Service Performance Indicators for Infrastructure Investment

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ABSTRACT

Infrastructure systems serving modern economies are highly complex, highly interconnected, and often highly interactive. The result is increased complexity in investment decision-making, and increased challenges in prioritising that investment. However, this prioritisation is vital to developing a long-term, sound, robust and achievable pipeline of national infrastructure.

One key to effective, objective and prudent investment prioritisation is understanding the real performance of infrastructure. Many metrics are employed to this end, and many are imposed by governments or regulators, but often these metrics relate only to inputs or outputs in a production process. Whilst these metrics may be useful for delivery agencies, they largely fail to address the real expectations or requirements of infrastructure users — quality of service, safety, reliability, and resilience.

What is required is a set of metrics which address not outputs but outcomes — that is, how well does the infrastructure network meet service needs? This paper reports on a study undertaken at a national level, to identify service needs across a range of infrastructure sectors, to assess service performance metrics in use, and to show how they or other suitable metrics can be used to prioritise investment decisions across sectors and jurisdictions.

Keywords: Infrastructure Investment, Performance, Service, Metrics

THE PROBLEM OF PRIORITISATION

Developed and developing economies depend on effective infrastructure for communication, transport, energy and health. However, infrastructure systems serving modern economies are highly complex, highly interconnected, and often highly interactive. This complexity grows as society's expectations grow, as 'big data' availability grows, as cities become 'smarter', and as system reliability and resilience become more important. The result is increasing complexity in investment decision-making, and increased challenges in prioritising that investment. However, in order to develop a long-term, sound, robust and achievable pipeline of national infrastructure, which grows national productivity while maintaining a prudent and sustainable level of investment, it is exactly this *prioritisation* that is critical.

Governments across the globe recognise this challenge. Government budgets struggle to balance income against growing expense lines for health services, education provision, and other essentials, while debate continues over the level of debt that a nation should contemplate in order to maintain or expand its long-term infrastructure investment. For many nations, this means that the "infrastructure deficit" is growing[1], while the national budget is constrained

1 Eg. Infrastructure Australia, *June 2013 National Infrastructure Plan*, p6, at http://www.infrastructureaustralia.gov.au/coag/index.aspx

in its ability to respond. Finding a way to prioritise that investment such that it contributes to the greatest possible improvement in national productivity and welfare is therefore critical, but is also complicated and contentious.

Part of the complication is that infrastructure is delivered by a wide range of agencies. State road and rail agencies, national aviation agencies, water corporations, energy networks, and telecommunications corporations all have their own objectives, their own ways of evaluating projects, their own delivery mechanisms, and their own methods of measuring output and value delivered. Each operates to its own technical standards and pricing regimes, each has its own regulatory bodies, each interacts with the private sector in different ways, and each engages with the wider community differently.

How then can a nation take an informed and objective view on national infrastructure priorities, in the midst of such complexity? How can a robust pipeline of investment be planned, maintained, tuned for changing conditions, and delivered? How can the basis of prioritisation be formulated and communicated to multiple stakeholders and communities, who may have conflicting priorities and points of view?

THE ROLE OF CENTRAL INFRASTRUCTURE AGENCIES

Any robust long-term pipeline of priorities must be based on detailed infrastructure planning. Yet much of this planning is undertaken not at a central or federal level, but by individual agencies responsible for managing State or other networks, whether transport or utilities. These agencies have access to information and resources beyond that which is readily available to central agencies.

In this context, we suggest that there are three critical roles for a central infrastructure agency:

a. to gather, coordinate, validate and disseminate data that will help agencies determine objectively how well they are meeting national infrastructure needs, and where their challenges and opportunities lie;

b. to ensure that the best projects filter through proposal and review processes, such that they can be prioritised for investment; and

c. to coordinate and cross-check that the key national priorities have been fully addressed by the aggregate of agencies' priority projects, and if not, to either adjust prioritisation or provide federal intervention, guidance and funding.

INFRASTRUCTURE PERFORMANCE, SCORECARDS AND RATINGS

To properly identify needs, and to prioritise those needs, the agency therefore must have a clear knowledge of current infrastructure *performance*. This study was undertaken to assess which performance metrics are being, or should be, employed to measure and report on our infrastructure, across sector and jurisdictional boundaries. The study aimed to identify, where possible, metrics already in use and publicly available, as its intention was to assist agencies in understanding the strengths and weaknesses, and the potential application, of various metrics or benchmarks. In particular, we sought to identify measures of *outcome*, as distinct from *output* or *input*, as our focus was on the *service performance* of infrastructure – how it meets the needs of the end user.

This focus on ***service performance*** is critical, as agencies will be better equipped to prioritise investment if they have a good understanding of how the outcomes of that investment are valued by the consumer. Similarly, this same understanding can enable a central infrastructure agency to better prioritise investments *across different infrastructure sectors*.

A range of 'Infrastructure Scorecards' has been developed in an attempt to represent holistically the condition of national infrastructure. Engineers Australia produces an annual *Infrastructure Report Card*[2], and the American Society of Civil Engineers produces a similar appraisal of US infrastructure[3]. More broadly, 'City Rating' systems abound. The Globalisation and World Cities Research Network developed in 1998 a ranking of "world cities"[4]. In 2008, AT Kearney

2 http://www.engineersaustralia.org.au/infrastructure-report-card

3 www.infrastructurereportcard.org

4 Taylor, Peter J, *World City Network: A Global Urban Analysis,* Globalisation and World Cities Research Network (2003)

with others initiated a ranking of global cities[5]. Monocle publishes annually *The Most Liveable Cities Index*[6], as an assessment of Quality of Life, and the Economist Intelligence Unit produces the *EIU's Global Liveability Ranking and Report*[7]. In an attempt to create some consistency of approach, the International Standards Organisation (ISO) has just released a standard indicating data which should be collected by a city, and the definitions and criteria to be used in collecting and reporting that data[8]. Whilst this is not a mandatory standard, it is a serious attempt to encourage cities to measure their own performance in a way that is consistent and comparable with others. This is a very useful thing to do; however, it assesses city-wide performance, not the service performance of individual water or power networks, or specific segments of a road or rail network. It therefore is not of great help in determining where investment should be prioritised.

To address these challenges, this study takes as its 'exam question' the following:

What metrics are currently in use to measure infrastructure outcomes or service performance, and how could they be adapted or adjusted to provide a basis for sound infrastructure investment prioritisation across sectors and jurisdictions?

APPROACH TO THIS STUDY

The approach taken to this study was to focus on "nationally-significant infrastructure", being transport, energy, communications and water infrastructure in which investment will materially improve national productivity[9]. Directing those investments is normally based on an "investment logic"[10] that links inputs to a set of outputs, which in turn contribute to achieving the desired outcomes and impact. For example, capital investment (input) might be directed towards constructing 10km of national highway (output), which is undertaken to improve travel safety and reliability (outcome) and thereby improve national productivity (impact). Much infrastructure reporting provides inputs and outputs as indicators of performance, but as the OECD has noted:

"… more spending should not be confused with better outcomes, as the size of [infrastructure sectors] says little about their impacts on welfare … outputs are often taken as proxies for outcomes"[11]

We therefore sought to develop a framework of ***outcome*** indicators across the chosen infrastructure sectors. This was done by a desk study of information made publicly available by state and federal agencies and network operators. Reference was also made to studies to determine which aspects of infrastructure are valued by users.

Across all infrastructure types, users are primarily concerned with the ***quality of the service provided.*** The concept of a 'good quality' infrastructure service can be unpacked into several outcomes groupings which are relatively consistent across different types of infrastructure:

- *reliability*: the ability of the infrastructure to meet normal or current demand (eg. proportion of trains running on time, road congestion in response to normal traffic demand)
- *stability*: the consistency of the infrastructure service provided (eg. drops in water pressure, surges in electricity)
- *safety*: the safeness of the infrastructure for those who use it (eg. microbial levels in water, frequency of road accidents)
- *resilience*: the ability of the infrastructure to respond in the event of unusual demand (eg. road congestion in response to unusual event, internet download speeds).

It should be noted that 'efficiency' is not considered as an outcome for the purposes of this framework. Efficiency is a measure of outputs divided by inputs, for example kilometres of road laid per number of hours worked. In this sense,

5 http://www.atkearney.com/documents/10192/dfedfc4c-8a62-4162-90e5-2a3f14f0da3a

6 http://monocle.com/film/affairs/quality-of-life-survey-2013/

7 https://www.eiu.com/public/topical_report.aspx?campaignid=Liveability2013

8 ISO 37120:2014, *Sustainable development of communities -- Indicators for city services and quality of life.*

9 See for example the Infrastructure Australia Act 2008 (No 17, 2008) – Section 3

10 See for example the Investment Logic Map process used by the Department of Treasury and Finance, Victoria at: www.dtf.vic.gov.au

11 Pisu, M., Hoeller, P. and Joumard, I. 2012, *Options for Benchmarking Infrastructure Performance*, OECD Economics Department Working Paper No.956, OECD: Paris. P.5

it does not measure an outcome that is of direct importance to the user — apart from the influence it may have on the price paid to access the infrastructure. It is clearly of importance to those who fund infrastructure, however this is outside the scope of this framework, as a poor efficiency outcome with respect to price would often necessitate a non-infrastructure solution (such as incentives to encourage competition).

OBSERVATIONS AND FINDINGS

In undertaking the investigation, and reviewing indicators against the framework above, we found a plethora of metrics. As expected, many were input or output measures, particularly of capital invested or quantity of infrastructure constructed. However, across Australia and around the world, there were also a considerable number of *outcome* indicators in use. These are outlined below.

The water sector in Australia operates under the National Water Commission's *National Performance Framework,* which identifies 188 indicators and sub-indicators. In the UK the Office of Water (Ofwat) uses a small set of key performance indicators on which utilities must report, and in New Zealand an industry association (Water New Zealand) undertakes performance benchmarking. From this analysis, combined with the findings of Victorian research into customer expectations, we have proposed four key performance indicators for urban water infrastructure.

The energy sector analysis focussed on electricity generation, transmission and distribution, and drew upon the Australian Energy Regulator's reporting regime, performance indicators from Australia's largest energy retailers, the UK's Office of Gas and Electricity Markets annual *Transmission and Distribution Reports*, the Annual Report from Contact Energy in New Zealand, and customer satisfaction studies by energy networks and Canstar Blue. From our analysis, we have proposed three key performance indicators for the electricity sector.

The communications sector performance is indicated by the Australian Communications and Media Authority (ACMA) in its *Communications Report* and the Government's *Broadband Availability and Quality Report*. International approaches include the UK's Office of Communications *Infrastructure Report* of communications speeds against the threshold minimum performance guaranteed under the Government's Universal Service Commitment on internet access. From our analysis, and review of ACMA's consumer survey on internet service provision, we have proposed four key performance indicators for communications infrastructure.

The road transport sector performance is measured at both state and national level, and Austroads (covering Australia and New Zealand) reports annually on 72 indicators in its *National Infrastructure Performance Web Report*. In a similar way, the US National Cooperative Highway Research Program provides a summary of performance indicators, as does Canada's Ministry of Transport Business Plan. Our analysis, combined with a review of transport user priorities identified in the Australian Transport Council's *National Guidelines for Transport System Management in Australia*, and similar guidance from Transport for NSW, has led us to recommend four key performance indicators for road transport infrastructure.

The freight rail transport sector study focussed initially on freight rail using Commonwealth-owned interstate freight rail networks. Performance indicators are published by the Australasian Railway Association, the Bureau of Infrastructure, Transport and Regional Economics (BITRE), and the Australian Rail Track Corporation (ARTC). Safety-related indicators are reported by the Australian Transport Safety Bureau. Similar data is measured and reported in the UK by Network Rail and by the Office of Rail Regulation. The latter also undertakes a regular survey of existing and potential freight rail users, and their service priorities. From our review and analysis, we have recommended four key performance indicators for freight rail infrastructure.

The commuter rail transport sector reports nationally on safety performance through the Australian Transport Safety Bureau. Beyond that, the sector tends to report by operator, primarily on the proportion of scheduled operations that actually run, and the proportion of scheduled trains that run on-time. Internationally, associations such as CoMET (Community of Metros), Nova, and ISBeRG (International Suburban Rail Benchmarking Group) report similar metrics. Operators variously assess user priorities, and in 2006 the Australian Transport Council undertook an extensive literature review of both stated and revealed user preferences. From our review and analysis, we have recommended five key performance indicators for commuter rail infrastructure.

CONCLUSIONS, RECOMMENDATIONS AND NEXT STEPS

Our study revealed a very wide range of infrastructure performance metrics in use across Australia and globally. These are employed for varied purposes, and report a considerable span of inputs, outputs, outcomes and impacts. From an infrastructure user's perspective, however, the *outcomes* are of primary interest and importance. This study has therefore focussed on identifying key outcome performance indicators across five sectors, arriving at nineteen such indicators.

These key performance indicators, for the very reason that they capture users' perspectives, also provide critical insights for infrastructure investment agencies at state and national level. Whilst input and output data are important measures of progress within the agency, our national investment must be guided by the outcomes it is delivering for infrastructure users.

The framework we have proposed provides a mechanism which could be used to compare performance across sectors, across jurisdictions, and importantly, between different parts of a network. This makes it an important part of the prioritisation toolkit. Further work is required to enable it to be used by lead agencies to proactively identify areas potentially in need of further investment. This work includes:

- collecting data for each indicator from the relevant sources, at an agreed geographical level;
- quantifying the cost of under-performance in each sector, to enable a cross-sectoral comparison of gaps and needs; and
- depicting the results of the performance management framework in a way that is engaging and that allows for easy identification of under-performing areas within a sector.

In this way, the greatest areas of need, and the greatest opportunities for improving national productivity, could be identified and evaluated in a framework that is meaningful to policy-makers and delivery agencies. This understanding is key to the objective prioritisation of infrastructure investment in Australia and in many other nations.