4. Asset management – assurance and utilisation

STRATEGIC OBJECTIVE **Optimise the management, performance and use of the State's assets**

SNAPSHOT

- The NSW Government currently manages assets worth more than $300 billion. In 2016-17, the NSW Government's maintenance expenditure was approximately $4.1 billion. This is expected to increase due to a growing and ageing asset base.[25]
- Population growth, climate change, expectations of improvements in the level of service offered by infrastructure and the age profile of assets are placing upward pressure on maintenance requirements and expenditure. As it is not always feasible to build new assets, it is essential for NSW agencies to make the most of existing assets.
- Asset management has focused primarily on individual infrastructure sectors to date, with an emphasis on inputs and outputs. This needs to be broadened to consider environmental, social and economic outcomes as well as interdependencies between sectors. The management and use of assets must become smarter, more productive and more efficient to avoid infrastructure spending increasing unsustainably.

RESPONSE	Summary of key recommendations
Improve asset management across government	• Introduce a revised asset management policy by the end of 2018, including an Infrastructure NSW assurance model and updated supporting policy and guidance materials, which require infrastructure agencies to: – make the most of their installed asset capacity – use clear and consistent definitions and methodologies to report to the Government each year on the size of any maintenance backlog in their sector and identify measures to address it, such that it becomes an input into the Budget process – broaden assessments of asset performance to take into consideration economic, social and environmental benefits – develop a 'system-of-systems' approach across interconnected infrastructure networks to drive an integrated vision of infrastructure provision and management, and create value, reduce costs, manage risks and improve the resilience of assets – adopt innovative, contemporary technologies to improve the operations and maintenance of infrastructure – use quality data for decision-making to balance cost, risk and asset performance.

25 NSW Treasury 2017, pp. 1-20

4.1 Recent progress

The major NSW infrastructure agencies, including transport, health, education and social housing, have developed and refined standardised asset management frameworks and systems. These frameworks and systems are underpinned by an asset strategy for each agency that comprises:

- renewal capital works identified through the application of an asset maintenance plan, which is based on 'asset condition' key performance indicators (KPIs) – for example, Transport for NSW has a Pavement Health Index and other intervention conditions
- improvement and enhancement of assets through capital works identified in a services and operations plan, which is driven by 'performance' KPIs (such as traffic congestion) or 'improved customer outcomes' KPIs (such as improved service safety, improved service reliability, more timely and accurate information, air quality or lighting levels)
- additional or new infrastructure capital works, identified through a growth and improvement process, which is driven by increased demand due to population growth, demographic change, economic growth, land use changes, environmental imperatives, technology, government policy or legislative change.

Some NSW agencies use asset management frameworks, supported by recently developed technologies, that capture and assess significant amounts of data. For example, NSW Health has established Asset and Facilities Management Online, a web-based integrated workplace management system for 'whole-of-life-cycle' asset management. This online system improves the management of assets and facilities by ensuring they are available in the right condition, at the right time and in the right location for optimal patient care. Another example is the Department of Education's Asset Management System, which holds relevant data about the Department's buildings and sites. This system interfaces with a life-cycle costing system to support the management of assets. A similar capability has recently been established in the Department of Justice.

Some agencies have established stand-alone bodies, such as Transport for NSW's Asset Standards Authority (see breakout box at right), which is responsible for the network design and standards for all NSW transport assets, and Health Infrastructure, which is responsible for the delivery of the NSW Government's major hospital building program. School Infrastructure NSW is a new unit within the Department of Education charged with the planning and delivery of new schools, upgrading existing schools, optimising existing resources and improving utilisation across schools in specific geographic locations.

Asset management frameworks form the foundation of NSW Treasury's Capital Investment Planning (CIP) policy, which seeks to ensure that the NSW Government's physical assets best support its service delivery responsibilities within the limits of available resources. CIP submissions from agencies are a key input to the annual NSW Budget process. NSW Treasury uses CIP submissions to:

- evaluate an agency's planned capital expenditure for the Budget year and Forward Estimates
- ensure that the State's capital program aligns with its priorities and service delivery levels
- assess each agency's capital programs against capital planning limits, where applicable
- identify and advise the NSW Cabinet's Expenditure Review Committee of potential risks to the implementation of agencies' infrastructure strategies by comparing proposed capital expenditure in CIPs against NSW Treasury's 10-year affordability projections
- provide advice to the NSW Government and agencies on capital strategy, asset management planning and related financial risks.

Infrastructure NSW considers the CIP policy to be an effective mechanism for planning specific infrastructure investments in a sector. However, the process does not consider asset performance (such as whether assets are well managed) or geographic outcomes (such as whether the assets improve a region or town); nor does it identify the contribution infrastructure makes to key outcomes such as the Premier's Priorities and State Priorities. A new approach is required where indicators are based on a prior definition by the NSW Government of its desired outcomes.

Transport for NSW's Asset Standards Authority

The Asset Standards Authority (ASA) is an independent unit established within Transport for NSW. It is the network design and standards authority for NSW transport assets. The ASA is responsible for developing engineering governance and frameworks to support the design, safety, integrity, construction and commissioning of transport assets for the asset 'whole-of-life-cycle'. The ASA is also responsible for providing the standards for NSW transport assets, which industry organisations can use to deliver projects and manage assets in an innovative, safe and efficient manner.

4.2 Challenges and opportunities

A key challenge for NSW is to extend the life of existing infrastructure assets for as long as possible to support continued service delivery. Infrastructure deteriorates due to natural ageing, wear and tear and external factors such as natural disasters. Without adequate asset maintenance practices and investment, there is a risk that the NSW Government will incur unforeseen and avoidable future costs associated with the renewal or replacement of infrastructure.

Asset maintenance was identified as a critical area for reform in the 2012 NSW Commission of Audit Interim Report.[26] That report made several important recommendations to improve asset maintenance, including preparation by the NSW Government of an asset management policy statement with a clear set of objectives and undertaking a rolling series of collaborative asset management evaluations for capital-intensive and large capital spending agencies in the general government and non-commercial Public Trading Enterprises. The report also recommended that NSW Treasury work with asset-intensive and large capital spending agencies to establish maintenance-related KPIs for incorporation into annual investment planning submissions to the annual NSW Budget process (now made under the CIP policy).

Only limited whole-of-government action has been taken since the release of the report.

In 2016, the NSW Audit Office examined the maintenance backlog for the three largest capital-intensive infrastructure sectors (transport, education and health) and found that:

- At 30 June 2015, Roads and Maritime Services, the Department of Education and NSW Health had estimated maintenance backlogs of $5.3 billion, $732 million and $323 million respectively.
- At 30 June 2016, Roads and Maritime Services reported a maintenance backlog of $3.4 billion, $1.9 billion lower than the $5.3 billion reported at 30 June 2015 due to the adoption of a refined methodology for calculating the backlog.
- The Department of Education is working to address a backlog in maintenance estimated at $775 million at 30 June 2016, an increase of $43 million from 2014-15. The Department will receive funding of $330 million over 2016–17 and 2017–18 to address maintenance needs in schools.
- NSW Health did not quantify its total backlog maintenance in 2015-16. However, NSW Health is refining its methodology and systems for identifying and reporting maintenance works following the implementation of a statewide asset management system (AFM Online). NSW Health's estimated backlog maintenance was $323 million at 30 June 2015.[27]

The 2016 reports of the NSW Audit Office did not define the concept of 'maintenance backlogs' or how they are measured. There is no single definition of the term within the NSW Government. In accounting terms, maintenance expenditure is either capitalised or incorporated into general operational expenses, which means that it is difficult to determine actual levels of maintenance expenditure or its relationship to asset management.

The Grattan Institute noted that Australia's transport investment level is the highest of all Organisation for Economic Co-operation and Development (OECD) countries, but that maintenance levels are among the lowest. This disparity can reduce the effectiveness of the infrastructure for users and lead to avoidable extra expenditure on remedial works and the premature replacement of assets.[28]

There is no clear and consistent reporting on the size of the maintenance backlog for agencies, their maintenance effort undertaken each year or their spending patterns (recurrent or capitalised). While some agencies have good systems in place, these do not feed through in terms of reliable reporting to the NSW Budget process.

Infrastructure NSW considers that current whole-of-government practices are inadequate and represent a risk to making the most out of the State's assets over the long term.

26 NSW Government 2012, pp. 101-140

27 Audit Office of NSW 2016, pp. 9-16

28 Terrill, M et al 2016, p. 8

4.3 Response

4.3.1 Meeting demand by making better use of existing assets

Many existing infrastructure assets in NSW are under stress because demand has risen beyond forecast levels. Examples of assets struggling to meet increasing demand include:

- NSW's rail network, which will find it hard to meet punctuality targets after 2019, based on forecast patronage increases, unless its capacity is increased significantly. If higher than forecast patronage growth continues, the network may even struggle to maintain its punctuality before 2019[29]
- Sydney's major roads, with some key arterial roads showing marked slumps in peak hour speeds. Peak hour speeds have declined by up to 25km/h in the past two years, meaning drivers are stuck in rush hour traffic for longer. The largest fall in peak hour speeds was on the M2 Hills Motorway from North Ryde to Carlingford, where the average speed fell by 25km/h to 46km/h[30]
- NSW hospitals, which are facing record numbers of emergency department presentations, admissions and elective surgeries.[31]

Other infrastructure assets in NSW are less productive than they could be because demand is 'peaky', meaning that while infrastructure must be available during occasional peaks, it is under-utilised most of the time. For example, NSW peak electricity demand in the evening of the hottest day of 2017 was 14.7 GW – nearly 50 per cent higher than the average daily peak demand in summer of 10 GW. The electricity system is expected to meet high security and reliability standards and be available 99.998 per cent of the time.

Given that it is not always feasible to build new assets, it is essential for NSW agencies to continue to make the most of their installed asset capacity by:

- enhancing peak capacity and throughput
- seeking to spread demand to reduce the peaks
- optimising the availability of assets by minimising downtime.[32]

4.3.2 Enhancing infrastructure capacity

Infrastructure assets often have reserve capacity that is not being used. This spare capacity, if made available, could ease bottlenecks. Some past examples of changes to NSW infrastructure to enhance capacity include:

- RMS implementing contraflow lanes on several key roads including the Sydney Harbour Bridge, Military Road and the Pacific Highway to increase throughput
- the then Sydney Catchment Authority accessing a body of water in dams known as 'deep storage', which had previously been inaccessible for water supply. In 2006, new pipes and pumps were built to reach deeper into Warragamba and Nepean Dams.[33] This increased the annual average amount of water available over the long term by 40 billion litres a year, or about seven per cent of Sydney's water needs[34]
- RMS upgrading the Sydney Harbour Bridge and Sydney Harbour Tunnel in 2016 with new technology to provide multi-lane free-flowing tolling to maximise capacity at choke points[35]
- the Department of Education improving the use of school sites by building larger schools on smaller sites, increasing the use of modular classroom blocks and building vertical schools where appropriate (refer to Chapter 13).

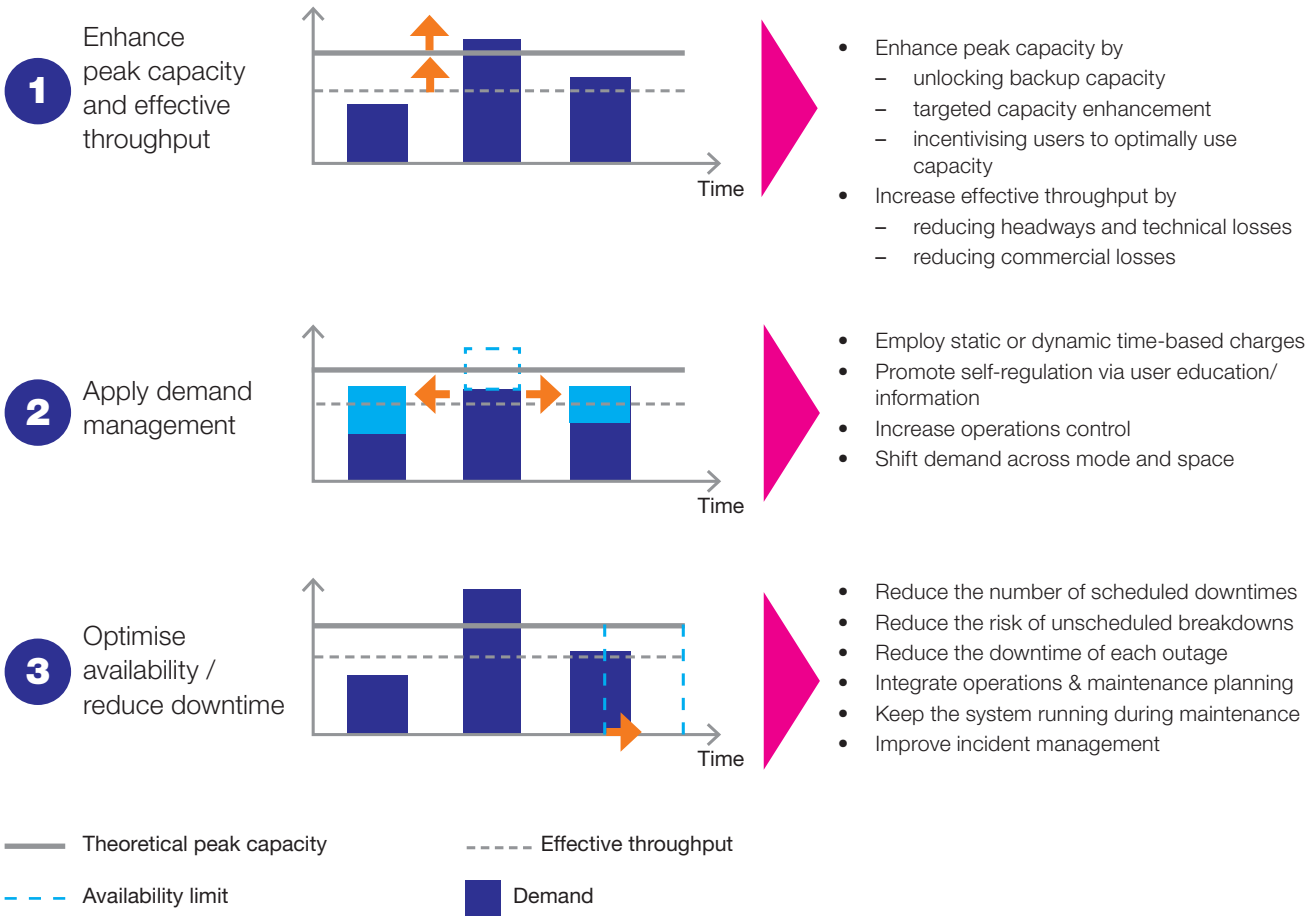
4.3.3 Getting more out of infrastructure through demand management

Strategies that redistribute demand in time, space or mode are also important in making the most of existing capacity. Examples of demand side management optimising the use of infrastructure capacity include:

- public behaviour programs aimed at increasing water conservation during the Millennium Drought from 1997-2009, which combined public education, target-setting, water restrictions, efficiency labelling, rebates and water pricing. Trends in Sydney Water's customer water use show that people have permanently adopted water efficiency programs, with water use remaining at record lows since 2008[36]
- changes to the management and treatment of patients in the NSW health system that enable patients to take advantage of in-home care and rehabilitation, increasing the number of hospital beds available for managing acute care cases. This can also contribute to lower average costs per patient.

29 Audit Office of NSW 2017
30 Roads & Maritime Services 2017
31 Bureau of Health Information 2017
32 World Economic Forum, in collaboration with The Boston Consulting Group 2014, p. 9
33 '*Deep water project expands Warragamba Dam*', 15 April 2006
34 Metropolitan Water Plan 2010
35 Roads & Maritime Services 2016
36 Sydney Water Corporation 2010

Figure 11 – Maximising the use of infrastructure



Source: World Economic Forum and the Boston Consulting Group 2014, *Strategic Infrastructure – Steps to Operate and Maintain Infrastructure Efficiently and Effectively*

Price signals have also been employed to assist with demand management. Examples include:

- electricity networks offering cheaper prices during off-peak times and introducing 'time of use' tariffs. The Ausgrid peak 'time of use' tariff is more than four times the price of the off-peak tariff. Smart meters can also provide half-hourly data on consumption, allowing users to pinpoint how much energy certain activities use[37]
- 'time of day' tolling for vehicles using the Sydney Harbour Bridge and Tunnel – assets that are used by over 43 million vehicles each year, making them two of the busiest roads in NSW. Time of day tolling was introduced in 2009 to help ease traffic congestion and to encourage motorists to travel outside peak hours where possible.

Pricing reform directions are outlined in Chapters 9.3.3 (Transport), 10.3.5 (Energy) and 11.3.5 (Water).

In addition to public behaviour programs, demand management and price signals, the provision of information and technology to help manage demand is proving effective. Customers with solar generators can avoid using power from the grid at peak periods if they have battery storage. Transport for NSW's CBD Coordination Office has implemented a Travel Choices program, which advises CBD employers on how they can help their workforce and business partners adapt to a changing CBD during the construction of Sydney Light Rail. The program has helped about 150,000 workers from more than 450 organisations to shift to more sustainable ways of moving into, out of and around the CBD.

37 Ausgrid 2017, p. 15

4.3.4 Optimising the time taken to maintain infrastructure

Long lead times to repair or replace an asset can result in significant downtime and service interruption. Asset downtime is an expensive challenge for infrastructure operators and reduces reliability for users. Operators are always seeking to maintain infrastructure in a way that minimises downtime. For example, early leak detection and repair is one of the main ways Sydney Water, with a network of over 21,000 kilometres of water pipes, can reduce water loss and downtime. Sydney Water uses acoustic devices to pick up the noise that water makes as it leaks from pipes. This helps the utility to quickly identify and repair hidden leaks before they become major incidents that have a system-wide impact.[38]

Similarly, Roads and Maritime Services uses preventative maintenance to minimise the cost of maintaining road pavement over the life of the asset. Timely and regular small-scale interventions reduce the need for more costly and disruptive road rebuilding activities.

Sydney Trains is constructing a new Rail Operations Centre that will modernise the control of Sydney's rail network by incorporating dozens of different systems into a single location. This will minimise delays and ensure incidents on the rail network are resolved quickly.

Although many NSW infrastructure agencies are taking steps to maximise the use of their installed asset bases, there is scope to do much more. It is critical that agencies make better use of existing assets before they spend funds on new capital projects. This responsibility should be embedded in the CIP policy, requiring agencies to provide evidence of how their assets are being used.

4.3.5 Delivering outcomes for the overall economy, society and the environment

The current planning and appraisal processes used by agencies focus on discrete, sector-specific assets and on inputs and outputs, not outcomes.

Many agencies simply focus on the estimated cost of delivering infrastructure to meet projected demand. For example, Roads and Maritime Services will construct a road at the lowest cost to meet projected use. A range of measures are used to manage and monitor performance to ensure the project and operations are on track. These include travel time, reliability and safety. However, there may be little consideration on whether the road itself achieves beneficial economic, social or environmental outcomes at its origin and destination.

This 'inputs and outputs' approach is being challenged by an alternative approach that assesses higher-level objectives in terms of the asset's contribution to the economy, society and the environment. A focus on outcomes provides more freedom in selecting solutions to identified problems, as performance is not locked into a particular type of infrastructure or technology.[39]

For example, contemporary developments in energy and nutrient recovery are increasing the value of sewage treatment processes and infrastructure. Wastewater treatment works are now becoming producers of energy and agricultural fertiliser rather than simply pollution remediators. Sydney Water is using food waste to power the Cronulla wastewater treatment plant. In other words, outcomes are valued over outputs.[40]

4.3.6 Taking a 'systems-based' approach

Current planning and appraisal processes in NSW can fail to identify and exploit potentially valuable interdependencies, due to a misplaced emphasis on discrete, sector-specific planning. Silo-based planning and appraisal processes may also be unable to identify potentially hazardous and costly interdependencies.[41]

A governance framework that ensures resilience measures are applied across critical infrastructure sectors is essential. Damage to one asset, for example electricity distribution infrastructure, can result in downstream disruptions to various sectors such as water purification and rail services.

The NSW Government should develop close partnerships with the private operators and owners of critical infrastructure, particularly in the energy and communications sectors, including a much greater exchange of information and potentially cost sharing.[42]

38 Sydney Water 2016, https://www.sydneywater.com.au/SW/water-the-environment/what-we-re-doing/current-projects/maintaining-our-water-supply/leak-detection-program/index.htm

39 World Economic Forum in collaboration with The Boston Consulting Group 2014, p. 32

40 Edkins, A et al 2016, p. 5

41 Rosenberg, G & Carhart, N 2014, pp. 15-24; International Symposium for Next Generation Infrastructure 2013

42 The Organisation for Economic Co-Operation and Development (OECD) 2016, pp. 13-14

Efforts are underway in NSW to develop and apply tools to assess the vulnerability of critical infrastructure to existing and future climate risks and compare the costs and benefits of adaptation measures. AdaptInfrastructure, a tool developed for this purpose, is being trialled for the Sydney metropolitan region by the NSW Office of Environment and Heritage (refer to Chapter 5.3.3).

Hurricane Sandy

Hurricane Sandy provides valuable lessons for managing interdependencies during emergencies.

Hurricane Sandy struck the east coast of the United States in October 2012, causing enormous economic damage because of the interdependent infrastructure systems in New York City.

Direct damages from the hurricane were estimated to be USD$78-97 billion. The indirect damages – that is, damage to areas that were not inundated but were affected by Sandy through interconnected infrastructure – are estimated to have cost USD$10-16 billion. Damage to the electricity sector and associated outages impacted other infrastructure such as water, communications, transportation, food supply and private sector supply chains.

New York City introduced initiatives to increase the resilience of critical infrastructure after the hurricane. These initiatives focused primarily on building hard infrastructure to decrease direct damages. For example, New York City's building sector has adopted methods to construct new buildings and retrofit old buildings in the floodplain to the highest resiliency standards. However, as indirect damages to the building sector as a result of Hurricane Sandy were larger than direct damages, future disaster risk reduction strategies also need to consider interdependent infrastructure to reduce indirect damages.

To reduce indirect damages due to business interruption, Con-Edison, which provides electricity services in New York City, is making sure that its system is less susceptible to similar storms. Con-Edison has embarked on a long-term plan focusing on the following areas:

- fortifying the electric, gas and steam systems against future storms
- decreasing the time needed to restore power in the event of an outage
- enhancing storm planning and restoration processes
- improving the flow of information to customers and other stakeholders.[43]

4.3.7 Using new technology to improve operating and maintenance practices

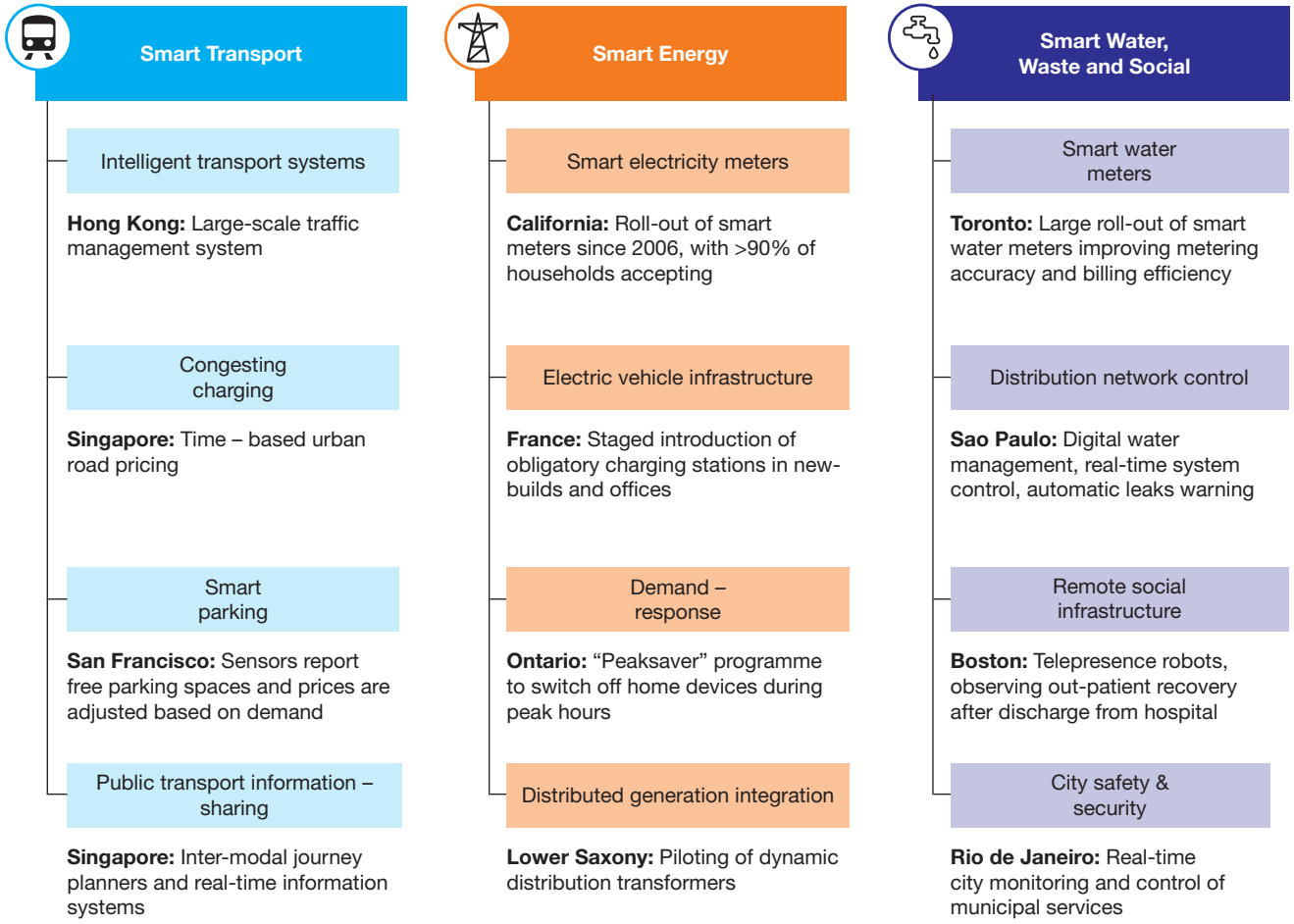
Infrastructure could soon experience a major productivity gain from innovative technologies that promise new operating and maintenance (O&M) solutions. Recent innovations in digital technology – such as remote sensing, advanced analytics, autonomous operations, Building Information Modelling (BIM) and integrated scheduling and control – mean that traditional 'bricks and mortar' infrastructure can now be used more effectively, and operated and maintained more efficiently (also refer to Chapter 6.3.3).

Innovative O&M solutions are often relatively affordable and cost-effective in otherwise capital-intensive industries. Even small O&M improvements can make a big impact. For example, water utilities in the UK use an advanced pressure management system, with software, sensors and controllers to detect leakages as soon as they occur. This has reduced water loss by 1.5 million litres per day.[44] The infrastructure sector has sometimes been slow to adopt new technology given its massive existing asset base and entrenched processes and systems. But many examples of O&M best practice exist in various infrastructure sectors and other heavy industries around the world. Best practice O&M, illustrated in Figure 12, needs to be explored more widely in NSW.

43 Haraguchi, M & Kim, S 2015

44 *"i2O Water helps Veolia water save 1.5 million litres of water a day"* (January 2012)

Figure 12 – Innovative O&M solutions can potentially make a big impact



Source: World Economic Forum and the Boston Consulting Group 2014, *Strategic Infrastructure Steps to Operate and Maintain Infrastructure Efficiently and Effectively*

Smart solutions, although effective, are not a panacea. O&M innovations can be difficult to integrate into legacy systems and the investment required for acquiring and installing them might not be justified by the benefits. Many of the promised benefits of the smart energy meter project in Victoria failed to materialise.[45]

Despite this uncertainty, many technologies that appear prohibitively expensive today will become cheaper and more cost-effective when implemented at scale, and will further enhance the effectiveness and efficiency of infrastructure assets.

4.3.8 Using data to improve infrastructure management and utilisation

Today's world produces a vast amount of digital data. The proliferation of low-cost sensor technology is providing many new information sources, including transactions, social media, sensors, cameras and global positioning systems (GPS), which can be harnessed by infrastructure operators.

New opportunities to improve asset management and use arise not just from the soaring volume of data but also from its increasing variety (which can now be mined even from unstructured data sources) and velocity (the speed at which data can be collected, processed and used for decision-making and automatic system responses).

45 Victorian Auditor-General's Office 2015

Data applications are becoming increasingly affordable, with rapid advances in processing power, storage density and connection speed. New applications present a major opportunity for improving productivity and efficiency in infrastructure, enabling operators to improve market research, enhance O&M decision-making and boost customer relationships and satisfaction.

In addition to productivity improvements, data can make infrastructure operations more efficient. For example, Stockholm's road authorities collect real-time traffic data from a variety of sources, including vehicle GPS, radar sensors, congestion charging and weather reports, and process it via algorithms to advise motorists on optimal travel routes.[46] This helps to ease congestion without the need for costly and disruptive capital works on the road system.

To take full advantage of data, infrastructure operators need to define open and interoperable interfaces and industry standards to enable data interchange. New York City's 'Midtown in Motion' congestion management system provides such an interface for app developers.[47] Infrastructure operators can publish data through application programming interfaces that enable entrepreneurs to unlock the value of the data, connect to other data and develop new user solutions. This improves the efficient operation of infrastructure and encourages innovative and collaborative uses of existing assets (also refer to Chapter 6.3.3)

Predictive maintenance on Sydney Harbour Bridge

A structural health monitoring system, developed and implemented by Data61, has been applied to the Sydney Harbour Bridge, which is now over 80 years old. The system incorporates over 2,400 sensors to monitor around 800 structural components of the bridge. The network of sensors can provide infrastructure planners with early warning signs about physical damage and potential weaknesses. The use of sensors for structural health monitoring can reduce maintenance costs through preventive maintenance, limit disruption to road users and extend asset life without drastically increasing expenditure.[48]

4.3.9 A new asset management policy and assurance model

Asset management has focused primarily on individual infrastructure sectors to date, with an emphasis on inputs and outputs. This should be broadened to consider environmental, social and economic outcomes as well as interdependencies between sectors. The new approach should focus on long-term directions, as well as immediate operational matters that cut across infrastructure sectors.

Agencies should continue to expand and harness productivity gains from innovative technologies that promise new operating and maintenance solutions, as well as using appropriate, good quality data to improve productivity and efficiency in infrastructure.

A new assurance model should be developed, allowing Infrastructure NSW, together with NSW Treasury, to lead an overall assessment of asset management maturity across infrastructure sectors. Such an approach will:

- enable cross-fertilisation between agencies and sectors
- overcome differences in maturity across sectoral agencies
- ensure more systemic and transparent metrics for the NSW Government
- ensure an outcomes-based approach is used, including consideration of interdependencies
- increase transparency for the NSW Government regarding operations and maintenance
- improve public confidence in the management of assets
- ensure the current asset base is appropriately maintained to deliver the intended customer outcomes.

The assurance process for the State's major asset systems should include the following features:

- a single point of accountability for independent assurance across the State's major asset systems
- a risk-based assurance process tied to outcomes based and financial performance
- escalating the levels of scrutiny applied to asset management systems when emerging risks are reported
- improved reporting and data collection through a fit-for-purpose reporting tool

46 World Economic Forum 2015
47 New York City Department of Transportation 2012
48 Data 61 2015

- aligning asset management systems against the ISO 55000 series for asset management and include a NSW Government Asset Management Community of Practice.

NSW Treasury should impose additional data requirements for asset management as part of the CIP policy so that:

- agencies provide digital asset management strategies linked to digitised asset registers and data management systems
- agencies provide evidence of how the use of assets is being maximised
- agencies use a consistent and standardised approach to develop systems and processes for assessing the performance of their assets
- agencies use clear and consistent definitions and methodologies to report on the size of maintenance backlogs, determine appropriate benchmarks and propose measures to address their backlogs
- agencies demonstrate that they have adopted and are using innovative technologies to improve the operation and maintenance of infrastructure
- agencies use data and other information in decisions to make infrastructure operations more efficient
- agencies clearly and consistently report to the Government each year on the size of their maintenance backlogs and measures to address these backlogs
- agencies report to the Government each year on their proposed expenditure for asset maintenance
- agencies broaden their assessments of asset performance to take into consideration the economic, social and environmental benefits
- a 'system-of-systems' view on interconnected infrastructure networks is developed to derive an integrated vision on infrastructure provision and management and ensure that infrastructure is effectively managed, maintained and optimised
- agencies undertake rolling, periodic assessments of the resilience and vulnerability of their assets to the impacts of climate change (such as rising sea levels), natural disasters (such as floods, bushfires, heatwaves and storms) and human-related threats (such as cyberthreats)
- an operations and maintenance budget for whole of life is defined and provisioned at the time an asset is acquired.

Recommendation 15

Infrastructure NSW recommends that the NSW Government introduce a revised asset management policy that includes a new assurance model managed by Infrastructure NSW, including updated supporting policy and guidance materials, by the end of 2018.

Recommendation 16

Infrastructure NSW recommends that NSW Treasury update by the end of 2018 the data requirements for asset management plans prepared by agencies as inputs into NSW Treasury's Capital Investment Planning policy.