Shifting Australia's Infrastructure Mindset to the Long Game

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Movers and shifters in infrastructure

This section presents an overview of some long-term trends in infrastructure. It reviews the big behavioral drivers that may shape infrastructure development in Australia, and interprets what that means for governments to provide infrastructure and the future involvement of private sector capital and expertise.

Introduction

The Australian status quo for infrastructure is similar to the broader Organization for Economic Co-operation and Development (OECD). It has had the benefit of an enormous legacy of roads, bridges, tunnels, and water energy and gas reticulation systems, along with a rich fabric of social amenities that support the economy.

It is true the bulk of this infrastructure is ageing, and its economic lives are being extended beyond original expectations. But the opportunities to revitalize this infrastructure have never been better, with a globally connected marketplace for design, engineering, technology and construction services. The transfer of technology and human capital between jurisdictions is high and is expected to intensify. Together these forces should assist Australia, and other developed and developing nations, to adapt and repurpose their infrastructure in a timely and purposeful way.

The composition, size and living patterns of societies continue to grow and evolve. Urbanization is well recognized around the world for the unprecedented impact it is having on the density of settlement and the associated infrastructure needs it is demanding. Australia continues to be one of the most urbanized nations on the planet and the infrastructure agenda for cities needs further enhancements particularly in respect of integrated long term planning of transport and land use, and access to sustainable funding and financing sources.

Australia has a population growth that is more akin to a developing nation, with growth approximately three times that of China (OECD 2016[1]). Figures 1 and 2 show that Australia is set to be the second fastest growing OECD nation and that, in absolute terms, Australia is set to increase its population more than any other developed country except the United States, Mexico and Turkey. Coupled with population growth is a dramatic shift in the demographics where aging will see shifts in living patterns and use of infrastructure that will place new and unexpected demands on the system.

A society that is more educated, connected and informed than previous generations is also emerging as an important ingredient to the infrastructure task. Both community and customers that make up the critical mass of stakeholders in infrastructure are more assertive in expressing their expectations of infrastructure. The complexity of planning, delivering and managing infrastructure has become more challenging, and will demand a great deal more of policymakers, project leaders and industry partners.

Governments must reassess and see that they too earn their social license for infrastructure to be developed. Without this, the scope for wastage and risk of discontent is acutely high for all stakeholders.

Sustainability as a word to describe infrastructure is an important and relatively new development in the vernacular of the industry, as is the emergence of resilience. Together they could be attributed to the issues of climate change and other environmental issues, but the community's expectations for more accountability and responsibility for the resultant service outcomes are in play as well. In particular, enhancing productivity through doing more with less, accommodating a society where time and space are scarce and sensitive to disruption and volatility are critical factors in shaping the policy and operating context of the industry. It is also related to the fact that cyber threats are real and significant across every dimension of the infrastructure system.

The political economy is also an important and enduring trend maker in the sector. Politics of infrastructure are favoring big and complex, and 'transformative' appears to be a word of choice for politicians in describing infrastructure. This in part reflects the difficulty in getting agreement to build infrastructure, and that bi-partisanship is more likely if the project is big. The preponderance of mega projects to be late and over budget is well documented.[2] However, less common is the ability for such projects to be responsive to new information and circumstances. This is often inadequate owing to poor project governance standards that could undermine the social license for both current and future projects.

The next section discusses the importance of retaining a strong institutional memory so that all stakeholders in infrastructure retain a more informed perspective on the size and scope of their current challenges relative to their predecessors. This will be followed by a forward looking assessment of megatrends that are the potential drivers of change expected to shape the infrastructure landscape over the next century.

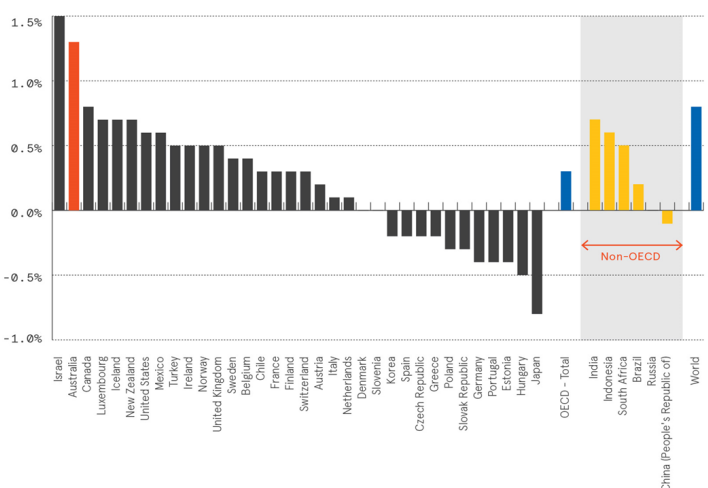
Learning an old lesson again

Infrastructure and human development are synomonous. The waves of innovation that heralded new opportunities for human endeavor and then displaced the old infrastructure are commonplace. But surprisingly, the relationship between economic growth and infrastructure is an area of considerable political and academic debate. Many macroeconomic and microeconomic studies have added to the body of discussion, but have not secured a consensus on its magnitude, causation and timing.[3]

Infrastructure as a word is relatively new and it continues to attract rich variations in definition. According to Goldsmith[4], it first appeared in the Oxford English Dictionary in 1927, and was more often used in a military context up to about 1960. The Proceedings of the Institution of Civil Engineers (Great Britain), published continuously since 1826, contained the first reference to the term infrastructure in 1933 in connection to ports and public works in India.

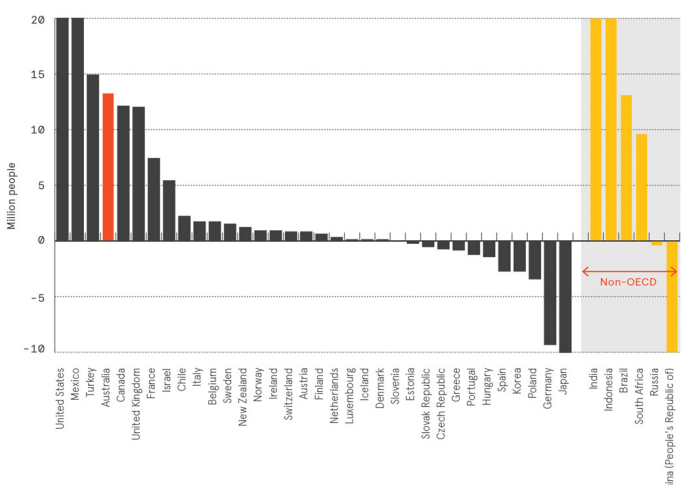
While the physical characteristics of an infrastructure asset and its function has been the cornerstone of most descriptions, there have been subtle shifts in describing the services the asset

Figure 1: Projected average annual population growth rate 2016-2050, OECD and Selected other countries



Source: Organization for Economic Co-operation and Develepment (OECD). 2016. Historical population data projections (1950-2050)

Figure 2: Projected addition to population by 2050, OECD and selected other countries



Source: Organization for Economic Co-operation and Develepment (OECD). 2016. Historical population data projections (1950-2050)

delivers, particularly as private capital is involved and long-term contracts secured. For example, the provision of the actual road is incidental to the fundamental point that the lanes on the road are available, safe and accessible. This has served to be a powerful force for change, when authorities focus on services delivered from the physical asset rather than just building assets.[5]

Despite the technical advancement in infrastructure evident today, much of this has been done in spite of a weak institutional memory. This loss of knowledge from previous infrastructure endeavors, however, is not unique to the modern context. While this is no excuse for permitting a weak institutional memory, it appears that some of the most bold infrastructure endeavors in human history suffered from the same problem.

For example, the Roman Empire created a network of roads and townships coupled with communications systems that would stand proud against any modern context. Importantly, the networks were subject to clear asset standards and project governance. These were standardized in the Law of the Twelve Tables in 450 BCE. There was a strong focus on whole-of-life costs, for example roads constructed to a standard to minimize ongoing maintenance costs. The Romans left a well-documented process on the 'how to' of building physical infrastructure.

Vitruvius (70-10 BCE) lamented, however, that the good practices of the past were being forgotten, and that the Romans had completely forgotten the disciplines of the Greeks in controlling the costs of public works. He cited a law in the Greek city of Ephesus that required architects, when entrusted with public works, to lodge a cost estimate with the magistrate. On completion, if the final costs did not exceed the estimate the architect was celebrated with decrees and honors. When the cost exceeded the estimate by no more than a quarter of the original estimate, it was defrayed by the public purse and no punishment inflicted. But when the cost overrun was more than 25 percent, the architect was required to pay the excess out of his own pocket.[6]

A compelling lesson from history is that our societies would be well served by having a strong institutional memory. In the current policy debate in Australia, it is expressed slightly differently as the need for evidence-based policy development and decision-making. However, calls to address this in infrastructure continue to be inadequate and urgent action is required to ensure these principles are applied.[7]

Wrestling with megatrends

A distinguishing characteristic of infrastructure is its relatively long economic life. It therefore has to accommodate the ebb and flow of multiple trends in business and society and their changing needs. In the case of transport such as bridges and tunnels, they can extend well beyond a century, which is also true for water-related assets like dams and reticulation systems. In the case of energy and social infrastructure assets, their economic lives are typically shorter but still last for many decades.

A megatrend, as defined by the Commonwealth Scientific and Industrial Research Organization (CSIRO), is a major shift in environmental, social and economic conditions that will substantially change the way people live. Megatrends are relevant to contemporary decision making and may prompt a rethink of governance models, business processes and social systems.[8]

It is from this perspective that a study of megatrends can be useful, not for trying to predict the future but for understanding the range of behaviors and forces at work that can shape our economy and society and in turn infrastructure. These megatrends are not intended to be comprehensive nor exhaustive but rather to start a conversation and debate about the drivers of change and their implications.

Megatrend 1: The inflation of expectations

The defining characteristics of successful infrastructure in Australia continues to shift because of a combination of factors related to wealth and income levels along with technological advancement and its availability to broader groups of people.

Traditional measures of the quality of a road in early 1900s were dominated by engineering considerations, such as smoothness of the journey, incidence of potholes. This evolved with an expectation of adequate street lighting to ensure safety, and the use of traffic lights at intersections for safety and improved flow by the mid-1950s.

Further enhancements continued with design flexibility to enable contra-flows to deal with peak demand and breakdown lanes and breakdown car removal services for clear lanes and regular traffic flow. More recent decades have seen real-time traffic information and measures like HOT (high occupancy transit lanes) on selected roads. Over time the basic road has changed from a piece of bitumen-based infrastructure into a higher level technological, information-based service asset. In doing so, it has graduated into a new class of asset performance that can accommodate time sensitive customers, especially in respect to accessing other transport modes, such as airports, as well as heavily congested areas such as central business districts.

Planning infrastructure for the future will need the design to be flexible enough so it can provide for not only additional capacity, but also the ability to break down traditional concepts of aggregate demand into more refined service outcomes for a variety of customer groups. It will also need to have greater service capacity per unit of physical infrastructure.

Other sectors in the economy are experiencing the complexity of demand, particularly in tourism and retail where the customer is seeking an experience (service) rather than the basic consumption of a product. This is affecting infrastructure in all its different forms, as the following examples show.

- Energy customers are expecting to know the origin of their power supply, and are expressing preferences for access to certain power sources that have attributes of no carbon or less intensive carbon emissions.
- Airports are no longer just concerned with the aeronautical functions of aircraft movement and safety. More contemporary drivers include landside facilities such as parking and shopping, along with airline passengers able to reach the hub conveniently, by positioning gates nearby for ease of interchange between planes.

- Water and waste provision is shifting with expectations of stronger environmental standards in the harvesting and distribution of water. Customers are also expecting responsible use of waste, which has triggered innovations for the production of renewable energy and recycled water. This is still evolving in Australia, but wastewater has the potential to change from a cost to a new revenue source.

The upshot is that community and customer expectations are on the rise, and that the static physical assets of infrastructure will need to evolve into dynamic service centers to cater for a plethora of preferences from the community and customers.

The ability to fulfil the escalating expectations of infrastructure customers will demand a different approach from policymakers. Not only is the traditional presumption that infrastructure is a 'one size fits all' for customers and services rapidly approaching redundancy the process of 'right sizing' will remain challenging. That is, how to fund infrastructure of the right size and the time taken to reach reasonable capacity utilization will have even more complexity to it.

Implied in this megatrend is how a focus on bigger, more solid assets may not correlate with the ability to meet the finer resolution of services required, and that more of this may be resolved at a micro-scale using technology, customer-to-customer and business-to- customer solutions that are discussed next.

Megatrend 2: Blurring boundaries

Traditionally infrastructure has benefited from a clear definition of the entities that supply infrastructure, and those that use it. The configuration of energy, water, and transport networks and the supporting regulations continue to have a strong mono-directional flow from producer to the user. The interaction with the customer is often minimal and perfunctory at retail level, but this is often changing for larger business customers.

Technology innovations are undermining this relatively simple 'supply-push' model where producers (which often are monopolies) create the assets and services that are pushed through the network according to a schedule of production and service timetable.

This simple 'supply-push' relationship between producer and user is eroding and 'demand-pull' forces are growing in importance. They bring potentially significant implications for the incumbent producers, and invite new suppliers to enter that can shift industry dynamics.

Supplier and customer boundaries are being eroded by technology that has lowered the transaction costs associated with making infrastructure available to a market of buyers and sellers. This is sometimes referred to as the sharing economy.

Examples of this in the infrastructure sector relate to transport and energy, and are causing greater complexity for policymakers to manage these innovations, and assess the implications for forward planning.

Australia has experienced a disruption in transport from new technologies, both from global and home- grown sources, generally known as a transport asset sharing platform. Uber is commonly recognized in this space, with its introduction to Australia in 2012, and then the introduction of UberX in mid-2014.

The blurring of the boundaries that has emerged with Uber and similar sharing platforms in the supply of transport services is yet to be fully understood or appreciated. These systems, however, do seem to have the capability to liberate latent spare capacity in the private vehicle fleet through an on-demand delivery model.

This is enabled when drivers that are registered on these sharing platforms can at their discretion liberate their time and spare capacity of a private vehicle for a financial return. The consequence of this additional supply is that customers can choose their vehicle of choice, and have a logistic solution to their exact point-to-point journey requirements.

The take-up of this technology remains relatively nascent; nonetheless as it matures and competition intensifies it raises the possibility that the sharing economy could in part meet the escalating freight and passenger logistics task of the nation's cities and regions. Aggregate demand modelling for future public transport projects will need to be cognizant of the potential risks of overstating the need for new projects because of unanticipated shifts in user behavior and technology that can reveal new supply side capacity.

A similar argument can also apply to driverless vehicles, where road productivity may be transformed by higher vehicle density, assuming the technology can do so without loss of speed or safety when vehicles are networked together.

Traffic simulation undertaken by FP Think (2014) suggests that with 75 percent of vehicles autonomous, freeway capacity might be increased by 35 percent.[9] The Bureau of Infrastructure, Transport and Regional Economics (BITRE 2015) estimates that if autonomous vehicles account for 30 percent of the light vehicle fleet by 2030, congestion in Australia will be reduced by around a quarter.[10]

Such technology could also accelerate the blurring between the consumption and supply of infrastructure services as ownership models change to exploit the new opportunities of generating third party revenue from latent capacity in the vehicle fleet.

In the case of the energy sector, the interplay between customer and supplier is also emerging as a source of disruption to the traditional model of centralized dispatch of electricity. For example, households with solar panels (and batteries) are increasingly capable of being more self-sufficient and independent from the electricity grid. As their micro-production of energy becomes more efficient, the excess power can be injected into the grid, making the household both a consumer of electricity from the grid and a source of production to it.

In both cases, replacing the 'push' model of infrastructure production in energy and transport logistics appears to be only a matter of time, as it is resource intensive, and inefficient in matching supply to customer preferences.

The more organic, dynamic and complex set of arrangements where technology is enabling the blurring of production and consumption of infrastructure services has the benefit of

liberating latent production capacity, and satisfying a more diverse and range of customer needs and expectations. As this megatrend evolves it may bring with it a number of implications.

- It may challenge infrastructure planners to question and re-evaluate demand forecasts for future infrastructure based on historical trends.
- Higher vehicle productivity may imply a future of fewer cars that travel more and deliver enhanced mobility but with a more cost effective vehicle-sharing ethos.
- It may refocus efforts to ensure legacy infrastructure can remain viable, as necessary, to interface with and accommodate new technology that liberates latent capacity and enhances customer service.
- It may enable a price for service culture to emerge. Instead, sharing assets can shift the size and scope of the so-called infrastructure dollar deficit, and reduce new capital investment requirements.

Finally, the need for new infrastructure to meet the strong population and economic growth of Australia will continue to be a priority for the medium term. However, the dividends to the nation of greater flexibility in reusing and repurposing existing infrastructure with the benefit of new technology needs greater understanding. This is a priority for public transport agencies to adopt new technologies that could delay or potentially substitute costly new projects in favor of more capital-efficient solutions.

An early understanding of the consequences and opportunities of the megatrend blurring boundaries could yield the economy and taxpayer a significant productivity boost, and money saved for the taxpayer from delayed or abandoned projects.

Megatrend 3: Risking innovation

Innovation is fundamental to our wellbeing, and wherever there are challenges and necessities of life to be met, there will be inventiveness. Extracting the full potential of innovation is desirable, provided it is legal to do so, and where its benefits exceed costs. But there are an expanding array of institutional, contractual, governance and cultural impediments that are frustrating the innovation process.

These regulatory and institutional impediments to innovation can have a number of effects, including the ability to stop innovation altogether, or shift the innovation to another less efficient part of the value chain.

For example, during the period of the early 1900s with the introduction and rapid propagation of private motor vehicle ownership in the United States, there was a ride-sharing scheme started in 1914 by L P Draper, a car salesman in Los Angeles. He observed very long queues to catch the public transport trams in the city so he set up a sign on his car to say he would take passengers wherever they wanted to go for a 'jitney' (slang for a nickel).[11]

Draper met with extraordinary success, by 1915 there were 50,000 rides per day in Seattle, 45,000 rides per day in Kansas and 150,000 rides per day in Los Angeles. Uber founder Travis Kalanick says that Uber 100 years later is doing 157,000 rides per day in LA. But within just a few years the Jitney bus was regulated and taxed out of existence, as the monopoly public transport authorities imposed onerous conditions and licensing fees on it because according to Kalanick they saw the ride-sharing scheme as pernicious.

The global economy had to wait almost 100 years before another scaled attempt at ride sharing began. In the meantime, without ride sharing, car ownership exploded and so did the inefficiencies of accommodating a car fleet that was prevented from extracting the true efficiencies of the private motor vehicle. Kalanick argues the results are congestion, massive carbon emissions and excessive spare capacity as private vehicles were used for less than 10 percent of their productive capacity. Cities were affected, with at least 30 percent of the building stock devoted to car parks and building and maintaining bigger roads.[12]

Innovations in the electricity distribution network are occurring vigorously at the household level, particularly in the form of micro-solar production and storage of energy. Regardless of the motivations of the households to adopt new technology (e.g. reduced carbon or hedging against future energy costs) maintaining continuous, reliable and secure electricity remains essential for the vast majority of customers.

The costs associated for household to invest in their own energy production and storage to maintain an uninterrupted energy supply is onerous; and it may not be beneficial from a social welfare perspective for them to do so. That is because the risks associated with accessing a suitable energy source and preventing an outage could be achieved much more efficiently at a higher level of the network.

For example, dealing with these types of risk can be effectively managed, if regulation permitted more customer-led innovation and adoption of new technology to occur within the central network, and in this case at the sub-station. The basic economics at play is that installation of batteries at the the sub-station could enable better risk pooling across a larger groups of people/ households.

Furthermore, different consumption and production profiles from households across neighborhoods can enhance reliability and cost effectiveness where technology and innovation enables greater efficiency and reliable two way flows between generation, storage and consumption. Improving the network configuration between households and their local sub-station may also infer wider economic benefits to management of the very elongated east coast grid and the role fossil fuel has had to play in helping to stabilize the network.

Customers can and should be driving change in the way assets and networks are governed. But too often regulatory and institutional arrangements are less dynamic, and can be quick to treat innovation as unnecessarily disruptive, denying both customers and taxpayers better services and superior productivity. While this could be boiled down to monopolies just seeking to protect their economic rent, it is also possible that infrastructure governance has over emphasized cost minimization and protecting the status quo in the interests of continuity and reliability of service delivery.

Australia should seek to enable, as many parts of its infrastructure networks be open to innovation and led by the customer.

However, when this is not possible owing to the impact of regulation or other restrictions, customer led innovation can be forced to the periphery of networks like at the household level. Greater freedom to adopt new technology and innovate at the household level can be very costly and potentially inefficient compared with what could be achieved if the network were more adaptable to customer requirements.

Infrastructure governance practices: a customer's friend or foe?

This section reviews current infrastructure governance practices with a special focus on land transport, and how this vital sector of infrastructure is engaging with, and enabling innovation, adaptability and customer-led services.

Introduction

The following section examines governance arrangements for publicly available contracts, some of which are PPPs, through two different but complementary lenses.

- Firstly, effectiveness in mobilizing resources in the early life cycle of infrastructure, from project inception to final delivery.
- Second, to understand how asset owners and operators that work within these long term governance arrangements manage the changing requirements from shifting long-term economic and social change over the asset life cycle.

Access to contractual documents, especially those relating to PPPs was limited owing to commercial in confidence. Only Victorian contracts were examined, with contract summaries relied upon for other PPPs. A list of the contracts reviewed is detailed in Appendix B found in the full report available online.*

Getting the basics right

There is a broad range of public infrastructure governance models at work in Australia as outlined in Table 1, with many variations, they basically range from the examples given below.

- Direct government provision: cradle to grave direct government provision where public sector design and construction contracts are led by public works departments. Operation and maintenance occurs through traditional contracting with private sector parties to supply some or all of these services to government agencies.
- Corporatization of government trading enterprises, which has introduced greater balance sheet discipline and accountability to the delivery of infrastructure services.
- Privatization of assets, which is now commonplace in sectors such as airports and telecommunications.

Much of the focus on infrastructure governance reform has been concerned with seeking to get the basics right. Reform effort focused on project origination linked to infrastructure needs assessments and development of value for money criteria used at the investment decision (business case) stage and contract execution. Technical enhancements have also been sought in the preparation of project documentation and procurement, including risk allocations and ensuring transparent competitive processes.

Lifting the quality of governance around whole- of-life asset management has seen significant developments in design and lifecycle maintenance to maximize lifetime value. PPPs have been at the forefront of this advancement, using output (rather than input) specifications and a risk allocation process to help drive efficiencies in whole-of-life design and operation.

The role of government as both a buyer and customer is very important in setting the way the market meets its needs. Despite improvements in governance arrangements, governments still have much room for further improvement, especially in respect to customer-led infrastructure decision- making. This improvement process will take time and is most likely to occur when governments evolve from being a basic buyer of infrastructure assets to a facilitator for deeper interaction between customers and asset owners. This will require governments placing market design at the center of infrastructure governance.

Market design is concerned with the way governments organize market actors, information, pricing signals, risk allocation and scope for innovation to achieve public policy objectives. The most basic precondition for this to occur is for governments to be more explicit, clear and transparent about the objectives of their infrastructure interventions, and in turn bring equal clarity with respect to the problem they are seeking to remedy.

The setting of clear objectives and problem identification when commissioning projects can help give the public and private service providers greater latitude to innovate. That is because the government is less prescriptive about inputs, which can invite more vigorous innovation including extracting more value from existing infrastructure, rewarding capital savings initiatives that reflect their true economic value to the taxpayer, and focusing on service outcomes rather than the more superficial physical characteristics of the proposed solution.

From this perspective, market design matters, as it goes to the core of asking the right things of the markets and shaping the values and behaviors of the market participants to deliver against clearly stated public policy objectives.

Challenging infrastructure to adapt

Markets can be a powerful means of transmitting signals for change and as a catalyst for infrastructure to adapt to the dynamic

Table 1: Overview of infrastructure governance models

Delivery Forms	Direct provision	Contracting	SOEs	PPPs	Regulated privatisation	Privatisation with liberalisations
Role of government	Planner, manager, producer	Planner and manager	Owner and planner	Planner and regulator	Regulator	Referee
Project selection	Government	Government	SOE and government	Government	Private firms but with government influence	Private firms
Governance mechanisms	Command and control	Public procurement law	Corporate governance	Contractual agreements	Sector regulation	Competition policy

Source: Organization for Economic Co-operation and Develepment (OECD), Towards a Framework for the Governance of Infrastructure, September 2015 (pp.26)

needs of customers and community. Of course, markets require customers and suppliers, and while this is a simple proposition there has been an extraordinary level of administrative complexity that has evolved around procuring infrastructure and delivering services.

This has occurred because of a number of factors, not least among them is that much of the infrastructure sector is made up of large monopoly entities that require regulation to ensure market power is not used inappropriately. In other cases, regulatory standards are important so infrastructure complies with public policy objectives such as safety, reliability and universal access.

Governance arrangements for utility services, such as electricity, gas, water and telecommunications, have changed greatly in the past twenty years and market forces play a much greater role in determining the services provided and which parties provide them. The private sector's role has increased markedly over this period.

Road and rail services exhibit monopoly characteristics and the government's role is still dominant and relatively little use is made of market forces and cost reflective prices to find out consumer preferences and inform future investments. Subsidies enabling heavily discounted prices compared to cost of delivery have somewhat perversely enabled the availability of infrastructure services to meet universal access and social equity objectives, but at the same time they have also blunted the quality of customer interaction.

For many public infrastructure services, the procurement of assets and service delivery is done administratively, and therefore the purchaser (in other words the government department or agency) acts on behalf of the users and customers. While this is done on a best endeavors basis, it nonetheless causes a wider separation between final consumer and infrastructure service purchaser/ procurer compared with competitive markets. It can also result in a less flexible service offering that is made on a 'take it or leave it' basis.

Equally, the distinction between funders and users is important. The latter generally has very limited scope to influence service provision because a government agency acts as purchaser and administratively determines service type and standard.

Table 2 provides a high level overview of the governance arrangements for service recipients and purchase arrangements and the scope for customer engagement that apply in a number of sectors that make up infrastructure. Despite a very wide spectrum of customer models there is a clear skew to relying on administrative-led service provision, which is where customer interaction is predetermined according to a production or service timetable schedule that is set by the infrastructure owner/ purchaser.

In the case of urban arterial roads and urban passenger rail, the primary beneficiaries of the infrastructure services are direct community users (the travelling public). For urban water services, the direct beneficiaries are those who receive the water services; however, very important externalities exist also in respect of public health. This is similar to urban roads and urban passenger rail where externalities in respect of public safety, congestion, air quality, and land use agglomerations are involved. Importantly, urban water users are paying overall for the full cost of providing these services, but individually may not be bearing the direct cost of the water service provided to the household.

It would be fair to point out that highly competitive markets operate in stark contrast to these examples. For instance, direct community users are in fact customers and are both the purchaser and funder of the service or product. Mobile telephony comes closest to this in the infrastructure sector.

In essence, where users of the infrastructure services are also funders, there appears to be much more scope for them as active agents in determining what, when and how services are supplied. That is being a customer as opposed to a passive 'user' where services are offered on a 'take it or leave it' basis.

The extent to which infrastructure users can transform into infrastructure customers entirely depends upon the nature of the infrastructure governance arrangements in place. While urban water users still have relatively little impact on the nature of services provided, wholesale customers appear to have a larger influence in electricity. In the case of mobile telecommunications, the customer is more fully empowered.

The state of play with governance in land transport towards supporting and empowering customers is in need of further reform. In fact, land transport continues to entrench the community as 'users' and significant reform is necessary to begin the transformation to the status of a customer and with it more disciplined investment, innovation and adoption of technology.

Translating administrative process to customer outcomes

Within Australia, specialist public sector agencies are responsible for arterial road and urban passenger rail system-wide service delivery. There has been considerable effort and reform to be more customer-centric. The models used range from a single entity with responsibility for planning, funding and delivery (e.g. roads in Victoria) to a purchaser- provider model (e.g. NSW, rail in Victoria).

It is important, however, to recognize that when infrastructure entities are established with relative autonomy and clear performance objectives and accountabilities, together this can help achieve better customer interaction and outcomes. This was borne out when the Australian Government and states undertook widespread corporatization in the late 1980s and 1990s. Improving the technical efficiency of the government trading enterprises, along with more disciplined capital investment to meet customer requirements were important outcomes.

Under a purchaser-provider model, a central public transport entity coordinates public transport and undertakes network-wide planning and contracts specialist service delivery entities to meet specified service level requirements. Performance-based contracts set out service delivery and reporting requirements to be met by the specialist delivery agencies.

There are important differences between models, and also within models, that influence the service responsiveness of the agencies. This is illustrated below by looking at the nature of the objectives set for the delivery agencies and the scope and specificity of key performance indicators (KPIs).

Table 2: Purchasers and service recipients

Sector	Service recipients	Purchaser	Customer engagement
Urban arterial roads	Direct community users (drivers and passengers)	Taxpayers (major); Direct community users (minor – despite tolls with full and partial cost recovery)	Limited, owing to lack of direct user charging (about 8 percent*) being a small proportion of road revenue. In the case of toll roads, there is potential of a higher level of engagement but may require a change in the contract deed to shift to a more active customer approach.
Urban passenger rail	Direct community users (passengers) Road users (via reduced road congestion)	Taxpayers (major); Users (minor – subsidised fares)	Limited, owing to lack of direct user charging to recover costs (under 30 percent**), prevents deeper price for quality exploration with customers. Strong attempts to create a customer oriented culture among public transport agencies through mainly punctuality and cleanliness performance criteria.
Urban water	Direct community users	Direct community users (postage stamp pricing)	Medium, scope to bundle services such as maintenance asset purchasing for water appliances and plumbing.
Corrections	General public (major) Inmates (minor)	Taxpayers	Very limited.
Highly competitive markets (eg mobile telephony)	Direct community users (customers)	Direct community users (customers, full cost recovery)	Unfettered for engaging, anticipating and shaping customer product and services. Active price discovery mechanism to allocate capital and manage risks. Full spectrum of price for quality offering.

**BITRE (2015) Australian Infrastructure Statistics Yearbook, Table T1.4*
***BITRE (2013 Urban Publiec Transport: updated trends, information sheet 59, p.12*

Suppliers of infrastructure services through traditional government contracts often have little commercial incentive (and few tools) to change supply arrangements to better satisfy customer needs. For instance, even in the case of current toll road PPPs there is limited use of the price mechanism for users to pay for a particular service outcome (e.g. HOT lanes on a motorway[13]). In Australia, toll road owners/operators generally have contractual discretion to lower tolls in off- peak periods (but generally do not as demand is inelastic) but on the other hand they do not have the discretion to raise tolls during peak periods.

However, even in best practice jurisdictions, there appears to be room for further improvement to better reflect opportunities for a more dynamic and service oriented approach to the customer within the broader transport system. That is governance arrangements tend to be modally centric, and have limited emphasis concerning the quality of the intermodal interface between trains, trams, buses, cars, bicycles and walking.

However, there are positive developments toward a better modal interface. For example, Transport for NSW is about to provide a customer discount for changing modes with the Opal Card from mid-2016. This is a powerful indicator of system-wide governance awareness and giving greater priority to a more seamless intermodal approach to transport logistics.

It is not clear, however, the way in which service standards and levels are set among the agencies reviewed in Appendix A (available to view in the full report online*) and what mechanisms are in play to allow these to be varied over time with changing customer and community priorities. Customer satisfaction surveys are important but they have limits in informing decision-makers about willingness to pay and the opportunity cost of investing in one area compared with another.

While considerable administrative effort has been expended by public agencies to understand user requirements and reflect it in specifying service type and quality, there is very little in these

processes that resemble market characteristics where prices and quality of service are set by customer interactions.

Surprisingly, it appears that clarity of objectives and accompanying KPIs directed at the customer appear to be more readily acknowledged with a purchaser- provider model than some PPPs. This is discussed further in the next section.

When market-based reforms are neither possible nor appropriate, governments can establish specialist delivery agencies with specific and transparent KPIs in favor of the customer, and reinforced with strong and independent monitoring arrangements. These were also the guiding principles at work in the period of wide spread reform of government trading enterprises in the late 1980s and early 1990s in Australia.

Internationally, some jurisdictions have been reforming their governance models for managing arterial roads that have been informed by the Australian experience and extended into areas that Australia did not include at that time. The following paragraph discusses Highways England as an important case example to help inform the next wave of reform for Australia.

Highways England

Highways England was established in 2015 as a government owned strategic highways company with responsibility for managing the English strategic roads network. Compared to the agency it replaced, Highways UK the new Highways England has been empowered with a strong governance model to be customer-centric and more accountable for its capital and maintenance decisions. It has the mandate to develop a 25-year vision along with a certainty of funding arrangements that are on a 5-year basis. Importantly, its funding level has been boosted significantly above that of recent years, to reflect past chronic underfunding of the road network.

Private contractors are responsible for the design and delivery of road maintenance in a particular area of England for a period of four or five years, with the option to extend to seven years. The road user has been placed at the center of Highway England's focus along with much longer-term planning.

The Department of Transport has set Highways England clear and measurable performance targets aimed at providing better and more efficient roads that is financially sustainable and forward-looking. Rigorous and transparent assessment of Highway England's performance, including by specialist independent agencies, is as part of the reform process.

Understanding the changing needs of road users through regular surveys and through its 'Smart Motorways' initiative is a focus of Highways England. It is aiming to make use of communications and other innovations to increase the capacity of a motorway by a third while only slightly increasing its physical footprint.

Highways England is a useful case example to inform the Australian land transport reform agenda. Providing funding certainty and access to a big enough revenue base to meet the life cycle costs of managing an arterial road network will present special challenges and inevitably will require a new set of financial arrangements between the Australian Government and the states.

Can customer responsiveness thrive in PPPs?

An underlying intent to PPPs is that the parties will work cooperatively to address changing circumstances and together the contractual parties will be open to new opportunities that are mutually beneficial during the term of the contract. To facilitate this, PPP contracts generally make explicit provision for change initiatives proposed by the private party. Key elements to these provisions typically are:

- government approval is required before any change can be made
- government must respond as soon as possible to the private partner's proposal
- parties agree to sharing costs and benefits
- unless specifically agreed by a government, agreement to a change proposal does not provide the private partner any relief from meeting its original contractual obligation.

In practice, private partners have activated change provisions in relatively few circumstances, as shown in the following examples.

- In the case of availability PPPs, where the private partner's focus is on cost reduction rather than revenue enhancement, there is often little scope for initiatives that materially reduce its costs while providing additional benefit to government. And where such proposals require significant additional payments by government, often the contracting agency does not have the fiscal autonomy to agree to such changes without going through the approval processes to secure an additional appropriation.
- Where the private partner's revenues come largely from users, there is greater scope in practice for private partners to suggest mutually beneficial value creation changes. However, in practice, these provisions are not designed for large value creation proposals. Governments have an underlying preference to use competitive tendering processes where it is practical to do so.

There appears to be a greater scope exercised by governments to transfer risk under PPP contracts, particularly full service toll road contracts. However, this has not translated to a high level of specificity in KPIs for customer service outcomes.

Risk transfer is based on the proposition that risk is transferred to the party best able to manage it. In the case of the private sector toll road concession holders, they generally have no control over the adjacent roads network or traffic flow and are essentially passive in their ability to control patronage. Developing new products and services, and use of the prices to engage and shape demand are extremely limited.

The upshot is that toll road concession holders are least able to manage patronage risk from a network perspective, and this is exacerbated further with very limited flexibility within the PPP contract to engage with and find the pricing and quality service outcomes.

This makes the operational flexibility of PPP toll roads very limited, and relatively static compared with the broader road network. Making changes is complex and potentially costly to the taxpayers, as the concession holder is entitled to compensation where changes are financially adverse.

There is also a high level of public interest sensitivity with variations to contracts. Some governments have established unsolicited bid frameworks to deal with large value creation proposals rather than rely on contractual mechanisms.[14] For instance, the Victorian Guideline states that: "Proposals must meet a series of important tests and be in the public interest to proceed under the guideline. Proposals will only proceed where they meet Government objectives, provide benefits to the community and achieve value-for-money."[15]

Unsolicited bids associated with live PPP projects that have been approved in Victoria include widening the Tullamarine Freeway component of City Link. This has required associated contractual amendments to the City Link PPP agreement.

While mechanisms exist to adjust PPP contracts, there is a legitimate question as to whether they are suited to the changes that arise in the adaptation to new technology and shifts in customer preferences over the medium to long term.

For example, road PPPs typically are very long-term contracts, ranging up to 40 years in length and rail PPPs can be up to 20 years. This period of time make it entirely possible that new technology, such as smart motorways and even 'driverless' vehicles could present a broad spectrum of challenges and opportunities to materially alter these contracts.

PPPs specify detailed performance requirements, and payment arrangements for meeting those performance requirements, day in, day out, for the length of the contract term. The winning PPP tenderer is the party that shows it has the best proposal to meet those requirements for government. As such, PPPs can provide a best value for money outcome for government compared with other delivery models in meeting the prescribed performance requirements, and in doing so provide long-term certainty for both parties to meet their obligations.

PPPs generally contain mechanisms for dealing with changes, such as capacity augmentations and/ or refinements to KPIs. In some tender processes, 'flexibility' is an evaluation criterion and tenderers are asked to provide a design that more readily allows for likely changes. For example, a government may anticipate that a proposed prison will require expansion in the future and ask PPP bidders to submit designs that will facilitate ready expansion when required in a way that minimizes cost and disruption to prison operations.

Consistent with this approach, change provisions in road and rail PPP contracts allow government options to secure additions like a road traffic lane or rail capacity. Change provisions also extend to improving service levels, along with mechanisms that determine the compensation provided to the private partner for undertaking the associated capital works and related ongoing operational costs. It should be noted, however, that the focus with these change provisions is concerned with securing the government's desired change at least cost.

All road PPPs acknowledge that government is free to make any changes – physical and operational (e.g. changing speed limits) to the broader arterial road network. The PPP contract cannot fetter government in its role as network operator. However, governments can face greater administrative complexity and financial compensation claims if the change leads to the concessionaire losing money.

This is particularly relevant in toll road PPPs where the private party's revenues rely on vehicle numbers. In some PPPs, for example EastLink in Victoria, Cross City Tunnel and NorthConnex in NSW, the physical protection provisions for the private party are limited to direct feeder and egress roads, as well as to changes that specifically affect the toll road (e.g. speed limits). In other cases (e.g. City Link), a broader range of network changes encompassing physical or operational changes can lead to compensation claims.

In the case of NSW Smart Motorways, the state and federal governments are planning to fund the $400 million upgrade to motorways that will entail variable speed limits and signage, extensive ramp metering and better use of on-shoulder traffic.

Together these measures will result in substantially better service outcomes for the motorway customer for traffic flow and improved arrival time, and be financially beneficial to the PPP operator on the adjoining network.

A question in search of an answer is, how could PPP operators responsible for the adjacent motorways be incentivized to make a smart motorway type investment on the entire Sydney ring road?

Regardless of the earlier merits of the original PPP contracts that helped accelerate the building of the Sydney ring road, there was insufficient consideration given to the operational and financial incentives for operators to be continuously improving customer outcomes through innovation and adoption of new technologies.

These challenges are exacerbated by the lengthiness of the toll road contracts – up to 40 years. Current government practice to extend the contract term as a form of compensation for the cost of enhancements made by the concessionaire (such as through acceptance of unsolicited bids from the concessionaire), means it may be a long time before governments could resume full and unfettered operational control over their urban arterial road network: without recourse to paying compensation to PPP toll road concession holders.

More generally, the failure decades ago of previous governments to establish PPP contracts with stronger customer service incentives are keenly felt by motorists and the community today. This highlights the limitations of past PPP contract practices, and the need to continue with a program of ongoing reform of contractual arrangements centered on services and customer outcomes over the long term.

The current road funding model provides little direct relationship between customer use, service standards and fees and charges for use of the network, even in the case of where the PPP can charge motorist full cost recovery.

This situation has been subject to considerable criticism; however, a simple shift to cost reflective pricing in the absence of other

measures, like fully integrated land use and transport planning, is unlikely to overcome the problem of perceived inadequate road space and escalating traffic congestion.

The existence of long-term toll road contracts in major metropolitan areas is likely to further complicate the introduction of broader road user charging owing to the obligation to provide financial compensation in some cases where there are material adverse effects on concession holders.

Governments could either seek to renegotiate the tolling regime on these roads, and provide the owners with the negotiated financial compensation or accept that they will not be able to introduce a comprehensive consistent road user charging regime until the final toll road contract expires, sometime after 2050.

The use of availability PPPs in the road sector (as in Peninsula Link) do not appear to pose the same constraints on operation of the arterial road network. In the case of the Australian rail PPP models, these are essentially 'availability' based and leave the government with much broader options for network governance and pricing reform.

In the Peninsula Link contract, the private partner receives a quarterly availability payment from the state, which it receives in full if all contractual KPIs are met. Changes made by VicRoads to the broader physical road network may affect traffic on Peninsula Link but will not alter the private partner's revenues. If the state seeks to change service level KPIs on Peninsula Link, it will need to negotiate compensation arrangements with the private partner but this should be relatively simple because it does not involve modelling traffic and revenue projections.

Performance-based contracts, such as the NSW stewardship road maintenance contracts, appear to provide a good model for future road service delivery contracts. They are customer focused with simple measurable comprehensive KPIs and with real incentives/sanctions for performance. The contract term is long enough for the service provider to take a longer-term perspective. Not only are the KPIs relatively extensive and well-targeted compared with toll road PPPs, but also the incentives and sanctions are relatively more important in terms of revenue at risk.

Shifting the mindset: play for the long game

This section argues that infrastructure governance should not lock in societies to second best infrastructure. Uncertainty about the future can be a powerful catalyst for innovation and is examined in the context of the Better Infrastructure Futures Framework. A case study on Australian airports concludes the section and is offered as an example of past infrastructure reform that can serve the nation well again in new areas of reform.

Introduction

There is a systemic preference that has emerged in the past 20 years around infrastructure governance.

On the one hand, there is an enormous concentration of effort in the continuity and reliability of infrastructure. While this is important, especially for life sustaining systems such as electricity and water, it has nonetheless come at a cost in the form of 'gold plating' infrastructure, especially in respect of some transport and electricity networks. However, a more subtle and potentially insidious cost has been the emergence of an overly cautious culture that risks stifling innovation.

While there may be sound reasons for this, one concern is that land transport is in need of much further reform to ensure it has access to full range of productivity enhancing options, in particular through tapping the latent capacity in the existing infrastructure through new technology and innovation.

This is an area that is in need of greater scrutiny and critique.

Managing a 'shovel ready' project culture

The planning of infrastructure is a very valuable period for policymakers because designers and engineers have the benefit of exercising the most flexibility in testing concepts and designs with the objective of finding the best and, hopefully, most enduring solution.

Governments can have a tendency to both rapidly conceive and announce major infrastructure projects that at times can be contrary to the long-term skillful planning of their departments. Speed and urgency to complete a project as soon as possible is often linked to the perceived need of policymakers to do so within the electoral cycle to demonstrate a fiscal stimulus is delivering on jobs and growth. While the transaction efficiency of major infrastructure is one dimension of social welfare, it is critical that the same process does not trade off the right scoping and right sizing of the proposed investment using flexible design.

Major projects concerned with building assets for the long term highlight the challenges for policymakers to commission them and ensure they can astutely navigate a very high level of uncertainty in the future. Reflecting these uncertainties in contracts such as PPPs is an onerous task and inevitably requires a range of assumptions to create enough certainty for the contract to be both workable and enforceable.

The longer the asset life, the more important it is to conceive a solution that can respond to uncertainty in the long term. Despite this obvious point, the governance of major projects in infrastructure often inserts assumptions about the future into contract terms with private owner/operators that are simply inflexible and constrain the asset owner to respond to uncertainty over the long life of the asset.

An example of unforeseen developments is in respect of Melbourne CityLink. The original contract was signed in 1995 allowing the concessionaire to increase tolls quarterly by whichever was higher, the inflation rate or 4.5% annually for the first 15 years after completion of the road. This contract was signed during a period when 4.5% annual inflation was not unusual. However, trend inflation had since fallen to around 3% annually making the toll increases well in excess of inflation for an extended period of time. This situation was compounded by a failure to link improved customer service outcomes with the onerous escalation in real prices the community has had to pay to use CityLink.

In response to the millennium drought many states invested in desalination plants as an insurance against future risks to water security in their jurisdictions. All of these were conceived with urgency as dam levels were diminishing. The Victorian

and NSW desalination projects shared common characteristics including very large water production capacity (e.g. Melbourne was set at 150 billion liters of water annually, making it the largest desalination plant in Australia).[16] Both are PPPs where government pays the concessionaire an availability payment irrespective of use plus a volumetric payment.

Insurance policy type investments such as desalination plants make value for money difficult to judge, until they are next called upon. That said, building a smaller plant with options for additional capacity through modular and flexible design may have offered a degree of relief. Another option is to have had the plant producing water at a reduced capacity but on an ongoing basis to help enable dams to release water for environmental flows and improve the health of rivers. Together these may have helped taxpayers secure better value for money.

A certain future risks new opportunities

A culture and expectation has evolved that the provision of infrastructure services is better done in an environment of no surprises. Contractual certainty is highly valued by government and proponents alike because it is more conducive to the mobilization of resources, and the attraction of cost-effective design and financing. While this can create efficiency benefits in the short to medium term, it can have an opportunity cost in the future should it lead to inflexibility and loss of incentive and competence to adapt to changing circumstances.

While the power of contractual certainty can be necessary and attractive to quickly mobilize resources in the early life of a project, these benefits potentially attenuate overtime. For example, inflexible high certainty contractual arrangements that make changes in scope and purpose difficult to achieve also risk creating disincentives for private proponents to not adopt essential behaviors that are abundantly evident in competitive markets. These involve using strategic investment and risk allocation to protect and expand their offering to first survive and then prosper in a changing marketplace.

High certainty contractual arrangements can blunt the willingness of proponents to learn, adapt and repurpose their assets and services as time progresses and circumstances may warrant it. This can be acute not only in the long term, but also in the early stages of project commissioning, particularly in periods of new information that may justify re-scoping, stopping or pausing on a major project.

Infrastructure is often referred to as being 'lumpy', that is it is difficult to break it down into smaller components or modules. While that can be the case, technology and engineering innovation is changing to where flexible design can more easily enable, but does not require, additional capacity.

The economics of flexible design is that it allows the building phase to meet the immediate demand, but with options to add more as growth occurs. On the other hand, inflexible design requires that the build is much larger so that the asset can accommodate future forecast growth.[17]

The difficulty with a project commissioning culture driven by urgency, is that it risks failing to take advantage of smaller but more flexible options. Establishing certainty through contractual arrangements to expedite a project can risk focusing on getting the project built while distracting from a proper exploration of flexible design through a culture that emphasizes future benefits of agility, innovation and adaptation.

Framework for better infrastructure futures

Figure 3 introduces the 'Better Infrastructure Futures Framework' (BIFF) with the intention of helping policymakers, investors and the community to better understand the strategic space of uncertainty and opportunity around long-term infrastructure.

The shaded area that originates from the period of project commissioning forms a conical shape that indicates an expanding strategic space relevant to the operation of infrastructure over time. In other words, the longer it is in time from project commissioning, the greater is the area of both uncertainty to threats and opportunities.

The grey cylinder in Figure 3 extends into the future, and is a stylized representation of an availability based PPP or similar infrastructure contracts that can have a contract term of up to and beyond 40 years. These contracts are robust legal instruments that are intended to be capable of ensuring the government and the private proponent together can continue to provide operations with a relatively high level of certainty. To that end, the owner/operator has the benefit of a number of assurances that insulate it from competitive threats that could disrupt their viability through new entrants and or changes to the environment that could have an adverse impact. By the same token, these uncertainties include but are not limited to shifting demographics, technology, and social preferences that could also imply foregone opportunities.

The point of the BIFF is the benefits of the contractual certainties offered to the concession holder to ensure stable and ongoing operations are attractive in many ways, not least of which is the ability to attract cost-effective debt and equity at project commencement and subsequent refinancing. However, these benefits are not costless, and indeed may have an escalating opportunity cost over time to both investors and the economy.

In fact, the longer the contract period, the greater chance the benefits of contractual certainty at project commissioning may be offset in future decades. This is because the contract may prevent or give little incentive for the concession holder to respond to emerging threats and opportunities. The result is infrastructure that is inflexible and static to its environment and customers.

In terms of long-term infrastructure efficiency, it is argued that the uncertainty and opportunity space denoted by the conical shape must be explored, and wherever possible contested by market actors to avoid the risk of stagnation and lock-in to a second best infrastructure solution. But the presence of a PPP contract can also work to shut down this uncertainty/opportunity space for other providers because of a lack of financial recourse to extract a return in light of the risk of contesting an incumbent PPP.

Should there be opportunities for the concessionaire or new entrants to develop additional products and services to explore this space, the figure shows that the spectrum of uncertainties and opportunities could complement and add value to the core contract, and equally there are threats that could detract from it.

Empowering market actors to engage this strategic space of customers, new services (core-plus) and products are critical to the long-term dynamic efficiency of infrastructure. Finding a way to achieve this without compromising the early stage benefits of certainty needs to be examined more comprehensively in the future.

The different stages of innovation are reflected in a stylized series of concentric circles in Figure 3. Each stage of the innovation process can influence the infrastructure contract to varying degrees.[18] The innovation referred to occurs in the economy and the adjacent systems that can materially affect the contract.

Stage 1: Maintain costs, exploit synergies

At Stage 1 it is more than likely that the focus is on incremental (small scale) innovations concerned with doing things better and faster towards more competitive costs. For physical infrastructure, incremental innovations are closely linked with the day-to-day processes of replacing existing components with new ones rather than replacing like-with-like. Central to the decision whether to innovate is the life and serviceability of the existing asset.

Optimized asset management planning has become a central concern of public and private infrastructure operators and is generally accommodated within say a PPP contract. However, if a contract is so lean, the concessionaire could be financially constrained to invest in asset replacement and there can be a tendency to 'sweat the assets' rather than modernize.

Significant savings and service quality improvements can be achieved through increasing the scale and scope of operation (economies of scale). Examples include consolidation of railway companies in the 19th century or water companies in the 20th century and the emergence of the private multi-utility model in the 1990s. Regulation can affect this type of action and needs to be carefully assessed to ensure the benefits are justified relative to the possibility of loss of competition from greater concentration of asset ownership.

Stage 2: Change the system, harvest new value

At Stage 2 radical innovations involve major changes to the way a system is configured or operates, and are more likely to occur in the medium term. In the case of infrastructure these can be triggered by a shift in relative price by virtue of a regulatory change. The dramatic shift to renewable energy is a case in point, driven by a combination of technology, regulation and prices.

In the 1950s and 1960s the USSR, US and UK did this with the introduction of nuclear power. Other examples of radical innovation are concerned with environmental infrastructure investments, especially in wastewater treatment and solid waste that have largely been driven by new regulations that allowed waste to shift from a cost to a profit center where energy can be produced and sold back into the grid.

Stage 3: Disrupt, energies new and old

Goldsmith refers to Stage 3 innovations as having systemic implications as they open up whole new ways of delivering infrastructure services. The pattern of use may not change overnight as it takes time to build the new networks and the incumbent infrastructure owners and operators have many options to respond and survive. Historical examples include the way railway technology replaced water canals, cars and roads replaced railways, electric lighting replaced town gas or mobile phones replacing fixed lines.

During the industrial revolution, canals were partially complementary to turnpike roads as they only took the heavy freight traffic for bulk materials or bulk manufactured goods off the roads and onto water. Canals were generally not used for short journeys or for passengers. Similarly, the invention of the internet gave a respite to the fixed telecoms operators faced with competition from mobiles as they could offer ADSL services over phone lines.

When the town gas monopolies were faced with being made redundant by the invention of electric lighting, they responded by reinventing themselves as suppliers of gas for cooking and heating. In fact, the survival strategies of 'old' infrastructures faced with new competition can lead to intense price competition that benefits customers along with unleashing a new wave of innovation about how to use the existing infrastructure better.

Stage 4: Start over and do it again

Just as this process began with small improvements and larger ones, all of them are intended to both improve and challenge the incumbent technology and service provider. Regardless of the merits of the incumbent their very presence should serve to invite the next disruptive technology that will trigger the commencement of a new cycle of innovation.

More competitive innovation trumps contractual certainty

Providing contractual certainty to infrastructure concession holders is central to modern PPPs. While PPPs invite intense innovation in the early stages of the project life cycle, they are particularly focused on cost management while ensuring the asset's continuity and availability. Despite these benefits, longer-term issues are at play that the concession holders are possibly less well equipped to manage by virtue of contractual arrangements.

From the perspective of designing infrastructure markets, long-term dynamic efficiency can only be achieved when the market explores the uncertainty and opportunity strategic space shown in Figure 3. When a contract from government prevents this, there needs to be greater scrutiny of the costs and benefits, because of the risk this could present in impediments to structural adjustment of the economy generally, and loss of customer focus and satisfaction specifically. Infrastructure generates a range of externalities, including a wider economic impact to the broader economy, which is why infrastructure governance needs to be comprehensive in its approach towards long-term efficiency.

Historical experience is clear on this point. The 150 years from the mid-1700s in Britain, slightly later in the United States, saw a massive mobilization of resources by the private sector that created the legacy networks of energy, water and transport that continue to shape these economies today.

The great railway companies of Britain and US were driven by enormous financial incentives to shift their land use patterns from their transport, energy and communication infrastructure.

The dividends of these risky endeavors were to secure first mover advantage, especially with respect to land access and customers, along with capturing the land uplift from their improved infrastructure amenity. The period provides important lessons for the stewardship of current infrastructure challenges.

- Firstly competition between the emerging technologies was important in ensuring the nation had the benefit of best of breed infrastructure.
- Competition brought many complications, including haphazard development, duplication and overdevelopment, in some areas and underdevelopment in others. However the upshot of it ensured Britain did not prematurely settle for a second best technology that could have limited its long-term growth potential.
- Despite its shortcomings, competition played an important role in shifting the focus to service outcomes as opposed to basic provision of physical assets. It sharpened the perspective about the function of infrastructure from what it is (the asset), to what it does (the service). It was this outcomes perspective that ensured markets were dynamic, and driven by whichever strategy had the better feature for its customers.

Australian airport reform

Giving permission for greater adaptability, more innovative and better risk management

The mid-1980s to the early 2000s in Australia was an important period of modern infrastructure reform when both state and federal governments created an opportunity to shift away from cumbersome, inflexible and bureaucratic procedures for investing and managing major infrastructure to a more disciplined and an evidence-based regime. This was in the form of the corporatisation of government trading enterprises, especially in the telecommunications, energy and water utilities, which heralded significant improvement in asset management, productivity and customer satisfaction. It was followed by privatisation for some areas, most notably telecommunications and airports, which will be examined in further detail below.

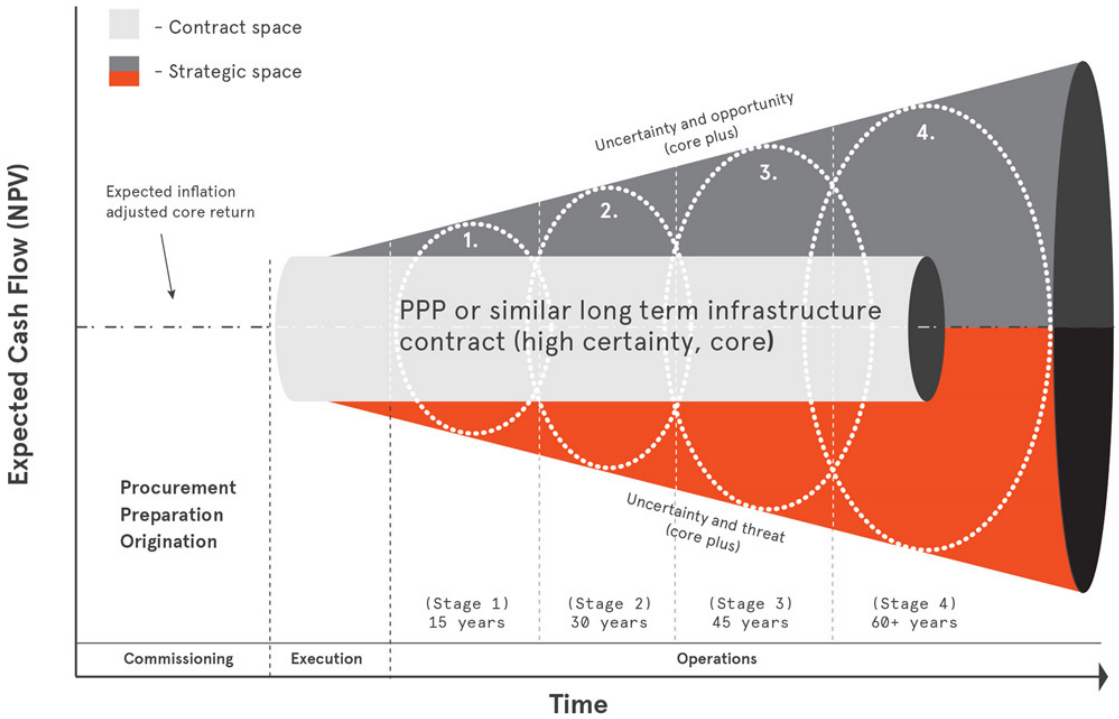
Australia was one of the first nations to reform its airports, and 2016 represents the 20th anniversary of these important public policy initiatives.

View the full report here to read more on airport privatization.*

Final Remarks

Infrastructure is not a low risk activity and it must be managed for the long game; it faces an array of complexities and uncertainties

Figure 3: Better Infrastructure Futures Framework (BIFF)



Stages:

1. Maintain costs, exploit synergies
2. Change the system, harvest new value
3. Disrupt, energise new & old
4. Start over and do it again

Source: Better Infrastructure Initiative

in its future strategic and operating environment. The most effective way of dealing with these is through disciplined balanced sheet management, a strong focus on customer interaction and to use and adapt assets to the maximum benefit of customers and shareholders.

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***Appendix**

http://sydney.edu.au/john-grill-centre/our-research/infrastructure/initiative-publications/shifting-australias-infrastructure-mindset-to-the-long-game.html

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Garry is an active contributor to the debate on infrastructure governance and investment in Australia and globally. He is uniquely placed to challenge and shape the current and future agenda for cities, regional development and the role of government and the private sector in the provision of infrastructure services. Garry is well known for thought provoking presentations, speeches and reports on the future of infrastructure that have been shaped from his unique balance of commercial and government experience spanning Australia, Asia and the OECD.

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Over a 25 year career Gordon has worked in banking and superannuation, as a political adviser and in industrial relations. His previous roles include Director of Investments and Economy at the Association of Superannuation Funds of Australia and Deputy CEO of the Committee of Melbourne. Gordon also works with Inflection Point Capital Management, a UK based investment advisory business and is a Director of the Network for Sustainable Financial Markets and Steering Committee Member for Australian Alliance to Save Energy.

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Glenn has spent much of his career in government – initially in Canberra with the Productivity Commission and Australian Treasury focusing on microeconomic reform matters, and then over 20 years from the late 1980s with the Victorian Government in the infrastructure field in the Treasury, Premiers' and Energy portfolios with experience ranging from policy development to preparation of business cases, assessment of proposals for funding approval, tendering processes, utility reform and the undertaking of privatisations and commercial transactions such as PPPs. Since 2011, Glenn has worked in the private sector as an advisor on infrastructure matters.