

John Boshier

# INFRASTRUCTURE INVESTMENT

## Supporting Better Decisions

This article is about making decisions on infrastructure. It is about widening the menu of methods used to evaluate infrastructure investment proposals. The article summarises the findings and recommendations of the report *Infrastructure Investment: supporting better decisions*, produced by the New Zealand Centre for Advanced Engineering (CAENZ) hosted at the University of Canterbury (Boshier et al., 2010).<sup>1</sup> The objective of the infrastructure study is to examine whether existing frameworks fully capture the goals of increasing the productivity of the economy and improving the social and environmental outcomes of infrastructure projects.

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John Boshier is a Company Director of several not-for-profit organisations and Project Director for the Centre for Advanced Engineering in Christchurch. He is also a consultant on energy and organisational matters. Previously he was Executive Director of the National Generators Forum, the representative body for Australia's electricity generators. For five years he was Chief Executive of Engineers Australia, the professional institution for all engineers.

Investment in public infrastructure is a key driver of the economy. It delivers a wide range of services that underpin the material standard of living of all New Zealanders. Modern society relies on infrastructure for domestic markets to function efficiently, for export goods to be produced and for social interaction to occur. The OECD suggests that investment in infrastructure, particularly in network infrastructure such as transport and communications, boosts long-term economic output more than other kinds of physical investment.

Investing in productive infrastructure is one of six policy drivers in the government's Jobs and Growth Plan for New Zealand, intended to help the country recover from the effects of the global financial crisis. Such infrastructure investment is designed to help increase the growth in productivity, maintain high levels of employment, improve our resilience to adverse events, and close the gap with Australia by 2025.

The Resource Management Act (RMA) has, for some time, been the *bête noire* of the development community, while decision-making practice has been somewhat under the radar. Refinement of the approvals processes for projects of national significance and other enhancements were enacted with the 2009 amendment to the RMA. More changes are to come under phase two of the reforms.

The CAENZ study has developed a complementary agenda for reform. It is designed to enhance decision making on infrastructure investments to augment the current tools, which are considered to be too narrow. It is fair to say that New Zealand has been generally slow to adopt extensions to cost-benefit analysis. Leaders in decision making have commented that evaluation does not at times match their intuition.

The emphasis now being placed on the role of infrastructure investment comes at a time when there has been a growing realisation that New Zealand is suffering the consequences of under-investment in network infrastructure as a proportion of GDP in the 1980s and 1990s (Figure 1).

It is now timely for this review. The publication of the National Infrastructure Plan (The Treasury, 2010) provides a platform that was previously absent. There are now improved analytical tools which can support decision makers seeking to understand wider economic benefits, network effects and opportunities, resulting in real options. There are also effective methods for incorporating a range of social, cultural and environmental factors into the assessment. Together with extended economic analysis, they can achieve the intent in the National Infrastructure Plan of improving the

advice provided to decision makers. These tools will provide a richer evaluation of infrastructure proposals being considered by government and the private sector.

Some aspects of our recommendations can be implemented simply through information and training. Others require some investigation and demonstration. All require the adoption of a rigorous and more standardised process by decision makers and analysts alike.

### Strategy in operation

The first main theme of the report is the need to 'operationalise' the government's strategy for infrastructure. When the study team interviewed a number of leaders of decision-making organisations, many commented on the need for a strategy for infrastructure development. The National Infrastructure Plan does provide a backdrop to enable government agencies and the private sector to better co-ordinate the provision of infrastructure. That said, an overall strategic framework for infrastructure investment is missing. Sector-specific legislation and policy statements are relied on to provide guidance for project appraisal.

Some of the concerns about the lack of a strategy may be addressed by greater transparency in the reporting of

analyses and decisions, and by 'closing the loop' through benefits management plans and benefits realisation testing. An important element would be the development of indicators to provide the (sometimes missing) link between vision and analysis, and which are then used to assess outcomes.

Accordingly the study makes recommendations to:

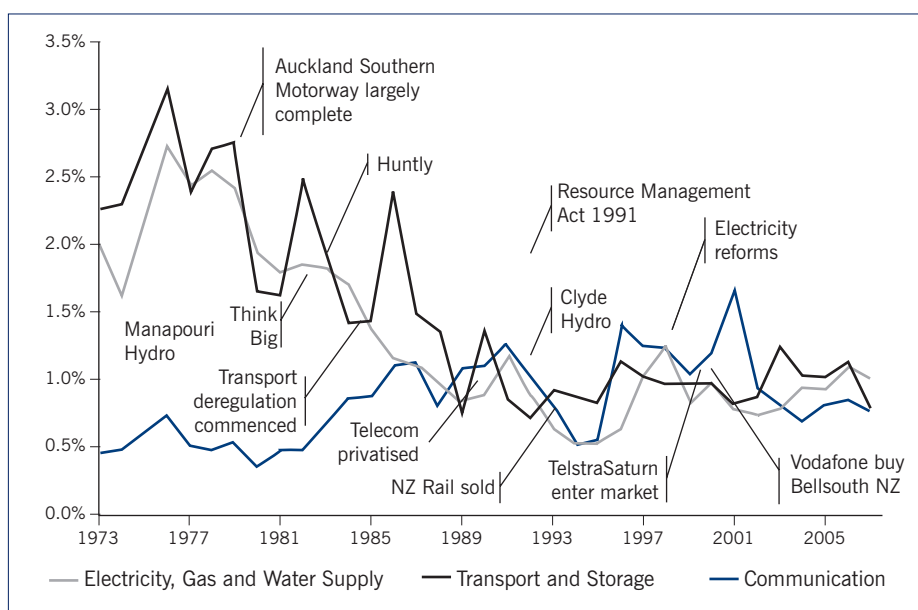
- augment the government's long-term vision and strategy for infrastructure investment with quantified performance indicators and national criteria for project selection, and include these in the National Infrastructure Plan;
- operationalise the relationship between strategy, project planning and evaluation through the use of logical framework analysis which clearly defines the links between ends, means, measures, assumptions and resourcing; and
- establish an ongoing programme of publication of analyses of investment proposals to provide increased transparency on infrastructure investment advice and decision making.

### The scope of projects

The second important theme is the need to properly define the scope of infrastructure projects. The way a project is scoped and the bounds of the effects that are evaluated are central to maximising the productivity of investments. Silo-thinking can inappropriately limit the scope of a project or curtail the assessment of benefits that might occur. Investment logic mapping is increasingly being used to provide rigour to the process of deciding the scope of a project, whether government intervention is required, and the outcomes that are expected.

Network effects are a core issue in project definition, in terms of making sure that the scope of the project that is assessed captures the full range of potential effects within a network. The effects of an enhancement to one part of a network depend on the consequences or enhancements to other parts. This can mean that all enhancements appear individually uneconomic even when

Figure 1: Infrastructure investment as a proportion of GDP



Source: New Zealand Council for Infrastructure Development

## The 'bottom-up' approach builds on the benefits of a more standardised approach to analysis recommended by the study by enabling a portfolio of high-performing projects to be built up which have been evaluated on a comparable basis.

the enhancements would all appear worthwhile when viewed collectively.

What constitutes the 'network' that should be analysed is not a simple

question. It is not always the collection of links in a single mode system like a motorway network. The New Lynn Transit Centre is a good example, where

the network comprised elements of rail, road, bus services, car and passenger access and commercial building development. Analysing any one of these would have served little purpose. The whole integrated combination of interacting components needed to be analysed and compared with its alternatives.

The interest in real options for the analysis of infrastructure investments arises because providing improved infrastructure can create opportunities for further investments. One classification defines five types of real options:



This symposium will examine the key economic, social, environmental and political challenges facing the Pacific. It will address the nature, relevance and implications of resilience. In particular, it will consider economic development and environmental issues and progress and prospects for achieving the Millennium Development Goals.

The aim is to encourage debate about, and critical analysis of, some of the key economic, social, environmental and political challenges facing the Pacific. It will facilitate dialogue amongst researchers, officials, the diplomatic community and non-governmental organizations.

Speakers include

- Hon Murray McCully, Minister of Foreign Affairs
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- Tuiloma Neroni Slade, Secretary-General Pacific Islands Forum Secretariat, Suva

- Carol Flore-Smrecznik, United Nations Development Programme, Pacific Centre, Papua New Guinea
- Professor Biman Chand Prasad, University of the South Pacific
- Sister Lorraine Garasu, Nazarene Rehabilitation Centre, Bougainville
- Dr Adrian Macey, Institute of Policy Studies and UNFCCC
- Amanda Ellis, Ministry of Foreign Affairs and Trade
- David Sheppard, Secretariat of the Pacific Regional Environment Programme
- Associate Professor Winnie Laban, Assistant Vice-Chancellor Pasifika, Victoria University
- Professor John Overton, School of Geography, Environment and Earth Sciences, Victoria University
- Professor Graham Hassall, School of Government, Victoria University
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- waiting-to-invest option: holding the necessary resources available to make an investment, but waiting until the time to do so is propitious;
- growth option: building an asset that can have its capacity expanded at a later date;
- flexibility option: the ability to alter the course of the investment after it is built;
- exit option: the ability to get out of or run down an investment if it proves to be redundant, or to have its life extended if it has ongoing value beyond its design life; and
- learning option: making an investment enables the holder to learn about an uncertain quantity, technology or opportunity.

Cost-benefit analysis has not conventionally included the potential benefits that might come from subsequent projects or developments, except in the petroleum industry. Where projects have clearly identifiable consequences in enabling other projects to go ahead, then it is valid to include this value in the project assessment.

The importance of options created by certain infrastructure investments means that a standard needs analysis may need to be supplemented by an ‘opportunities analysis’. Some caution is needed when the possibility is purely speculative. Rather than attempt a doubtful valuation, it may be better to assess the extent to which the project falls short of breaking even without including any option value. The question for decision makers is then whether they are prepared to believe that the option is worth at least that much. It is for these reasons that the report makes recommendations to:

- promote the use of investment logic mapping and the inclusion of the governance viewpoint at project inception to add rigour to problem identification, to ensure wide coverage in options definition, and to capture opportunities;
- undertake investigations to show how the value of ‘real options’ might be incorporated into analyses of infrastructure investments; and
- extend the use of the State Services Commission’s Gateway review process

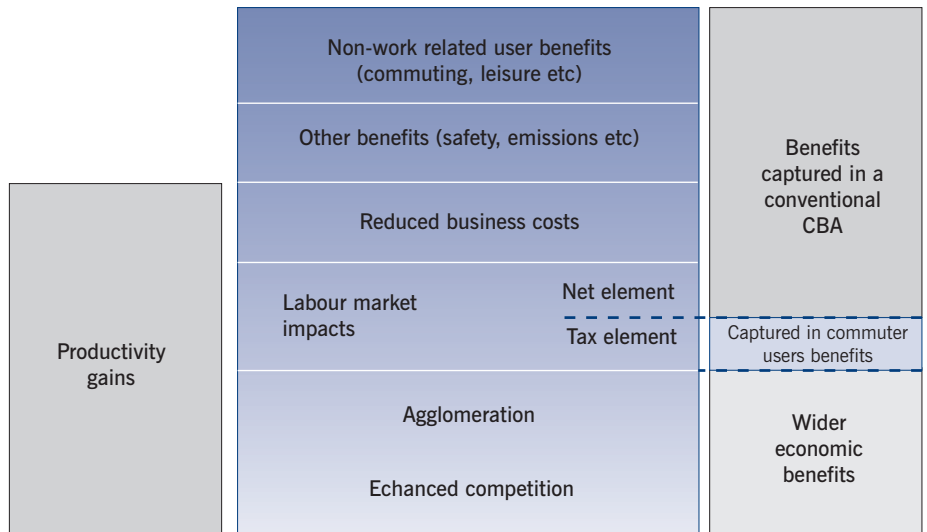
across the public sector, including agencies and local government.

**Wider economic effects**

Wider economic effects derive from improving the efficiency with which markets operate through agglomeration, through mitigating existing market failures, and through an increased output in imperfectly competitive markets.

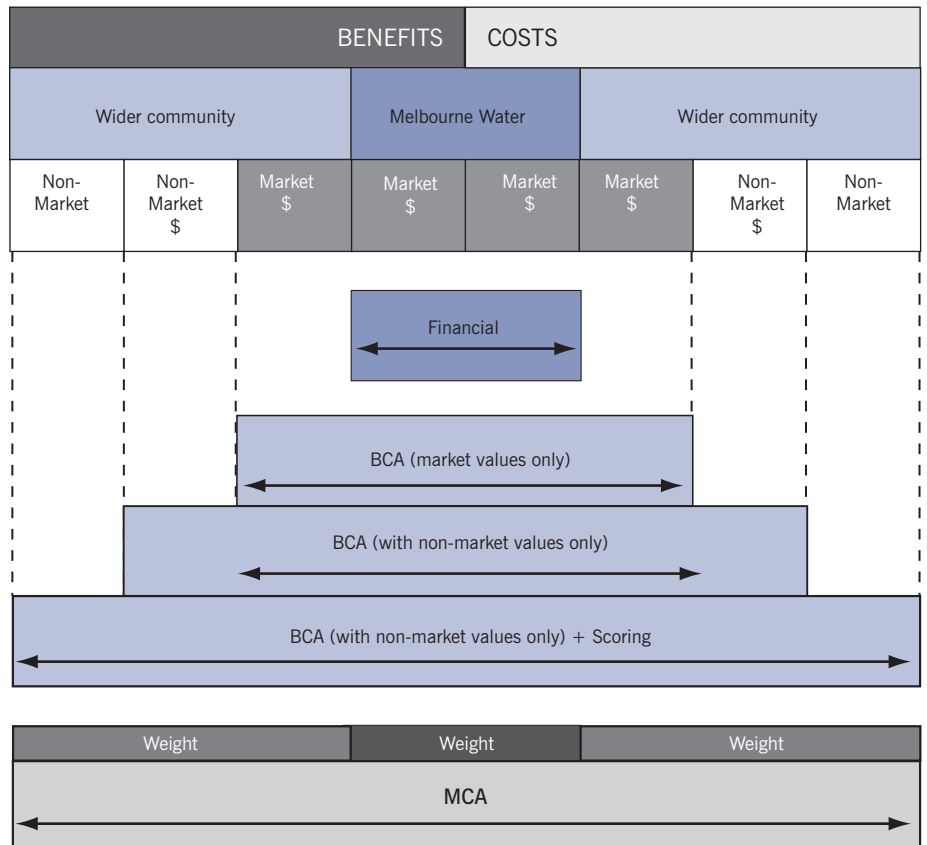
Improvement in transport links improves efficiency in a number of ways, including the facilitation of closer production linkages. In sectors where there are economies of scale, this results in productivity improvements, raising efficiency as well as the volume of production. Reduced barriers also enable businesses to relocate to more central locations to gain further economies of

**Figure 2: Productivity gains identified by extended cost-benefit analysis**



Source: Dialogue Consultants

**Figure 3: Overview of triple bottom line assessment**



Source: Melbourne Water

scale while still accessing the resources they need from the hinterland.

Such agglomeration benefits are typically the most important of the wider economic effects. They are additional to the benefits captured in a narrowly-defined cost-benefit analysis appraisal. Wider economic effects can also include other improvements to the efficiency of economic activity, through enhanced competition, labour market effects, taxation, trade gains, and technology and knowledge transfer.

A trial application of the method developed for the UK Department for Transport commissioned by the New Zealand Transport Agency (NZTA) examined the Waterview motorway extension project. NZTA established the workability of the method in New Zealand. The wider economic effects calculated in that study added another \$250 million, or 23%, to the conventionally captured benefits. While the method in this case is specific to road transport, the same general principles apply in other sectors.

To give confidence to the assessors of projects that wider economic effects have been properly examined, the report makes recommendations to:

- require a benefit management plan for every major infrastructure project; and
- investigate benefit realisation on a range of past investments to determine lessons that can be learned and identify exemplars for the promotion of good practice to be used with the portfolio of methods.

#### Productivity gains

The CAENZ research has identified an approach to the vexed question of selecting the most productive infrastructure investments after exploring both ‘top-down’ and ‘bottom-up’ approaches. The preferred approach is ‘bottom-up’, by considering the productivity gains offered by individual projects and network-based programmes based on an extended cost benefit (Figure 2). The ‘bottom-up’ approach builds on the benefits of a more standardised approach to analysis recommended by the study by enabling a portfolio of high-performing projects to be built up which have been evaluated on

a comparable basis.

Comparisons can be made between sectors by identifying projects which may have high benefit-cost but which were not funded due to budget constraints. There may be a case for switching funds into the sectors with more high-value projects, especially those which offer high productivity gains.

#### Standardised methods and presentation

One of the more interesting frameworks for systematic and sequential analysis is that used by Melbourne Water with its triple bottom line (TBL) assessment, illustrated in Figure 3. What differentiates a triple bottom line assessment from a purely financial assessment is the extent to which it takes into account the broader effects on the environment and the community. Within these TBL guidelines, at least one and usually two of four different evaluation techniques are used to define the ‘optimal’ solution, in the following sequence:

- financial analysis;
- benefit-cost analysis (BCA) with wider costs and benefits that are monetised; and
- multiple criteria analysis (MCA).

The financial analysis is used to differentiate between options on the basis of the cash flow implications to Melbourne Water, while benefit-cost analysis and multiple criteria analysis are used to account for wider effects on the environment and society.

An important feature of the Melbourne Water approach is that the weighting used in the multi-criteria analysis is based on widespread consultation, based on the understanding that ‘the weight given to factors and the identification of relevant distinguishing factors is subjective and cannot be decided by “experts” in isolation’. Sensitivity analysis, changing the discount rate and modelling probability distributions for uncertain effects are then used to incorporate risk and uncertainty in the decision making.

The CAENZ report makes recommendations to:

- undertake a pilot benchmarking project across a range of central and local government agencies on the quality of

analytical methods and tools used for infrastructure investment;

- prepare and foster the adoption of a standard portfolio of analytical tools and indicators to ensure comparability of investment proposals that would capture monetised user benefits, wider economic effects, network effects, life cycle costing, and effects that cannot be monetised (principally social and environmental); and
- develop a process using the standardised project assessments to present the economic benefits and productivity gains of projects and programmes in different sectors, to inform the discussion of budget allocation between sectors and develop a portfolio of high-performing investments.

#### Conclusions

This study by the Centre for Advanced Engineering is designed to support those leaders in Cabinet, councils and company boards who are responsible for making decisions to invest in infrastructure. The authors intend it to be complementary to the government’s Jobs and Growth Plan for New Zealand. We have explored what it means to invest in productive infrastructure, and how the wider economic benefit may be captured, and made specific recommendations on techniques to give greater assurance on the evaluation and delivery of projects.

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