <https://www.gov.uk/government/organisations/infrastructure-uk/about>.
- HM Treasury 2013, *National Infrastructure Plan 2013*, December.
- Infrastructure Australia (IA) 2014, 'Infrastructure Australia', 3 November, available at <http://www.infrastructureaustralia.gov.au/>
- Infrastructure Australia 2013, 'Infrastructure priority list update – December 2013'.
- Infrastructure Finance Working Group (IFWG) 2012, *Infrastructure finance and funding reform*, report to Infrastructure Australia, April.
- Keefer, P and Knack, S 2007, 'Boondoggles, rent-seeking, and political checks and balances: Public investment under unaccountable governments', *Review of Economics and Statistics*, vol. 89, no. 3, pp. 566-72.
- Krueger, AO 1990, 'Government failures in development', *The Journal of Economic Perspectives*, vol. 43, no. 3, pp. 9-23.
- Layard, R and Glaister, S 1994, *Cost-Benefit Analysis*, Cambridge University Press, Cambridge.
- Mackie, P 2010, 'Cost-benefit analysis in transport – A UK perspective', *Joint Transport Research Centre Discussion Paper*, no. 16.
- Maddock, R 2013, 'Principles for Australian infrastructure finance', *Monash University Department of Economics Discussion Paper*, no. 55/13.
- Mishan, EJ and Quah, E 2007, *Cost-Benefit Analysis*, 5th Edition, Routledge, New York.
- Office of the Infrastructure Coordinator 2014, 'Attachment A', Submission to the Productivity Commission Inquiry into Public Infrastructure.
- Organisation for Economic Co-operation and Development (OECD) 2013, *G20/OECD High-Level Principles of Long-Term Investment Financing by Institutional Investors*, Developed by the OECD Task Force on Institutional Investors and Long-Term Financing, September.
- OECD 2006, *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity*, vol. 1, OECD Publishing, Paris.
- Parry, I and Small, K 2009, 'Should urban transit subsidies be reduced', *The American Economic Review*, vol. 99, no. 3, pp. 700-24.
- Pickford, M 2013, 'State highway investment in New Zealand: The decline and fall of economic efficiency', *Policy Quarterly*, vol. 9, no. 3, pp. 28-35.
- Poole E, Toohey, C and Harris, P 2014, *Public infrastructure: A framework for decision-making*, Proceedings of a Conference jointly hosted by the Lowy Institute for International Policy, Productivity Commission and Reserve Bank of Australia on Financial Flows and Infrastructure Financing, Sydney.
- PPP Canada 2014, 'PPP Canada – About us', 8 August, available at <http://www.p3canada.ca/en/about-us/>.
- Productivity Commission (PC) 2014, *Public Infrastructure – Volume 1*, Productivity Commission Inquiry Report, 27 May.
- PC 2013, *Electricity Network Regulatory Frameworks*, Productivity Commission Inquiry Report, no. 62, Productivity Commission, Canberra.
- PC 2011, *Australia's Urban Water Sector*, Productivity Commission Inquiry Report, no. 55, Productivity Commission, Canberra.
- PC 2006, *Road and Rail Freight Infrastructure Pricing*, Productivity Commission Inquiry Report, no. 41, Productivity Commission, Canberra.
- Robinson, JA and Torvik, R 2005, 'White elephants', *Journal of Public Economics*, vol. 89, nos. 2-3, pp. 197-210.
- Romp, W and de Haan, J 2005, 'Public capital and economic growth', *EIB Papers*, vol. 10, no. 1, pp. 40-70.
- Straub, S 2008, 'Infrastructure and growth in developing countries: Recent advances and research challenges', *World Bank Policy Research Working Paper*, no. 4460.
- Warner, AM 2014, 'Public investment as an engine of growth', *IMF Working Paper*, no. 148.
- Winston, C 2006, *Government failure versus market failure: Microeconomics policy research and government performance*, AEI-Brookings Joint Center for Regulatory Studies, Washington DC.
- Winston, C 2014, *How the private sector can improve public transportation infrastructure*, Proceedings of a Conference on Financial Flows and Infrastructure Financing, Reserve Bank of Australia, Sydney.
- Woetzel, J and Pohl, H 2014, 'Infrastructure: Doing more with less', *World Bank Policy Research Working Paper*, no. 6882.