



**Developing Strategic
Approaches to
Infrastructure Planning**

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The International Transport Forum

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The full list of Working Group members appears as Annex B.

Foreword

Infrastructure underpins both national economies and the wider quality of life people enjoy. It provides the physical and digital connectivity needed to transport goods, exchange ideas, and stay in touch with family and friends, as well as powering homes and businesses and supplying the water that keeps people alive. Infrastructure networks account for a substantial proportion of both government and private sector investment, and, given its scale, it is critical that such investment is deployed effectively. Poor infrastructure investment decisions can lead to congestion, wasted resources and environmental harm; improving decision making can deliver increased benefits over many decades.

That is, however, easier said than done. The very long timescales for developing and delivering infrastructure, which mean that the benefits are not felt until many years after the costs begin to be incurred, do not sit easily with shorter term political and electoral cycles. A lack of commonly accepted metrics to measure infrastructure need and performance prevent meaningful comparisons being made between countries and sectors. Technological and demographic change, together with the potential for ground-shifting events such as the current pandemic, mean that any infrastructure plan must deal effectively with uncertainty.

The increasing interactions within and between different sectors, particularly as the electrification of road transport gathers pace and digital systems are embedded across all infrastructure networks, also create additional complexity. These interactions make it increasingly important that infrastructure decision making is guided by strategic plans that are long-term and cross-sectoral in scope.

For all these reasons, the question of how infrastructure investment strategies are developed is both vitally important and hugely challenging. Recent years have seen a number of new approaches that aim to deliver more sophisticated strategic plans, better targeted at meeting future needs. These include the development of new and innovative methodologies to capture the wider economic benefits of investments, the creation of independent advisory bodies to support and challenge government decision makers, and an increasing focus on measuring the actual performance of major infrastructure projects. This report reviews those developments, seeks to understand their impact and makes recommendations to improve the quality, consistency and coherence of infrastructure planning and decision making.

As countries across the world develop strategies to recover from the devastating economic impacts of COVID-19, infrastructure investment will play a central role – providing fiscal stimulus to support job creation and growth, creating and strengthening the networks on which renewal will depend, and enabling the transition to a lower carbon, more sustainable economic model. It is more important than ever, therefore, that such investment is well-planned and targeted and its benefits are felt where they are needed the most.

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Executive summary

What we did

This report explores the actual and potential use of strategic planning by governments in ITF member countries as a means of improving the quality of major infrastructure policy making and investment decisions. This includes the scope and content of strategic plans, and the extent to which decision making on individual infrastructure projects takes account of the priorities and directions established in the plans. Secondly, the report investigates the emerging role of independent infrastructure advisory bodies as a tool to help governments adopt a long-term, cross-sectoral approach to infrastructure planning and decision making. Thirdly, it explores current practices and trends in relation to project identification, appraisal and selection, and the role of ex post evaluation.

What we found

Strategic planning is a relatively commonly used policy tool and is becoming more widespread. However, the nature and scope of strategic plans vary widely: some are sectorally based, some regionally focused and a few are cross-sectoral, or even have a whole-of-government perspective. Some are limited to the identification of broad strategic orientations and/or objectives, while others identify individual projects – typically those large in scale and/or transformational in impact. Strategic plans enable more co-ordinated decision making, which takes account of synergies between projects, considers the demand for, as well as the supply of, infrastructure services, weighs the competing claims of different sectors and enables investment decisions to be oriented towards national priorities.

There is an apparent correlation between the adoption of strategic plans and the establishment of independent infrastructure advisory bodies. The relatively recent establishment of these bodies in most countries means firm conclusions as to their effectiveness in improving decision making cannot yet be drawn. The widely differing range of responsibilities given to these bodies also complicates such judgements. However, the independent expert advice on infrastructure needs and priorities these bodies provide appears to improve the information base for decision making, as well as enhancing transparency and accountability.

Project appraisal is subject to explicit process and methodological requirements in most countries, and cost-benefit analysis (CBA) is central in virtually all cases. Many countries report proposed projects must meet certain benchmarks (e.g. have a positive net present value [NPV]) to be eligible for approval. Others report CBA is only one among several analyses conducted, and a positive NPV may therefore be neither necessary nor sufficient for a project to be selected. Differences in the scope of CBA may explain some of these apparent differences, with some countries adopting broader CBA by requiring the use of indirect valuation techniques that enable the quantification of many non-market benefits and costs.

Appraisals of large-scale infrastructure projects increasingly include wider economic benefits (WEBs). This adds an element of macroeconomic analysis to the microeconomic approach of CBA. WEB assessment is both data- and resource-intensive. As WEBs are likely to add only 10-30% to traditional benefit estimates for all but the most transformative projects, WEB assessment is generally reserved for projects that are

expected to have a large impact on labour markets. Significant uncertainty surrounds most WEB estimates, but WEB analysis can help provide a clearer picture of the beneficiaries of the project.

Many infrastructure assets serve numerous, often quite different economies and societies. Developing shared infrastructure can yield efficiencies of scale and scope and deliver higher quality infrastructure more quickly. By deepening economic inter-dependence, such arrangements can also promote further efficiency gains and function as a force for positive engagement between countries or regions. However, the effective operation of shared infrastructure requires sound institutional architecture, clear policy objectives and agreed allocations of responsibilities.

Strategic infrastructure planning includes the allocation of expenditure between new infrastructure projects and the maintenance and upgrading of existing infrastructure. This means strategic infrastructure planners should address the stewardship of existing assets, as well as the means by which new projects are chosen and developed. Efficient asset management will significantly reduce the life-cycle cost of infrastructure.

What we recommend

Governments should adopt a strategic approach to infrastructure planning. This should be communicated clearly via an explicit, detailed and periodically updated strategic infrastructure plan.

These plans should address all major physical infrastructure sectors and take plausible scenarios bearing on infrastructure demand and supply into account. They should propose clear objectives for infrastructure development and operation to inform government investment decisions and set the policy framework underpinning regulatory decisions and private sector investments.

Strategic infrastructure plans should be linked to explicit infrastructure funding envelopes, with project pipelines identified, at least in broad terms.

There should be clear linkages between strategic infrastructure plans and individual project selection processes.

Governments should consider the merits of establishing independent infrastructure advisory bodies to provide transparent, expert advice on long-term, cross-sectoral infrastructure strategy, planning and policy development, as well as priorities for medium-to-longer-term infrastructure investment.

Evidence to date shows these bodies constitute a low-cost and effective means of improving and complementing existing processes. Establishing independent advisory bodies by statute enhances their ability to provide frank and fearless advice and their credibility with a range of stakeholders.

Arrangements for the establishment of independent bodies should address key governance principles, such as those identified in the OECD's Principles for the Governance of Regulators.

Advisory bodies should be required to publish their advice to governments, and governments should be required to respond to that advice in a timely manner.

Infrastructure project appraisal should, as far as possible, be based on a consistent and transparent methodology.

It should capture all substantial effects of the proposed project, including sustainability, health, safety and distributional impacts. Addressing these through an expanded CBA will contribute to a more integrated analysis that aids comparisons between investment options. A selective approach should be taken to the

use of WEB analysis, focusing on the largest projects, and those that have wider objectives than are traditionally pursued via transport infrastructure projects. WEB estimates should highlight key uncertainties and, where appropriate, incorporate scenario analysis. Project appraisal should clearly separate WEB from other analyses to clarify the impact of WEBs on the overall outcome.

The OECD/ITF should publish a review of government and private sector infrastructure-related responses to the Covid-19 pandemic.

This review should consider how demand for infrastructure (especially transport and telecommunications) is likely to change due to the pandemic. It should also assess whether, and how governments and private infrastructure providers are changing their strategic plans, project appraisal processes and prioritisation of projects.

A formal policy framework should guide decisions on the stewardship of major infrastructure assets.

The objective should be to ensure efficient asset utilisation, maximising availability and performance and minimising life-cycle cost. This should be achieved by setting out relevant performance standards and establishing incentives for optimal maintenance and upgrade scheduling. This implies separating asset ownership and management and creating clear financial accountability and incentives. It also requires an adequate (preferably cross-sectoral) regulatory regime to be established where workable competition is absent.

Governments should review their infrastructure regulatory frameworks.

The review should seek opportunities to support integrated approaches to cross-sectoral planning in order to avoid unintended consequences.

Ex post performance assessment should be undertaken for all major projects.

This should be conducted using standard CBA frameworks and methodologies. Meta-analysis should be undertaken to better inform future infrastructure policy.

National infrastructure institutions and statistical agencies should co-ordinate internationally to develop consistent infrastructure performance measures.

Performance measures and indicators can help identify strengths and weaknesses in infrastructure systems and evaluate the impact of past interventions. Successes in international harmonisation of other areas of economic statistics suggest the potential to develop comparable measures of infrastructure performance, which can underpin broader, international comparisons by national infrastructure institutions and statistical agencies.

Where cross-border infrastructure projects are adopted, they should be managed by a specific-purpose body with all parties represented. Policy objectives and performance standards should be clearly specified and governance, funding and accountability mechanisms established.

The effective operation of shared infrastructure imposes important challenges, particularly where larger numbers of countries or regions must co-operate and where they differ widely in economic or cultural terms. Addressing these challenges effectively requires an appropriate institutional architecture, clear policy objectives and agreed allocations of responsibilities.

CHAPTER 1

Introduction

Infrastructure investment is a major expenditure item for all governments. The OECD estimates that transport infrastructure spending alone in OECD countries totalled USD 440 billion in 2016, or 0.79% of gross domestic product (GDP) (OECD, 2019). Moreover, the current level of expenditure is relatively low by historical standards: the International Transport Forum (ITF) notes (ITF, 2015; 2018) that transport infrastructure spending in Western Europe progressively declined as a proportion of GDP, from a high of around 1.5% in 1975 to 0.7% in 2015, before rising slightly in the most recent period. Reflecting this trend, there have been numerous warnings of a developing “infrastructure gap” in recent years. This suggests that the relative importance of transport and other infrastructure in terms of overall government spending is likely to increase in the medium term.

The scale and scope of infrastructure spending, together with the long lifespan of most infrastructure assets, make it essential that decisions about what infrastructure to build and when are well-based. That is, the opportunity cost of poor decision making in relation to infrastructure investment is very high. Moreover, infrastructure quality is a key determinant of the productivity performance of the economy as a whole. Even where infrastructure sectors are privatised, government policies and objectives set the context in which regulatory and private sector investment decisions are taken. Robust and consistent processes and methodologies are needed to ensure systematically that the right infrastructure is built at the right time, and that it is constructed and maintained at efficient cost. The temptation to make infrastructure choices on political grounds provides a further rationale for using explicit, standardised processes and methods to identify and assess project options and inform decision making.

Good processes and methods are needed to underpin the key tasks of project identification, appraisal and selection. However, even where such mechanisms are in place, decision making undertaken wholly at a project-specific level, without consideration of the trade-offs between expenditure options within and between sectors, will not consistently serve the wider range of policy objectives to which infrastructure investment contributes. In addition to being a key contributor to productivity, infrastructure investments serve objectives including improved connectivity and accessibility, regional economic development, and broader strategic economic objectives. The fact that there are frequently synergies between projects (both positive and negative), further complicates the decision-making process and also points to the need for a strategic approach to be taken to maximise the benefits of infrastructure spending.

Recognition of these factors has seen governments in an increasing number of countries move toward adopting strategic approaches to infrastructure planning. These entail identifying high-level priorities and weighing infrastructure investment options both within and between sectors – looking at options relating to both the supply of and demand for infrastructure. They can also involve addressing the issue of the overall level of expenditure needed to achieve infrastructure-related goals and the means by which these spending levels will be funded. At the same time, governments are making significant reforms to the processes and methods used to undertake project identification, assessment and selection. This includes expanding the scope of the appraisals undertaken, improving the methodologies employed and strengthening feedback loops through enhanced ex post assessments.

Box 1. Defining strategic infrastructure planning

The objective of the strategic infrastructure planning agencies and processes examined in this report is to enhance the quality, affordability and sustainability of infrastructure services. This entails: establishing outcome-focused objectives for infrastructure services; reviewing and updating relevant policy processes; and identifying, assessing and prioritising projects and programmes on a cross-sectoral basis. Strategic infrastructure planning should consider options that address both the supply of and demand for infrastructure services. It necessarily has a long-term focus, typically reflecting a minimum 10-15 year time horizon and, in some cases, extending as far as 30 or 40 years. It covers both the policy framework governing infrastructure development and operation and the identification and prioritisation of investments. Developing a more strategic approach to planning usually involves significant reform of processes for project identification, assessment and appraisal and ensuring that they are applied consistently.

Strategic infrastructure planning is typically primarily concerned with broad investment directions and priorities, rather than individual projects, although many plans will identify some specific projects, particularly where these are major, long-term investments likely to be transformative in nature. An important aim of strategic infrastructure plans (SIPs) is to build consensus around the goals that infrastructure investment and operation are intended to achieve and to identify evidence-based strategies to achieve them. Such strategies should recognise the uncertainties necessarily inherent in long-term investment planning and take account of the challenges of sustainability and climate change. To do this, SIPs should be able to demonstrate that the relative merits of different investments are considered on a consistent and cross-sectoral basis and that possible positive and negative interactions between investment decisions are taken into account. Where infrastructure sectors are fully or partially privatised, SIPs will focus particularly on ensuring that sound policy frameworks, and associated regulatory strategies, are adopted to underpin the efficient private provision of infrastructure services.

A fundamental change currently underway is that strategic infrastructure plans are increasingly being integrated with land-use plans. This integration of policy and planning across sectors offers major opportunities to achieve synergies in development and enhance the quality of urban environments.

This report examines a number of dimensions of strategic infrastructure planning. Good practices in each area can and should be mutually supportive. Hence, the discussion in each chapter highlights the links between different elements of strategic infrastructure planning, including potential synergies and tensions. The report focuses in particular on transport infrastructure; however, many of the issues discussed and the strategies for improving infrastructure investment practices identified are broadly applicable across all areas of physical infrastructure.

Chapter 2 provides a brief overview of current practices and recent trends in respect of project identification, appraisal and selection. It is based on material provided by working group members in response to a questionnaire and covers 11 ITF member countries. It discusses the processes adopted, the institutions responsible for major tasks, and the appraisal methods and decision criteria adopted.

Chapter 3 addresses institutional and process issues in detail, focusing on three key issues. First, it discusses key issues in the use of SIPs, focusing on their scope and content, addressing cross-sectoral issues, the use of public and stakeholder consultation in developing SIPs, the use of scenario planning, and the merits of linking SIPs to indicative infrastructure budget allocations. Second, it discusses the role of independent infrastructure advisory bodies in providing advice and other inputs to governments to

contribute to the development of SIPs. This section describes the spread of these bodies across several ITF member countries in recent years, including at the subnational level; identifies and analyses the range of functions that they perform; and reviews the relationships between the independent advisory bodies, other government entities and non-governmental stakeholders. Third, the chapter addresses the stewardship of existing infrastructure assets. It explores the importance of ensuring timely, programmed maintenance in minimising the life cycle costs of infrastructure and discusses the relationship between ownership structures, regulatory architectures and incentives, and the achievement of these outcomes. It also briefly considers the trade-off between new project funding and the maintenance and upgrading of existing assets when allocating infrastructure spending.

Chapter 4 deals with project appraisal methodologies. A central issue is that of how to ensure that all of the significant impacts of major infrastructure investments can be captured within the appraisal process and assessed in an integrated and consistent way. Only if this is done can fully informed decisions be made, taking account of all relevant trade-offs. Key questions include:

- how and when to expand the analysis to include wider economic benefits
- how to ensure equity impacts are accounted for, including regional impacts
- how infrastructure spending should be financed, and what implications different options have for inter-generational equity
- how sustainability impacts can be included within the analysis
- how cross-border issues, such as the determination of appropriate infrastructure investment and the allocation of costs, can be addressed by sometimes disparate neighbouring countries and subnational administrations investing in infrastructure to serve the region.

Chapter 5 discusses the role of ex post assessment of the performance of infrastructure projects. Ex post assessments have been relatively rarely undertaken in the past, but are increasingly recognised as a core part of a best practice strategic infrastructure planning process. This reflects the broader movement toward recognition of the need to evaluate major policy choices if the policy cycle is to be completed and sound policy processes are to be established in the dynamic sense. Chapter 5 describes emerging practices in relation to ex post assessment, particularly in relation to methods and processes, and the role of these assessments in the policy process.

CHAPTER 2

Project identification, appraisal and selection

The Working Group gathered data on infrastructure project identification, appraisal and selection practices via a survey of its members, with responses being received in respect of 11 ITF countries.¹ These data, which cover all infrastructure sectors, were compiled to provide insights into both current practices and emerging trends, and are summarised below.

In this chapter, project identification refers to the institutions and processes by which possible infrastructure projects are identified, including questions of what linkages exist between the identification of individual projects and strategic plans. Project appraisal refers to the processes and methodologies used to assess the societal benefits and costs of possible infrastructure investments. Project selection refers to the institutional and procedural means of choosing between different infrastructure investment options, and the decision criteria employed.

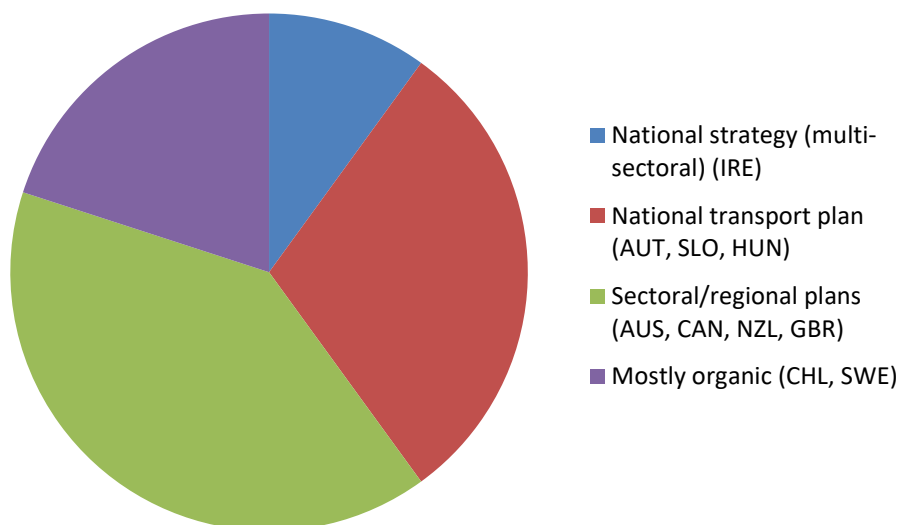
Project identification and selection

This section summarises country responses in relation to project identification and selection, focusing on the two key dimensions of the use and extent of strategic planning and the allocation of institutional responsibilities.

Use of strategic planning

Infrastructure investment decisions are taken in the context of strategic plans in most of the respondent countries; however, the nature of these plans varies widely. While seven of the ten countries that provided information on this issue stated that strategic plans were in place, only three (Austria, Hungary and Slovenia) stated that a National Transport Plan had been adopted. Four more countries stated that either mode-specific or regional plans are used.² In only one respondent country (Ireland) does transport infrastructure planning occur within the larger framework of a national strategy that covers all key sectors of the economy. In the remaining two respondent countries, project selection is essentially undertaken on an organic basis. Chapter 3 discusses the nature and uses of strategic infrastructure plans.

Figure 1: Strategic planning and project selection in ten countries



Source: working group analysis.

Institutional responsibilities

A wide range of entities are involved in project generation. However, national transport agencies, which are commonly quasi-independent bodies operating at arm's length from the relevant ministries, were most commonly identified as performing these functions. There appears to be a trend toward the merger of previously mode-specific agencies. For example: Transport Infrastructure Ireland was formed in 2015 via a merger of the former National Roads Authority and the Railway Procurement Agency; the Slovenian Infrastructure Agency is responsible for both the road and rail sectors;³ and the Swedish Transport Administration (Trafikverket), formed in 2010, is responsible for infrastructure planning across the road, rail, aviation and shipping sectors. The growth of multi-modal transport agencies provides opportunities for more strategic decision making that compares the relative merits of project proposals across different transport modes.

Many responses also highlighted the partly decentralised nature of project generation activity. In federations, such as Australia and Canada, constitutional factors mean that primary responsibility for infrastructure accrues to subnational levels of government. However, a high level of vertical fiscal imbalance means that co-funding from the national government is a feature of many of the largest projects and, in turn, implies that national governments exercise significant influence on project selection. Unitary countries such as Sweden also highlighted the fact that much project generation activity occurs at the regional level. In this context, regional planning and public transport agencies, as well as regional offices of transport agencies such as the Swedish Transport Administration, can have significant roles in project generation.

Project selection is largely separate from project generation in most of the surveyed countries. Several stated that this reflects the fact that project selection decisions are ultimately political, with ministers taking decisions based on the advice of transport agencies or ministries and decisions on the largest projects typically taken at a Cabinet level. However, conscious separation of these activities is also found

within the administration. For example, while Transport Canada both assists infrastructure agencies with project generation and undertakes assessments, these functions are kept separate, with officials who work on one task not undertaking the other. In New Zealand, project generation and option selection are carried out by “approved organisations”, while selection of projects that require access to the National Land Transport Fund is undertaken by the NZ Transport Agency. Sweden reports that there is an overlap between project generation and selection, with the multi-modal Swedish Transport Administration both being a significant player in project generation and being responsible, within the scope set by the government, for the development of the national and regional transport strategies, which are the vehicles for the project selection process.

Several countries indicated that projects’ degree of consistency with strategic plans was central to the decision criteria adopted for project selection purposes, although projects are generally also required to meet relevant economic and financial benchmarks, as demonstrated via a business case process. Sweden stated there was no standardised set of criteria with pre-defined weights, but that consistency with the transport objectives set by parliament was the key driver of project selection decisions. Transport Canada identified the following criteria: an adequate business case; support for improved supply chain performance; contribution to increasing the resilience of the transport system, including climate resilience; addressing the economic and social development needs of the north; and ability to leverage investments from other partners.

New Zealand has an Investment Decision-Making Framework and an Investment Prioritisation Method, which form the basis for project selection decisions. These are based on the business case approach and consider the project’s degree of alignment with overall government strategic priorities as well as the results of CBA. Similarly, Ireland pointed to its Public Spending Code and Common Assessment Framework as the key framework documents for project selection. Australia noted the existence of some variations in approach between jurisdictions (i.e. between national, state and territory governments), but stated that, in general, projects’ alignment with strategic plans, economic and financial appraisals, and the delivery strategy are all weighed during project selection. However, among these factors, the financial appraisal (including the call on government budgets) is generally accorded the greatest weight. The delivery strategy for the project also receives significant attention, due to the political risks of failure to deliver projects on time and on budget.

Project appraisal

Formal project appraisal processes are required to be followed for most or all publicly funded infrastructure projects in all of the respondent countries. The formal appraisal requirements typically apply above a specified project cost threshold, which varies quite widely between countries. For example, a threshold of EUR 2.5 million is applied in Slovenia, a EUR 5 million threshold is used in both Austria and Sweden, and a EUR 20 million threshold is used in France and Ireland. Australia’s federal government requires projects to have their business cases assessed by the independent infrastructure advisory body, Infrastructure Australia, and to be drawn from the Infrastructure Priority List, if the expected federal government contribution exceeds AUD 100 million (EUR 60 million),⁴ while several state and territory governments apply similar rules. The United Kingdom does not have a formal monetary threshold for project appraisal, instead adopting a general requirement that a “proportionate” level of analysis be undertaken. This requirement is applied within the context of a five-part business case, including strategic, economic, commercial, financial and management analyses.

Appraisal methodologies

All the respondent countries publish methodological guidance on project appraisal, thus helping to establish clear expectations and promote consistency in analytical standards. Two countries (Hungary and Slovenia) noted that their guidance is based on European Union standards. Published guidance documents generally set out a wide range of potential impact types, which the appraisal is required to include where relevant. Most also identify what analyses are required to be completed. For example, Transport Canada's guidance states that the net present value, benefit-cost ratio (BCR) and internal rate of return must be calculated, with sensitivity analysis also undertaken.

Guidance on indirect valuation methods is provided in most cases, in order to ensure monetary values are calculated for as many impacts as feasible, while parameter values for key variables are specified in some cases to promote consistency between appraisals. Guidance on indirect valuation is typically provided in respect of most or all of: the value of travel time, safety benefits, noise impacts, pollution impacts and greenhouse gas emissions.

Eight of the 11 guidance documents explicitly state that impacts that cannot be monetised even indirectly (e.g. network resilience or travel time reliability benefits) should, nonetheless, be included in the analysis. However, only around half of these provide specific guidance on how this should be done, beyond general statements that such impacts should be assessed qualitatively. Slovenia requires multi-criteria analysis (MCA) to be used, but does not specify particular MCA methods or weightings. Ireland requires unquantified impacts to be assessed using a seven-point scale, rating the impacts from "very negative" to "very positive". Austria also uses an MCA-like scoring system, with weightings sometimes applied.

In addition, some guidance documents identify a range of specific equity-related impacts that are required to be included in the analysis. For example, in Ireland, this includes impacts on physical activity, accessibility, and social inclusion and integration. In New Zealand it includes impacts on social inclusion, cultural and heritage values, and indigenous people.

Quality control

The conduct of project appraisal is, in all cases, the responsibility of the project proponent, although several responses highlighted the fact that this function is contracted to external experts in many or most cases. Independent quality control mechanisms exist in most, but not all, countries. This quality control function is most commonly undertaken by the transport agency or ministry (including in Austria, Canada, New Zealand and the United Kingdom), with other quality control bodies including:

- other ministries (e.g. the Department of Public Expenditure and Reform in Ireland and the Ministry of Social Development in Chile)
- independent infrastructure advisory bodies (Australia, at both state and national level)
- groups of independent experts appointed by the proponent agency for this purpose (Slovenia and Sweden)
- external audits (France).

Where used, quality control by an independent body is generally seen as a key element of an effective project appraisal process. This is consistent with the practices of OECD countries in relation to regulatory impact assessment, which applies CBA and related methods to appraise the merits of regulatory proposals. The OECD recommends that independent oversight be applied to ensure the quality of all regulatory impact assessments (OECD, 2012).

Decision rules

No respondent country stated that a single, unambiguous decision rule is adopted in project appraisal. Four countries (Chile, France, New Zealand and Slovenia) stated that a positive net present value was generally seen as a prerequisite for a project to be approved, while Australia noted that its independent infrastructure advisory body had placed increasingly heavy weight on the BCR in recent times, albeit that two other criteria – “strategic fit” and delivery strategy – are also included in the decision process. Conversely, several responses described the outcome of the CBA as being only one element of the appraisal, which must be weighed alongside other factors, such as the project’s contribution to the government’s strategic objectives for the transport system, its linkages to other projects and its distributional implications. The Swedish response stated that the three elements of its project appraisal (CBA, distributional impacts and contribution to transport objectives) are unweighted and cannot be summed.

Ex post assessments

Ex post assessment of projects is widely practised, although the nature and extent of the assessments differs significantly between countries. Seven of the 11 respondents stated that ex post assessments are required for all projects, but in two cases (France and Ireland), the mandatory assessment requirement applies only to projects with a cost higher than the identified threshold value (EUR 20 million and EUR 83 million, respectively). The United Kingdom requires plans for ex post evaluations to be included in business cases, but notes that these are not completed systematically in practice. In Austria and New Zealand, ex post assessments are conducted in respect of “selected” projects only,⁵ while in Australia ex post assessments are recommended, and guidance on how to conduct them is published, but they are not generally mandatory.⁶

Stakeholder engagement

Ireland, New Zealand and the United Kingdom report that stakeholder engagement is an expected part of the project development and/or business case development process, while Infrastructure Australia encourages project proponents to engage with stakeholders during project development, notably via its published Infrastructure Decision-Making Principles (2018). France notes that stakeholders are formally able to engage in the assessment via the project consultation process, but that the highly technical nature of CBA means that there is little engagement in practice. Canada has legislated requirements for stakeholder engagement to be undertaken during the development of environmental impact assessments, though not in respect of the development of business cases more generally. Stakeholder engagement appears to be limited in the other respondent countries.

Use of public-private partnerships

Countries differ widely in terms of their propensity to use public-private partnerships (PPPs) to deliver infrastructure projects. While the use of PPPs is widespread in Australia, Canada, Ireland and the United Kingdom, they are rarely employed in several other countries. Notably, there have been apparently significant moves away from the use of PPPs in several countries in recent years. The Swedish government adopted a strong recommendation against the use of PPPs in transport infrastructure in 2012, which largely remains in place, albeit that there has been some reconsideration of the issue in recent years. The French Cour des Comptes also recommended against their use in a 2017 report (Cour des Comptes, 2017).

In the United Kingdom, which has been a pioneer of PPPs and adopted them widely, the government announced in 2018 that it was discontinuing the use of its second-generation PPP policy, the Private Finance 2 (PF2) initiative, following the publication of a critical report by a parliamentary committee (UK Parliament, 2018). These moves away from the use of PPPs seem to have been driven largely by value-for-money concerns, although increasing understanding that PPPs cannot expand the public funding envelope may also be a factor.

CHAPTER 3

Institutional and process issues

The environment in which infrastructure investment decisions must be made has become increasingly complex and challenging for most countries in the OECD and beyond. Infrastructure must be delivered and maintained in an environment of falling productivity growth, increasing pressure on public budgets, rising inequality, and increasingly urgent concern over climate change and sustainability. These challenges have sharpened awareness of the necessary trade-offs involved in making infrastructure investment choices and the importance of ensuring that investment choices reflect broad social priorities. This, in turn, has been a significant factor in driving the increasing adoption of strategic infrastructure plans internationally, highlighted in Chapter 2.

This chapter reviews institutional issues associated with strategic infrastructure planning processes and decision making. Well-governed institutions and sound processes are fundamental to effective strategic planning as they are more likely to deliver effective infrastructure plans and decisions. In particular, the chapter addresses:

- strategic infrastructure plans, notably: the use of scenario planning, the importance of broad consultation, challenges in integrating planning across infrastructure sectors, linkages to government budgets, and links to individual projection selection
- the increasing role of independent bodies in providing advice to governments on strategic infrastructure issues
- the long-term stewardship of existing assets, including what regulatory arrangements can be adopted where the operating environment is not workably competitive.

Strategic infrastructure plans

The International Transport Forum published guidance in 2017 on best practice in strategic infrastructure planning (ITF, 2017b). The report included 11 “policy insights” (Box 2) to assist governments in improving their strategic infrastructure planning and associated decision-making processes. This paper does not canvass those insights further, as they are only recently articulated and there is no evidence of material developments to suggest they are no longer relevant.⁷ Indeed, the COVID-19 pandemic has probably highlighted the importance of some insights. The following section discusses four areas in which application of the insights can be problematic. These are:

- the use of scenario planning
- the importance of consultation
- challenges in adopting a cross-sectoral approach to planning
- the need for strategic plans to be linked to budget processes.

Box 2. Policy insights from the ITF report on strategic infrastructure planning: Systemic risks can be reduced where projects form part of a broad and long-term strategic plan

When it works well, strategic planning can set out a stable set of priorities and future investment with durable cross-party support.

Strategic infrastructure planning nevertheless carries its own risks.

A successful infrastructure planning process balances a stable framework with maintaining flexibility.

The planning process requires clear objectives, a degree of independence and an open, collaborative approach.

The planning methodology needs to address risks and uncertainties, take into account binding policy constraints, and include consideration of pricing the use of infrastructure.

A top-down approach to infrastructure planning to complement traditional project by project assessment is essential to a strategic assessment of long-term economic infrastructure needs across sectors.

Infrastructure planning across sectors can help identify the most important systemic risks early.

Using analytical methods such as a scenario-based approach to analysis can be helpful in future-proofing infrastructure plans.

It is important to consider how demand for scarce infrastructure can be managed.

A top-down approach could foster the development of an analytical framework for investment decisions reflecting both demand- and supply-side considerations.

Source: ITF (2017b).

Scenario planning

The ITF report found that policy makers have made only limited use of scenario planning, although some examples were identified. These included the use of scenarios to estimate long-term infrastructure needs by RTE, France's electricity transmission network operator, and similar work undertaken at a Europe-wide level by ENSTO-E. France's 1Mobilité 21 Commission also used two economic growth scenarios in developing its Long-term National Sustainable Mobility Plan (ITF, 2017b).

The development of Australia's National Freight and Supply Chain Strategy was informed by an analysis of various scenarios. This analysis was used to:

- **anticipate** future developments, i.e. what challenges may be faced by the Australian freight sector and what opportunities may arise within the time horizon explored (20 years)
- **brainstorm** what government and industry may do in the future, i.e. generate ideas about what directions, policies and measures stakeholders may decide to pursue
- identify **blind spots** in the decision process, i.e. explore, given the directions, policies and measures under consideration, whether anything important has been left out
- **test** decisions, i.e. to explore whether the policies and measures under consideration would be appropriate in the different scenarios identified (Centre for Supply Chain and Logistics, 2017).

New Zealand also uses scenario planning in a number of transport contexts. In particular, these include assessing future demand in areas including freight and passenger movements. In recent times, the Ministry of Transport has developed a range of COVID-19 recovery scenarios to inform priorities for future policy development to ensure the transport system is sustainable and resilient. Scenario studies are used to help inform discussions with stakeholders and the public on the strategic direction of investment, feeding into long-term planning documents such as the Government Policy Statement on Land Transport Investment.

Governments' reluctance to use scenario planning may be due, at least in part, to the difficulty of addressing multiple objectives. However, they may also be concerned about how such exercises will be perceived in the community and in the media, and see scenario planning as an unnecessary risk. In one jurisdiction, a scenario planning exercise became the subject of media criticism and ridicule when a "left field" scenario involving the arrival of aliens was canvassed early in the process. This example illustrates two important points. First, scenarios should be reasonably plausible, and able to be influenced by government decisions. Second, infrastructure planning is necessarily a public exercise, and the media has considerable interest in this field; governments therefore must manage media and public discussion about the scenarios. In particular, governments need to manage public messages about pessimistic scenarios, lest they be accused of "planning to achieve a disaster".

The effort required to implement scenario planning may also be a reason why the technique is not often applied. Scenario planning typically requires significant commitments of time and resources, whereas Cabinet processes tend not to provide time for the analytical and strategic thinking associated with scenario planning.

Governments should consider how they can adapt their policy- and decision-making processes to support the use of scenario planning and its influence on decision making. That said, scenario planning must demonstrate an ability to add value to decision-making processes. The following factors will be critical if scenario planning is to become a standard element of planning practice within governments:

- support for its use at senior levels of the civil service: senior officials must promote the value of scenario planning, e.g. by providing clear advice as to how scenarios can be used to shape strategy, planning, investment and policy decisions
- ministerial support for scenario planning as a tool in planning and decision making
- Cabinet willingness to commit time to developing and updating scenario plans.

Some governments have taken steps toward establishing a scenario planning capability as a part of their decision-making processes. For example, in Australia, the New South Wales government adopted a range of "common planning assumptions" in November 2017 (and updated in early 2020) that have to be addressed in plans and project business cases. The assumptions are developed by a working group convened by the Ministry of Finance. Project proponents can vary the assumptions if there is a compelling case to do so; however, any departures from the common assumptions are assessed as part of the business case review processes.

Governments, or their advisory agencies, could consider formally establishing and publishing a range of scenarios for use in strategic planning, policy making and the evaluation of project proposals. The use of scenarios would encourage deeper reflection on the uncertainties associated with a project than simply adding X% +/- on to the parameters in a CBA, which often appears to be the extent of risk assessment contained in project business cases. The scenarios could be used to assess whether projects remain robust under a plausible range of circumstances, or whether staging a project (where that is practicable) would be an appropriate way of managing uncertainty and risk. The scenarios themselves would need to be the subject of periodic review and challenged.

The COVID-19 pandemic has highlighted the fact that the future is uncertain, and that events can dramatically upend forecasts and projections. Infrastructure decision making is typically concerned with long-term matters, with major investments having lifespans of many decades and lengthy payback periods. The COVID-19 pandemic has underlined the need for governments to acknowledge uncertainty in a deeper way, and to consider making greater use of scenario planning in their decision making.

At least two of the independent bodies – Infracom and Infrastructure Western Australia – are using scenario planning as a tool in the development of their forthcoming infrastructure strategies. Work on both strategies commenced before the pandemic, and the organisations’ use of scenarios reflects their belief in the value of scenario planning, including its ability to clarify the interconnections between seemingly disparate events that might bear on different infrastructure sectors (Infracom, 2020b).

Consultation

The ITF (2017a) also highlighted the importance of stakeholder engagement in the strategic planning process, both as a means of ensuring the credibility and legitimacy of the resulting plans and as a data source. However, consultation on strategic plans presents numerous challenges. Consultation processes can miss key voices and raise concern in some quarters about the direction of government plans, particularly in a context of declining trust in governments and their institutions in many countries.⁸ This suggests that significant effort is needed to engage the public in strategic planning and to involve a broad cross-section of society in discussing the difficult policy and investment trade-offs that strategic plans seek to address.

Government agencies continue to experiment with ways to engage more effectively with the public, including those who may not normally be involved in strategic planning processes. For example, in the development of its 30-year infrastructure strategy, Infrastructure Victoria used a “citizens’ jury” process to complement more established consultation processes. Juries were assembled in both metropolitan and regional areas, with each comprising approximately 40 randomly selected community members. They each met on six occasions, enabling a broad cross-section of individuals to become more deeply engaged with the issues being considered in the planning process. Infrastructure Victoria provided detailed responses to every recommendation made by the juries (Infrastructure Victoria, 2016) and subsequently conducted a detailed survey asking for respondents’ views on the objectives underpinning the strategy. This work was undertaken to seek feedback on the objectives and their relative priority and, in turn, to inform the next cycle of strategy development.

In Scotland, the Infrastructure Commission for Scotland (ICS) developed a stakeholder engagement strategy and action plan to capture the views of infrastructure stakeholders. This included the use of “deliberative research” methods with citizens and consumers of infrastructure. Similar to Infrastructure Victoria’s use of citizen juries, this is a form of interactive engagement, and provides detailed information to participants in order to facilitate more informed input. In the ICS case, this included detail on the concept and practicalities of trade-offs, in both urban and rural settings.

Robust processes such as these, and the insights they provide, can provide governments with confidence that the strategic direction they are pursuing is founded on solid policy analysis and a well-researched understanding of public aspirations and concerns. They provide a powerful defence against claims that governments are “out of touch”. Extending these sorts of processes to scenario planning is a “next step” worthy of further consideration.

Challenges in adopting a cross-sectoral approach to infrastructure planning

The adoption of a cross-sectoral approach to infrastructure planning has been advocated for some time. For example, in introducing legislation to establish Infrastructure Australia, the then Minister for Infrastructure stated, “... it is clear that, when it comes to planning on infrastructure, we ... need a co-ordinated approach to infrastructure that is whole of government and that recognises that there are relationships between our transport infrastructure – that is, roads, rail, shipping and aviation – and our water infrastructure, energy infrastructure, communications infrastructure and social infrastructure. We need to do much better on these issues in the future than we have done in the recent past” (Albanese, 2008).

Similarly, the ICS has strongly emphasised the need to address interdependencies between different forms of infrastructure, especially if Scotland’s economy is to be decarbonised.

However, while changes have occurred in the process of planning for individual infrastructure sectors, cross-sectoral planning arguably remains beyond the frontier of infrastructure planning practice. The case for cross-sectoral infrastructure planning is founded on an expectation that it will make infrastructure networks (individually and collectively) more resilient and generate greater economic benefits than a series of uncoordinated sector-specific plans.

Resilience

Over the last two or three decades, attention has increasingly focused on the resilience of national and regional infrastructure systems. This reflects growing recognition of the threats to the economies and communities dependent on those systems posed by long-term shifts such as climate change, as well as short-term incidents such as terrorist attacks. COVID-19 has also served to emphasise the importance of resilience to systems across all sectors of the economy and society.

The focus above on the term “systems” rather than “infrastructure” is deliberate. Although the physical infrastructure itself needs to be as resilient as reasonably possible in the face of these shifts and events, it is the resilience of the transport system overall, including possibilities for substituting the mode of transport, that counts. At the same time, it is increasingly clear that ensuring the continuity of the supply of infrastructure services requires that all of the numerous elements that comprise infrastructure systems should demonstrate resilience. The focus must therefore be on these broader systems, rather than individual assets. This includes strategic and asset management planning, operational procedures, management and integration across infrastructure sectors (not just within transport) and with emergency and security services.

The promotion of a cross-sectoral approach to infrastructure planning and decision making has been a key part of the rationale for establishing independent infrastructure advisory bodies, as discussed below, and the resilience of infrastructure systems appears to be a particular focus of their work. Given their broad remit, the independent bodies are well-placed to explore cross-sectoral interconnections, whereas individual line agencies necessarily face difficulties in addressing the interaction of their own work with other sectors. The independent bodies therefore complement the work of the line agencies in this regard. Digital and energy infrastructure have been identified as having particularly important linkages to other sectors, as all forms of infrastructure need to be supplied with energy and, increasingly, all forms of infrastructure are dependent on digital control systems.

In the United Kingdom, the scoping report to the recent study of resilient infrastructure by the National Infrastructure Commission (NIC), the UK government’s independent infrastructure advisory body,

observed that “... there is a significant focus on resilience issues in individual sectors, but there is currently limited understanding of the resilience and vulnerabilities of the UK’s economic infrastructure. Some organisations have begun to look at cross-cutting resilience challenges, but the current approach is insufficient to address them ... But the fact that the current landscape is focused on individual sectors is itself limiting; it is difficult to find examples of holistic and cross-cutting approaches and there is not yet an adequate understanding of the resilience and vulnerabilities of the UK’s economic infrastructure as a whole.”

The final study report, published in mid-2020, concluded that:

- while there are resilience standards, there are gaps, the standards are not regularly reviewed, and, in some cases, the standards are out of date.
- infrastructure operators do not always have the right incentives to invest in resilience.
- cross-sectoral interdependencies are not as well understood as they might be, and “Increasing interdependencies can also lead to ‘emergent’ outcomes, which are not related to any specific aspect of the system but emerge from all the elements combined, and can be very difficult to foresee. These vulnerabilities are not well understood.”

Importantly, in conducting the study, the NIC piloted a modelling methodology to test interdependencies between sectors, helping to understand: “cascade failures”; how different ways to enhance resilience can be compared; and how opportunities for improving resilience could arise from planned changes to infrastructure networks (NIC, 2020). The situation identified by the NIC may well be replicated in other countries. Infrastructure Australia’s 2019 Infrastructure Audit also pointed to complex and interconnected risks affecting Australia’s infrastructure networks.

Economic and social benefits

The economic benefits of cross-sectoral planning are perhaps more readily demonstrated at a regional level than at a national level. Regional development strategies often comprise a mixture of infrastructure projects as well as non-infrastructure investment in areas such as training, business subsidies, fostering intra-regional collaboration and other economic development programmes. Cross-sectoral planning can also offer other economic and social benefits. Co-ordinated planning and delivery of infrastructure should, in theory, lead to better asset utilisation, with:

- lower needs for new capex, e.g. through the use of shared infrastructure
- lower risks of stranded infrastructure
- avoidance of situations in which investment occurs too early and is then dependent on the delivery of other infrastructure before it can be used (and paid for through user charges).

Cross-sectoral planning also minimises the risk of social costs being incurred due to the development of new settlements without timely delivery of supporting infrastructure. This is relevant at levels below that of truly long-term, strategic planning. For example, in Australia, the Greater Sydney Commission, a body responsible for the city’s strategic planning, is co-ordinating infrastructure-related inputs from a wide range of state government agencies and local councils to develop a series of “growth infrastructure compacts” for various parts of Sydney. These typically have a 10+ year outlook and are aimed at ensuring new development is supported by high-quality infrastructure. Critically, the compacts will influence the sequencing of new urban development. As the name implies, the compacts are intended to secure inter-governmental and inter-agency agreement on, and commitment to, a co-ordinated programme of

investment. There is concern in some quarters as to whether the compacts can be delivered. For example, some local councils are concerned that the New South Wales government will have insufficient funding to follow through on timely delivery of certain infrastructure. Nevertheless, the compacts represent a significant step forward in planning and, importantly, prioritisation of investment.

Linkages to government budgets

Strategic plans can sometimes be little more than “wish lists” of projects, lacking clear funding arrangements. At one level, this is understandable; strategic plans necessarily take a long view of infrastructure needs, extending beyond the budget cycle. However, plans that do not have a reasonable chance of being implemented artificially raise expectations. Where funding constraints lead to planned projects being scaled back or abandoned, public trust risks being damaged. Plans that do not plausibly address funding needs also present other problems. In particular, they:

- fail to address necessary choices about prioritisation of scarce resources
- put off debates about policy reforms that might be a more effective means of dealing with various infrastructure challenges – e.g. transport charging and pricing.

As noted earlier, the UK and Welsh governments provide the NIC and National Infrastructure Commission for Wales (NICW) with a fiscal remit for their work and recommendations to the government. The UK government is the only government to have set a specific fiscal target for its independent body. The NIC is required to “demonstrate that its recommendations for economic infrastructure are consistent with, and set out how they can be accommodated within, gross public investment in economic infrastructure of between 1.0% and 1.2% of GDP in each year between 2020 and 2050.” This is quite an important statement, both because of its strategic significance (i.e. it provides a clear indication of the government’s views on the long-term share of the general government budget available for infrastructure spending) and because it necessarily requires the commission to demonstrate the reasons for prioritising some initiatives over others.

In response to these requirements, the NIC included a funding profile of recommended infrastructure outlays in its 2018 National Infrastructure Assessment, showing total outlays at 1.2% of projected GDP up to 2035 and then falling to 0.8% of GDP by 2045-50. Because the assessment also made recommendations regarding the policy frameworks governing the private provision of infrastructure assets and services, due to the high level of infrastructure privatisation in the United Kingdom, the assessment was also required to include the commission’s assessment of the impact of its recommendations on bills paid by households, businesses and the public sector.

The fiscal remit for the NICW is more open-ended. It states, “In making its recommendations, the NICW should take account of, but not be unduly constrained by, recent trends in spending. It may make the case for exceptional investment if it believes it to be justified. If doing so, it may consider the availability of alternative funding streams.”

In recognition that various infrastructure is funded through user charges, the remit letter for both the NIC and the NICW also set an “economic remit”. This states that “when making recommendations, the NIC [NICW] should include a transparent assessment of the impact on costs to businesses, consumers, public bodies and other end users of infrastructure that would arise from implementing a proposal.”

Linking infrastructure plans to plausible long-term fiscal estimates provides some degree of confidence that the plans are financially “deliverable” and economically defensible. In turn, this can assist

governments and the community to consider the investment (and policy) trade-offs that are implicit in any infrastructure plan.

Independent infrastructure bodies

Several countries have established independent infrastructure advisory bodies over the past decade. Typically, these bodies work with, but stand apart from, conventional government agencies responsible for infrastructure policy, planning and delivery. They also engage with business groups and other stakeholders.

At a national level, the following bodies have been established: Infrastructure Australia (established in 2008); the UK National Infrastructure Commission (established in an interim form in 2015 and permanently in 2017); the National Infrastructure Commission for Wales (2018);⁹ and the New Zealand Infrastructure Commission (Te Waihanga, also known as Infracom, late 2019). The Infrastructure Commission for Scotland was established in early 2019 to provide advice to the Scottish government on reforms to infrastructure planning and development but, unlike the bodies mentioned above, is not intended to be a permanent body and is expected to finish its work by the end of 2020. Almost all of Australia's state and territory governments established similar bodies in the decade after the establishment of Infrastructure Australia. Annex A provides a high-level comparison of these bodies.

The independent advisory bodies all have remits that cover a wide range of infrastructure sectors. This distinguishes them from other independent infrastructure bodies, such as IMobilité 21 in France, that provides advice to governments in relation to a single sector. They are permanent agencies with an ongoing responsibility to perform identified functions. In this, they differ from independent inquiries that might be established by governments (or, potentially, by parliaments) for a fixed term to investigate a particular issue.

In a few jurisdictions, independent infrastructure bodies also undertake independent assessments of project business cases. However, this appears to be the result of country-specific institutional and fiscal characteristics, rather than necessarily constituting a core role for such bodies. While independent (of the proponent) assessment of business cases is a valuable process element that can substantially improve the rigour of assessments and subsequent project selection choices by governments, it is not clear that an independent infrastructure advisory body is likely to be better-placed to perform this function than other, potentially better established and resourced, bodies within government, such as the Ministry of Finance. In those jurisdictions where other entities assess project business cases, the independent bodies' project-related focus lies in identifying infrastructure service **needs** that are likely to then require some form of investment response.

Rationale

All of the independent infrastructure bodies were established in response to concerns that existing processes within government and, in some cases, existing institutions, were not meeting the need for effective long-term infrastructure planning and/or for rigorous, sensibly prioritised capital investment decisions.

Infrastructure Australia was established because of concerns that investment decisions had become overly politicised and, in particular, that there was a need to correct a situation whereby the Australian government invested little in Australia's cities, even though this is where the majority of Australians live and where most economic activity occurs.

In the United Kingdom, the Armitage Review (2013) highlighted the challenges of developing and maintaining a well-conceived long-term strategy in a parliamentary democracy. The NIC was established to address these and other concerns and provides government with impartial, expert advice on major long-term infrastructure challenges.¹⁰ In establishing the NIC, the UK government noted that “the commission’s independence will ... enable it to make recommendations on potentially controversial issues, and bring stability to long-term infrastructure plans, which will increase the likelihood of its recommendations attracting a political consensus. This consensus will come from a clear, transparent analysis of what infrastructure is needed; what the key trade-offs and dependencies are; and how these needs can best be met” (HM Treasury, 2016). The high level of privatisation of infrastructure in the United Kingdom makes the establishment of stable, long-term policy frameworks all the more important, if investors are to benefit from consistent and predictable decision making by government and regulators.

In New Zealand, Infracom was established in response to the national government’s concerns that: decisions within and across central and local government were not well integrated; there was a lack of transparency regarding planned infrastructure; and there was an undue focus on building new assets, rather than the outcomes that governments are trying to achieve and the nation’s ability to deliver those outcomes. As in the United Kingdom, New Zealand has recognised the importance of working to build a consensus on infrastructure planning. The act establishing Infracom explicitly states that the commission has the function of developing “broad public agreement”, while its core function is to develop “an approach to infrastructure and the services provided by infrastructure that improves the well-being of New Zealanders” (New Zealand Parliamentary Counsel Office, 2019).

The National Infrastructure Commission for Wales (NICW) was established in response to concerns that infrastructure decision making in Wales needed to be more clearly focused on pursuing a long-term strategy, rather than being driven by short-term considerations. The commission is also seen as a means of adopting a cross-sectoral approach to infrastructure, similar to that being applied elsewhere by the Welsh government, and of providing “integrated responses to some of the most pressing challenges facing Wales today” (Skates, 2018).

In 2018, Consult Australia, an industry advocacy organisation, published a report on the governance of Australia’s independent infrastructure advisory bodies (Consult Australia, 2018). In making the case for such bodies, the report emphasised similar themes or aspirations to those mentioned above:

- taking politics out of infrastructure development by establishing long-term strategic plans
- providing independent and expert advice about current and future infrastructure needs
- creating a pipeline for the roll-out of infrastructure projects that will deliver jobs and growth
- making infrastructure decision making transparent and evidence-based.

Structure and governance arrangements

Differing models for the organisations’ legal form have been adopted. Infrastructure Australia and Infracom have been established by statute as specific legal entities, arguably giving them greater permanence. Almost all of the subnational bodies in Australia have also been established by statute. However, the NIC, the NICW and the ICS have been established as executive agencies; in the case of the NIC, as an executive arm of the Treasury.

The key consideration is not whether these bodies have been created by statute or by an administrative decision of government; rather it is the governance principles underpinning the bodies’ establishment and responsibilities. Guidance on infrastructure governance published by the OECD is relevant in this regard.

Key principles highlighted in the guidance are reflected in the bodies' operations and decision making: taking a long-term perspective, rigorous and evidence-based decision making, effective engagement with stakeholders, co-ordination of policy and investment, transparency in decision making, and avoidance of conflicts of interest (OECD, 2017a).

All of the organisations report to a nominated minister, usually a senior minister with overall responsibility for infrastructure matters. For example, the NIC currently reports to the Financial Secretary to the Treasury. In addition to responsibility for tax policy and customs, the Financial Secretary also has responsibility for various infrastructure-related matters, including the NIC and public-private partnerships (UK Government, 2020).

In some cases, the legislation or charter establishing these bodies establishes reporting and accountability obligations in respect of both the advisory body and its responsible minister. These typically include a responsibility to publish and respond to the organisation's reports and recommendations. For example, the NIC's charter and the NICW's terms of reference commit the respective governments to:

- respond publicly to the commission's reports and recommendations within six months and never more than 12 months of the report being received
- give reasons where it disagrees with the NIC's recommendations and, where appropriate, provide an alternative proposal for meeting the identified need
- table the report and the government's response in parliament as soon as possible after their publication.

The UK government published an interim response to the NIC's National Infrastructure Assessment in October 2018, and has implemented many of the NIC's recommendations. Nevertheless, the absence of a final response suggests that while statements such as those in the charter are a useful means of supporting the independent bodies and their work, they also require ongoing commitment from governments. Equally, however, without some form of sanction for non-compliance, it is unclear whether a legislated obligation to respond to reports from the infrastructure body would deliver a different outcome. Other parties and civil society actors have a role to play in reminding governments of their undertakings.

Importantly, the NIC is also required by its charter to publish an annual monitoring report, taking stock of the government's progress in areas where it has committed to taking forward recommendations of the NIC.

In New Zealand, the government must table any report from Infracom in the parliament as soon as practicable after receiving it and must provide a response within 180 days. There is no obligation on the Australian government to publish and respond to reports from Infrastructure Australia. However, in 2016, the government responded in a detailed manner to the organisation's Australian Infrastructure Plan (Australian Government, 2016).

These arrangements do not commit governments to accept the organisation's recommendations; ultimately, governments have reserved policy- and decision-making responsibility for themselves. However, these arrangements foster greater transparency in the way the independent organisations work, make governments more accountable for their stance on particular issues, and contribute to broader debate about how best to deal with the major infrastructure issues facing the country.

A balanced board is broadly accepted as critical to the governance of these organisations. The boards are selected and appointed by the relevant minister overseeing the organisation. Commonly, they include directors from a number of infrastructure sectors. The directors of the independent bodies are drawn largely from the private sector although, not infrequently, the boards include individuals with prior

experience working inside government or who come from academia. This suggests that, in selecting the boards, governments are seeking to establish a balance between:

- the independence offered by a predominance of private sector directors, i.e. individuals (usually with some infrastructure experience) but with no direct connection to the government; and
- the desirability of having directors with knowledge of how the institutions of government work, and some insight into the key infrastructure policy challenges facing the government.

In some cases (mainly at the subnational level in Australia), the boards include the chief executive or secretary of one or more government agencies, such as the civil service or the Ministry of Finance; one or more of the larger infrastructure agencies (often including transport); and, on occasion, the land-use planning agency. There are advantages and disadvantages to the inclusion of senior civil servants on the board. On the one hand, their inclusion provides access to decision-making processes and priorities within government. On the other, their presence may be viewed as compromising the body's independence. Governance rules might be a means to, at least partially, address such concerns. Examples include:

- ensuring that civil servants constitute a minority of board members
- making it clear that civil servants are appointed as individuals for their professional knowledge, rather than as a representative of a particular agency or a government as a whole, and that in their role as a board member, the civil servant's first responsibility is to the body
- rigorous board decision-making processes, e.g. how the individual may (or may not) participate in a discussion or vote on matters relevant to their agency or government.

Prior to 2014, three of Infrastructure Australia's board members were senior civil servants selected by the minister on the nomination of the subnational governments. It appears this may have been done to ensure the organisation had access to insights about the particular issues faced by the subnational governments, especially in a federal country such as Australia, where most infrastructure is their constitutional responsibility.

Objectives and strategic focus

The NIC and the ICS have been given explicit objectives, while those of Infrastructure Australia and Infracom can be inferred from the legislation establishing each entity. Objectives for the NICW can be inferred from the commission's terms of reference. While the organisations' objectives differ in detail, there are similarities in their overall intent. For example, the main function of Infracom is to co-ordinate, develop and promote an approach to infrastructure that encourages infrastructure development that *improves the well-being of New Zealanders* (emphasis added). This simple exposition captures the fact that infrastructure exists to support the broad needs of a nation. Similarly, the NIC has been given an objective to contribute to improving the quality of life of people living in the United Kingdom. The objectives for the NICW capture a range of economic, social and environmental considerations.

To varying degrees, the organisations' objectives assign primacy to economic considerations. However, they also typically refer to social or equity issues. In some cases, such matters are referred to quite explicitly. For example, the ICS has specific objectives in relation to the development of an inclusive low-carbon economy. Similarly, the NICW is to support the Welsh government's efforts to develop an

inclusive economy, and “drive up the incidence of fair work”. The ICS’s objectives also refer to “inclusive economic growth” and “increasing industry competitiveness, whilst tackling inequality”. The NIC’s objectives refer to “economic growth across all regions”. Statements such as these point to the challenge of ensuring that infrastructure decision making has regard to equity considerations, both social and regional, as well as efficiency benchmarks.

Table 1 summarises the key strategic issues which the various bodies’ respective governments and parliaments have identified and on which they are seeking advice. They are sometimes identified in the legislation establishing the organisation, but are more commonly set out in a “letter of expectations” or “remit letter” (or some equivalent term) periodically issued by the responsible minister to the chair of the board. In the cases of Infrastructure Australia and Infracom, both of which are established by statute, the power (or obligation) to issue a letter of expectations is set out in legislation. On occasion, the responsible minister will separately issue terms of reference for an inquiry into a specific issue.

Importantly, within the broader policy priorities set out in the letters of expectations or remit letters, the infrastructure bodies have been given the freedom to identify and pursue work on particular issues as they see fit. They also have considerable freedom to adopt their own methodologies and make recommendations without direction from government.

Equally, the organisations are expected to recognise the need to engage with the government of the day, and work with other government agencies. For example, the remit letters to the NIC and the NICW state that the commission “should ensure that its recommendations do not re-open decision-making processes where programmes and work have been decided by the government, or will be decided in the immediate future.” The letter of expectations for Infracom states that the commission will work with ministers and officials “on a ‘no surprises’ basis with respect to the content, timing, information management and timing of its publication advice.”

Table 1: Comparison of governments' focus in establishing an infrastructure body

Strategic focus	Infrastructure Australia	UK National Infrastructure Commission	National Infrastructure Commission for Wales	Infrastructure Commission for Scotland	New Zealand Infracom
General					
Economic development	Legislation refers to improving national productivity. Letter of expectations refers to supporting economic growth through better use of existing assets.	Remit letter refers to contribution “to sustainable economic growth across the UK”, and “to improve the UK’s international competitiveness.”	Remit letter refers to building an inclusive economy, and refers to raising productivity and supporting agglomeration.	Remit letter refers to international competitiveness, and the markets and connections Scotland requires for goods, services and people.	“Long-term economic well-being” referred to in the ministerial letter of expectation.
Demographic change	Not explicitly referred to in legislation or letter of expectations, but addressed in Infrastructure Australia’s work.	Not explicitly referred to in the remit letter, but is addressed in the commission’s work, notably its National Infrastructure Assessment.	Not expressly addressed in terms of reference or remit letter, but implied due to Well-being of Future Generations Act.	Yes. Identified in government remit.	Yes. Identified in legislation as a focus.
Climate change	Legislation refers to climate-related policy issues.	The National Infrastructure Commission (NIC) has interpreted the “sustainable” element of its growth objective as including climate change.	Not expressly addressed in terms of reference or remit letter, but implied due to linkage with Well-being of Future Generations Act.	Yes. Identified in government remit.	Yes. Both mitigation and adaptation identified in legislation as a focus.
Technological change	Yes. Mentioned in letter of expectations.	Yes. Identified in the remit letter, and addressed in the National Infrastructure Assessment.	Yes. Referred to in remit letter.	Yes. Identified in government remit.	Yes. Identified in legislation as a focus.
Infrastructure development ownership and financing	Policy advice on funding and financing mentioned in legislation and letter of expectations. Legislative requirement to conduct five yearly national infrastructure	Not explicitly referred to in the NIC Charter or remit letter, although the 2018 National Infrastructure Assessment considered these matters.	Yes. Financing referred to in remit letter, particularly if seen as a barrier to delivering infrastructure.	Yes. Identified in government remit, including a possible Scottish National Infrastructure Company.	Letter of expectations asks Infracom to consider providing advice to the minister on “opportunities for PPPs [public-private partnerships] in

Strategic focus	Infrastructure Australia	UK National Infrastructure Commission	National Infrastructure Commission for Wales	Infrastructure Commission for Scotland	New Zealand Infracom
	audits and prepare infrastructure plan.				the short to medium term.”
Other	Legislation refers to promoting public awareness of infrastructure-related issues.	Resilience referred to in the remit letter.	Remit letter refers to the importance of place-building.	Remit refers to place-making.	Legislation provides Infracom with freedom to identify other matters.
Other specific matters					
	Contributing to an inquiry into freight and supply chains. Contributing to an inquiry (which has not proceeded to date) into road user charging for light vehicles.		Consider environmental duties of ministers under other legislation.		Letter of expectations refers to: more efficient port sector Upper North Island supply chain procurement practices.

Source: ITF analysis of legislation, government charters or remit letters for the bodies.

Although the NIC and the NICW are not established by statute, both governments have committed (in the charter or terms of reference for their respective commission) to publishing a remit letter (including a fiscal remit). The fiscal remit is discussed later in this chapter.

Independence

The degree of independence of these bodies is a critical concern. In some cases, civil servants from outside the organisations have criticised the infrastructure bodies as being too independent and “politically naive”. Conversely, other officials have criticised such organisations for being too close to the government of the day. This “independence challenge” is well-summarised in a report prepared by the New Zealand Treasury in the lead up to Infracom’s establishment. The report notes that, during consultation on the commission’s proposed role and structure, one party had stated, “There is a balance to strike with the entity’s degree of independence – too far removed and it lacks leverage; too close to the Crown and it could lack credibility.”

These criticisms tend to be made more commonly in relation to decisions on individual projects (reflecting the immediate political impact of such decisions) than broader debates about strategy and policy. For example, most of the longer established infrastructure bodies have advocated for some form of road pricing or charging in their respective jurisdiction. Indeed, several of the bodies have recommended such a reform, knowing that it was likely to encounter strong resistance from the government of the day, from opposition parties and from various non-governmental organisations.

Size of the organisations

The bodies are all relatively small, relative to the breadth of their responsibilities. The NIC had a budget of GBP 5.7 million (EUR 6.4 million) in 2019-20 and in 2020-21, and about 40 staff. Infrastructure Australia had a budget of approximately AUD 12 million (EUR 7.6 million) in 2018-19, and employed 24 full-time equivalent staff at June 2019. Infracom had a budget of NZD 9.1 million (EUR 5.4 million) in 2019-20 and NZD 13.5 million (EUR 8.0 million) in 2020-21. The ICS has approximately five staff members, including four professional staff.

Sectoral scope of the organisations' work

As shown in Table 2, differences exist in the sectoral scope of the independent bodies' work. Some, such as the NIC, have an explicit focus on economic infrastructure. Until relatively recently, Infrastructure Australia also focused exclusively on economic infrastructure, despite there being no statutory limitation on its scope. This changed in 2017, when it was asked by the responsible minister also to consider social infrastructure, and social infrastructure was addressed for the first time in the *2019 Australian Infrastructure Audit*. The newer organisations appear to have been given a broad remit covering economic and social infrastructure. Moreover, the ICS has recently argued that "natural infrastructure" needs to be addressed as part of a broad approach to infrastructure planning (Infrastructure Commission for Scotland, 2020).

Infrastructure and land-use decision making are closely linked, especially in the case of transport infrastructure. However, the role of the bodies in addressing land-use issues, e.g. housing matters, varies. For example, while Infrastructure Australia has no express mandate to address housing issues, in the last two years it has begun to do so, first as part of a report on the sequencing of urban development and infrastructure and, more recently, in a chapter on social housing in its *2019 Australian Infrastructure Audit*.¹¹ The ICS has an express mandate to address housing matters. The NIC, Infracom and the NICW consider housing and land-use matters indirectly. For example, interactions between infrastructure and housing supply are considered (such as the need for housing to be supported with certain infrastructure), although housing as a distinct class of infrastructure is not directly addressed.

Table 2: Sectoral scope of independent infrastructure bodies

Infrastructure sector	Infrastructure Australia	UK National Infrastructure Commission	National Infrastructure Commission for Wales	Infrastructure Commission for Scotland	New Zealand Infracom
Transport	Yes	Yes	Yes	Yes	Yes
Energy	Yes	Yes	Yes	Yes	Yes
Water	Yes	Yes	Yes (including drainage)	Yes	Yes
Telecommunications	Yes	Yes	Yes	Yes	Yes
Waste	No	Yes	Yes	Yes	Yes
Flood defences	No	Yes	Yes (including coastal erosion)	Yes	Yes
Social housing	Yes	No	No	Yes	No
Health	Yes	No	No	Yes	Yes
Aged care	Yes	No	No	Yes	No
Education	Yes	No	No	Yes	Yes
Open space and recreation	Yes	No	No	Yes	Yes
Arts and culture	Yes	No	No	Yes	Yes
Justice and emergency services	Yes	No	No	Yes	Yes
Defence	No	No	No	No	Yes
Natural infrastructure	No	No	No	Yes	NA

Source: ITF analysis of websites of the various independent bodies.

Scale of infrastructure

The minimum scale of the infrastructure considered by these bodies varies across countries. Moreover, individual bodies are taking a flexible approach to this question. Infrastructure Australia and the NIC focus on matters that are nationally significant in some sense, for example larger projects on major networks and/or policy reforms that are likely to be of national significance. However, the more recently constituted bodies appear to be considering a broader range of investments. For example, Infracom’s consideration of the infrastructure pipeline includes projects to be undertaken by local councils, with relatively lower capital values.

The legislation establishing Infrastructure Australia establishes some functions that refer to nationally significant infrastructure, and defines that term as “infrastructure in which investment or further investment will materially improve national productivity” (Australian Parliament, 2014).¹² Until 2018, the term was interpreted to mean investments that were likely to require more than AUD 100 million in Australian government funding. Since 2018, Infrastructure Australia has argued that “an infrastructure investment is nationally significant if, based on the evidence presented, the Board expects the investment to have a material impact on national output by:

1. addressing a problem that would otherwise impose economic, social and/or environmental costs
2. providing an opportunity for realising economic, social and/or environmental benefits, or
3. both addressing a problem and providing an opportunity.”

For the purposes of assessing submissions to the Infrastructure Priority List, Infrastructure Australia has applied a threshold value of AUD 30 million per annum (nominal, undiscounted) in measuring the material net benefit of the project, while also taking potential unquantified quality-of-life considerations into account (Infrastructure Australia, 2018b).

Neither the NICW nor the ICS operate under an explicit statement concerning the scale of the infrastructure that falls within their responsibilities. However, given the emphasis on “place-making” (which necessarily deals with local considerations) in their remit and work, it can be inferred that both organisations will work on both nationally and locally significant infrastructure.

Clearly, the focus of each organisation’s efforts is a matter for the relevant government (through the remit letter) and the organisation itself. However, the organisations’ modest size necessarily raises questions as to their capacity to address both national and regional/local level issues. Limited resources are likely to be best deployed in establishing robust planning, policy and investment settings at the national level. Additional resources are likely to be needed if the infrastructure bodies are asked also to address issues of more local significance.

Roles and functions

Ministers and governments remain the decision makers on infrastructure matters, as the independent bodies have no executive authority. Rather, the outputs of their work – principally strategies and other reports on particular issues and projects – are advisory in nature. As such, the organisations’ principal currency is the rigour of their work, their independence and the quality of their relationships.

As noted, the organisations’ small scale necessarily dictates a focus on higher level issues of strategy, policy reforms and, where relevant, large projects. Limited resources have sometimes meant that some functions assigned to the organisations have not been performed, e.g. Infrastructure Australia has not reviewed infrastructure funding programmes; instead, its project-related work has been confined to the assessment of large, individual projects.

Similarly, the organisations appear not to have been involved in assessing the success or otherwise of projects. This appears to be the result of both the resourcing reasons mentioned above and a broader reluctance across governments to undertake and publish post-completion reviews of projects. This could be a useful area into which to expand their remits, given the numerous examples of major projects that have both cost more and delivered less than expected. Where post-completion reviews are not already being undertaken by other government organisations, independent bodies could draw on experience in delivering projects and play an important role in drawing lessons for better infrastructure planning, project development and delivery.

A broad distinction between the roles of infrastructure advisory bodies is that, while all are tasked with providing strategic advice, only a proportion also have the role of providing specific, project-related advice. Tables 3 and 4 highlight the similarities and differences in the roles of the various infrastructure advisory bodies.

Table 3: Comparison of infrastructure bodies' strategy-related functions

Function	Infrastructure Australia	UK National Infrastructure Commission	National Infrastructure Commission for Wales	Infrastructure Commission for Scotland	New Zealand Infracom
Audit of existing infrastructure	Yes. Explicit statutory requirement.	Yes. Implicit in the conduct of the National Infrastructure Assessment.	Yes. The commission has to prepare a "state of the nation" every three years.	No. Although the "Findings report" (January 2020) includes comment on existing assets and governance.	Yes. Legislation requires examination of existing assets to meet future needs.
Development of a strategy or a plan	Yes. Prepared at least every five years. Fifteen-year outlook, unless board decides otherwise.	Yes, prepared at least once in every parliament (five years). Approximately a 30-year outlook.	Not expressly, although the state of the nation reports can make recommendations. Terms of reference require a 5-30 year outlook.	Yes. Recommends a 30-year outlook.	Yes. Prepared at least every five years. Thirty-year outlook. First plan, due by end 2021, will focus on strategies and priorities rather than specific projects.
Strategic advice on specific issues, both in relation to planning matters and particular infrastructure policy	Yes. Legislation refers to various matters, including: pricing, regulatory issues, climate change. Letter of expectation refers to additional matters, including: promoting best practice in reforming strategic infrastructure planning and whole-of-life asset management.	Yes. The commission produces regular studies on more focused topics that are agreed with the Treasury. Recent examples include reports on freight, regulation and resilience.	Yes. The commission can produce occasional reports on particular infrastructure matters as it thinks fit.	Yes. Implicit in the commission's broad remit.	Yes, including submissions to inquiries initiated elsewhere in government.

Table 4: Comparison of infrastructure bodies' project or investment-related functions

Function	Infrastructure Australia	UK National Infrastructure Commission	National Infrastructure Commission for Wales	Infrastructure Commission for Scotland	New Zealand Infracom
Project assessment	Yes. Strongly focused on CBA, though the framework is subject to periodic review, and current emphasis on CBA may be broadened.	In general, "no". However, the commission has been asked to review the options and sequencing for rail schemes in the Midlands and North of England.	No. Remit does not include reviewing programmes and work that has already been decided or is near a decision.	No, at least not explicitly.	No, at least not explicitly, but yes as an independent support to project agencies.
Advice on infrastructure priorities	Yes. Publishes an infrastructure priority list twice annually, showing specific projects and initiatives.	Yes, indirectly via strategic advice on broad investment priorities.	Yes. Includes providing advice on value for money on public and private investments.	Yes. Implicit in the role of providing advice on how to implement a strategic vision for Scottish infrastructure.	Yes.
Post-completion (ex post) reviews (PCR)	Yes. Infrastructure Australia provides guidance and frameworks for undertaking PCR.	No.	No, at least not explicitly.	No, at least not explicitly.	No, at least not explicitly.
Procurement advice	Yes.	No. The commission has provided advice on funding approaches (such as public-private partnerships, infrastructure banks). Procurement of specific projects is the responsibility of the Infrastructure and Projects Authority.	No, at least not explicitly in relation to individual projects. The commission can provide advice (it appears with more of a policy focus) on "cross-cutting issues" that bear on the ability to deliver on infrastructure needs.	Yes, implicitly as part of providing advice on how to implement a strategic vision for Scottish infrastructure.	Yes.

Source: ITF analysis of entity and other websites.

Strategic advice

In broad terms, the organisations' work in this domain falls into the following areas:

- development of cross-sectoral, long-term infrastructure plans focused on policy reform and the identification of medium- to long-term investment needs (as opposed to assessment of specific projects)
- advice on specific policy matters and (occasionally) on specific investment needs, usually prepared on the initiative of the organisation itself, but occasionally prepared at the request of the responsible minister.

Development of the plans typically involves an “audit” or review of the existing environment (e.g. policy settings, regulatory arrangements and governance) and current infrastructure networks, and a (necessarily high-level) assessment of the ability of those networks to meet prospective demand and/or adapt to changing conditions. These are not audits in a conventional sense, which assumes the existence of clearly specified standards and determines whether an entity has operated in conformance with those standards. Rather the audit or assessment is a broader examination as to whether a country's infrastructure networks, policies and infrastructure governance are adequate to meet that country's future needs. Undertaking the assessments necessarily requires input from line agencies, emphasising the importance of collaborative relationships between the independent bodies and other agencies. In many cases, the independent body's ability to undertake its work is underpinned by statutory or ministerial requirements for line agencies to work with the bodies. This is harder where inter-governmental relations are involved.

Project advice

Infrastructure Australia has a strong focus on evaluating individual project proposals. Most are received from subnational governments, occasionally from local councils (or from groups of local government bodies) and very occasionally from private sector parties. A large majority of proposals (probably greater than 95%) are for projects in the transport sector. This reflects both the fact that transport is almost entirely funded by governments in Australia and that there is a high level of vertical fiscal imbalance between the national and territorial governments. As a result, the state and territory governments typically ask the Australian government to co-fund major projects.

- In relation to projects, Infracom's functions appear to be different from those of some of the other entities. Infracom's legislated functions relate more to the strategic co-ordination of programmes and to consolidating and reporting information to present a project “pipeline” aimed at fostering private sector interest in the development and construction of various projects. Importantly, the commission also has a function of providing support services to delivery agencies on particular projects, i.e. to be a “collaborative friend”. However, this support is also underpinned by a government direction that, for projects valued over NZD 50 million, or where innovative approaches to procurement and alternative financing arrangements are being considered, project agencies must:
 - consult with the commission early in the development of their business case
 - follow relevant published Infracom guidance
 - involve Infracom in the assessment of the project's business case and advice to ministers
 - invite Infracom to participate in relevant project steering and working groups, and in the selection panels.

Infracom has recently published more detailed advice on how it can assist project agencies and local councils (Infracom, 2020a).

Project assessment is likely to be the most consistently controversial and difficult role for the independent bodies, as projects attract far more political and media interest than strategic documents. Other than in the most controversial of areas, e.g. road charging, strategies are often viewed as “something to be dealt with in the future”. Moreover, it is generally relatively easy to agree on strategic ends, even if the policy and investment programme means to achieve those ends might be debated. Projects, on the other hand, are more concrete and immediate.

The “collaborative friend” approach (a phrase found in the letter of expectations issued to Infracom) differs somewhat from the approach taken by Infrastructure Australia, which because of its mandate and history has focused on receiving and then evaluating submissions from proponents. This is not to suggest that Infracom will not argue for rigorous project evaluation. Clearly, that is the parliament’s expectation. Nor does it suggest that Infrastructure Australia does not work with proponents; indeed, it has actively sought to work with proponent governments and their agencies early in the life of a project, and not just wait for a project to be submitted for evaluation. In addition to critically appraising project proposals, Infrastructure Australia assists proponents, e.g. it has highlighted areas where a project’s economic appraisal may have underestimated project benefits. Nevertheless, the discussion above highlights an important difference in organisational approach, with impacts on the way an organisation is perceived and, in turn, operates.

Both approaches carry risks: the organisations risk accusations of “being a soft touch” or “being out of touch”. A “soft” approach, especially if consistently applied, runs the risk that the organisation will be “captured” by proponent agencies and, in some cases, by central agencies. A “hard” approach risks fracturing relationships with proponent agencies that are crucial if the overall value of the independent body is to be realised. In the worst case, the relationships can break down altogether, and the independent body can be bypassed, at least to some extent.

Ultimately, the boards and the senior executives of the independent bodies, in conjunction with the proponent and other agencies of government, must manage these challenges collectively. Goodwill is required, as is the need to set aside institutional “turf wars” between relevant line agencies and the independent body, and instead work together for a shared outcome.

Robust and widely agreed assessment frameworks are a means of addressing these challenges. Those bodies that have a role in project assessment, notably Infrastructure Australia, have played an important role in working with other agencies to develop and maintain these frameworks. However, while assessment frameworks can notionally be aligned, differences in key variables can persist; for example, the parameter values used in economic appraisals (whether generally or in the case of a specific project) can be debated at length. Thus, the existence of an assessment framework is a necessary, but not sufficient, step to improving decision making. Governments must endorse these frameworks, and mandate their application.

A particular issue within this field is that of compliance with project assessment frameworks in the case of the largest, and most politically sensitive, projects. While project assessment frameworks often mandate more rigorous scrutiny for larger projects, the experience of many countries is that projects promoted at the political level from an early stage – which tend to be among the costliest of all – often largely escape scrutiny via established project appraisal processes. This lack of scrutiny is associated with poorer project performance and tends to distort project selection processes and reduce overall infrastructure productivity. For example, a recent study of cost overruns on Australian transport infrastructure found that poor adherence to project appraisal processes is associated with a greater probability of cost overruns, and that cost overruns were 23% higher on average for projects that received a funding

commitment during an election campaign. Moreover, while only 32% of the transport infrastructure projects completed over a 15-year period were announced early (i.e. without proper project appraisal being conducted), these were responsible for 74% of the total cost overruns identified (Terrill, Coates and Danks, 2016; Terrill and Danks, 2016).

It is not yet possible to conclude whether the independent advisory bodies will prove capable of substantially improving compliance with project appraisal requirements and, if so, what key success factors might be identified. However, Infrastructure Australia has argued that the adoption in Australia of an Infrastructure Priority List has “been successful in guiding investments toward projects with demonstrated economic benefits” and that “... governments are prioritising the delivery of historically significant infrastructure” by choosing increasingly to fund projects from the list (Infrastructure Australia, 2018a).

This is also an area where the ICS is providing leadership. As well as providing advice on a 30-year infrastructure vision for Scotland (the “why and what”), it has also been asked to consider options for delivery (the “how”).¹³ The commission was also asked to provide shorter term five-year guidance to ministers on both of these matters. In its “Findings report”, released in January 2020, the ICS recommended substantial changes to the Scottish project appraisal system (see Box 3) to support the government in its aim of developing an inclusive net-zero carbon economy.¹⁴ The recommendations acknowledge that achieving the government’s strategic vision will require a substantial reform process, which will take time to implement. The ICS recognises “the possibility of significant trade-offs between pro-growth and pro-equality infrastructure measures, at least in the short run.”

Box 3. Leadership recommendations from the Infrastructure Commission for Scotland

1. All Scottish government-funded projects included in its 2020 Infrastructure Investment Plan should be prioritised against available inclusive net-zero carbon economy outcomes.
2. The Scottish government should, by 2021, develop and publish a new infrastructure assessment framework and methodology that will enable system-wide infrastructure investment decisions to be prioritised on the basis of their contribution to inclusive net-zero carbon economy outcomes.
3. The Scottish government should publish by 2023 a system-wide Scottish infrastructure needs assessment covering all infrastructure sectors defined by the Scottish government, and the inclusion of natural infrastructure is recommended. The assessment should be refreshed and updated at least every five years thereafter.
4. A fully updated infrastructure investment plan should be developed by the Scottish government for publication by 2025 using the new assessment framework and methodology and informed by the infrastructure needs assessment

Source: Infrastructure Commission for Scotland (2020).

Independent infrastructure bodies can also support better infrastructure decision making by taking on other roles. Noting the above-mentioned findings from Terrill and Danks, the independent body might be given the function of providing published advice on large infrastructure proposals that have been made in the lead up to, or during, election campaigns and have not been subjected to the standard project appraisal processes.

The obvious risk with this approach is that it puts the independent bodies in the middle of the political fray. The bodies may be reluctant to become involved in such sensitive environments and there is a risk of retribution from aggrieved parties after an election. However, as promises of new projects are central to most election campaigns, and as elected governments feel some obligation and mandate to pursue promised projects, there is a case for considering this further step. Given Terrill and Dank's findings on the correlation between projects announced during election campaigns, non-compliance with project appraisal processes and cost over-runs, there is a clear case for establishing a means of subjecting such projects to greater scrutiny.

The independent infrastructure bodies might work in conjunction with bodies such as the Parliamentary Budget Office (or similar entities) that have been established in some jurisdictions. These entities are sometimes called upon to provide costing and other commentary on promises in other policy areas made during election campaigns, with the aim of fostering more informed debate.

Transparency

A commitment to transparency is common across the independent bodies and is a key strength of this model. To varying degrees, all are committed to publishing their reports and the specialist advice they commission. Publication is important for several reasons. First, it is fundamental to achieving the consensus on infrastructure strategy that governments and parliaments are seeking by creating these bodies. Second, publication helps to meet the expectations of increasingly well-informed populations for detailed information and analysis on which to form their own views. The infrastructure bodies have a role to play in democratising infrastructure decision making, e.g. clarifying the difficult distributional decisions and trade-offs that governments need to make. Third, in an era of "fake news" and increasingly divided politics, credible analysis of infrastructure needs and potential solutions is more important than ever. Finally, the strategic direction that the independent bodies are expected to deliver must be able to survive changes in the responsible minister and in the government. If this is to occur, opposition and minority parties must be provided with the necessary information, data and tools to convince them of the merits of the case being made by the independent body.

At present, transparency is demonstrated in greater depth in relation to strategy-related reports than in relation to project advice. This needs to change, notwithstanding the evident political difficulties in doing so. Maintaining and increasing transparency in the independent bodies' operations requires:

- a demonstrated public commitment to transparency from governments and parliaments
- a requirement that governments publish substantive responses to the bodies' advice and recommendations within a set time frame, including giving specific reasons for not endorsing the independent body's advice
- sufficient resources to communicate their message effectively.

A legislated commitment to timely publication of the body's advice is crucial. An example is the legislation establishing Infrastructure Australia, which requires the organisation to publish a summary of each project proposal that it has evaluated during a calendar quarter as soon as practicable after the end of that quarter. The evaluations published by Infrastructure Australia are quite detailed and include content on a project's strategic alignment, CBA and delivery matters. Nonetheless, some argue that further detail should be provided.

The question of the level of detail included in published project evaluations relates to the matters discussed above regarding the nature and depth of the independent body's relationships with the

government and its agencies. Project proponents typically argue for their business cases to be treated confidentially, especially if the project proposal is assessed to be of questionable value or to require further analysis to substantiate the claimed benefits. An appropriate default position might be that, unless publication of the detail materially compromises a government's commercial position in tender and delivery processes, the details of a project business case should be available on a government website. There does not appear to be any clear reason why a commitment to publishing a response could not apply to both an organisation's strategic advice and project-related advice.

The independent advisory bodies need the capacity to present their analysis in different ways to meet the needs and expectations of different stakeholders. At one end of the spectrum, a set of key points need to be available for those who are time poor or only have a passing interest in infrastructure issues. At the other end of the spectrum, the independent bodies need to publish sophisticated, data-rich analysis if they are to convince key players such as major industry groups. The independent bodies are moving down this path. They are adopting modern social media communication strategies. Increasingly, they are publishing detailed technical reports and data sets underpinning their overarching reports.

Evidence on performance to date

The independent bodies have a difficult set of responsibilities. They have been asked to address weaknesses in planning and decision making that, in some cases, have existed for many years. Moreover, they are being asked to develop a consensus in an area of public policy that is often highly politicised, both in a broader strategic sense (e.g. agreeing on different objectives and different ways to achieve common objectives) and, for some bodies, in the short term (e.g. assessment of projects where there are markedly different views about the merits of a particular project).

The organisations inevitably operate in budget-constrained environments, where trade-offs must be made; for example, between addressing investment in crowded, rapidly growing cities and improving access to sometimes basic services in regional areas.

As the independent bodies are mostly relatively new organisations, it is difficult to draw firm conclusions as to how well they are managing these challenges and improving planning and decision making in the infrastructure sectors. That said, there are clear signs that the independent bodies have achieved some success. They allow potentially difficult issues, e.g. road user charging and approaches to dealing with climate change, to be raised in a comparatively safe environment. They can lend credence to the policy and advocacy work of actors in civil society. Importantly, they also provide a means for those working on challenging and unpopular issues within line agencies to gain a voice. Finally, they provide genuine thought leadership on particular issues. Examples include:

In Australia, Infrastructure Australia's work on asset recycling, the protection of corridors for future infrastructure development, and the sequencing of urban development and associated infrastructure.

In the United Kingdom, the NIC's work on improving the resilience of existing infrastructure networks.

Project assessment processes in Australia have improved in large measure because of the work of the various national and sub-national independent infrastructure advisory-bodies. On the whole, project business cases are now better documented and more robust than a decade ago, albeit governments still choose to build projects that have received positive project appraisals, as is their right.

Each country faces its own infrastructure challenges, and has its own cultural and institutional context. A model that works in some jurisdictions may not work in others. Each government therefore needs to consider what governance and institutional challenges it ought to address, then determine whether and

how the establishment of an independent body might offer a solution to those challenges. However, it is noteworthy that most of the independent bodies have been given remits that focus on medium- to longer term issues (broadly 5-30 years into the future). This suggests governments believe that:

- while project decision making may have been improving (perhaps in response to earlier changes in assessment processes), infrastructure strategy still needs greater attention
- an independent body (rather than changes within and between agencies) can help by:
- bringing a fresh, cross-sectoral perspective to the country's infrastructure challenges and options to address those challenges
- fostering informed debate, based on rigorous analysis
- supporting the development of some degree of consensus about the most promising solutions to the country's infrastructure challenges.

This requires the organisations to concentrate on policy reform and on shaping the priority, mix and broad scope of projects that might be funded beyond the current budget cycle. In particular, the independent bodies' advice on medium-term (five to ten year) investment priorities can help inform short-term government decisions as to where to direct their budgets for planning and feasibility studies.

There is considerable value in independently assessing individual project proposals. However, whether that assessment is undertaken by an independent body or some other specialist entity, such as the United Kingdom's Infrastructure and Projects Authority, is a matter for individual governments. There are arguments in favour of both approaches. On the one hand, assessment by an independent body allows the government to test whether the arguments which informed inclusion of an investment priority in a plan have been adequately reflected in the project proposal. Moreover, investment in large projects are strategically important in their own right. On the other hand, project assessment is resource-intensive, suggesting that the modest resources of the independent bodies might be better deployed in focusing on strategic matters.

The independent bodies are sharing their experiences and learning from each other. The Australasian I-bodies (now including Infracom) have met two to three times per year for the past five years. Increasingly, the Australasian and UK bodies are also in contact. This "community of practice" approach reflects best practice efforts in other contexts, such as the OECD's Network of Economic Regulators, which provides a forum for regulators – including those working in regulated infrastructure sectors – to compare experience and new developments.

Sound institutions and processes are also fundamental to successfully addressing infrastructure challenges. In this context, several countries have established independent bodies to provide fresh views on their country's infrastructure needs and how to deal with them. As the independent bodies are relatively new, it is difficult to reach firm conclusions as to where and how they have improved infrastructure decision making. However, the early results are encouraging: infrastructure planning and decision making in these countries appears to be stronger than before those bodies were established. In particular, they are providing a useful long-term, cross-sectoral lens to policy development and medium- to longer term investment. The bodies are becoming an established part of institutional settings in those countries. Other countries could benefit from adopting similar structures, albeit adapted to their own institutional and cultural circumstances.

Stewardship of existing assets

With the possible exception of digital infrastructure, most of the infrastructure that will be needed and used in 20, 30 or 40 years exists today. The long lifespan of most physical infrastructure gives rise to several key challenges. Infrastructure assets must be:

- well-maintained, to ensure their continued availability to meet user needs
- adaptable, i.e. able to be modified or used in a different manner as users' needs change and as technological and other changes emerge
- used optimally, to maximise user and other benefits, thereby deferring or avoiding the need for capital expenditure
- prudently developed and expanded, to ensure efficient expansion of the network to meet future needs.

It is apparent that these aspirations for asset management are not being realised on a consistent basis. Moreover, there is now an additional imperative to better manage existing assets as part of broader efforts to reduce greenhouse gas emissions. The ICS notes in its “Key findings” report, for example, that it is “essential that these [infrastructure] assets are most effectively and efficiently utilised, maintained and enhanced to net-zero carbon readiness.” The report indicates that achieving net-zero carbon readiness is likely to involve, among other things: a presumption of enhancing, repurposing or maintaining existing infrastructure over developing options for new infrastructure; and a presumption against like-for-like replacement of existing assets and the construction of new, single-organisation/purpose assets in favour of shared facilities (Infrastructure Commission for Scotland, 2020).

Over the last 20-30 years, many governments have corporatised or privatised utility infrastructure networks, and established economic regulators to ensure that utility owners are operating efficiently and that revenue from user charges is sufficient to ensure they remain going concerns capable of delivering infrastructure services into the future. In this context, a number of questions arise:

- Can aspects of these regulatory approaches be applied to infrastructure sectors (e.g. the transport sector) where user charging is less widespread, or where the funding of infrastructure remains heavily reliant on government budgets?
- What mechanisms exist to optimise maintenance expenditure?
- What mechanisms exist to ensure rational trade-offs between spending on new projects and maintenance spending?
- Is there a case for the decision criteria adopted by the economic regulators to be changed so that the impacts of regulatory decisions on other infrastructure sectors are addressed?
- Is there a case for the decision criteria adopted by the economic regulators to be changed so that non-asset objectives can be addressed more effectively?

Maintenance of existing assets needs to be improved

Suboptimal asset maintenance practices are common across a range of jurisdictions and infrastructure classes. For example, the ITF's 2013 Annual Summit heard that the backlog in maintenance of US urban public transport systems is valued at over USD 80 billion. The Forum noted that “infrastructure maintenance has generally been underfunded to the benefit of new capital investments and this has

deteriorated the present value and performance of transport networks. Many reasons were adduced for this systemic bias towards new construction, but foremost was the political preference for high-visibility ribbon-cutting over “hidden” expenditure on system maintenance” (ITF, 2014b).

Weaknesses in the management and maintenance of existing assets are not confined to the transport sector. For example, in its 2017 assessment of US infrastructure, the American Society of Civil Engineers observed, “With [drinking water] utilities averaging a pipe replacement rate of 0.5% per year, it will take an estimated 200 years to replace the system – nearly double the useful life of the pipes” (American Society of Civil Engineers, 2017).

Applying regulatory approaches to additional infrastructure sectors

In this context, comparing approaches to asset management in sectors that are largely funded and managed by government (principally transport) with those that are largely funded by users and subject to economic regulation (utilities) is instructive. While the economic regulation of utility networks is not without its issues (OECD, 2017b) – e.g. data and information asymmetry, information overload for consumers and risks of legal disputation – it appears that the regulatory approach provides a better means of ensuring sound stewardship of existing assets. That said, limited direct evidence is available and conclusions must therefore be based more on observations about the processes than on measured outcomes such as costs to users, service quality and integrity of the asset base.

A well-managed regulatory approach is more likely to elicit information on the condition of existing assets and on what maintenance practices and expenditures might be required to ensure the asset meets users’ requirements, and will also provide a funding regime to meet the efficient cost of maintaining network assets. However, those processes, while supportive of good outcomes, do not guarantee success and regulators have to deal with a range of challenges in discharging their responsibilities.

Lessons can be learnt from various infrastructure sectors. The Lisbon Charter, prepared by the International Water Association, provides guidance on the formulation of national and local public policies for the sector, the creation of associated regulatory frameworks for water services, and good practice for the implementation of such policies and regulations (International Water Association, 2015). The principles underpinning the charter are relevant to most infrastructure sectors. They are:

- effective water supply, sanitation and wastewater management make a positive contribution to sustainable development
- the provision of services should enshrine accountability and transparency
- the economics of service provision should be framed by long-term infrastructure investments and cost-recovery instruments
- service provision should take into account the financial, social and environmental aspects of all water resources
- effective service provision relies upon the collective actions of interdependent stakeholders.

The key messages in these principles – the importance of accountability and transparency, the use of long-term cost-recovery instruments, the need for the regulated services to take account of a range of considerations (not just financial ones), and the need for effective engagement with stakeholders – are similar to some of those set out by the OECD Network of Economic Regulators (OECD, 2014).

Transparency and funding arrangements are the principal areas of concern in applying an economic regulatory model to non-regulated infrastructure. The transparency potentially afforded by economic

regulation is likely to put into the public domain matters that governments might otherwise want to manage and resolve internally, such as asset condition and prioritisation of spending. However, there are clear benefits to enabling open debate about the nature of the trade-offs involved.

Funding issues fall into two broad areas: firstly, debates as to whether non-regulated infrastructure should be subject to user charging; and, secondly, if user charging is not applied, whether a regulatory type of structure inappropriately fetters governments' fiscal discretion. For example, if a regulatory approach were applied and it was found that the government should spend materially more to achieve certain service standards, a government might argue that it is its responsibility to take decisions about both the overall level of public expenditure and the balance of expenditure across portfolios.

Table 5: Regulatory functions that might be adapted and applied to non-regulated infrastructure

Function under the economic regulation of infrastructure	Could this function be applied to non-regulated infrastructure?	Comment
Determine need for asset maintenance, capital investment for other operating costs needed to meet service standards over the foreseeable future.	Yes	For regulated infrastructure, the regulator considers proposals from the owner/operator. In the case of non-regulated infrastructure, an independent entity would consider submissions from: the relevant infrastructure agency and/or the government (e.g. through the department representing the head of government and/or the Ministry of Finance). As with the regulation of utility infrastructure, the mandate of an independent body reviewing proposals from the government and infrastructure agency could be specified so that the government still decides which capital projects are pursued and how to deliver maintenance.
Determine efficient costs associated with the delivery of maintenance and capital investment	Yes	For regulated infrastructure, the regulator considers proposals from the owner/operator. In the case of non-regulated infrastructure, an independent entity would consider submissions from the relevant infrastructure agency and the public.
Set revenue requirements over a defined regulatory period (say five years, although it could be longer), based on efficient costs and, in some cases, tariffs within the overall revenue requirement.	Possibly	In an environment where user charging is not applied or only partially applied, the independent body could still make a recommendation on the total revenue required to maintain and develop the network to meet required standards. Whereas in the case of regulated utilities, the regulator's determination would be binding, in the case of non-regulated infrastructure, the independent body's advice would be a recommendation to the government. To address the need for transparency, the recommendation would also need to be made public.

Source: Working Group.

Nevertheless, principles along the lines of those mentioned above should be the starting point for considering how at least some of the attributes of a regulatory structure can be applied to infrastructure sectors that are still funded mainly or wholly by general government. This is a different sort of independent evaluation to that currently undertaken by the independent bodies. As noted above, they currently tend to focus on broader strategic issues and the evaluation of individual projects or schemes. They do not look at overall funding programmes and needs. Although the fiscal remit for the NIC requires some assessment

of programmes and overall outlays, the result is one where the commission must fit the cost of its recommendations within the given funding envelope; it does not have the remit to argue that the overall funding envelope should be expanded to achieve certain outcomes.

Application of the above principles requires consideration of which elements of the regulated approach could be applied or adapted to infrastructure that is not subject to user charging (or where charging meets only a small share of costs). Within the regulatory framework and policies established by government, economic regulators perform the broad functions set out in Table 5. The table offers some observations about whether these functions could be applied to non-regulated infrastructure.

Such a process would shed light on the maintenance and capital needs of the infrastructure in question. It would also clearly identify the service standards themselves and address the question of whether they require reconsideration. In the case of transport, or other sectors where there are multiple means of meeting infrastructure needs, planning and policy setting would still need to be undertaken by the government. For example, the government would still need to make choices about the balance between various forms of public and private transport necessary to meet local needs.

If the approach is fully transparent, including publication of the independent body's recommendations to the government of the day, it has the advantage of placing information in the public domain against which government policies and priorities can be assessed.

Without the introduction of greater application of user charging in the transport sector, there are obvious challenges in adopting a regulatory or semi-regulatory approach. However, the funding of an asset manager within the government sector via user charges is currently being applied in specific cases. For example, ASFINAG plans, finances, builds and maintains Austria's motorway network. It is fully owned by the Austrian government and is funded by toll revenues. The ASFINAG example shows that, although the application of user charging to the entire road transport network continues to present political and other difficulties, applying user charging to the most economically critical (and most heavily used) parts of the road network, e.g. motorways with a manageable number of entry and exit points, is achievable. However, as noted by the OECD, creating an incentive framework for publicly owned infrastructure operators is challenging (OECD, 2017b). A recent paper for the ITF comments on efforts in Australia to take a range of "no regrets" steps towards a broader system of road charging (Alchin, 2019). Those steps are still ongoing, highlighting the difficulties in this area.

However, it is possible to apply a contract-based model, in which the Ministry of Transport agrees to fund a state-owned enterprise that has management responsibility for a portfolio of infrastructure assets at a certain level, contingent on specified service standards being met, which can provide similar performance incentives without requiring direct user charging. This model, in which a regulatory oversight body monitors performance against agreed indicators and standards, provides an improved evidence base to ensure the accountability of asset managers (Makovšek and Veryard, 2016).

Optimising maintenance, and trade-offs between new projects and maintenance

The importance of good maintenance practices is broadly accepted, although it is not consistently realised in practise. Underperforming assets – such as roads and railways that are subject to load restrictions, or electricity networks that suffer from brownouts and blackouts – and assets that fail, e.g. bridges that collapse, impose immediate and sometimes long-lasting economic and social costs on society. Repairing assets after their condition has degraded materially is more expensive than timely investment in routine and preventative maintenance.

As noted earlier, the ICS has argued in favour of a presumption that existing assets will be used in preference to new investment. However, in various situations, infrastructure networks must be expanded to address growing demand. Governments, infrastructure owners and operators need sound asset management plans to provide the basis for striking a reasonable balance between these competing imperatives. Striking an appropriate balance between the need for new investment and the need to maintain existing assets is also a challenge (OECD, 2017a). This is true not only for government-funded infrastructure, but also for infrastructure that is funded through user charges.

Asset management plans should be the result not only of technical considerations, but also input from users and other stakeholders. Decisions about where, when and how much to maintain existing infrastructure assets are subject to the same economic and social expectations as investment in new infrastructure. A strictly economic focus on maintenance would prioritise spending on more heavily utilised assets that are important for the economic development of a region or country. However, this approach may lead to underspending on assets that are required to ensure reasonable levels of accessibility and service across a region or country.

Governments can improve the rigour and transparency of these decisions by ensuring that sufficient funds are committed to enhancing agencies' asset management planning. Similarly, when making their revenue determinations, economic regulators could include an allowance in their revenue determinations for infrastructure owners to collect and present comprehensive asset management data, then require the owners to present and use those data in seeking future determinations. Without this funding, and the asset management expectations that go with it, material improvement in decision making on the balance between maintenance and capital spending seems unlikely. Asset management plans should be informed by:

- Condition assessments – this is a particular challenge for local infrastructure, where local council capacities are often constrained by funding and their ability to employ and retain enough well-trained professionals with the requisite experience and skills.
- Fit-for-purpose modelling of prospective demand.
- Service standards – although these are politically contentious, they are vitally important to enable governments, owners, regulators, users and the community at large to have some basis for debating the aggregate level of spending on maintenance and new capital as well as the distribution of that spending. Without published service standards, the levels of service that users might expect are simply implicit rather than explicit.
- Judgements about the nature and timing of technological change that is likely to affect the infrastructure sector in question.

Such an approach would enable the parties to understand the economic benefit of existing infrastructure. It would also enable an explicit valuation of the subsidies necessary to provide a target level of service where user charges are either not applied or do not meet costs, and to clarify the extent of any under- or over-investment.

Adapting economic regulation to address broader objectives

The issues discussed earlier – notably the long-term resilience of infrastructure networks, the potential benefits of cross-sectoral planning and the social impacts of infrastructure decisions (e.g. the equity implications of user charges and/or differences in access to services) – raise important questions for the economic regulation of infrastructure. In particular, questions arise as to whether and, if so how, economic

regulation can address some or all of these matters. As Cifuentes (2016) notes, the objectives of economic regulation in the infrastructure sector have generally been far more limited: “Internationally, the role or objectives of economic regulators of infrastructure tends to include one or more of the standard economic objectives of achieving economic efficiency, encouraging investment, promoting competition, mitigating monopoly power, allowing cost recovery and protecting the interests of consumers.” As a result, the issues mentioned above have generally fallen outside the regulators’ remit.

Moreover, the regulators themselves tend to be reluctant to take on new responsibilities, such as making trade-offs between social and environmental objectives and traditional objectives such as securing economic efficiency where there are natural monopolies and otherwise fostering competition. This reluctance appears to stem from concerns at:

- a potential loss of clarity in their regulatory remit
- the potential for “regulatory overload”.

Moreover, there are considerations of legitimacy. For example, one commentator has observed, “the broadening of regulatory responsibilities to account for social and environmental obligations can represent a significant shift in the division of responsibilities between government and economic regulators. Such a shift may not sit easily within existing regulatory frameworks; and the resulting tensions have the potential to impact detrimentally on the types of outcomes economic regulators are normally intended to promote; namely business certainty, investment and economic efficiency” (Decker, 2010).

These concerns are most evident in relation to the distributional impacts of regulatory decisions. It is broadly accepted that, in a democracy, governments are best-placed to deal with the distributional impacts of regulatory decisions, principally by transparently subsidising the infrastructure charges paid by specific members of society. Regulators are not accountable at elections and are therefore not well-placed to make those judgments. Where distributional matters are to be considered by a regulator, it is vital that the government provide clear guidance to the regulator on its role and the weight to be given to particular considerations.

There is little evidence that the economic regulators of infrastructure take account of cross-sectoral considerations when making regulatory determinations. This is likely to be largely a consequence of the regulatory “rules of the game” that the regulators must operate within. Owners and operators of regulated networks might also resist such an approach. Thus, if cross-sectoral regulation is to occur, governments will need to lead by changing the frameworks within which the regulators operate. This is not to argue that cross-sectoral matters should not be considered; rather, it is to make the point that governments need to provide direction and clarity as to their expectations.

A recent NIC study has considered some of these matters (NIC, 2019a). It concludes that, in the case of the United Kingdom:

- the current regulatory system needs to be adapted to meet the long-term challenges confronting society, including achieving net-zero emissions by 2050, improving resilience in the water sector and supporting an increasingly “digitalised” society
- government needs to take a leading role in setting out a long-term strategic vision for the regulated sectors, because infrastructure owners and regulators do not always have the right incentives to do this
- national regulators need to engage with devolved and local strategies

- regulators should have duties to promote infrastructure resilience, support the achievement of greenhouse gas emissions reduction targets and collaborate with other regulators
- regulators should regulate investment in strategic enhancements separately from maintenance of existing networks, using “competition for the market” and longer price controls where appropriate
- The UK Regulators Network should have a stronger role and be supported by an independent chair, developing more joint data sets and knowledge sharing.

These observations are also likely to be relevant in other jurisdictions.

The context for reform

Each country faces its own unique infrastructure needs and circumstances. However, some key challenges are common across countries and across infrastructure sectors and, increasingly, they can be seen as inter-related. These include climate change, technological change, and the maintenance and replacement of existing assets. The environment in which these challenges must be addressed is characterised by falling rates of productivity growth, rising international tensions, increasing pressure on public budgets, rising inequality and falling trust in public institutions. Governments, industry and society at large face difficult decisions, many involving uncomfortable trade-offs, in managing these challenges. The need to address this complex environment and make sound choices which consciously balance competing objectives has driven the increasingly widespread adoption of strategic infrastructure planning and the progressive expansion of the scope and content of these plans in many countries.

Notwithstanding changes and improvements in infrastructure planning practice, further improvement is needed. Various strategic planning techniques can help anticipate and manage the impacts of an uncertain future. These include: scenario planning, planning on a cross-sectoral basis and improvements in consultation with those who will be using or affected by infrastructure decisions. However, the application of scenario planning remains comparatively rare, while cross-sectoral planning is on the frontier of planning practice. Both of these techniques aim to deal with complex systems. Presenting the results of that analysis in a way that is comprehensible to governments and the community at large is particularly difficult. Governments, industry, academia and professional associations should continue to apply and improve those techniques, despite these difficulties

CHAPTER 4

Broadening the scope of infrastructure appraisal

This chapter discusses current infrastructure appraisal practices, highlights key criticisms and considers how appraisal practice can be expanded to ensure that all the relevant impacts of infrastructure investments are taken into account in the decision-making process.

The role of cost-benefit analysis

Decisions about investment in road, local transport and passenger rail infrastructure are rarely based on private sector commercial principles. Among the reasons for government intervention in such decisions are the absence of a transparent method of charging road users for the benefits they derive from the infrastructure and the presence of monopoly and network effects, which inhibit the development of a competitive market for providing transport infrastructure. In addition, transport infrastructure and its use have impacts that extend well beyond the interests of the providers and users, including impacts on the environment, air quality and greenhouse gases.

The method

CBA provides decision makers with a method for assessing the return to society that a proposed infrastructure investment can be expected to achieve. As a methodology, CBA is founded on welfare economics principles. The CBA measure of social returns is based on the value of benefits that the users of the scheme will derive, including the improvement in accessibility (measured in terms of time savings), improvements in journey quality and any other cost savings. A broad CBA should also include a range of impacts that must be quantified indirectly, such as the impacts of the transport project on the risk of accidents and injury, on local communities in terms of effects such as noise and pollution, and on wider concerns such as climate change.

Research conducted over the last half century has substantially improved the evidence base regarding how transport users and those affected by a project value the outcomes of a project and how these values can be expressed in monetary terms, thus facilitating this broader approach. Moreover, monetary values for such effects as time savings, reductions in fatalities, improvements in air quality are now well established and most countries have either compiled their own sets of values or adopted values derived from studies carried out by comparable countries (IER Stuttgart, 2005).¹⁵ This means that CBAs are increasingly adopting a broader scope, which incorporates monetary values for the social and environmental impacts of proposed projects into the core analysis. This is essential to ensure that the full impact of a proposed project is understood and weighed appropriately.

The specification and design of the project will determine the size of a project's impacts when compared with scenarios in which the project is not constructed or an alternative project is built. Estimates of transport users' responses to the improvements delivered by the new infrastructure can be developed on the basis of knowledge of how users value time and other cost savings, and of the expected extent of these savings. This, in turn, will provide the analyst with an estimate of the responses to the project in terms of

choices of route, mode, time of travel, destination and other key variables. Changes in people's travel choices will also have an impact on the external impacts of transport, such as local and global pollutants, that can be estimated from the changes in travel patterns that take place. When combined with projections of travel demand over the life of the project, the costs and benefits over the project's lifetime can be estimated.

Its uses

CBA provides decision makers with an understanding of the likely outcomes of a project or policy. It shows whether the benefits to transport users and to others affected are likely to exceed the costs and so helps the decision maker understand whether there is a strong case for approving the project. A project can be considered to be in the national interest if the mix of social and financial returns is expected to exceed the project's costs. The costs are generally funded by taxpayers, who are part of the same population as the beneficiaries. CBA helps the decision maker reach a view on priorities and to choose between mutually exclusive options when faced with several projects competing for a limited budget. A well-conducted CBA also provides decision makers with information about aspects of a project that cannot easily be quantified or valued. If these impacts are considered likely to be significant, the decision maker can then make an informed judgement about the relative importance of the quantified and unquantified impacts when reaching a decision about whether to approve a project.

There is a risk that decision makers will interpret the results of a CBA as being in conflict with their intuition. For example, a public transport improvement aimed at influencing mode choice and emissions might result in existing public transport users reaping the greatest benefits. Analysts must work to ensure that decision makers understand CBA methods, the way in which it simulates a market-based assessment, and the information it gives them about the choices and trade-offs that they face.

The use of a common CBA methodology and consistent benchmark values for key variables (e.g. the value of a statistical life) has the further advantage of facilitating a consistent approach to decisions about transport projects across different transport modes, by the different institutions responsible. Even where responsibility for setting some values, such as the value of time savings, is delegated to the relevant authority, CBA ensures that such variations are transparent and, in most cases, supported by evidence about transport users' preferences.

Undertaking a CBA is only one step in the project planning process. Decision makers also require evidence of funding availability and of any potential revenues in order to demonstrate the financial case for the project. At the same time, the sponsor will need to show the capability to procure the project effectively, to allocate and manage the risks, and to provide for the maintenance of the assets over their lifetimes.

Wider economic benefits

While the majority of the benefits of a transport infrastructure project generally accrue to transport users, such as time savings and associated user effects, a comprehensive CBA must also identify the impacts on other affected members of society. There are well-developed techniques for measuring and putting a monetary value on changes in the environmental externalities of a project, including changes in greenhouse gases, local air quality and transport-related noise levels.

More recently, work has been undertaken to develop methods that extend the analysis of the external impacts of a project to incorporate its effects on the wider economy. These can include impacts on productivity, labour supply and investment. These effects, described as "wider economic benefits" (WEBs),

extend the scope of project analysis into the realm of impacts on the macroeconomy, usually at a local or regional level. In essence, the focus is on estimating the extent to which output and employment may increase in the aggregate (i.e. at the economy-wide level) as a result of the transport infrastructure investment. This will occur if the investment successfully addresses some existing market imperfections.

Wider economic benefits may be real and significant, particularly in the case of larger projects designed to have transformative impacts, suggesting that including them in the appraisal of such projects will be important to achieving a comprehensive assessment of expected impacts. The methodology adopted must avoid the risk of double-counting impacts that are already captured in the CBA. This can occur due to confusion regarding the conceptual nature of some impacts. Venables (2016) highlights this point:

Transport improvements enable savings in transport and communication costs for firms, workers, and consumers, enhancing effective proximity. In turn, cheaper, more reliable and faster transport may allow firms to change the way in which they organise their logistics or production (e.g. just-in-time manufacturing technologies). These gains are user-benefits, and are accounted for in calculation of those benefits. They should not be double-counted as a wider economic impact.

Such evidence as has been published suggests that WEBs are generally substantially smaller in size than the benefits that accrue directly to transport users. For example, the United Kingdom's Department for Transport guidance¹⁶ notes that "where productivity impacts are relevant, they are generally in the range of 10% to 30% of total transport economic efficiency user benefits". However, analysis of a few, very large and transformative projects, such as the Grand Paris Express currently under construction, have concluded that wider economic benefits are likely to constitute a significantly larger proportion of the total project benefits.¹⁷

Productivity impacts

There is a well-established relationship between aggregate levels of investment in infrastructure and the rate of growth in a country's GDP. At least at certain stages in the cycle of economic development, countries that invest more in infrastructure aimed at relieving constraints on capacity tend to experience a faster rate of economic growth (Aschauer, 1989), albeit that some research suggests that this effect is dependent on the quality of infrastructure investment decisions.¹⁸ Recent analysis of the potential causes of this finding has focused on the role of urban agglomeration on productivity and on the role of transport infrastructure in enabling a change in the level of agglomeration.

Research undertaken at Imperial College London (Graham, 2007) and elsewhere on the relationship between transport, cities and productivity has established a measure of "economic mass" (the term "effective density" is also used) or agglomeration. There are two parts to the measure of economic mass. The first is the number of workers in each zone in the city, with the zones often defined to correspond with the structure of zoning adopted in the transport model used in estimating the changes in travel patterns for the CBA for the project. The second is the level of accessibility (in terms of travel time and costs) between that zone and all other zones, with the value of the measure for the other zones each weighted by the number of employees in that zone. Thus, transport costs are an integral part of the measure of economic mass. Analysis of data on productivity – defined as output per worker – shows a causal relationship between economic mass and productivity. Thus, investment in transport increases economic mass, in turn increasing productivity. Better connected cities are more productive places. The effect of changes in economic mass on productivity in any zone in the city declines with distance from the project, with negligible productivity effects in zones more than around 20 kilometres from the project.

Cities that have experienced an increase in economic mass induced by a transport scheme tend to benefit from a second-round effect. Firms relocate to the city, while existing firms expand, because of better access to workers, suppliers and customers and because each expanding or relocating firm benefits from the increase in productivity from the first-round effect. Thus, both components of the economic mass term change – each nearby zone has become more accessible and each zone has an increased employment density because of the relocation of activity. The UK Department for Transport appraisal guidance¹⁹ defines the first-round effect as a “Level 2”, or static, impact and the changes following from the relocation of economic activity as a “Level 3”, or dynamic, impact. The “Level 1” analysis is restricted to the more conventional benefits of time and cost savings, and social and environmental impacts.

Induced investment

The economies of all countries change continuously. Existing firms expand or contract: new firms are established and others close. Transport infrastructure is one factor that influences firms’ decisions. The business and regulatory environment and the quality and skills of the labour force are some of the many other factors that firms take into account when planning their future. Transport is an enabler of economic growth, but is not the sole cause.

In certain cases, transport investment can generate new or additional investment and employment – i.e. investment that, in absence of the project, would not take place. For example, better infrastructure can attract foreign direct investment which, by introducing new management methods and working practices, can boost productivity. These effects may, over time, spill over to domestic suppliers. The extent to which transport investment on its own can be the cause of additional economic activity is context specific and differs from place to place and from country to country.

Importantly, investment induced by a transport project in one location may often displace activity that would have taken place elsewhere. The extent of unemployed or underemployed resources in the local economy that would be drawn into productive activity by the transport project will determine the assumption made in the economic appraisal about whether displacement is less than 100% and the scheme therefore has a net impact on total employment. In some countries, such as the United Kingdom, the default assumption for all transport appraisal purposes is that, at a national level, 100% displacement occurs and there is no net additional impact on the level of employment.

Investment in transport infrastructure, by changing the attractiveness of different locations, can change the locus of economic activity. Where such displacements of economic activity occur, the main benefits of such changes to the firms that take advantage of the new infrastructure are reflected in the time savings and vehicle operating cost savings that form part of the conventional CBA. However, certain effects of such changes fall into the WEB category, as they are additional to the factors that have influenced the decision taken by the firm or household. When a transport scheme induces a firm to move to a new location and that location is one where the measure of effective density is higher than in their former location, the increase in the density of employment and, hence, productivity as a result of that move benefits all firms in the new location. This benefit is necessarily larger than the sum of the costs due to reductions in effective density in the locations from which the firms have moved. However, it is important to ensure the analysis only weighs the net benefits of these density changes – i.e. offsets the costs due to density reductions in areas that lose companies or workers against the benefits due to density increases in areas that gain them. The net density benefit is additional to those measured in the conventional approach: the relocating firm does not consider, in its decision to move, these impacts on other firms.²⁰

The benefit attributable to the project due to workers who move is delivered by both the increase in employment density and the increased productivity of the jobs to which the workers have moved.

However, there is some uncertainty about the extent to which workers who move to a location where productivity is higher benefit from spillover effects and become as productive as existing workers in that sector and location. UK practice has tended to test the sensitivity of the results of this part of the WEB appraisal by also including a scenario that assumes that workers who move to a more productive location continue to have lower productivity than the existing workers in that location. New infrastructure can also result in a firm deciding to move to a less productive place. By increasing the accessibility of an area, inter-urban road projects can induce firms to take advantage of lower rents, and potentially wage costs, by locating outside the urban area. However, this has the effect of reducing the effective density benefits accruing to firms that remain in the agglomeration – i.e. of imposing “wider economic costs” which will, at least partly, offset the WEBs.

Employment impacts

Infrastructure that reduces the time or other costs of the journey to work will have some impact on the willingness of economically inactive potential employees to join the labour market. The extent of this impact depends on the extent to which the project reduces barriers to access to work for those who are on the margins of the labour market and on the demand for labour with the skills of this group of potential workers. There are close linkages between the impacts of infrastructure on investment, as described above, and its impacts on employment. In most cases, changes in the level and location of investment will have corresponding effects on the location and level of employment. Assumptions about the extent of job displacement and of any net employment increase should follow those made in the assessment of investment effects.

CBA provides decision makers with a national-level assessment of project impacts. However, the impact of a project on local or regional labour markets is often a key policy objective. Additional modelling of relocation and land-use changes, as described below, is needed to show whether the project is likely to deliver these regional policy objectives and can help to indicate what additional measures might be needed.

As noted above, investment in infrastructure changes the relative attractiveness of different locations and can lead to firms deciding to relocate or expand. In a fully employed economy, a shift of activity to a location with improved infrastructure results in less economic activity in other locations. If effective density differs between these locations, the overall level of economic activity will change because productivity differs between locations. Decisions taken by firms about location choice include consideration of the cost of access to labour markets, thus linking the employment and the investment effects of a project. Land-use planning decisions such as authorising an increase in the supply of land for housebuilding will also have an impact on employment, enabling firms to access a larger labour market at a lower cost.

Quantifying wider economic benefits – first-round agglomeration impacts

The transport model used to quantify the changes in travel time and other costs experienced by users of a project also plays a major role in estimating the extent of the wider economic benefits. Quantification of the first-round effects – the impact of the changes in transport user costs on productivity – requires data on the average gross value added or wages per worker in each of the zones in the transport model, data that in most cases are segmented by broad industrial category. Two further terms are required: 1) an elasticity of productivity with respect to effective density; and 2) a distance decay function, which is based on evidence of the decline in the change in productivity with distance from the zones through which the project passes. With this information, the change in economic output in each zone and in each segment of the urban economy can be estimated and added to the conventional estimate of the user benefits.

The values of the sectoral elasticities and of the distance decay function are derived from econometric studies using time series and/or cross-sectional data from different cities; the costs of using the transport network; and the volume of trips, employment densities and the productivity of the different sectors of the city's economy. Such studies are data-intensive and complex. Where local data on sectoral elasticities and on the decay function are not available, default values can be adopted, such as those found in the UK Department for Transport's guidance in TAG Units A 2.1-A2.4 and the associated TAG databook (UK Department for Transport, 2019).

Quantifying wider economic benefits – second-round agglomeration impacts

The methods needed to quantify the second-round agglomeration effects that result from a change in the location of economic activity are significantly more demanding than those used to estimate first-round effects. The transport model that serves to estimate the changes in the trips made by those who benefit from the project is, for the most part, based on the assumption that these changes have no effect on land use. Estimation of these land-use changes requires supplementary economic modelling, for example using a Spatial Computable General Equilibrium (SCGE) or Land Use and Transport Interaction (LUTI) model, so as to take account of the changes in the costs incurred by firms in doing business in different locations and of their responses to the changes in such costs as a result of the transport project. LUTI models use data on access to labour, customers and suppliers and on rents in different locations, together with data on land-use planning regulations and restrictions, to estimate the changes in location made by firms in order to reduce their costs or increase their profitability in response to the transport project.

LUTI models were initially developed to help land-use planners appreciate the likely effects on traffic flows and public transport demand of approving housing and commercial developments as part of a comprehensive rezoning strategy. However, political approval for the rezoning of an area at an increased density, which might justify a new public transport link or more highway capacity, may not be forthcoming. Good practice therefore requires that a range of scenarios about the extent of the proposed rezoning should be modelled in the analysis.

The LUTI model is supplemented by an economic model to estimate the impacts of the transport and land-use changes on GDP and on government revenues. In some applications of LUTI-based economy models, the component used to estimate effects on tax revenues and productivity relies entirely on the land-use change and the changes in effective density caused by the changes in the location of employment.²¹ The methods of SCGE,²² however, also take direct account of any efficiency gains to the firm of the relocation decision and of gains to developers, as well as providing a more comprehensive assessment of the changes in tax and government revenues. In addition, many applications of both LUTI/economy models and SCGE models take account of further potential impacts on productivity and government finances. These include the second-round effect of spending from the demand generated by the agglomeration impacts on investment and on employment and the consequences of both funding the project and of the tax revenues generated on public finances.

The labour market effect of workers moving to a different job in a more productive location is estimated through the same method used to estimate the relocation decisions made by firms. The relocation decision depends in part on the availability of labour, with an improvement in transport infrastructure making a location more attractive both to workers and employers. The monetary value of such changes for inclusion in the CBA is determined by the additional tax revenues paid by those who move to a more productive, and so higher taxed, job.

The worker's decision to change location is based on the change in post-tax earnings and in transport costs when compared with the previous job and its location. The transport user's benefit for the worker who

relocates is measured through conventional transport appraisal methods – the rule of a half for generated trips. Since the worker could always have earned the increased income by changing workplaces before the improvement in transport infrastructure but chose not to do so, there is no additional benefit to the worker from the higher post-tax earnings: they compensate for the longer journey to work or other attributes of the more productive job. But additional to this is the incremental tax revenue from these workers – additional when compared with their previous place of work. The additional tax revenues on the increased pre-tax earnings is counted as a source of wider benefits as it permits all other taxpayers to pay marginally less (assuming total tax receipts remain unchanged).

There are several sources of evidence on the impact of a reduction in the costs, time and inconvenience of the journey to work on the economically inactive but adequately qualified labour force. The UK Department for Transport’s guidance is based on evidence of the effects of tax and social security benefits on labour force participation and on the assumption that a change in the generalised costs of commuting has the same impact as the equivalent change in post-tax income. The benefit is valued taking the same approach as for the change in job location, based on the change in income tax payments, on the grounds that the individual’s change in employment status was determined by the increase in post-tax income made possible by the project.

Data requirements for estimating WEBs will differ between countries according to the level of spatial detail at which information is published. The UK Department for Transport’s Wider Impacts Dataset²³ provides an example of what is needed to estimate this source of benefit.

A well-conducted CBA makes allowance for the inevitable uncertainty about values and methods and about projections of future demand, costs and values. In this way, decision makers can assess a number of scenarios for each project and understand which projects are the more likely to yield positive net benefits in a wide range of plausible scenarios. The nature and extent of WEBs are at least as uncertain as the key CBA variables: for example, land-use related benefits that depend on zoning changes may not be realised, or may be reduced in scale, if lobbying by local populations prevents or reduces the extent of the assumed rezoning. More generally, because the methods of estimating WEBs are less well established, their extent is likely to be more uncertain than are key CBA variables. While setting out an economic narrative, as described in Section 4.3 below, helps to reduce the “black box” nature of the WEB estimates, the limitations of the methods used to estimate WEBs and the uncertainty that inevitably is part of predictions of local economic impacts remain. Decision makers should be aware of these limitations and WEB estimates should be identified separately from those of CBA. WEB analysis should be reported in a transparent manner that allows decision makers to understand the key assumptions underpinning the analysis, the level of uncertainty attached to them and the effect of these assumptions not being borne out on the estimated benefits.

When should an assessment of wider economic benefits be undertaken?

Modelling and estimating wider economic impacts is data-intensive and adds to the resources required for preparation of the overall project appraisal. Such additional analysis is likely to be justified only where projects are likely to have impacts that go beyond those of a conventional transport scheme – i.e. reducing congestion, reducing accidents and improving the local environment. The resources required to estimate the first-round impacts are significantly less than those needed to estimate second-round impacts. There is therefore a case for estimating these first-round impacts even if land use is assumed to remain unchanged (i.e. there are no second-round effects). Projects aimed at relaxing constraints on land for housing and business development, and which are associated with proactive policies such as improvement to the urban realm, are among those likely to merit the more comprehensive modelling of land-use change

and the implications of such changes for WEBs. The aims of the project sponsors and the promoter's vision of how the transport project will interact with these wider policies will be a more relevant consideration than the capital costs of the scheme. It is unlikely that any but the highest cost schemes will merit the full assessment of wider economic impacts. In the case of smaller schemes, much useful information can be provided through a well-constructed economic narrative, as described in the following section.

Integrating WEB assessments with traditional CBA

As noted above, WEBs, when quantified in terms of the agglomeration impacts and the additional tax revenues from workers moving to more productive jobs, count as additional impacts to those included in traditional CBA. In addition, if evidence suggests that a project might have the effect of bringing into the labour market workers who would otherwise be inactive, the benefit of their participation in the labour force also counts as an additional impact.

Even if full quantification of these WEBs is infeasible, a qualitatively based economic narrative can complement the CBA and other project analyses. Such a narrative can inform policy makers and others about how the scheme is expected to deliver the predicted WEBs and what additional policies and decisions may be needed to build on the expected improvements in accessibility and ensure the productivity and other wider impacts are obtained in practice. A well-constructed economic narrative might start with an assessment of the economic development of the urban area or region and its strengths and weaknesses, and describe the opportunities that arise from the project. This assessment should outline the steps that can be taken by both the public and the private sectors to realise those opportunities. Additional considerations will be the skills of the labour force, measures to upgrade these and to ensure a well-functioning housing market in response to the relocation of economic activity.

An assessment of the institutional framework, including the roles of the different national, regional and local authorities responsible for delivering the transport and other related interventions needed for the successful delivery of the strategy should form part of the plan set out in the economic narrative. The narrative should also set out incentives for these bodies to deliver the economic strategy and the role of the private sector in developing and delivering the land-use change and the subsequent changes to the economic structure of the city. A description of the roles of the key actors in delivering the strategy and of the interactions between them will provide decision makers with information on the part that they will need to play in delivering the wider benefits.

The economic narrative should also identify transmission mechanisms and describe how the improvements in accessibility delivered by the scheme improve productivity, labour supply and other economic variables. The aim of this stage of the assessment is to ensure that the economic narrative remains founded on the processes through which the WEBs are quantified and modelled. Transport is an enabler of higher productivity and is rarely its sole cause. The narrative should ensure decision makers understand the additional measures that need to be implemented to build on the transport project and to deliver the desired outcomes. The assessments of the strengths and weaknesses of the local economy, of the labour force and of the business environment, as described above, will help clarify the complementary measures needed to maximise the value of the transport investment. An appreciation of the project's potential to deliver economic benefits can help those responsible for its implementation to identify the critical success factors for the package.

Metrics – BCR and GDP effects

CBA is founded on welfare economics concepts. It clarifies the comparative societal welfare impacts of different investments by assessing the utility, or value, people place on the impacts transport investment will have on them. It is not intended to measure the effect of an investment on the national economy, defined in terms of GDP, a macroeconomic metric that conforms to national accounting conventions and which is restricted to marketed goods and services. Impacts such as savings in travel time on leisure trips or environmental impacts figure in CBA methodology but are not part of the conventional national GDP accounting process.

However, most governments have an objective of raising productivity and so of increasing GDP as an indicator of the growth in a country's prosperity. One of the strengths of the appraisal of the WEBS of a transport scheme is that these impacts can be valued either in the context of a welfare framework, as described above, or in terms of GDP and national accounting methods. The increase in output per worker is caused by the transport investment, the costs of which are already part of the cost-benefit calculation. No additional input is required of the workers who benefit from working in a better-connected city, with the opportunities that this facilitates. The CBA includes both the additional post-tax income earned by workers and the tax they pay on these earnings from which society as a whole benefits. These additional pre-tax earnings also will be counted in a country's national accounts as a measure of increased productivity and hence as an impact on GDP. In this respect, the welfare impact and the GDP effect are identical.

The additional earnings generated by the relocation of economic activity are treated differently in a CBA and a GDP metric. The welfare benefit gained by those who change where they work is measured through the change in transport costs they experience, with the most marginal person who moves gaining a minimal benefit and hence the average traveller who moves jobs getting half of the benefit of existing users. Added to this is the social benefit from the additional tax revenue on these higher earnings. But the GDP metric counts the entire increase in output since the additional time spent in commuting or the additional demands on the worker when in the higher paid job do not count as costs in the GDP calculus to be offset against the increase in productivity.

Estimates of the GDP effect have helped decision makers understand the potential for raising funds for major projects. Such estimates can show how much of the initial capital costs might subsequently be recovered through tax payments on the additional income generated by the changes in the location of economic activity caused by the project. An analysis of the GDP effects of London's Crossrail scheme helped to make the case for the introduction of the business rate supplement, an additional local tax levied on all large firms in London, which provides around a third of the funding for the scheme.

Equity impacts and regional effects/economic rebalancing

One of the criticisms sometimes levied at CBA is that it is unfair, as it is said to favour higher income users and regions. Many of these criticisms are unjustified. Most countries adopt a national average value for time savings for any given journey purpose. This policy of treating all travellers' time savings as of equal worth, despite evidence of a higher willingness to pay by higher income groups, is one way of ensuring all transport users are treated equally in the conventional appraisal method.

Changes in the structure of many countries' economies towards greater agglomeration in the most productive conurbations have had the effect of increasing the gap between the richest and the poorest parts of most economies. Moreover, recognition of the contribution that transport investment can make to increasing the productivity benefits of agglomeration and the tendency to invest in places where the

benefits are the highest has risked increasing this divergence. As noted above, the evidence used to quantify agglomeration effects is based on the differences in output per worker between locations and hence shows greater returns in higher income locations. However, there have been strong political pressures in many countries in recent years to reverse this imbalance and to target transport infrastructure to the less prosperous cities and regions.

The methods used for appraising WEBs and the associated impacts on local and regional GDP can help decision makers understand the trade-offs they face when deciding where to target transport investment and what additional measures might increase the returns to investment in the regions they wish to favour. For example, policy makers might decide to adopt measures that shift the allocation of new housing construction to lower growth regions. In such a case, the modelling and appraisal of the project's WEBs will help decision makers understand the effect of such a policy on labour supply, the effect of this change on the attractiveness of the region to employers and the extent to which the policy enhances the first-round impacts on transport users derived from conventional CBA.

Sustainability impacts

CBA and the methods used for modelling the effects of a project on traffic and travel patterns are generally capable of demonstrating the likely impact of the project on many, if not all, of the set of sustainability objectives. For example, traffic modelling methods are used to show how changes in highway infrastructure influence traffic volumes (including induced traffic) and vehicle speeds and hence the net effect of the scheme on greenhouse gases, air quality and noise levels. There are well-established values for changes in such environmental impacts, often based on data from epidemiological and other studies. Impacts on landscape, biodiversity and heritage are more difficult to value and decision makers are often given a qualitative assessment of these impacts as part of the information to inform their choices.

Individual transport projects are not in themselves the way of delivering a sustainable transport policy. The assumptions and monetary values that are derived from the overall policy of moving to a more sustainable economy should form inputs to the CBA model. For example, a shift to electric vehicles will reduce the costs of motoring in most countries, unless associated with other changes in the way motorists pay for road use, as well as having an impact on emissions, noise and carbon. An appraisal of an infrastructure project that includes a scenario for the electrification of the vehicle fleet should therefore incorporate assumptions about road users and external costs in the appraisal of the options for the scheme. These assumptions will also form part of the case of the do-nothing default option.

Integrating the different dimensions of appraisal

As noted in the opening section of this chapter, CBA aims to provide decision makers with the information they need to judge whether a specific project provides a mix of social and financial returns that are expected to exceed its costs. This information also helps decision makers choose between mutually exclusive projects and to rank projects where there is a budget constraint and not all schemes with acceptable benefit/cost ratios can be funded.

However, the ratio of benefits to costs is not the only consideration of relevance. As noted, not all the impacts of a project can be expressed in monetary terms. For example, many countries lack robust techniques for deriving monetary values for the impacts of infrastructure on certain environmental outcomes. The UK Department for Transport's Guidance 24TAG Unit A3 sets out means of deriving a qualitative scale to assess the impacts of a scheme on unquantifiable variables including landscape, townscape, historic environment, biodiversity and the water environment. A seven-point scale, ranging

from largely beneficial to largely adverse, is used and forms an integral part of the appraisal. Thus, decision makers are presented with a mix of quantified, monetised impacts and impacts which, while the categorisation is based on a consistent method, are described in terms of their relevance and weight in the decision.

The role of the decision maker is to consider the trade-offs in choosing between options. For example, approving a scheme with, for example, benefits valued at EUR 25 million and costs of EUR 15 million and rejecting an alternative with the same benefits, costs of EUR 10 million but, unlike the higher cost option, with an adverse impact on both landscape and biodiversity shows that the decision maker puts an implicit value of at least EUR 5 million on saving the environment from these adverse impacts.

Decision makers often also face a choice between projects with higher net benefits in a more prosperous part of the country and a project with lower net benefits that benefits a region where productivity is lower. A policy that favours investment in parts of the country that are already experiencing higher than average growth might be criticised as inequitable, despite its greater contribution to national prosperity. A set of appraisals that cover projects in different locations and include both conventional benefits and wider economic impacts can give decision makers valuable information about the trade-offs between considerations of inter-regional equity and national productivity growth.

Decisions on transport infrastructure inevitably involve the exercise of judgement. A well-conducted CBA, supplemented by WEB where needed and other relevant analysis can help to inform such decisions and provide the decision maker with a yardstick for assessing criteria that are not easily quantified and expressed in money terms.

Linking project appraisal and selection with strategic plans

Infrastructure plans, even at the strategic level, are generally objective led. Objectives such as eliminating bottlenecks, improving the accessibility of more remote areas, increasing the size of the labour market accessible to the major conurbations or increasing cohesion all influence the direction of strategic planning. Linking these strategic objectives with indicators, such as congestion hotspots, traffic flows and journey time maps, provides a means of identifying locations where there is an *a priori* case for intervention. Colour coded maps of networks and traffic flows are an invaluable tool in building the strategic case. Such maps can show where there is a divergence between the relevant strategic objectives and the performance of those parts of the network.

Below this strategic level is a process of option generation and appraisal. In some cases, the set of options might extend to more extensive interventions, such as new regulations on all vehicles to improve air quality rather than attempting to address this policy objective through individual projects. In most cases there will be infrastructure-based interventions, whether new links or improvements at junctions, capacity enhancements or the use of new technologies to manage the network better. Each of these options will undergo the various stages of CBA, starting with a high-level sifting exercise in advance of full quantification and prioritising against the set of criteria that relate to the high-level strategic objectives. As the options are narrowed and practical considerations, such as whether the option is a feasible one and can be delivered to the required timescale, are taken into account, the next stage is to undertake a more detailed specification of the short-listed options and embark on the quantified CBA. In this way, the top-down strategic planning and the bottom-up appraisal process are linked.

Issues in cross-border strategic infrastructure planning

Infrastructure planning in respect of assets that serve communities in two or more countries or self-governing regions entails specific challenges that must be managed successfully to ensure efficient infrastructure choices can be made, implemented and sustained over time. This section outlines two significant case studies of cross-border infrastructure planning and management, highlighting the nature of the challenges faced in each case; the institutions, policies and mechanisms used to address them; and providing an assessment of the outcomes. It then proposes general lessons for policy makers dealing with cross-border infrastructure planning issues.

The Danube River

The Danube is the longest river in the European Union and a vital artery for millions of people and unique natural habitats. With its 2 857 kilometres, the Danube is a significant route of transport, trade, energy, migration, social and cultural exchange. Touching ten different countries, the Danube River is the world's most international river. The Danube region is home to more than 115 million inhabitants, living in very diverse countries with significant differences in culture, language, religion, social cohesion, political integration and level of economic development. The region stretches from the Black Forest (Germany) to the Black Sea (Romania-Ukraine-Moldova). Some of these countries are among the world's wealthiest, while others qualify as developing countries under World Trade Organization or United Nations definitions. Some are EU member states, while others are EU candidates or keep the status of EU neighbour countries. Apart from these differences, the region is also marked by long history of political conflicts, showing the delicate situation in the region. Therefore, several instruments have been developed to foster and facilitate cross-border and transnational co-operation, some of which could serve as best practice examples for other regions with a similar background.

Definition of the region

The Danube region refers to 14 countries identified by the EU and defined as the so-called Danube macro-region. A strategy to boost the development of this region was proposed by the European Commission and endorsed by EU member states, creating the EU Strategy for the Danube region (EUSDR).²⁵ The main goal is to jointly address common challenges faced by EU member states and third countries in the same geographical area, which shall benefit from strengthened co-operation contributing to the achievement of economic, social and territorial cohesion.²⁶ The Danube region comprises ten riparian countries of the river itself (Germany, Austria, the Slovak Republic, Hungary, Croatia, Serbia, Romania, Bulgaria, the Republic of Moldova and Ukraine) and four countries taking part in the EUSDR linked to the river basin either via important tributaries (e.g. Sava) or via their close historical and economic ties: the Czech Republic, Slovenia, Bosnia and Herzegovina, and Montenegro. Nine of the countries are EU members (Austria, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Romania, Slovenia and the Slovak Republic) and five are non-EU countries (Bosnia and Herzegovina, Moldova, Montenegro, Serbia, and Ukraine).

Figure 2: The Danube region – territorial coverage



Source: European Union.

Economic and political situation in the region

A major issue for infrastructure policy co-ordination is the very diverse economic status of the countries concerned. Average GDP per capita across the region as a whole is only about two-thirds of the EU average and less than 60% of that of OECD countries.²⁷ However, some countries, especially on the upper part of the river, are among those member states of the EU with the most highly developed regions (EU economic performance by NUTS-2 in 2015),²⁸ and among the highest scorers on the UN Human Development Index (HDI).²⁹ Others are among the weakest performing economies in Europe and, in some cases, even qualify as developing countries under HDI or World Trade Organization rules. In addition, many countries show great internal differences between the capital and other urban areas and the countryside.

Actors in the Danube region

The EU is present in the region through both its general policy programmes and funds and some specific infrastructure-based initiatives. The newly established Transport Community³⁰ brings together the EU and a number of non-member states from South East Europe in an initiative aimed at the integration of transport markets of the South East European Parties into the European Union transport market. This includes action in the areas of technical standards, interoperability, safety, security, traffic management, social policy, public procurement and environment, for all transport modes except aviation.

In recent years, the People's Republic of China has increased its economic presence in the region by way of both its One Belt One Road initiative and the 17+1 initiative. The Russian Federation has a traditionally strong political and economic presence and is a member of several international organisations, such as the Danube Commission. The Danube Commission supervises the implementation of the 1948 Convention on Navigation on the Danube, which provides for free navigation on the river in accordance with the interests and rights of the contracting parties and supports its further development. The commission has worked to address environmental protection issues connected with navigation on the river and has driven fundamental change in the way fairways are maintained and developed. The United States is present in the region both via North Atlantic Treaty Organization and via the so-called Three Seas Initiative.

The most important Danube river-related international organisations, apart from the EU, are:

- the Danube Commission, which deals with inland navigation

- the International Commission for the Protection of the Danube River, which deals with the environmental protection of the Danube river basin
- the United Nations Economic Commission for Europe (UNECE), which contributes to the development of transport infrastructure through two projects: TEM for roads and TER for railways.³¹

The EU Strategy for the Danube region: Cross-border co-operation in strategic infrastructure planning

The EUSDR is designed as a policy framework, specifically established for countries in, or adjacent to, the Danube River basin. As a “macro-regional strategy”, it offers an integrated framework to address common challenges faced in a defined geographical area that includes both EU member states and third countries. It is intended to benefit all parties via strengthened co-operation, contributing to the achievement of economic, social and territorial cohesion.³²

The EUSDR was jointly developed by the European Commission, together with the Danube region countries and stakeholders, in order to jointly address common challenges. The strategy seeks to create synergies and co-ordination between existing policies and initiatives taking place across the Danube region.

The goals of the EUSDR are laid down in an Action Plan, which represents a central working document and integrated response to the common set of challenges and opportunities. In 2020, the EUSDR Action Plan underwent a major update since 2010 streamlining, concentrating and updating the so-called targets and actions, putting them into a strategic background, and providing links to embed the EUSDR into other EU and national funding and financing programmes.

The EUSDR’s working programme is structured in four so-called thematic pillars, as set out in the EUSDR Action Plan. These pillars define the main goals of the strategy:

- connecting the Danube region
- protecting the environment in the Danube region
- building prosperity in the Danube region
- strengthening the Danube region.

These pillars are sub-divided into 12 so-called priority areas (PA), two of which mainly cover the issue of transport: PA1a (waterways mobility) and PA1b (rail-road-air mobility), which are co-ordinated by Austria and Romania (PA1a), and Slovenia and Serbia (PA1b). These two PA have the following targets, which determine what concrete projects are to be supported by the EUSDR:

PA1a:

- Increase cargo transport on the river by 20% by 2020 compared to 2010.
- Remove obstacles to navigability, taking into account the specific characteristics of each section of the Danube and its navigable tributaries and establish effective waterway infrastructure management by 2020.
- Develop efficient multimodal terminals at river ports along the Danube and its navigable tributaries to connect inland waterways with rail and road transport by 2020.
- Implement harmonised river information services on the Danube and its navigable tributaries and ensure the international exchange of river information services data preferably by 2020.

- Solve the shortage of qualified personnel and harmonise education standards in inland navigation in the Danube region by 2020, taking duly into account the social dimension of the respective measures.

PA1b:

- Support efficient freight railway services and improved travel times for competitive railway passenger connections between major cities in the Danube region by 2030.
- Support fully functional multi-modal TEN-T core network corridors by 2030.
- Support the development of efficient multimodal terminals at sea, river and dry ports in the Danube region and ensure their connectivity and access through the integration of all modes of transport and efficient logistics services by 2030.
- Support improvement of the regional air connectivity and the implementation of the Single European Sky Initiative.
- Facilitate the improvement of secondary and tertiary roads in the Danube region.
- Support safe and sustainable transport and mobility in the Danube region.

The EUSDR does not have its own administrative structure or a dedicated budget. Rather, it relies on other resources, such as INTERREG (Danube Transnational Programme) and the CEF (the Connecting Europe Facility). Its added value is that it offers participants a platform to co-ordinate their needs, programmes and projects with regard to transport infrastructure specifically. Both PAs have produced significant achievements, which serve as positive examples of cross-border co-operation on strategic infrastructure planning. The following describes some of these.

Achievement 1: Fairway Rehabilitation and Maintenance Master Plan (Pa1a)³³

In 2012, a majority of the Transport Ministers of the Danube region signed the “Luxemburg Declaration”, which committed them to implementing effective waterway maintenance measures. A “Fairway Rehabilitation and Maintenance Master Plan” (FRMMP) for the Danube and its navigable tributaries was developed within the framework of the EUSDR and endorsed by the Danube Ministers of Transport in December 2014. Their commitment was reconfirmed by ministerial declarations in June 2016 and December 2018. The Master Plan was also on the agenda of the Ministers of Transport during the Austrian Presidency of the Council of the EU in 2018. Key parts of the Master Plan are being implemented through the FAIRway Danube project (2015-20).

The FRMMP highlights national needs and short-term measures to ensure the efficient and effective realisation of harmonised waterway infrastructure parameters along the entire Danube and its navigable tributaries within the existing legal framework (especially the UNECE’s AGN agreement [European Agreement on Main Inland Waterways of International Importance] and Belgrade Convention)³⁴ and along the lines of the Luxemburg Declaration. It includes an overview of existing critical waterway sections or locations, needs, and actions.

The FRMMP also estimates the required investment and operational costs per country needed to achieve the required service levels. These service levels are defined by the above two conventions. The AGN divides European waterways of international importance into different classes (I to VI), with different requirements for a guaranteed water depth over a specified amount of days per year for each class. The Belgrade Convention requires the parties to keep their part of the Danube in a navigable state, a term now generally understood to mean in a state consistent with the AGN requirements.

With its ten riparian states, the Danube is also the most international river in the world. In addition, its hydrological, morphological and biological status differs greatly between the upper, central and lower Danube. Therefore, the FRMMP contains a description of the situation in each riparian state at the time of the creation of the plan (2014), including information on the responsible authorities, critical locations and their length, major problems, etc.

The waterway management authorities governing the Danube and its navigable tributaries have estimated the costs of bridging the gap between the status quo in fairway maintenance and management and the common minimum levels of service at EUR 93 million. This total comprises investment costs of about EUR 84.9 million and operational costs of about EUR 8.1 million. The main investment needs are for dredging equipment, riverbed surveying and fairway marking.

As a consequence of the master plan, the countries concerned initiated the CEF-funded project FAIRway Danube, which led to the development of national action plans³⁵ on fairway maintenance and rehabilitation. These contain a status report, hydrological conditions at critical areas, monitoring of activities, ecological status, budget status and an outlook for each country. They are updated twice a year.

Achievement 2: Transport study for the Danube region (2017) (PA1b)³⁶

The purpose of this study for PA1b is to present an overview of the transport modes and identify regional transport projects that are relevant at country level and important for the Danube region, while achieving the maximum geographical coverage. The study describes the socio-economic characteristics of the region, the transport networks and the links between them in the light of transport policy. It also describes population trends and future transport needs in the region.

For road and rail, the study shows a significant disadvantage of rail in terms of the modal split. For demand, national transport operations prevail for both for passengers and freight.

For air transport, yearly passenger traffic increased from 125 million to 146 million trips in the five years to 2015 (i.e. by 17.3%, or 3.5% per year), while cargo volume rose from 843 tonnes to 915 tonnes per year (8.5%, or 1.7% per year). Significant shares of passengers and cargo transit through the hubs of Munich and Vienna (respectively 44% and 67% in 2015), while other primary international airports are in Bucharest, Budapest, Prague and Sofia and the airports of Belgrade and Zagreb are regional hubs in the Western Balkans. All have different needs in terms of infrastructure adaptation to meet user needs. For example, whereas most people travelling from or through airports in southern Germany and Austria are business travellers, those travelling within the Western Balkans are usually migrants or tourists.

The basic findings of the study were that road will most likely keep its advantage over the other modes, that the overall population of the region will decrease (albeit with different trends at country level) and that GDP will increase, leading to higher passenger and freight demand, especially in road transport, especially in the Western Balkans. Bottlenecks were found to result largely from lack of compliance with infrastructure with technical standards, lack of capacity (e.g. near urban areas), deterioration due to lack of maintenance, and differences in track gauge for rail (with Moldova and Ukraine).

In order to better assess infrastructure requirements at an international level, the study divides the Danube region into nine “functional regions”, based on the following five criteria:

- choice of the basic spatial entity by disaggregating the EU member states, the accession countries of the Western Balkans and the neighbouring countries
- spatial interactions: analyse the spatial interactions among basic spatial entities relying on the intensity of the flows of freight and passengers of the land transport modes
- socio-economic homogeneity

- transport context: to what extent the functional regions identified are embedded in the context of the TEN-T/CEF corridors, South-East European Transport Observatory and Eastern Partnership transport networks
- measures of accessibility.

Following this approach, the following nine functional regions were identified: Southern Germany and Western Austria; Eastern Austria and Slovenia; the Czech Republic and the Slovak Republic; Hungary; Croatia and Bosnia and Herzegovina; Montenegro and Serbia; Bulgaria; Western Romania; and Eastern Romania, Moldova and provinces of Ukraine. Based on a number of criteria, 23 priority projects were identified for road, rail and aviation in the region.

In conclusion, good cross-border infrastructure and services promote economic development and contribute to improving people's living conditions. In many parts of the Danube region, it also contributes to promoting stability in the region.

The Öresund region³⁷

The Öresund region consists of the regions closest to the Öresund strait between Denmark and Sweden. In Sweden, the major cities involved are Malmö (Sweden's third-largest city), Landskrona, Helsingborg and Lund. The region involved is Skåne, covering 33 local municipalities in the southernmost part of Sweden. Copenhagen, the capital, is the dominant Danish city in the Öresund region. Other major cities are Roskilde and Elsinore, though both are much smaller. Two formal regions in Denmark are normally seen as involved in the Öresund region: Hovedstaden, surrounding Copenhagen, and Sjælland (Zealand), covering the northern part of Zealand. There are 46 local municipalities in the two Danish regions. A total of 3.8 million inhabitants live in the region, of whom 2.5 million are on the Danish side.

Figure 3: The Öresund region



The 1991 decision to build the Öresund Bridge was taken by the national governments and was intended, in part, as a means of regenerating Malmö and Copenhagen, both of which had suffered from structural economic declines, with little new development replacing the shift away from traditional industrial production and ship-building during the 1970s and 1980s. The decision to build the Öresund Bridge was intended to boost the regional and national economies, and to connect Scandinavia more closely to the EU internal market. It was designed to integrate labour and housing markets on both sides of the bridge, linking lower priced accommodation on the Swedish side to a more buoyant job market on the Danish side. The project was just one component of a suite of multi-sectoral policies for economic rejuvenation based on investment in higher education, research facilities and technology-based industrial parks in both

Copenhagen and Malmö. Integrated development planning across sectors was the key to the Öresund fixed link successfully delivering the benefits foreseen in project appraisal (OECD, 2006).

The project led to the establishment of new collaborative structures and organisations at the regional and municipal levels and has prompted progressively greater collaboration across the Öresund region in many fields over the subsequent three decades. The Öresund Committee was, among other things, responsible for fostering closer regional co-operation, including on transport issues generally. However, formal planning responsibilities have largely stayed with the national government agencies and ministries in the two countries.

Regional co-operation was seen by many stakeholders as having faltered during the 2010s. This led to a 2018 reorganisation which created the Greater Copenhagen area, which included the Skåne and Halland regions of Sweden. Transport planning and public transport are areas of responsibility of the new regional body.

For some time, the closest co-operative arrangements have been between the municipalities. There are two main examples of this in the transport space: 1) the plans for a new fixed link between Helsingborg and Elsinore, with the two cities being heavily engaged in the project and preparations; and 2) the plans for an extension of the Copenhagen metro system to Malmö. The Copenhagen and Malmö municipal governments have been the main actors in this project.

The Öresund Bridge

In 1991, the Swedish and Danish governments signed the agreement to construct a combined bridge and tunnel across the Öresund strait, and it was officially opened in July 2000. The Öresund Bridge is a 16-kilometre road and railway connection between Denmark and Sweden. It consists of three parts: a bridge, an artificial island and a tunnel. The eight-kilometre bridge is constructed on two levels, with trains running on the lower level and cars on the upper level. The artificial island, Peberholm, connects the bridge with a four-kilometre tunnel that ends at the Copenhagen central station. The car journey across the bridge takes 10 minutes and a train trip between central Malmö and Copenhagen takes 35 minutes.

The traffic flows on the Öresund Bridge have greatly exceeded expectations. Over 70 million cars have crossed the bridge and almost 300 000 regular customers use a “BroPass”. The main drivers for commuting across the strait have been the lower housing prices on the Swedish side and higher wage levels on the Danish side. Initially, 41% of the bridge traffic was commuters. In recent years, a widening exchange rate gap has further strengthened this effect. In practice, the bridge has significantly expanded the size of the labour market.

In 2019, an average of 20 400 vehicles crossed the bridge each day. Car traffic continues to predominate, however the growth in freight traffic has been substantially greater than that of private vehicles in the past two decades. While the total volume of traffic crossing the bridge increased by around 150%, to 7.5 million, between 2001 and 2019, the number of trucks (> 6 m in length) approximately quadrupled to 0.6 million. Bridge crossings by trucks accounted for 51.5% of all truck crossings of the Öresund strait in 2012.

Rail traffic across the bridge comprises commuter traffic, mainly the local Öresund trains, and international freight traffic that connects Sweden to the European continent. Between 2001 and 2011, rail freight increased by almost 50%, to a peak of around 31 million tonnes, before stabilising at 28-30 million tonnes in subsequent years. Approximately 6 500-7 000 freight trains ran each year before 2010, while numbers in subsequent years have been significantly higher, at 8 500-9 000.³⁸

Rail passenger numbers rose progressively from around 5 million in 2001 to a peak of 12 million in 2015, before stabilising at similar levels in subsequent years. The construction of the City Tunnel in Malmö has

reduced the journey time to Copenhagen central station to 35 minutes, as well as improved access via the two new stations opened as part of the project. The train now departs six times per hour in peak periods. The Öresund regional trains run from Kalmar, Karlskrona and Gothenburg through Malmö and Copenhagen to Elsinore. Most (75%) train trips have both their point of departure and final destination in the Öresund region.

To increase interest in events taking place on the other side of the Öresund, the Öresundsbro Konsortiet, the company operating the Öresund Bridge, has focused on leisure trips and created new incentives for passengers and other users (e.g. “Snabbtursrabatten” and “Club Öresundsbron”).

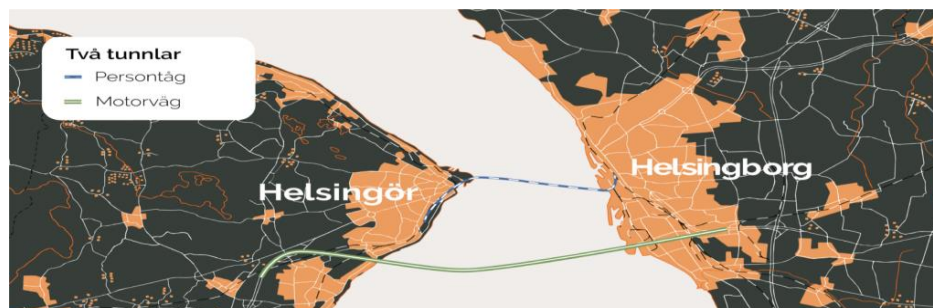
Governance, financing and organisation

The Öresundsbro Konsortiet was created to build, finance and operate the Öresund Bridge. It is jointly owned by the Danish and Swedish governments.³⁹ The company is required to guarantee a high level of accessibility to, and security on, the bridge and secure the repayment of the loans raised to finance its construction. The agreement signed by the Danish and Swedish governments requires the construction, financing and operations of the bridge to be financed by user fees. In addition to tolls paid by road traffic, the Swedish Transport Administration (Trafikverket) and the Danish Agency Banedanmark pay an annual fee for using the railway.

The Helsingborg-Elsinore connection (HH-link)

In the two decades since the opening of the Öresund Bridge, a number of published reports have pointed to the future need for another fixed link in Öresund. EU Interreg-funded projects have been a vehicle for joint strategic planning exercises in the Öresund region. One of these, the IBU Öresund report on infrastructure and urban development (Infrastruktur och byutveckling i Öresundsregionen, 2010) was the result of co-operation between the three regional governments (Skåne, Zealand and Hovedstaden) and 25 other parties and has played an important role in promoting a future Helsingborg-Elsinore connection (HH-link). The report took a regional development perspective, highlighting the possibilities for future growth and international competitiveness based on assets of the whole Öresund region. The construction of an HH-link was one of a number of measures proposed to achieve these outcomes. The HH-link is currently in an early planning phase.

Figure 4: The proposed Helsingborg-Elsinore connection



Note: Two tunnels (passenger train – persontåg – and motorway – motorväg) illustrated for the fixed HH-link.

Source: HH-gruppen.

The proposed HH-link comprises two tunnels for railway passenger traffic across the Öresund strait between the central station Knutpunkten in Helsingborg and the central station in Elsinore; a tunnel for rail freight traffic between Ramlösa and Snekkersten; and two tunnels for cars between Malmöleden and

the Elsinore motorway's ending. Its expected capacity is 16 000 cars daily, 2 000 trucks, 120 passenger trains and 75 freight trains.

The IBU report predicts an HH-link will enhance integration in the whole Öresund region, creating new opportunities for economic growth. It is also expected to divert rail freight traffic from the Öresund Bridge, increase the reliability of the transport system as a whole across the Öresund strait and contribute to modal shift from road to rail. The report includes a CBA of a combined project incorporating the HH-connection and a motorway and railway (Ring 5) that would connect Elsinore and Köge on the Danish side. This concludes the project has a positive present value and that the project could be financed via user charges over a 30-year period. A report commissioned by the city of Helsingborg and carried out by PwC in 2013 reached a similar conclusion. It also highlights the need for competitive regions to attain a certain critical size and have good internal communications.

The HH-link is estimated to increase cross-border commuting by 40-50%. The estimated cost is DKK 32 billion (EUR 4.3 billion), including adjacent connections. Ring 5, which is both a motorway and a railway, is estimated to cost DKK 18 billion. Ring 5 is considered a prerequisite for diverting freight trains onto the HH-connection, connecting Elsinore with Köge bypassing Copenhagen. Most of the traffic on Ring 5 is expected to be of regional character and only 10% to be transit.

A further step in the planning for another fixed link was taken as a part of an overall transport analysis carried out for the Swedish and Danish governments during 2014 and 2018 (Sverigeförhandlingen). The committee recommended that the analysis be carried forward. A joint Danish/Swedish strategic analysis has been arranged, following a joint ministerial declaration on the scope of the analysis. The analysis is being carried out during 2018-20 and will be published late in 2020 or early in 2021.

Governance, financing and organisation

Transnational infrastructure projects are traditionally undertaken by national governments; however, there are alternatives that include other actors. The PwC report identifies four possible models for financing and implementing the HH-link: 1) the traditional model; 2) the Sund & Baelt (state guarantee) model; 3) a Nordic public-private partnership (PPP) model; and 4) a private alternative. The Sund & Baelt model was used when constructing the Store Baelt Bridge and the Öresund Bridge, and will be used for the Fehmarn Baelt connection.

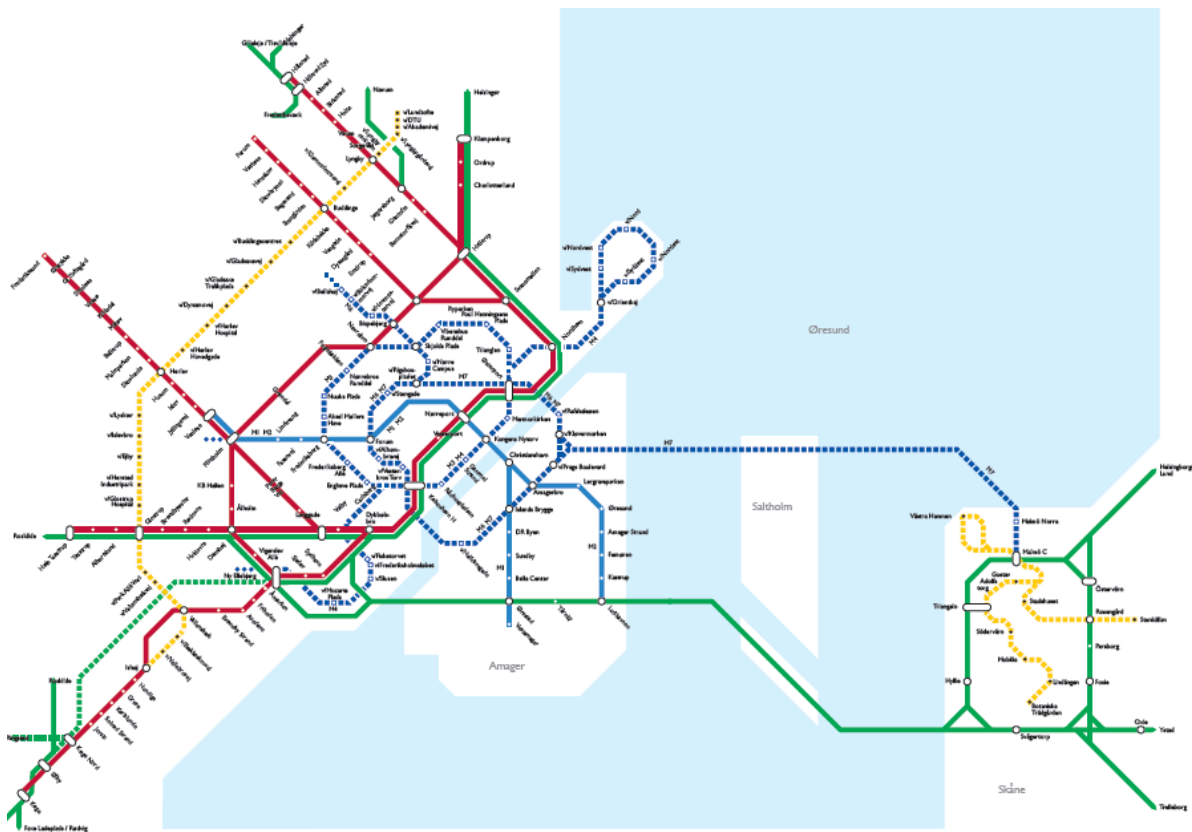
In the traditional model, the investment would be publicly funded and the public sector would bear the project risks. The Sund & Baelt model is expected to yield efficiency gains compared to the traditional model, via the creation of a specific-purpose entity, but the public sector also bears the project risks. The Nordic PPP model is expected to yield similar efficiency gains as the Sund & Baelt model, while also shifting project risks to the private sector. The private alternative has the advantage of not requiring public funding. Project completion time is expected to be reduced in all of the non-traditional models. However, the non-traditional models entail political risks (e.g. in the event of changes of government yielding policy changes) in relation to regulations and the tendering process. In the ongoing strategic analysis, the Danish Sund & Baelt model has been chosen as the main alternative to analyse.

One issue in relation to the financing of an HH-link is that it is not currently included in the EU TEN-T network. This reduces the probability that EU funding would be made available and, consequently, the governments are considering whether to propose the inclusion of this link in their respective proposals for the imminent updating of the TEN-T network maps. A recommendation to this effect may result from the ongoing strategic analysis.

The Metro-line extension Copenhagen-Malmö

The proposed Copenhagen-Malmö Metro-line extension, hereafter referred to as the Metro, is a third joint Swedish/Danish infrastructure proposal in the Öresund region. It originated in the 2000 document “Malmö och Köpenhamn – en stad” (Malmö and Copenhagen – One City), in which the two cities agreed to work towards a common goal: “In 2025, Copenhagen-Malmö should have developed into one combined, well-integrated and sustainable major city, promoting growth throughout the region” (City of Copenhagen “Kommuneplan” and City of Malmö “Översiktsplan”). Figure 5 illustrates the proposed extension (dotted blue line).

Figure 5: Proposed Copenhagen-Malmö metro extension



Source: Transport Data Lab (2013).

The two cities began investigating options for a Metro connection in 2011. The project received EU research grants for 2012-13 and a project involving seven studies was conducted to explore the effects of a Metro from different perspectives. The report⁴⁰ illustrated the dynamic effects of a Metro with regard to economic growth and increased transport capacity and included four scenarios for developing the project by 2032. Two reports focused on the costs and benefits of the Metro and on methods for calculating these, and others focused on its impacts on labour markets and business, research and development, culture and events, and international competitiveness. These were followed by a third investigation phase, completed in 2017, while a fourth phase of reports is to be published late in 2020.⁴¹

A train trip from Malmö Central station to Copenhagen Hovedbanegård passing over the Öresund Bridge today takes 35 minutes. A direct metro is expected to reduce the journey time to 15-20 minutes,

depending on the number of stops. The project cost was estimated in 2013 as DKK 22 billion, including a contingency allowance of 50%. This estimate has since been revised to DKK 30 billion.

Governance, financing and organisation

The report, “Results and assessments of the Öresund – Copenhagen – Malmö metro pilot project 2013” (Resultat og vurderinger I forprojektet Öresundsmetro Köpenhamn Malmö 2013”, analysed several possible models for the construction and operation of the Öresund Metro. The national governments of Denmark and Sweden are seen as the natural leaders of the project, with possible contributions from local governments. One option is that the national and local governments could share responsibility for both the construction and operation of the project. The 2013 report assumes that the national government will finance the construction of the tunnel and presents three models for the operation of the Metro:

- a national grants model, where financing is allocated by the national banks or taken up as loans on the international financial market with national guarantees
- the Öresund model (i.e. the state guarantee model)
- a PPP model, in which private capital would come from pension funds, with a 25-year contract period.

The report favours the Öresund model, with potential financial contributions from the private sector, as the most promising option for further consideration. No decisions have so far been taken in regard to the Öresund Metro.

Comparing the Danube and Öresund cases

A comparison of the Danube and Öresund cases highlights the wide range of different contexts in which cross-border co-operation takes place. On the one hand, the Öresund project required co-operation between only two countries which have similar economic circumstances, are culturally linked and have a strong history of co-operation. This has meant that developing the necessary collaborative relationships has been relatively straightforward, notwithstanding the fact that the relevant regional and municipal governments have also been involved. The projects discussed have been developed with limited EU involvement.

By contrast, the Danube involves a much larger and more culturally and economically diverse group of countries which have not always enjoyed positive relationships. In this context, the development of a shared vision and specific targets is an important step in order to be able to foster better transport planning and common action, albeit one which is challenging to maintain in the long term, as countries’ strategic views change over time. The role of the European Union, as a major international organisation of which the majority of relevant countries are members (and others aspiring members), has been of substantial importance in this regard. In particular, it has financed strategy studies that have assisted in the development of shared objectives and targets and, in turn, helped to underpin the development of levels of co-operation that may otherwise not have developed or survived.

However, a common feature is the need to ensure that feasible and generally acceptable financing models for the realisation of the infrastructure plans are established at an early stage.

CHAPTER 5

Ex post measurement of infrastructure performance

This chapter sets out the rationale for systematically conducting ex post evaluation of major infrastructure projects. It does this by highlighting the key differences between ex ante and ex post assessments and discussing, in this context, the means by which ex post evaluation can contribute to better project appraisal and selection processes. It goes on to identify the challenges faced in conducting ex post evaluation and summarises common approaches to measuring the performance of infrastructure assets. Finally, it considers how the results of ex post assessments can be used in the strategic assessment of infrastructure needs.

Differences between ex ante and ex post assessments

Ex ante appraisal occurs during the preparation of an infrastructure project. It sets out the strategic rationale as part of the business case for the project, considers options for design and delivery, estimates the expected costs and benefits of each option, applies discounting to help compare options over time, and selects a preferred option using the net present value and BCR metrics (HM Treasury, 2018).

The ex ante appraisal informs decisions as to whether to proceed with a project and which delivery options to choose, based on assessment of the project's expected impacts on societal welfare and comparative assessments of the best use of public funds. Chapter 2 of this report discusses current practices in project identification, appraisal and selection in a range of ITF countries.

Monitoring takes place before, during and after project delivery. It involves collecting data on the baseline before the project begins, details of the project delivery, and the impacts and outcomes of the project after it has been completed.

Evaluation is the systematic assessment of an infrastructure project's design, implementation and outcomes. Ex post evaluation takes place after the project has been delivered. However, planning for the ex post evaluation should commence at the design phase and continue throughout the lifetime of the project. This approach improves the quality of the evaluation by ensuring that data needs are identified ex ante and arrangements are put in place to ensure that the relevant data are collected.

Together, monitoring and ex post evaluation identify the actual impacts of infrastructure projects. Measuring these impacts yields three key benefits. First, it enables the evaluator to assess whether the project's performance has been consistent with the expectations identified in the ex ante analysis. Second, it enables lessons to be drawn to improve appraisals, and design and delivery decisions in future projects (OECD, 2015). Third, it generates new evidence to inform infrastructure strategy and assessments of infrastructure needs. The following discusses each of these benefits in greater detail.

The value of ex post evaluation

Ex post evaluation assesses the results of an infrastructure project compared to the expectations set out in the business case and ex ante appraisal, incorporating:

- the objective(s) the project is aiming to achieve
- the value of expected costs and benefits, and the resulting value-for-money assessment (net present value and BCR)
- other expected outcomes, including the performance of the infrastructure in operation and wider impacts.

Understanding project outcomes

This allows an assessment of how successful a project has been in achieving its stated aims, and whether the expected value-for-money outcome was achieved.

As well as reviewing whether the expected costs and benefits were realised, the evaluation can identify and quantify any unforeseen externality impacts (whether positive or negative) that emerged during the course of the project's development and operation. These unanticipated impacts can be substantial in size and careful assessment of them as part of ex post evaluation can provide useful insights to inform future investment decisions and, if required, guide the development of mitigation measures. Evaluation provides an opportunity to explore the reasons for divergences between ex ante expectations and actual outcomes. This is particularly important in identifying lessons for future projects.

Learning lessons for future project design, appraisal and delivery

The accuracy of future ex ante appraisals can be improved by comparing ex post project outcomes with the expected outcomes identified in the ex ante appraisal. Elements of the appraisal that may benefit from this approach include assumptions, projections and modelling methodologies. Understanding the extent of the uncertainty inherent in project appraisal can contribute to better scenario analysis, while information on the nature and extent of systemic bias (typically optimism bias) can provide a basis for correcting for such biases in future analyses.

Such benefits are unlikely to be achievable via analysis of a small number of individual ex post assessments. This points to the need for ex post analysis to be completed systematically on all significant infrastructure projects, so that a clearer picture of how appraisal inputs and procedures should be revised can be developed over time using meta-analysis (UK Department for Transport, 2016).

Evaluation can also yield lessons for improving the design and delivery of similar infrastructure projects in the future, by exploring what worked well, what could be improved and why. Evaluation may also lead to a better understanding of how different procurement and financing models affect outcomes.

If infrastructure is delivered according to standard, well-established methods, evaluation may provide limited value. However, where a project uses innovative approaches to planning, construction or financing, it is particularly important to research how well these work in practice and how they can be improved for the future. A post-implementation review by the project team may provide some insights, but significantly greater value is likely to be obtained by employing independent evaluations, based on transparent information provided by the project team, to assess the effectiveness of new approaches.

Producing new evidence

In addition to learning lessons applicable to the appraisal and delivery of future projects, ex post evaluation can generate new empirical evidence to inform future strategic assessments of infrastructure needs, and improve understanding of the wider economic benefits (WEBs) of infrastructure (OECD, 2016). These benefits can be achieved if the ex post review goes beyond measurement of the direct impacts of the project to include evaluation of its wider impacts on the performance of infrastructure networks, the environment and economic outcomes such as productivity, wages and employment.

As with learning lessons for future appraisals, building a reliable evidence base that captures the full range of impacts of different infrastructure types, in different contexts, requires a system of robust, regular and consistent ex post evaluation of infrastructure projects to be implemented. While this is necessarily relatively resource-intensive, it will ultimately support better decision making, leading to infrastructure choices that better meet identified needs and achieve better value-for-money outcomes.

Enhancing confidence

Ex post assessment can have an important role in enhancing and maintaining confidence in ex ante project appraisal processes. By systematically assessing actual outcomes against proponents' initial claims for project performance, ex post assessment introduces an important element of accountability to the process. This may be particularly important where such assessments are commenced prior to project completion, as is the practice of the United Kingdom's National Audit Office. In addition, the ability of ex post assessment to act as a feedback mechanism, which improves the accuracy of future ex ante assessments, can also underpin greater public and stakeholder confidence in those ex ante assessments (ITF, 2017a).

Challenges for ex post evaluation of infrastructure

Both the long-term nature of infrastructure investments and the wide range of impacts that must be taken into account pose challenges for the evaluation process. The evaluation of the indirect impacts, or externalities, associated with projects is particularly problematic. Two key considerations are the timing of infrastructure projects and impacts, and methodological challenges and data limitations.

Timing of infrastructure projects and impacts

Infrastructure projects typically have long construction phases and their benefits are delivered over extremely long useful lifespans. These characteristics add to the difficulty of evaluating infrastructure impacts in a robust and timely way. In many cases, the full benefits of a project are only realised after an extended delay. For example, traffic levels have been observed to take up to five years to adjust and stabilise following the completion of new road infrastructure projects. Observing and measuring second-round impacts such as induced changes to land use is similarly only feasible after a significant delay. Ex post evaluation is therefore necessarily a long-term commitment.

These long lags mean that there is limited scope to use the findings of an ex post evaluation to improve the performance of the infrastructure that has been evaluated. Infrastructure is, in general, difficult and expensive to modify. Whereas a policy can be adjusted to reflect shortcomings revealed via evaluation findings, it may not be possible to improve an infrastructure intervention that is poorly designed or located in the wrong place. This implies that the main benefits of ex post evaluation are the systemic ones –

i.e. their impact in improving future ex ante analysis and on better understanding future infrastructure priorities.

Methodological challenges and data limitations

Policy evaluation is most accurate when it can be carried out using randomised allocation to a treatment group who are exposed to the policy and a control group who are not. The randomisation allows the evaluator to control for factors other than the policy that might cause differences in outcomes. This is why randomised controlled trials are generally considered the gold standard of evaluation.

The nature and cost of infrastructure projects means that it is rarely possible to run randomised controlled trials or pilot schemes. Because infrastructure is generally fixed in place, people and businesses cannot be randomly allocated to a treatment or control group in the same way as in other types of public policy. Even if this were possible, the high costs, long lag times and network benefits of infrastructure would make running small pilot schemes impossible for many types of project.

To understand causality, the observed impacts need to be compared with a counterfactual of what would have happened without the intervention. The lack of random allocation when evaluating infrastructure projects introduces risks to successfully isolating the causal effect and accurately quantifying the project impacts.

The first risk is reverse causality. Although evaluators usually want to measure how infrastructure affects a particular outcome, changes in the outcome being measured may cause changes in the infrastructure planning. This happens because the location of infrastructure is not random, but is chosen because of an area's characteristics. For example, it may be difficult to establish whether a new road stimulated an increase in local economic activity, or whether the road was built in response to an actual or anticipated increase in local economic activity. Either would result in an observed positive correlation between road building and economic activity, but the direction of causation is more difficult to identify (Venables, Laird and Overman, 2014).

The second risk is attribution: understanding what benefits can be attributed to the intervention rather than to other factors. Infrastructure projects are often accompanied by other policy and economic changes, making it difficult to isolate the impact of the infrastructure alone. For example, where transport investment is used as part of a wider policy package to regenerate an area, it can be difficult to identify the contribution of transport investment to the area's subsequent growth as distinct from other interventions such as planning changes and tax breaks.⁴²

The attribution issue is particularly acute for the wider impacts of infrastructure schemes. To take the examples of broadband and transport infrastructure, it may be straightforward to measure how these are used, but it is more difficult to isolate their impacts on local economic growth from other policies and wider economic trends. This is particularly problematic where WEBs have been identified as a key element in the business case justifying the investment. Moreover, WEBs from infrastructure may arise through channels such as improving the effectiveness of an entire network. These broadly spread benefits are particularly challenging to measure because of the difficulty of distinguishing between users and places affected by the infrastructure, and a control group that is unaffected.

The most challenging circumstance is where the interactions between infrastructure projects are of interest, as might be the case when multiple schemes are deployed to try and improve local economic performance. Most measurement approaches are designed to measure impacts of projects in isolation, so will struggle to capture interactions between projects.

A related issue is being able to appropriately identify and isolate the relevant scope of the project to be evaluated. Particularly where the economic impacts of infrastructure projects rely on complementary investments or land-use changes, if these other factors do not occur as anticipated at the ex ante appraisal stage, then the project outcomes might not meet expectations for reasons unrelated to the infrastructure project itself.

Finally, while data availability is necessarily a less acute issue in carrying out ex post evaluation than for ex ante assessments, the challenges can nevertheless be substantial. The ITF has previously referred to the “fleeting” nature of data and emphasised the need for data collection to be planned from the outset, as post-hoc reconstruction of relevant data sets is often impossible. France’s transport observatories were one model for ensuring systematic data collection and analysis. These bodies collect data, set benchmarks and public audits of transport projects, and have been found to greatly improve data quality for transport schemes (ITF, 2017a).

Data issues are particularly significant in the context of measuring WEBS. High-quality evaluations of economic impacts often require labour market and business data with large sample sizes and a high degree of spatial detail. This is gradually becoming more feasible as administrative data become more readily available and data science analysis of novel data sources improves, but the availability of these kind of data has been very limited in the past in some countries.

The next two sections discuss the characteristics of a sound ex post evaluation, including means of addressing the challenges identified in this section.

Common approaches to measuring infrastructure performance

This section briefly discusses three common approaches to measuring infrastructure performance: direct performance measures, outcomes monitoring and impact evaluation.

Infrastructure performance measures

Measurement of infrastructure performance is a first step toward identifying infrastructure impacts and needs. By comparing performance between places and sectors, over time and against desired standards, areas of weak performance can be identified which indicate shortfalls in infrastructure provision (NIC, 2018b). A framework of infrastructure performance measures should meet a number of criteria to ensure that they provide meaningful information about infrastructure needs:

- Objectives: The measures should have a clear link to society’s objectives for infrastructure, so that they measure relevant outcomes.
- Consistent: The outcomes measured, as well as the framework and methodology for measuring them, should be kept as consistent as possible across time and sectors. Applying the same framework across different infrastructure sectors should help to identify data gaps: for example, there may be good data on reliability of energy supply but not on reliability of travel time.
- Comparable: The performance measures should also aim to be comparable across regions and countries. This requires measurement methodologies to be aligned. To improve comparability between places, measures should ideally not vary directly with geographic or population scale.
- Quantified: The measures should be quantitative, to facilitate their use in analytical assessment of needs and impacts, and to make them more comparable across time, sectors and places.
- Manageable: The total number of performance measures should be limited, so that they are manageable to maintain and review.

The UK National Infrastructure Commission (NIC) developed a framework of infrastructure performance measures that meets these criteria, to inform its assessments of infrastructure needs (NIC, 2018a). This framework classifies each measure as belonging to one of the six “domains” of volume, resilience, quality, cost, environment and efficiency. Most of these domains are applicable across all sectors of economic infrastructure, which helps to meet the consistency criterion.

The NIC’s chosen measures are aspirational as well as practical, including some topics for which economic valuation methodology is still being developed, such as design and natural capital. The commission aims to fill data gaps in this framework by working with stakeholders to identify appropriate measures, and by developing its own metrics such as transport connectivity (NIC, 2019a).

International agreement on a framework, methodology and infrastructure performance measures would help regions and countries to compare their outcomes measures. This is a challenge, but other areas of economic statistics have successfully moved towards international harmonisation, greatly benefiting cross-country evaluation of policy and performance.

Outcomes monitoring

Much of the ex post measurement of infrastructure interventions will be based on the monitoring of outcomes such as:

- adherence to planned milestones and the overall timetable
- the level of outputs delivered, compared to what was planned
- adherence to planned costs and the overall budget
- performance metrics post-opening, compared to what was forecast
- impacts on outputs in the wider system that are expected to be influenced by the infrastructure.

Impact evaluation

In addition to monitoring approaches, evaluation may be used to estimate the impact of the intervention in comparison with the counterfactual situation in which it did not happen. This requires special techniques to overcome the methodological challenges set out above. Some common approaches include:

- **Before versus after.** This common counterfactual simply entails comparing the performance of the new infrastructure with that of the old infrastructure it replaced. A weakness of this approach is that it does not account for any other changes that may have affected performance.
- **Difference in differences.** This is an example of a quasi-experimental approach. It mimics an experiment that randomly allocates subjects to two groups: treatment and control. The change in performance associated with the new infrastructure (compared with the old) is compared with the change for similar infrastructure that has not received improvement. The impact of the intervention is calculated as the change in performance for the new infrastructure minus that for the comparison infrastructure.
- **Area comparison.** A variation of the above, where the infrastructure is expected to produce effects for a particular geographic area, for example local economic effects. Spatial data for the variables of interest for the area around the infrastructure can be compared with those for a comparison area that had similar characteristics in the “before” period. There are various forms of comparison that use statistical methods to create a close match between the treatment area and a comparison area.

Different forms of infrastructure will require different counterfactual approaches. Essentially, simple before-versus-after comparisons may suffice when it can be assumed that performance levels are directly caused by the infrastructure while more complex approaches are necessary where performance measures are expected to be also influenced by other factors.

Examples of ex post measurement practices

The following briefly summarises ex post performance measurement practices in two specific contexts in the United Kingdom: local government growth promotion policies and strategic road schemes.

United Kingdom: What Works Centre for Local Economic Growth

The United Kingdom's What Works Centre for Local Economic Growth was established in October 2013 to analyse what policies are most effective in supporting and increasing local economic growth. It is funded by the Economic and Social Research Council and government departments.⁴³ The centre has produced a series of evidence reviews on the impact of local economic policies, drawing on the global literature. The foci of these reviews were economic impacts such as employment, incomes and productivity.

A stringent approach was taken to the determination of acceptable evaluation standards, with a score of Level 3 on the Maryland Scientific Methods Scale (difference in difference, instrumental variable, discontinuity design or randomised selection approaches) established as the minimum acceptable level of evidence. This filtering reduced the large literature to a relatively small number of robust studies.

The evidence reviews most related to infrastructure were broadband, transport, estate renewal, public realm, and sport and culture. In general, these reviews highlight the limited number of high-quality evaluations. For example, on broadband, of 1 000 evaluations reviewed, only 16 met the centre's minimum standards. Of these, eight looked at employment effects and only two found a positive impact.

To encourage the production of higher quality evaluation in the future, the centre:

- runs workshops on how to best use evaluation findings to improve outcomes for local economies
- engages local and national policy makers in collaborative projects with academics and policy experts to increase evaluation
- publishes advice and toolkits to encourage more frequent and robust evaluations of policies that aim to support local growth, including infrastructure.

United Kingdom: Highways England post-opening project evaluations and Department for Transport strengthening links report

In the United Kingdom, Highways England uses a consistent methodology in the ex post evaluation of strategic road schemes (Highways England, 2019). This post-opening project evaluation (POPE) methodology entails measurements of key metrics of interest such as traffic flows, journey times and safety levels at three stages:

- before opening
- one year after opening
- five years after opening.

The approach uses before and after comparisons to assess to what extent the expected benefits of the intervention have been delivered. As part of this, an ex post BCR calculated as part of the five years post-opening study and compared with the ex ante estimate.

By adopting a consistent methodology to evaluate a large number of road schemes, POPE is able to both identify trends in the extent to which interventions deliver their planned benefits and assess how post-opening performance differs for different types of project, such as motorways and dual carriageways. This system has led to improvements in the accuracy of estimates of the likely costs of future projects, reducing the average error in forecast costs from 20% to 2% between 2000 and 2009 (Highways England, 2015).

The UK Department of Transport published a report on *Strengthening the Links between Appraisal and Evaluation* (UK Department for Transport, 2016). Among the steps proposed for this was the introduction of appraisal handover packs to ensure that key analysis and assumptions from appraisal are carried forward for use in evaluation.

Using evidence from ex post measurement in the strategic assessment of infrastructure needs in the United Kingdom

Performance measures are needed to identify areas of strength and weakness in current infrastructure systems. To support the development of such measures, the UK National Infrastructure Commission published a framework and an example set of infrastructure performance measures, as described above. Having identified infrastructure needs, responding with appropriate strategic plans requires evaluation evidence to enable the impacts of previous projects on infrastructure system performance and the wider economy to be understood. Evidence of how these infrastructure impacts have varied by context is also vital for getting infrastructure strategy right. This might include understanding differences between urban and rural locations; or in different policy and institutional settings, such as levels of devolved governance.

The NIC set out priorities for the country's infrastructure over the next 30 years in its National Infrastructure Assessment (NIC, 2018c). It relied on evidence from ex post measurement to help it make informed judgements. This included a review of the evidence on the links between infrastructure and economic growth, on the operational benefits of full fibre broadband, and on the historic construction costs of nuclear power stations (NIC, 2017a; 2018c: 21 and 37).

The commission also noted inconsistencies and systematic weaknesses in infrastructure appraisal and evaluation. For example, it found that journey time savings from major road schemes tend to be lower than forecast, and that better evaluation of the performance of past projects would help inform choices between public and private finance (Highways England, 2015; NIC, 2017b). Consistent and publicly available ex post data on the costs and performance of infrastructure projects are rarely published, with efforts to conduct ex ante appraisals disproportionately greater than to evaluate ex post. The commission recommended that, to better inform decision making, ex post cost and performance data should be reported systematically for projects with life cycle costs above the following thresholds:

- GBP 10 million for flood management
- GBP 100 million for roads
- GBP 500 million for rail.

The commission also recommended that there should be a focus on ensuring the comparability of ex ante and ex post cost estimates, as well as cost estimates undertaken in different sectors. All public bodies

taking decisions on strategic economic infrastructure should publish the forecast costs and benefits of their major infrastructure projects at each appraisal stage and at a suitable point after completion (NIC, 2018c: 100-102).

Criticisms and responses

The case for undertaking systematic ex post evaluation of infrastructure projects is often questioned, both on the basis that it is time- and resource-intensive and because it is argued that little productive action can be taken in response to the findings, in many circumstances. If the performance levels of a power station or flood defence are below expectations, it may be neither possible to improve them by re-engineering nor cost-effective to scrap them and start again. For this reason, infrastructure operators, policy makers and politicians may be reluctant to have ex post evaluations undertaken that have the potential to reveal deficiencies in major infrastructure projects.

However, the value of ex post evaluation of infrastructure performance is primarily found in its ability to improve the planning of future projects. Understanding the failures of a completed intervention can suggest improvements for future interventions. Evaluation can improve the accuracy of ex ante appraisal via more realistic benefit and cost assumptions, tighten delivery mechanisms, and increase understanding of the risks associated with changes in background assumptions. This is a vital input to strategic infrastructure planning and its value is likely to be substantially greater if ex post assessments are conducted by bodies independent of project proponents, who can bring a disinterested view to the task (ITF, 2017a).

Understanding the impacts of infrastructure on people, the economy and the environment helps to prioritise investment and make interventions that are appropriate to the place and context. Yet evaluating the wider impacts of infrastructure is extremely difficult, due to the challenges of attributing causality to identified impacts. However, improved data and methodologies are helping to expand the stock of robust evidence. Higher quality evaluations can also be achieved by ensuring their timing, processes and methods are established and appropriate data collection is begun at the outset.

While the challenges of ex post evaluation are substantial, best practice examples from across the OECD show that effective evaluation is possible. This can include the use of a range of simple but effective techniques, such as consistently monitoring project outcomes. When done properly, ex post measurement adds much value to strategic infrastructure planning.

CHAPTER 6

Conclusions and recommendations

Many governments have now adopted some form of strategic plan to guide infrastructure investment decisions. However, while the adoption of a strategic plan appears to be a developing trend, the form of these plans varies widely: national transport plans appear to be relatively common, as are sectoral and regional plans. The integration of such plans into larger national plans is much less common. Where strategic plans exist, consistency with the plan is generally an important criterion in project selection decisions, albeit projects are frequently also required to meet financial benchmarks, typically specified in cost-benefit terms.

Adopting strategic infrastructure plans

Strategic plans enable project selection decisions to be taken in a co-ordinated manner, taking account of synergies between projects, weighing the competing claims of different sectors and providing the opportunity for investment decisions to be oriented toward national priorities, rather than taking such decisions on a piecemeal basis. However, the scope, focus and content of strategic infrastructure plans vary considerably. Plans are not always clearly linked either to funding envelopes or to individual projects, or project pipelines. Where this linkage is absent or limited, they have much less influence on project choice.

The value of strategic planning is, at least potentially, enhanced by the fact that the current context is one in which the degree of uncertainty regarding some of the major drivers of infrastructure demand has probably never been greater. In this context, an additional change that would be likely to have considerable value is for governments to make greater use of scenario analysis in their planning and project decision making. However, there is to date only limited evidence of movement in this direction.

Another key contextual element is that an increasingly engaged citizenry is demanding a greater say in infrastructure planning. Notwithstanding the complexity of infrastructure planning, especially where multiple scenarios and interactions might have to be communicated, governments should increase their investment in consultation. This helps them make difficult trade-offs, enable users and taxpayers to debate the issues in question and, ultimately, provide the social licence for the decisions taken.

In the transport sector, more than in most others, infrastructure plans and programmes require significant government spending. Proposals to expand user charging have multiplied in recent times, and progress has been made in some areas, particularly in relation to major motorways. However, many user-charging proposals fail for want of political and public support and that transport infrastructure will constitute a major call on government financing at least into the medium term in most countries. Transport plans therefore need to be founded on a solid understanding of government finances and transport's plausible share of those finances.

Finally, governments should continue to explore opportunities for cross-sectoral infrastructure planning and decision making. The major challenges facing nations and the globe – climate change, declining rates

of growth in productivity and pressure of public finances, among others – will require greater collaboration and co-ordination across infrastructure sectors.

Recommendation: Governments should adopt a strategic approach to infrastructure planning. This should be communicated clearly via an explicit, detailed and periodically updated strategic infrastructure plan that, at a minimum, addresses all the main physical infrastructure sectors, and which has regard to plausible scenarios bearing on the demand for and supply of infrastructure. There should be clear linkages between strategic infrastructure plans and individual project selection choices.

Recommendation: Strategic infrastructure plans should be linked to explicit infrastructure funding envelopes, with project pipelines identified, at least in broad terms, in order to ensure the practicability and credibility of the plan and its consistency with project-level decision making.

Independent infrastructure advisory bodies

There is an apparent correlation between recognition of the need for strategic planning and moves to establish independent infrastructure advisory bodies. There is, to date, limited practical experience with these bodies. However, early indications are that the independent and expert advice on infrastructure needs and priorities that these bodies are able to provide has the potential to significantly improve the information base for decision making at the political level and, hence, the quality of those decisions. Involving independent bodies may also help to increase the credibility of governments' infrastructure programmes, by adding transparency and accountability.

Recommendation: Governments should consider the merits of establishing independent infrastructure advisory bodies with a charter to provide transparent, expert advice on:

- long-term, cross-sectoral infrastructure strategy, planning and policy development
- infrastructure investment, notably on priorities for medium- to longer term investment.

Evidence to date shows that these bodies constitute a low-cost and effective means of improving and complementing existing processes.

Existing infrastructure advisory bodies fall into two broad categories. The first focuses exclusively on strategic matters, such as planning, policy and the identification of broad investment needs. The second also has a role in relation to specific projects, notably including assisting with project development and in the evaluation of proposals.

Infrastructure decision making is often highly political in nature, yet the typically long-term nature of the investments requires that decisions be informed by independent, expert advice, provided in a transparent fashion. This means that the governance arrangements applied to independent advisory bodies will be significant determinants of their likely success. Establishing independent advisory bodies by statute enhances their ability to provide frank and fearless advice as well as their credibility with a range of stakeholders. However, other mechanisms can also be employed to achieve these objectives. The formal status of these bodies is therefore less significant than the quality of the governance arrangements to which they are subject.

Recommendation: Arrangements for the establishment of independent bodies should address key governance principles, such as those identified in the OECD's Principles for the Governance of Regulators.

In particular, advisory bodies should be required to publish their advice to governments and governments should be required to respond to that advice in a timely manner.

Methodological issues

Project appraisal is subject to an explicit, standardised process and methodological requirements in most countries, with CBA being at the heart of the methodological process in virtually all cases. Quality assurance through review of the project appraisal by a body that is independent of the project proponent is widely, but not invariably, used. Such independent scrutiny can contribute substantially to the overall quality of project appraisal and selection and help guard against optimism bias.

While CBA is almost invariably central to project appraisal, there is some variation in the effective weighting of the CBA result. Many countries report that proposed projects must, in effect, meet certain benchmarks (e.g. have a positive net present value or meet a minimum BCR) in order to be eligible for approval. However, a number of countries report that CBA is one among several analyses conducted and that these are considered separately, rather than additively. Consequently, a positive net present value may be neither a necessary nor a sufficient condition for a proposed project to be selected.

Differences in the required scope of CBA may be significant in explaining some of the apparent differences between countries in decision criteria. Indirect valuation techniques enable a broader CBA than traditionally used to be developed, for example, by taking a range of sustainability impacts into account. However, there remain limitations on the potential to integrate all significant impacts within a single analysis. For example, the fact that CBA is not well suited to addressing distributional impacts is frequently significant, and may be increasingly so in a context in which governments are increasingly looking toward major infrastructure projects as a means of achieving regional economic rebalancing.

Recommendation: Infrastructure project appraisal should, as far as possible, be based on a consistent and transparent methodology.

The appraisal methodology should be sufficiently broad as to be able to capture all substantial effects of the proposed project, including environmental/sustainability, health and safety, resilience, and distributional impacts, as well as wider economic benefits (where relevant). Addressing these impacts, as far as possible, through an expanded CBA which includes monetised values for key social and environmental impacts will contribute to a more integrated analysis that enables different investment options to be more readily compared. The quality of project appraisals should also be assessed by an expert body that is independent of the project proponent.

Appraisals of large-scale infrastructure projects increasingly incorporate consideration of wider economic benefits (WEBs). This implies a major change in approach, in that it adds an element of macroeconomic analysis to the microeconomic CBA approach that forms the core of traditional project appraisal. Assessments of WEBs are both data- and resource-intensive to conduct, particularly if extended to include second-round impacts. Conversely, WEBs are likely to add only 10-30% to traditional benefit estimates for all but the most transformative projects. There is significant uncertainty attached to most WEB estimates, due to factors such as the need to identify and estimate displacement effects. However, WEB analysis can help to provide a clearer picture of the beneficiaries of the project, which may in turn assist in identifying funding options.

Recommendation: A selective approach to the use of WEB analysis should be adopted, focusing on the largest scale projects, particularly those that have objectives extending beyond those traditionally pursued via transport infrastructure projects.

Where WEB analysis is used, care should be taken to avoid double-counting of impacts already captured in the CBA. WEB estimates should be accompanied by discussion of the nature and extent of the uncertainties involved. Project appraisal should clearly separate WEB from CBA and other relevant

analyses in order to clarify the impact of WEBs on the overall outcome of the appraisal. Where appropriate, scenario analysis should be included.

Recommendation: The OECD/International Transport Forum publishes a review of government and private sector infrastructure-related responses to the COVID-19 pandemic, including:

- how it sees demand for infrastructure (especially transport and telecommunications infrastructure) changing
- whether, and to what extent, governments and private infrastructure providers and users are changing their strategic and asset management plans, project appraisal processes, and prioritisation of projects as a consequence of those potential changes.

Stewardship of major infrastructure assets

Infrastructure assets almost invariably have long lifespans. This means that efficient asset management can significantly reduce the life cycle cost of infrastructure provision, particularly by ensuring that maintenance is appropriately scheduled and costly remedial work prevented. Responsibility for asset management should be clearly allocated and financial transparency in relation to asset performance required, to provide the right incentives to favour effective management.

Recommendation: There should be a formal policy framework to guide decisions on the stewardship of major infrastructure assets.

The objective should be to ensure efficient asset utilisation, maximising availability and performance, and minimising life cycle costs through the use of performance standards, optimal maintenance and upgrade scheduling. This implies financial and potentially functional separation of asset ownership and management and clear financial accountability and incentives. That is, a corporatised and regulated approach should be adopted where adequate competition is absent. Infrastructure managers should be subject to periodic, public audits of their compliance with performance standards, asset management capabilities and performance.

Recommendation: Governments should review their infrastructure regulatory frameworks.

The review should be conducted to determine whether there are opportunities to support integrated approaches to cross-sectoral planning in order to avoid unintended consequences.

Ex post assessment

Recommendation: Ex post performance assessment should be undertaken for all major projects

Ex post assessments should be conducted using standard frameworks and methodologies to ensure they provide meaningful information about infrastructure needs. Meta-analysis of these assessments should be undertaken to better inform future infrastructure policy.

Research shows that ex ante estimates of infrastructure performance err systematically toward optimism. Improving understanding of the reasons for this apparent systemic bias, and its expected extent, can be a powerful means of improving ex ante analysis, by correcting for these apparent biases and pointing toward key risks. Detailed ex post assessments of major infrastructure projects are needed to achieve this end. They can also help to identify the need for remedial actions in relation to completed projects and increase the likelihood such actions will be undertaken in a timely manner. Conducting audits of ex ante business

cases during the construction phase can similarly aid in the timely identification of issues and encourage appropriate revisions to project plans.

Recommendation: National infrastructure institutions and statistical agencies should co-ordinate internationally to develop a framework of consistent infrastructure performance measures.

Performance measures can help identify strengths and weaknesses in infrastructure systems, and to evaluate the impact of past interventions. Successes in international harmonisation of other areas of economic statistics suggest the potential to develop comparable measures of infrastructure performance, which can underpin broader, international comparisons. The measures should be quantified and aligned to society's objectives for infrastructure. This would help countries and regions to compare outcomes and identify best practices to inform their infrastructure plans.

Cross-border issues

Recommendation: Where cross-border infrastructure projects are adopted, they should preferably be managed by a specific-purpose body with all parties represented. Policy objectives and performance standards should be clearly specified and appropriate governance, funding and accountability mechanisms clearly established.

As the discussion in Chapter 4 demonstrates, many important natural infrastructure assets serve numerous, often quite different, economies and societies. Developing shared infrastructure can be an important way to achieve efficiencies of scale and scope and enable the delivery of higher quality infrastructure services more quickly. By deepening economic inter-dependence, such arrangements can also promote further efficiency gains, as well as functioning as a force for stability and positive engagement.

However, the effective operation of shared infrastructure necessarily imposes important challenges. These will be particularly acute where larger numbers of countries or regions must co-operate and where there are greater differences between them in terms of economic circumstances and/or cultural perspectives. Addressing these challenges effectively requires an appropriate institutional architecture, clear policy objectives, and agreed allocations of responsibilities.

Notes

- 1 Responses were received for Australia, Austria, Canada, Chile, France, Hungary, Ireland, New Zealand, Slovenia, Sweden and the United Kingdom.
- 2 One of these countries, the United Kingdom, is expected to publish a National Infrastructure Strategy in late 2020.
- 3 Though not for motorways, which are the responsibility of DARS, a separate state-owned enterprise, or for the main port).
- 4 Projects that fall below this threshold contribution are also required to be subjected to a CBA-based appraisal process.
- 5 New Zealand is, at the time of writing, developing a standardised benefits realisation framework, which will apply to all transport infrastructure projects.
- 6 Projects that are jointly funded by federal and state governments as part of “national partnership agreements” are required to have post-completion reports undertaken; there is no requirement for either independent involvement in their development or publication of the report.
- 7 With the possible exception of the implications of the COVID-19 pandemic – which, if it is relevant, is instructive on the need to use strategic analysis techniques.
- 8 The Edelman Trust Barometer has been published for 20 years. It can be found at: <https://www.edelman.com/trustbarometer>. The Pew Research Center in the United States also publishes longitudinal research on public trust in institutions. The Pew Research Center’s trust-related work can be found at found at: <https://www.pewresearch.org/page/2/?s=trust&topics=trust-in-government>.
- 9 The Welsh government has established a National Infrastructure Commission for Wales (NICfW) to support independent, better-informed advice on a longer term strategy of infrastructure investment, incorporating the principles of the Well-being of Future Generations (Wales) Act 2015. The NICfW is a non-statutory, advisory body. Its remit is to focus on the economic and environmental infrastructure needs of Wales over 5-30 years. The commission will also consider the interactions of these needs with “social infrastructure”, such as schools, hospitals and housing. However, the NICfW is not expected to consider and advise on social infrastructure needs in detail. The advice provided by the NICfW will be strategic and forward looking in nature. Advice on existing or upcoming infrastructure schemes will not be part of the commission’s remit.
- 10 In September 2013, Sir John Armitt published an independent review on long-term infrastructure planning in the United Kingdom. The recommendations in the Armitt Review received widespread support and in large part have now been adopted by the current government, contributing to the establishment of the National Infrastructure Commission. The report is available at: https://www.policyforum.labour.org.uk/uploads/editor/files/The_Armitte_Review_Final_Report.pdf.
- 11 In its recent Australian Infrastructure Audit, Infrastructure Australia started to address social infrastructure, including health and aged care, education, social housing, and “green, blue and recreational infrastructure”. See Infrastructure Australia (2019).
- 12 At the request of the minister, Infrastructure Australia can also address other infrastructure.
- 13 The “how” options are not public at this time. However, based on the “Findings report”, they are likely to cover: the quantum and prioritisation of investment in new assets, strategies for managing existing assets, including means of securing greater utilisation of existing infrastructure; improvements in design; and greater use of data in decision making.
- 14 The Scottish government first introduced the language of inclusive economic growth in its 2015 Scotland’s Economic Strategy, although the principles are evident from its first strategy in 2007. Scotland, as well as New Zealand, is also a founding member of the Wellbeing Economy Governments partnership within the Wellbeing Economy Alliance (<https://www.gov.scot/groups/wellbeing-economy-governments-wego>). The alliance’s vision for a global economy that delivers human and ecological well-being sits well with the Scottish government’s ethos. In addition to the economic landscape, Scotland passed a bill to achieve net-zero emissions by 2045, five years ahead of the United Nations Paris Agreement. It is within this political backdrop that the Infrastructure Commission for Scotland has made its recommendations for Scotland’s infrastructure over a 30-year period.

6. CONCLUSIONS AND RECOMMENDATIONS

- 15 www.gov.uk/government/publications/international-comparisons-of-transport-appraisal-practice
- 16 <https://www.gov.uk/government/publications/webtag-tag-unit-a2-1-wider-economic-impacts-may-2018>.
- 17 The Grand Paris Express is expected to yield benefits of EUR 77.5 billion, of which EUR 34.5 billion derive from the WEBs of agglomeration benefits (EUR 14.3 billion) and the value of long-term job creation (EUR 20.2 billion).
- 18 Some research suggests that countries with high levels of expenditure on relatively less productive infrastructure are likely to have lower economic outcomes for a given level of aggregate investment. See, for example, Egert, Kozluk and Sutherland (2009).
- 19 <http://www.gov.uk/government/publications/webtag-tag-unit-a2-1-wider-economic-impacts-may-2018>
- 20 The UK Department for Transport's TAG guidance – TAG Unit A2.2 – includes as an additional investment impact the land developed for housing or business purposes that is dependent on the transport project. This somewhat specialist case, in which a lack of transport capacity prevents consent for a change in land use, is outside the scope of this Chapter.
- 21 https://www.researchgate.net/figure/Overall-structure-of-a-DELTA-based-model_fig1_263143333.
- 22 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/371810/2-economy--wider-impacts-assessment.pdf.
- 23 www.gov.uk/government/publications/tag-economic-impacts-worksheets.
- 24 www.gov.uk/guidance/transport-analysis-guidance-webtag
- 25 <https://danube-region.eu>
- 26 The EUSDR has operated since 2012 and was established via the European Commission Communication on a European Strategy for the Danube region of 8 December 2010, the European Council Conclusions on the European Union Strategy for the Danube region of 13 April 2011 and the EUSDR Action Plan (currently under revision).
- 27 <https://danube-region.eu/joint-statement-of-ulum-on-the-eu-strategy-for-the-danube-region>.
- 28 Source: Economic Performance by NUTS-2 in 2015, on an EU-wide (top) and macroregional (middle) comparison, Study on Macroregional Strategies and their Links with Cohesion Policy.
- 29 http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf.
- 30 International organisation established by the treaty establishing the Transport Community Transport Community in 2017: <https://www.transport-community.org>.
- 31 <https://www.unece.org/trans/main/tem/tem.html>; <https://www.unece.org/trans/main/ter/ter.html>.
- 32 The EUSDR has operated since 2012 and was established via the European Commission Communication on a European Strategy for the Danube region of 8 December 2010, the European Council Conclusions on the European Union Strategy for the Danube region of 13 April 2011 and the EUSDR Action Plan (currently under revision).
- 33 www.viadonau.org/fileadmin/content/viadonau/02Infrastruktur/Dokumente/2014-11-13_Masterplan_Instandhaltung_Wasserstrasse.pdf.
- 34 European Agreement on Main Inland Waterways of International Importance: <https://www.unece.org/fileadmin/DAM/trans/doc/2019/sc3/ECE-TRANS-120r4efr.pdf>; [Convention regarding the Regime of Navigation on the Danube: www.danubecommission.org/uploads/doc/convention-en.pdf](http://www.danubecommission.org/uploads/doc/convention-en.pdf).
- 35 www.fairwaydanube.eu/national-action-plan-updates.
- 36 https://transport.danube-region.eu/wp-content/uploads/sites/2/sites/2/2019/09/Intermodal_Study_Danube_region2.pdf

- 37 This case study is substantially based on Hasselgren and Lundgren (2014).
- 38 <https://www.oresundsbron.com/en/info/railwaystatistics-on-oresund-bridge>.
- 39 Oresundsbro Konsortiet is owned by Svensk-Danska Broförbindelsen SVEDAB AB and A/S Öresund. A/S Öresund is 100% owned by Sund & Belt Holding A/S, which is owned by the Danish government. SVEDAB AB is owned by the Swedish government. The two companies each appoint four members to the governing board of Öresundsbro Konsortiet. The board appoints a chairman and vice chairman.
- 40 Visionsrapport Öresundsmetro mellem Köpenhamn og Malmö – en shuttle der gör Köpenhamn og Malmö till bydele i same by” at:
https://interreg-oks.eu/webdav/files/gamla-projektbanken/se/Material/Files/Oresund/Projekter/xresundsmetro_final.pdf.
- 41 <https://oresundsmetro.com/en/knowledge-bank>
- 42 For example, evaluation of the UK Jubilee Line Extension as described in Worsley (2014).
- 43 <https://whatworksgrowth.org/about-us>

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Annex A. Comparison of the form and roles of Australian subnational infrastructure bodies

	Infrastructure New South Wales	Infrastructure Victoria	Building Queensland	Infrastructure Tasmania	Infrastructure South Australia	Infrastructure Western Australia
Basis for establishment	Legislation	Legislation	Legislation	Administrative	Legislation	Legislation
Legal form	Government agency	Body corporate	Statutory body	Part of the Department of State Growth	Body corporate	Body corporate as agent of the Crown
Composition of the Board	Chair, not more than five members with private sector experience (appointed by the elected head of the government – the Premier), the CEO of Infrastructure New South Wales, and the CEO of the Department of Premier and Cabinet (DPC), Treasury, Department of Industry and Regional Development, and Department of Planning and Environment.	Chair, deputy chair, two other directors appointed on the recommendation of the responsible minister, CEO of the DPC, Treasury, Department of Planning and Environment.	Chair, four other Board members, Auditor General, Under Treasurer (in effect), the CEO of the department administering the act.		Seven-person Board comprising four private sector representatives (including the chair) nominated by the responsible minister, and the CEO of the DPC, Treasury and a representative from the land-use planning and infrastructure department.	<ul style="list-style-type: none"> • Up to ten members. The CEOs of the DPC, Treasury and Planning Department are board members. • Government members cannot exceed the number of non-government members. • Board members must have, between them, expertise across a broad range of infrastructure sectors.
Roles	<ul style="list-style-type: none"> • Policy advice (including preparation of 20-year strategy and a 5-year plan). • Sectoral strategies. • Project evaluations (“gateway” reviews, typically not published). • Various roles in project implementation – some at the request of the Premier, i.e. the head of the government. 	<ul style="list-style-type: none"> • Preparation of a 30-year infrastructure strategy (following public consultation). • Development of five-year plans. • Policy advice on matters requested by the minister. • Support agencies in the development of sectoral plans. • Undertake and publish research. 	<p>Focused on projects, rather than policy and planning, particularly on:</p> <ul style="list-style-type: none"> • CBA framework. • Assistance in preparing proposals (projects AUD 50-100 million). • Evaluation of proposals. • Preparation of business cases (projects > AUD 100 million). • Preparation of a project “pipeline” document after state budget. 	<ul style="list-style-type: none"> • Development of a 30-year strategy. • Assess and prioritise all major publicly funded infrastructure investment proposals, leading to a ten-year project pipeline. • Provide independent and objective advice about proposals 	<ul style="list-style-type: none"> • Promote efficient, effective and timely co-ordination, planning, prioritisation, delivery and operation of infrastructure. • Prepare a 20-year strategy and 5-year reviews. • Statement of capital intentions, i.e. major projects (> AUD 50 million) that 	<ul style="list-style-type: none"> • Prepare a 20-year state infrastructure strategy (including public consultation), covering investment and policy reforms. • Assessment of major infrastructure proposals with an expected capital cost over AUD 100 million. • Provide policy advice on other matters, in conjunction with (or on behalf) of state agencies. • Post-completion reviews.

ANNEX A: COMPARISON OF THE FORM AND ROLES OF AUSTRALIAN SUBNATIONAL INFRASTRUCTURE BODIES

	Infrastructure New South Wales	Infrastructure Victoria	Building Queensland	Infrastructure Tasmania	Infrastructure South Australia	Infrastructure Western Australia
			<ul style="list-style-type: none"> Leading the procurement of particular projects. 	<p>to the Minister for Infrastructure and the Treasurer.</p> <ul style="list-style-type: none"> Responsibility for co-ordination of all major infrastructure funding submissions to the Tasmanian and Australian governments. 	<p>should proceed within five years.</p> <ul style="list-style-type: none"> Evaluation of projects with an expected capital cost over AUD 50 million. Prepare other strategies as it sees fit or as requested by the minister. 	
Scope	Seemingly, there is no restriction in the legislation. Strategies, etc. cover a wide range of economic and social infrastructure.	Seemingly, there is no restriction in the legislation. Strategies, etc. cover a wide range of economic and social infrastructure.	Definition in act covers all sectors. Focus is on investment which may have significant economic, environmental or social impact on the state.	Appears to concentrate on transport and water.	"Infrastructure" not defined. In practice, therefore, scope is as determined by the Board or the minister. It covers economic and social infrastructure (including housing, cultural and recreational facilities and waste).	Definition is not limited to particular classes or sectors of infrastructure.
Annual budget	AUD 8.9 million (2018-19)	AUD 9.8 million (2017-18)	AUD 23.4 million (2017-18). Building Queensland can charge agencies for services provided (c. AUD 15.8 million in 2017-18).	Unclear (but probably under AUD 1.5 million)	AUD 2.0 million (2018-19)	Not available.
Number of staff	45 (at June 2018)	30 full-time equivalents (FTE) (at June 2018)	27 FTE (at June 2018)	Unclear (but probably only 3-4)	6 FTE	Not available.

ANNEX A: COMPARISON OF THE FORM AND ROLES OF AUSTRALIAN SUBNATIONAL INFRASTRUCTURE BODIES

	Infrastructure New South Wales	Infrastructure Victoria	Building Queensland	Infrastructure Tasmania	Infrastructure South Australia	Infrastructure Western Australia
Reports to:	Premier.	<ul style="list-style-type: none"> • 30-year strategy is reported to parliament. • Government detailed response to strategy to be published within one year of presentation to parliament. • Nominated minister where he/she requests advice. 	<ul style="list-style-type: none"> • Minister responsible for the act. • Agencies in relation to particular projects. • Not stated in legislation but (presumably) to Cabinet when projects are considered for final funding decision. • Some business cases are released publicly (in full or in part). 	Minister for State Growth and, separately, to the Treasurer, and to the Secretary of the Department of State Growth.	Minister responsible for the act.	<ul style="list-style-type: none"> • Premier. Premier must submit to parliament within 60 days (+28 days if strategy is resubmitted to Infrastructure Western Australia). • Premier on other matters. • Publication of annual work programme.
Government obliged to adopt recommendations?	<ul style="list-style-type: none"> • Government agencies to co-operate with Infrastructure New South Wales. • No, though strategies and plans are to be adopted (with/without alteration) and be made public, or referred back to Infrastructure New South Wales. 	<ul style="list-style-type: none"> • Government agencies to co-operate with Infrastructure Victoria. • No, though government required to respond to strategies and plan within one year. • Infrastructure Victoria required to report in each annual report on its assessment of the government's progress against the five-year plan. 	<ul style="list-style-type: none"> • The act appears to be silent on this matter. • 2017-18 annual report states that the government accepted Building Queensland's recommendation on some of the 11 detailed business cases it prepared. 	Unclear. But probably not.	<ul style="list-style-type: none"> • Minister must adopt recommended 20-year strategy and statement of capital intentions with or without amendments (or refer it back to Infrastructure South Australia. • Infrastructure South Australia can advise minister it does not agree with amendments made by the minister and make that advice public. 	<ul style="list-style-type: none"> • Government agencies must co-operate with Infrastructure Western Australia. • Government must provide response to parliament within six months. • Premier and Treasurer to develop/publish a ten-year state infrastructure programme (SIP) within three months of the state budget, showing how it reflects the strategy (to the extent to which the government supports the strategy). • Premier to publish summary report on major projects within six months of receiving report from Infrastructure Western Australia. • Infrastructure Western Australia to publish annual report in progress against the strategy, having regard to government response and SIP.

Annex B. Working Group participants

Working Group participant affiliations were provided at the time of their participation in meetings.

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Developing Strategic Approaches to Infrastructure Planning

This report documents trends in the use of strategic planning in a range of countries and the associated establishment of independent infrastructure advisory bodies. It documents practices in the areas of project identification, appraisal and selection. It considers the appropriate scope of impact assessments, including the use of wider economic impacts and the role of ex post evaluation in contributing to better appraisals of future investments. Finally, it looks at how the effective stewardship of existing infrastructure assets can maximise their ongoing productivity.

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