Smarter Infrastructure for Queensland

Directions Paper

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Introduction

Infrastructure underpins every aspect of modern life, supporting growth, improving productivity and building resilience. Increasingly though, we need to think beyond traditional infrastructure solutions as the pressure to deliver more from Queensland's infrastructure grows. Smarter infrastructure solutions present an immediate and significant opportunity to leverage innovation and technology to extract greater value from new and existing assets.

Queensland companies are developing innovative and practical solutions that are ready to be applied to the infrastructure sector. The Queensland Government is working to promote these local innovations so that we may benefit from their products and services. The Queensland Government is also actively addressing the smarter infrastructure agenda through key initiatives, including:

- the establishment of the Infrastructure Innovation Taskforce
- release of the Smarter Infrastructure for Queensland Discussion Paper
- hosting the Smarter Infrastructure for Queensland Summit (the Summit).

The Summit is just one part of positioning Queensland as a leader in smarter infrastructure. The Summit outcomes will assist the Queensland Government to plan for the knowledge economy of the future by adopting smart and sustainable infrastructure, and by preparing the workforce of today to deliver this future.

This paper describes the following key themes from the Summit, as well as ideas and feedback from attendees, and written submissions received through the online portal. It also describes what the Queensland Government is going to do next.

Themes

Being customer-centric: placing the customer at the heart of smarter infrastructure Reimagining the role of government: an enabler, and not simply a provider Innovation from less prescription: moving to an outcomefocused procurement approach More from existing assets: 'sweating' and re-purposing the infrastructure we already have

Adopting agile thinking: build trust, embrace challenges, and learn from others Data focus: improving the collection, sharing and use of data between government, industry and academia Collaboration across sectors: improve cross-sector collaboration, showcase innovation, and attract and retain skills

Smarter infrastructure

Smart infrastructure is the intersection between traditional physical infrastructure, and digital technology and innovation.



The value of smart infrastructure is being able to respond intelligently to changing usage patterns in physical infrastructure assets, reducing costs, maximising capacity and minimising disruption. By improving our understanding of existing infrastructure, future infrastructure can be optimised to improve capacity, cost and utility.

Summit attendees were asked – "What does the term smarter infrastructure mean to you in practice?"

Smart Infrastructure has the potential to make a revolutionary impact on the efficient use of existing infrastructure.¹99

Smart infrastructure improves user experience, offers value for money, enables better decision-making and provides better benefit or policy outcomes for the same or similar cost. In the short term, smart technology has been identified as an opportunity to preserve existing assets. In the longer term, it is expected to improve service delivery standards and decrease the need for investment in new physical infrastructure.²

Whilst this is an existing opportunity for Queensland, it is important to remember that the transition to using smarter infrastructure will have challenges. It will be important to carefully plan this transition, to ensure that all Queensland communities can participate and benefit, while also managing the impacts of digital disruption.

Government can't deliver this smarter infrastructure on its own. It needs the community, industry and academia to come together to drive a smarter infrastructure agenda for Queensland. The Queensland Government's activities to date, including this Summit, are about kicking off this collaborative effort.

Affordable a Social Value Multi-purpose a Automated Definition of the Social Value Definition

¹ Smart Infrastructure: getting more from strategic assets, Cambridge University, 22 June 2017.

² Inquiry into the role of Smart ICT in the design and planning of infrastructure – Chapter 2: What is Smart Infrastructure? Parliament of Australia, 15 March 2016.

The Summit

The Smarter Infrastructure for Queensland Summit was held on 17 October 2017. The Summit brought together public and private sector experts and thought leaders from the digital, innovation and infrastructure sectors, to identify challenges and pathways to deliver smarter infrastructure.

On the day, 93 attendees from a broad spectrum of backgrounds collaborated and contributed to the development of Queensland's smarter infrastructure agenda. Members of the joint industry-government Infrastructure Innovation Taskforce, established in June 2017, came along to listen and share ideas.

Topics considered by speakers and panels included:

- What do we mean by smarter infrastructure?
- The Australian and Queensland socio-economic and demographic setting
- The megatrends shaping our future
- Uptake of technology in industry
- Smarter approaches to infrastructure
- The value of smarter infrastructure
- Showcasing Queensland's innovation
- Building pathways to success for smarter infrastructure.

The Infrastructure Innovation Taskforce will examine and report back to government on a range of matters including:

- 1. the benefits of integrating technological solutions into infrastructure planning and delivery
- 2. the efficiency of procurement processes, and
- 3. whole-of-life cost modelling benefits to improve the use of existing assets³.

Discussion paper and survey

Prior to the Summit, the Queensland Government sought to set the scene for the day, through the release of:



- The Smarter Infrastructure for Queensland Discussion Paper (September 2017). The Paper identified some challenges and opportunities to smarter infrastructure and highlighted a number of case studies where smarter infrastructure is already in use across Queensland, Australia and the world.
- Canal Canal Coveniment
- A publicly available online survey to capture feedback about smarter infrastructure. Some responses to survey questions were then used to inform the key themes discussed at the Summit event.

Jointly, the government and industry have recognised the importance of smart and innovative infrastructure solutions to improve vital services, so communities are not left behind as our society, community and economy changes.

The online survey asked – "What is the biggest opportunity presented by the smarter infrastructure agenda?"



³ State Infrastructure Plan, Part B: Program, Department of Infrastructure, Local Government and Planning July 2017.

Summit activities

During the Summit, two interactive activities were conducted, led by facilitators at each table. Attendees worked together with their facilitator to:

- Expand and define the challenges and opportunities that are presented by smart infrastructure, as prioritised by the online survey responses.
- Having regard to the challenges and opportunities, develop solutions and pathways as well as any other ideas for smarter infrastructure.

Throughout the day, attendees were also asked their views on various topics via interactive polling – highlights of these results are presented throughout this paper.

"The future is not a place at which we arrive, it is something that we create by decisions that flow from days like this" – Mark McCrindle, McCrindle



The summit presentations sparked interesting discussions about the smarter infrastructure agenda, including:



Being customer-centric: placing the customer at the heart of smarter infrastructure

At its core, smart infrastructure is about improving the lives of residents and visitors to Queensland communities. We want pleasant, well designed, beautiful places to live, work and play. Residents of a community typically know what their needs are as their community grows. Therefore Queenslanders should be involved as much as possible in the decision making about changes to service provision in their communities.

Moving to a more customer-centric frame of reference means that solutions can be informed more deeply by those who will ultimately use the infrastructure. For instance, customer driven decision making might identify that the community would prefer new cycling infrastructure to enable behaviour change, rather than building new roads to address congestion.

This theme is about government and industry moving from a service delivery mindset to a customer-led delivery focus. Attendees, speakers and panellists on the day discussed that one approach is not the same for everyone. What is right for residents in urban centres may not be right for rural and remote communities. In a digitally connected world, previously unimagined opportunities exist to align government plans to the needs of residents. Decision-making processes need to listen to our communities and reflect their views.

Ideas included:

- The development of a digitally enabled approach for community engagement on infrastructure decision making. This may include online community forums to discuss a problem and the options available to provide the best possible solution.
- Allowing infrastructure customers to access real time information, and provide feedback, on infrastructure usage experiences or government services. This could span many sectors from travel and public transport through to energy and water. Summit attendees suggested this could be in the form of an app, and coined the name "my Queensland". These responses could help government and the community understand how existing infrastructure is currently used, make decisions on specific assets and apply that knowledge to decisions made in other communities.

Summit attendees were asked – "Smart cities or Smart citizens – what should be our priority?"



Smart cities

Smart citizens

"Technological change by itself does not disrupt - you also need poor customer experience. Infrastructure should focus on improving that customer experience." – Stephen Uhr, Arcadis

Reimagining the role of government: an enabler, and not simply a provider

A strong message which emerged from the day is that government, often seen as a provider of critical services, can also adapt to becoming an enabler of industry to respond directly to the demands of the community.

Speakers and facilitators on the day cited examples across the world where government regulation is being tested by the sharing economy. This includes:

- in-home dining for visitors to cities and towns, which challenges the notion of defined dining precincts and strict regulation of restaurants, bars and liquor licensing
- the now commonplace ride sharing industry, which challenges the conventional taxi industry
- the predicted rise of autonomous and shared vehicles, which will mean changes for speed, parking, registration and safety regulations.

Our society is built on fundamentally free market principles, where entrepreneurs can identify a market for services that our communities want and need. As such, there is a significant opportunity for government to transition to a role of 'enablement' of new technologies and the industries and individuals that develop them.

This means ensuring that regulation is less restrictive and less focused on the 'how' of infrastructure delivery, and more focused on the 'why'. This will allow the market to respond to the community more directly, but still within the bounds of what our society values, including fairness, safety and equality.

The Queensland Government will continue to help grow the competitiveness of our businesses, industries and regions, by focusing on education, training and collaboration with academia. This will ensure a smooth transition of the workforce to new and emerging industries. This is particularly important in areas where employment is highly concentrated in a few specific industry sectors or where regions are susceptible to disruption.

Ideas included:

- Adapt existing regulations to be flexible to the direct sale of excess capacity in community and personal assets. Examples of platforms for such direct transfers include ride sharing apps, parking apps and accommodation sharing apps.
- Simplify the existing market-led proposal process to encourage innovative use of infrastructure.

"There is an opportunity for government to consider a different approach to regulation, to enable new technology through market response, while protecting government values." – Sally Noonan, Queensland Department of Transport and Main Roads

> Summit attendees were asked – "Should the share economy be controlled or embraced?"



Number of respondents

Innovation from less prescription: moving to an outcome-focused procurement approach

Following on from the themes of 'customer-centric' decision making and 'enablement', Summit attendees discussed the role of government where it needs to remain the provider of an essential services. In keeping with the view of government as an enabler, it is important to realise that government may not always have the best solution to a service delivery or infrastructure problem.

Across the world, governments tend to go to industry and ask them to deliver something very specific. It might be a new road, or a new school, or a new hospital. On the day, attendees noted that often we need to step back and clearly articulate 'what is the problem?' before we think of any solutions. For example, the problem may be an increasing hospital waiting time in certain districts. The best answer may not be a new hospital, but rather it might be digitisation of operations in existing hospitals to improve productivity. This process is underway at Queensland Health. Similarly, the solution might be a preventative health campaign, or an app that supports people to self triage and improve caseloads by visualising real time waiting lists, allowing people to decide which hospital to visit. The Queensland Government's project assessment and investment frameworks, such as the Project Assessment Framework, which guide government investment in infrastructure, are already in place to ensure that a range of solutions – including noninfrastructure solutions – are thoroughly appraised and evaluated. However, there is more scope to move from an 'input-specification' approach, where a solution is well defined, to an 'output-specification' approach, where the outcomes required are specified. Industry should be given more free rein to innovate and adapt the solution to the problem at hand.

"Let's admit that government doesn't know the answers and, instead, put challenges to the market to encourage more small and medium-sized enterprises, more startups and a broader spread of people to work with government." – Paul Martyn, former Department of Science, Information Technology and Innovation

Innovation from less prescription: moving to an outcome-focused procurement approach

Ideas included:

- Update investment decision making frameworks and processes to shift to outcome-based procurement approaches and require consideration of smart solutions and/ or technology and data. This would foster innovation within the procurement process itself, rather than treating this as a 'separate' discussion. Part of this is also using open data systems from across various levels of government to help inform procurement processes.
- Emphasising a systems view of infrastructure over considering assets in isolation. This could involve consideration of how a transport-centric problem might involve land uses, health and education services provision etc. Taking a system view requires integrated planning and delivery within and across asset classes and sectors.
- Develop a narrative for what government wants to achieve over a defined time period (for example, reduction in traffic incidents, reduced water consumption, increased educational outcomes) so that industry can provide innovative solutions to government-defined problems within that narrative.

Summit attendees were asked – "Can we improve how we integrate smart infrastructure into procurement processes?"



More from existing assets: 'sweating' and re-purposing the infrastructure we already have

A consistent response from both survey participants and Summit attendees was thinking about how we extract the greatest efficiency from the already significant asset base across Queensland.

Across the state, there is latent capacity in our existing road networks, in our power network, our water infrastructure and even in our schools and hospitals that can be unlocked through new technologies, improved usage monitoring and data analysis. We will need entirely new projects in the future, however, increasingly we have the opportunity to adapt, modify and retrofit what we have to make sure we are getting the most out of it. Where previously we might have considered an entirely new project, the age of digital disruption means that there may be a way to extract much more from the assets we already operate.

Current examples of this include the work that the Department of Transport and Main Roads is doing to improve digital signage on our roads. Low cost digital signage which warns of hazards, automatically adjusting speed limits and improves wayfinding means that traffic is able to better adapt to conditions. As a result, more traffic can use the same route without causing or encountering congestion. This is a much less expensive and time consuming solution than building a new road or widening lanes.

Not only can government extend the life of the infrastructure – there is also an opportunity to let industry develop its own new and innovative uses for getting the most out of existing infrastructure. A prime example is the latent capacity in school buildings across the state, which could be further used outside normal school hours for co-working spaces or community activities.

"Before we know where to go we need to know where we are now and what infrastructure assets we have to leverage." – Scott Reid, RIoT Solutions and Member, Infrastructure Innovation Taskforce

Ideas included:

- Conduct a broad-scale review of all existing infrastructure in Queensland across all industries

 to set a baseline against which upgrades and utilisation can be measured and subsequently improved.
- Develop a strategy for identifying, managing and utilising newly created capacity in existing infrastructure created by new technology (e.g. managing the reduced need for carparks as the uptake of automated vehicles begins).
- Establish a behavioural economics capability in government to achieve more targeted delivery of services and drive greater uptake of existing assets (an existing example of this is the adjustment of electricity tariffs to incentivise load shifting away from peak demand times).

Summit attendees were asked – "Rank smart infrastructure opportunities by their relative importance, with '1' reflecting the highest priority."



Adopting agile thinking: build trust, embrace challenges, and learn from others

Throughout the day attendees voiced views on the need to challenge the status quo of how we think about problems in infrastructure, how we think about solutions, and how we think about delivery. By nature, many of us in work and in life adopt 'waterfall thinking', a linear progression of logic that is often successful but at the same time can be over-cautious. Adapting to new cultures of thinking, such as the 'agile' approach (which emphasises speed, flexibility and taking calculated, small risks for greater success) may help us adapt to a rapidly changing world.

In practice, this means encouraging the adoption of unproven but promising new solutions in a controlled, and at first, small-scale environment, over 'tried and true' approaches. This means acknowledging that imperfect outcomes are an acceptable outcome, not only successes. This is something that's already happening in Queensland. For example, the Mackay region's water management system has been recognised nationwide for the introduction of a ground-breaking automated water meter infrastructure and software monitoring system which allows residents and council to rapidly assess their consumption and monitor for water leaks.

More and more, we will need to move more rapidly to confront changing essential service delivery needs. There was little doubt in the minds of attendees that disruption to the infrastructure sector is not only imminent – it is upon us – and adopting a cultural shift in the way we think about implementing infrastructure solutions will help us ride the wave.

"Transformative change is on the horizon

embedding change as a cultural norm in

communities and corporations will be a strategic advantage." – Stephen Yarwood, Urban Futurist

Summit attendees were asked – "What they thought were the best ideas to stimulate smarter infrastructure."

Open access data MyQld app Develop alternative infrastructure uses Support early adopters Behavioural economics analysis (nudge unit) Government as an enabler Marketplace for data Improve contract risk transfer Educate decision makers Procure by outcomes Culture of piloting Establish skill requirements

Adopting agile thinking: build trust, embrace challenges, and learn from others

Ideas included:

- Promoting rapid take-up of learning from outside sources. This may include dissemination of successful and failed case studies, increased engagement with local government which tends to have a great deal of direct engagement with local infrastructure projects, or sponsoring private sector personnel within government to allow government employees to learn from private sector approaches to problem and solution development.
- Adapting risk sharing positions within government procurement processes (i.e. through explicit selection criteria) and contracting models to prioritise prototyping and experimentation – with the understanding that results can at times be unintended.
- Support a culture of piloting, trialling new solutions and agile development approaches where 'fast failures' are accepted and built upon. By encouraging this style of thinking, our efficiency, responsiveness and competitiveness will improve.



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Data focus: Improving the collection, sharing and use of data within and between government, industry and academia

The digital age has brought with it a flood of data – computing and artificial intelligence has taken data collection and analysis beyond the limitations of our minds. We have generated multiple times more data in the past decade than we have generated in the preceding history of humanity. There is a giant opportunity to greatly improve the way we procure, deliver, maintain and monitor the usage of new infrastructure. We can also revolutionise the way we use data to make more informed decisions. Even though we may collect data that presently does not have a descriptive, diagnostic, predictive or prescriptive purpose, a purpose may be found as technologies mature.

There is scope for data collection and analysis (for example, traffic volumes, air pollution, waste collection, power consumption) to be improved between industry and government, by diving deeper into lower levels and comparing data across multiple channels. For example, new insights may emerge when examining power consumption arranged by dwelling type, or air pollution at an individual street level. Not only does this extend to broadening the scope and sample size of existing data collection, it means improving dissemination. Increasing open source access to raw data collected by industry, government and academia would allow all parties to better understand government's needs and better respond to those needs. Of course, this must be balanced with the need to preserve private rights to intellectual property and industry's right to profit from innovation.

Changing the way we approach data collection, analysis and communication borrows elements from previous themes, including the need to adopt an 'agile' mindset. This means increasing speed, flexibility, and willingness to experiment, including collecting data for which we don't yet have a purpose, but may in the future.

Data will drive tomorrow's solutions. We should be collecting it and disseminating it, even if we don't yet know how we are going to use it, because someone out there might have an idea." – Neil Glentworth, GWI and Member, Infrastructure Innovation Taskforce

Data focus: Improving the collection, sharing and use of data within and between government, industry and academia

Ideas included:

- Developing asset utilisation
 'feedback loops'. Usage
 information can be fed back to
 both consumers, industry and
 decision makers, with the aim of
 improving or refining everything from
 customer experience and asset efficiency
 through to policy making and procurement.
- Review existing government data collection, analysis, communication and dissemination systems to determine the scope for expansion of existing sample sizes and creation of new data sets. Attendees took the view that the more data available to industry and the community, the better, because even if government doesn't use the data for a specific purpose, industry might, thus fostering innovation.
- Creating a centralised 'point of truth' for collection, analysis and management of data, in order to improve the interoperability of datasets between government agencies, departments, academia and industry.

Summit attendees were asked – "Does your organisation effectively utilise data to inform infrastructure decisions and/or advice?"



Number of respondents

Collaboration across sectors: seek to improve cross-sector collaboration, showcase innovation, and attract and retain skills

Summit attendees agreed that in order to capitalise on the opportunities provided by smart infrastructure, there needs to be an increase in the transfer of ideas between government, industry, the community and academia. This theme was broad in scope – it not only extends to ensuring engagement between the community, public and private sectors and educational institutions – it means facilitating engagement within those sectors, and attracting and retaining talent, skills and resources. Not only is this important for maximising the placing of Queensland at the forefront of smarter infrastructure, it is also critical to support our regions to transition to the economy of the future.

For government, this borrows from the theme of 'agile' thinking. Government needs to understand industry drivers, and understand the solutions being developed by the private sector. It needs to understand the successes and failures of other government tiers and departments, and it needs to do so by broadcasting case studies, and learning from past successes and failures regardless of the source.

For industry, this borrows from the themes of customer-centric government, and the proposition of government as an enabler. It means understanding what drives government and the community at large, what government wants to achieve for the community and how that informs the problems that industry will endeavour to solve. It also means industry needs to understand and showcase successes and failures. For example, information technology professionals need to talk to construction companies and understand one another's objectives before designing solutions. Likewise for academia, it means understanding government and community drivers in order to inform the direction of research. It means engaging with industry about what they will require from the next generation of workers. This will help prepare graduates for an increasingly multidisciplinary employment market where scientific, engineering, marketing, data analytics, management, commercial, legal and financial skillsets may all be drawn on at once. Part of this is also ensuring that Queensland attracts and retains skills and talent, particularly in an increasing environment of disruption for traditional workforces.

"There is a great opportunity for government to learn from other industry sectors – defence, aviation and information technology amongst others – and apply lessons from those sectors to the procurement and construction of new or retrofitted smart infrastructure." – Mair Brooks, Ernst and Young and Chairperson, Infrastructure Innovation Taskforce

Collaboration across sectors: seek to improve cross-sector collaboration, showcasing of innovation, and attract and retain skills

Ideas included:

- Create a mechanism or program of activities and events for establishing ongoing collaboration between government, industry and academia.
- Strengthen collaboration between workplaces and education/academic institutions, including considering how to improve work and training practices to best-fit future skills demand.
- Continued showcasing of innovations and talent, including the possibility of a formal showcase that highlights some of Queensland's latest innovations and inspiring solutions. By showcasing and leveraging this talent, this will also assist in attracting and retaining skills and resources.
- Increased focus on science, technology, engineering and mathematics (STEM) skills in curriculums to remain competitive in a knowledge-based, data-driven economy.





What the Queensland Government is going to do next

Responses to the Discussion Paper and Summit raised many innovative ideas and concepts for Queensland's smarter infrastructure agenda. Importantly, government cannot pursue these ideas alone. It needs the community, industry and academia to come together, collaborate and to drive this agenda forward. If this can happen, it is clear that the benefits will be profound, and help us shift towards the positive future state of a customer-centric, knowledge-driven economy and community.

The Summit outcomes provide a foundation to take forward the ideas discussed at the Summit, through government initiatives or programs. These key priorities will also feed into a forward work program that will help shape the future direction of Queensland's smarter infrastructure agenda, including:

- Infrastructure Innovation Taskforce
- Showcasing Smarter Infrastructure
- Infrastructure Innovation Challenge
- Building Information Modelling.

We want to keep the collaboration and cross-sector discovery going!

www.qld.gov.au/smarterinfrastructure

Notes	

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