Australian Government

Department of Infrastructure and Regional Development

Disruptive Technologies

Submission to the Productivity Commission

Research Project:

Disruptive Technologies – what do governments need to do?

February 2016

Introduction

Information and Communication Technology (ICT) is changing the way we do business. The rise of the digital economy[1], enabled by the Internet and ICT advances, is rapidly revealing opportunities and challenges for our economy and broader society. In infrastructure and transport, technology and innovation are vital to enhancing productivity, efficiency, safety, security, and environmental outcomes. The question for Government is how to realise the benefits, eliminate barriers and encourage smarter infrastructure and transport initiatives using technology and innovative approaches.

This paper considers a few of the 'disruptive' technologies that present both opportunities and challenges for Australian infrastructure and transport, now and into the future. It also looks at relevant work within the Department to position a conversation between governments, industry, research bodies, and the community. Collaboration with all stakeholders on these issues will help determine the way forward for Australian infrastructure and transport policy, programs and regulation.

This research project has the potential to make an important contribution to Government views on disruptive technologies. As such, the Department remains eager to provide any further information that might assist the Commission.

Technologies driving change

An array of rapidly developing technologies are already finding applications in transport and infrastructure, including the Internet of Things (IoT), data analytics, artificial intelligence, robotics, 3D printing, virtual telepresence, and remotely piloted aircraft systems (or drones). As part of the growing digital economy, such technologies are boosting productivity, and changing the way businesses operate and the nature of roles in the workforce.

While such technologies will help support future economic growth, increased mobility and access to services, and help tackle rising infrastructure and transport demands, it remains difficult to crystal-ball the exact way such new technologies will transform our landscape.

As our population grows to over 30 million by 2031[2], mobility and access to services will be increasingly important. Reducing congestion is critical, as increasing freight and passenger demand will surpass the capacity of current transport infrastructure. The Bureau of Infrastructure, Transport, and Regional Economics (BITRE) projects congestion costs of approximately $37.3 billion by 2030. Technology, as a key driver of innovation and efficiency, will be critical in addressing such costs.

[1] See OECD Digital Economy Outlook 2015; http://www2.deloitte.com/au/en/pages/media-releases/articles/79billion-australias-digital-economy-grows-and-grows-250315.html
[2] State of Australian Cities 2014-15; https://infrastructure.gov.au/infrastructure/pab/soac/files/2015_SoAC_full_report.pdf

Smarter use of technology in infrastructure and transport will help to support economic growth, as ICT use correlates with the efficient use of land, buildings, roads and inventories. Technology-driven productivity increases in transport and logistics (as an enabler) can amplify gains in other industry sectors. To unlock such opportunities for the broader economy, policy and regulatory frameworks will need to support innovation and new technologies.

To illustrate this, the following section illustrates this challenge using examples from a number of particular areas where disruptive technologies are presenting great opportunities requiring new policy approaches in order to seize benefits – both now and into the future.

Challenges and Impacts

Australian cities continue to be car-centric, and the road carries significant non-bulk cargo. The dominance of the car is likely to remain, but could be dramatically disrupted through increased use of driver assistance technologies and the growth of the sharing economy. These two forces will coalesce with the convergence of telecommunications and transport as integrated enablers of productivity. Over the coming decades, congestion management will be a key area where transport infrastructure can facilitate productivity growth.

Intelligent Transport Systems

Part of this work will be in Intelligent Transport Systems (ITS), or the use of information and communications technology in transport networks (including aviation, maritime and land transport). ITS implementation can help address transport challenges, by improving transport productivity, increasing capacity utilisation of infrastructure, minimising congestion on transport networks, and improving road safety, mobility and environmental outcomes. ITS can be either a key component of a new infrastructure project, or enhance and optimise the operation of existing infrastructure (potentially avoiding the need for new infrastructure).

Successful deployment of ITS in Australia will require government and industry efforts on:

- consistent, interoperable ITS systems throughout Australia and harmonisation with standards being developed internationally;
- robust security and data privacy protections; dedicated spectrum and communications technology for connected vehicles and infrastructure; and
- using the growing volume of data becoming available from ITS application to improve transport outcomes for the traveller and the operator.

The current review of the Transport and Infrastructure Council's 2011 Policy Framework for Intelligent Transport Systems in Australia will consider these issues. The Commonwealth is working with states and territories on this review, and will consider future governance arrangements for ITS. The revised Framework will be provided to Council at its next meeting in May 2016.

Potential ITS applications include:

- connected vehicles, where real-time traffic flow data is collected and used by vehicles and roadside infrastructure (such as for collision avoidance, and to reduce congestion—for example, Victoria already uses active traffic management tools on its managed motorways such as ramp metering and variable speed limits to reduce congestion and increase throughput);
- telematics, which allow for monitoring of individual vehicle movements, including recording the speed, location and mass of a vehicle—this provides many useful applications for fleet managers and road managers;
- advanced driver assistance systems, which automate, adapt or enhance vehicle systems for safety and better driving (such as adaptive cruise control, lane departure warning, and autonomous emergency braking);
- automated vehicles, which can enhance safety by allowing certain safety-critical control functions, such as steering or braking, to occur without direct driver input. Fully automated vehicles (or 'driverless vehicles') are in development internationally and are likely to provide substantial productivity benefits;
- traveller information services to assist transport users across all modes to plan or adapt their journeys in response to changing conditions (such as warnings of road works or accidents);
- electronic toll connection, which can reduce delays and congestion and increase convenience for road users; and
- smart ticketing, which allows people to make journeys across multiple transport modes on a single ticket, using electronic ticketing technologies.

Automated (Driverless) vehicles

Partially automated vehicles, such as those with self-parking or autonomous emergency braking systems, are already commercially available in Australia. Major vehicle manufacturers are planning to bring automated vehicles to the market in 2020, but it will be some time before they become a commercial reality.

Some driverless vehicles are currently in use in the mining industry in Australia and are remote controlled from mine operation centres on non-public roads in remote locations in Australia. In addition, the first Southern Hemisphere on-road driverless vehicle demonstration was held in Adelaide on 7 November 2015.

The Commonwealth is continuing to work with the States and Territory governments to prepare for emerging transport technologies, including automated vehicles. The National Transport Commission (NTC) has commenced a project to identify regulatory and operational barriers to uptake of more autonomous road and rail vehicles.

Safety and security will continue to be paramount with the development and deployment of automated vehicles. Austroads has been commissioned to undertake a project to look at the safety issues, including the benefits, of automated vehicles. The findings of this work will inform Australia's preparations for automated vehicles.

Point-to-Point on demand transport services

Perhaps the most prominent 'disruptive' technology in road transport is 'ride-sharing'.

Enabled by mobile network technologies, services like Uber, Coseats and Catchalift are providing dynamic transport options, letting us make use of or monetise any spare capacity. Uber does not own a single road vehicle, though its smartphone application connects available drivers to consumers seeking transportation services. The application shows customers where the nearest Uber driver is, the expected wait time, the cost of the fare, and even processes payment. Uber is by no means alone. Other sharing models include: Goget car sharing services; Meemeep, matching up those wanting to move things with drivers that can move them; and ParkingMadeEasy, allowing dynamic use of private parking spaces.

Potential benefits are significant. Ride sharing provides a cheaper, more flexible transport option for consumers, and may ultimately reduce traffic congestion in cities, due to increased carpooling and use of vehicle capacity. In the US, 'Uber for Business' has also provided business savings of up to $1000 per employee per year, as well as increased efficiency, via provision of business-specific taxi services. On the flip-side, concerns persist over competition with taxis, safety and insurance standards, pricing, and legal status. Uber's 'price surging' algorithm, matching supply with demand, has also sparked criticism. Instances such as the four-fold price hikes for users seeking a ride out of Martin Place during the siege in December 2014 resulted in Uber having to issue refunds and amend its pricing algorithm during states of emergency.

Governments' responses to ride sharing vary widely in form and tempo. In California, Uber's carpooling service UberPool was deemed illegal. Other US cities, including Dallas, Atlanta, Seattle and Tampa, are reportedly considering how Uber can be integrated into public transit, especially for first and last mile services. In Australia, ride sharing services are considered 'point-to-point on demand transport services' (as are taxi and hire car services) which are regulated by state and territory governments. Several jurisdictions have announced that ride sharing has been (ACT) or will be (NSW, WA) legalised, following reviews into their on-demand transport services, and reviews are also underway in the NT, SA, and Queensland. While the Commonwealth government has a range of interests in point-to-point on demand transport (such as competition and taxation), the Department's primary interests relate to whole-of-government coordination and disability standards.

The Department notes the importance of whole-of-government discussions and consideration of a consistent national approach, where possible, as disparate regulations and policies will create issues—particularly for cross-border regions (for example Albury–Wodonga, Canberra-Queanbeyan, Coolangatta-Tweed Heads). At its November 2015 meeting, the Transport and

Infrastructure Council agreed the importance of sharing learnings across all jurisdictions, and agreed to work towards harmonised standards and regulation to ensure that Australia is well positioned to adopt new technologies.

The Department also notes that the Disability Standards for Accessible Public Transport 2002 apply to taxi services (which are the largest provider of public transport services to people with disability), but not to other on-demand operations. Governments will need to monitor trends in on-demand transport to ensure the emergence of new services does not significantly reduce levels of service available to people with disability.

Remotely Piloted Aircraft Systems

Like elsewhere, the Australian 'drone' or Remotely Piloted Aircraft Systems (RPAS) industry has experienced rapid growth in recent years. Growth in the number of RPAS is due to advances in technology, their increasing availability to the general public at low cost and the expanding number of applications for RPAS.

RPAS range from small recreational devices weighing less than one kilogram, to large fixed wing aircraft weighing hundreds of kilograms. Similarly, they can operate from only feet above the ground up to altitudes of more than 5,000 feet and beyond.

Australia was the first country to regulate Remotely Piloted Aircraft Systems (RPAS) with the introduction of safety regulations in 2002. Like in other comparable jurisdictions, there are separate rules to recreational and commercial RPAS operations. Recreational users must meet standard operational requirements, such as no flying within 30 metres of people or buildings, and always within visual line of sight. Commercial use requires an unmanned operator's certificate (UOC) and remote pilot certificate, issued by the Civil Aviation Safety Authority (CASA). On top of the recreational popularity, it is a growing industry, with UOCs issued now numbering 400 (up from 51 in 2013).

RPAS impacts and challenges

The commercial potential of RPAS is significant as they have the ability to reduce the costs and risks associated with hazardous, difficult or time-consuming activities. As RPAS have become more prevalent, they are being used across a growing range of Australian industries. In particular, there has been a significant uptake in industries such as media and photography, police and emergency services, agriculture and farming, as well as mining and scientific research. As these industries evolve and make greater use of RPAS, their workforce may need to develop skills to ensure that they are able to harness the benefits without impeding productivity.

It is important that as the use of RPAS increases, an environment is created that allows for RPAS to be operated in a way that is safe and does not hinder the operation of conventional aircraft, but that over time will also allow RPAS to integrate with other transport modes, for example, integrating the use of courier RPAS with road transport and pedestrians.

Current regulations include restrictions on where and how RPAS may be flown and penalties can be imposed for breaches of these regulations. However, there is also the risk that as the use of RPAS expands, the scope for inadvertent or deliberate misuse of RPAS increases and that the existing regulatory framework may not adequately reflect the RPAS environment.

Regulatory compliance and enforcement activities for RPAS are difficult, particularly for recreational use, where it is often hard to achieve the necessary evidentiary standards required for prosecution. Some jurisdictions, such as the United States, are establishing registration systems in an attempt to have visibility and identification of the vast numbers of RPAS increasingly being operated by private citizens for recreational purposes. The utility and limitations of such systems remain to be seen.

Regulation governing the use of RPAS will therefore need to be robust yet flexible enough to keep pace with technological advancement and the evolving use of RPAS. This will require constant monitoring and assessment of the RPAS environment and the regulatory settings to ensure that the sector is regulated in a manner that supports the continued growth and productivity gains being experienced through the use of RPAS, while ensuring the safety of other aircraft, people and property.

Future regulations will also need to take into account the policies and practices of the international community relating to RPAS. This includes standards set by the International Civil Aviation Organization, which is currently developing international safety standards and recommended practices for the use of RPAS.

In addition to concerns about safety, there has also been considerable interest in the privacy implications of RPAS. The Commonwealth regulates RPAS operations from a safety perspective under the Civil Aviation Safety Regulations 1998 (CASR). However, privacy is principally a state and territory matter, with privacy-related legislation and arrangements varying between states and territories. Federally, there are some limited protections that may be available under the *Privacy Act 1988,* or at common law.

Automation and the workforce

When considering disruptive technologies and the infrastructure and transport sectors, it is worth considering the impacts for industry profiles and the workforce. Despite the broad productivity benefits, automation and big data will likely have some acute or disruptive impacts – particularly relating to the workforce. PwC suggest that 44 per cent of Australian jobs could potentially be supplanted by robotics and artificial intelligence-based systems over the next 20 years.[3] The potential impacts are far reaching – and likely to affect population distribution and demands for transport infrastructure, as passenger and freight movement patterns change in response to their environment.

[3] https://pwc.docalytics.com/v/a-smart-move-pwc-stem-report-april-2015

Glimpses of such disruption are already evident. For example, the automation of container transport systems at Asciano's Port of Brisbane and Port Botany terminals. Port of Brisbane opened its automated terminal in 2005, with the change-over at Port Botany last year (2015) halving the terminal's workforce. Developed with the help of the Australian Centre of Field Robotics, the terminals use machines (Autostrads) to stack and move containers from crane to truck. This automation provides efficiency and safety benefits, and can operate without the need for night lighting.

Such benefits will be critical for our future competitiveness and economic growth. Automation, technological advancement, competition, and future regulatory development are all key factors in determining the health of 'enabling services' – those service sectors such as transport that enable business to function and get their products to market. In considering what the future holds for the Trade, Transport and Logistics services group, the Australian Industry Report 2015 notes that 3D printing, wireless sensor tags, space technologies and automation may be of particularly relevant trends.[4] Automation is expected to have both disruptive effects on the workforce, as well as assisting workers to perform additional tasks.

The challenge is how to best handle this disruption without impeding productivity, efficiency, and safety benefits. Part of the answer may be workforce transformation, new skills development, re-profiling job roles, and fostering better links with the education system. The imperative for industry to remain competitive is not about letting robots take control, but harnessing technical expertise and knowledge. Jobs least at risk to automation are concentrated in knowledge-based industries. The transition towards an increasingly sophisticated transport environment will accordingly need new skills, including in science, technology, engineering, and mathematics. With big data on the rise, and as low skilled positions become increasingly redundant, the transport sector will need to adapt and innovate to transition the workforce in this changing environment. This dual-edged prospect presents both opportunities for our future scientists, engineers and analysts, while signaling some challenges for those without the ability to adapt. The transport sectors will also need to make sure that as its ageing workforce retires, it does not lose valuable knowledge and experience it might need to guide its future growth.

Conclusion

Closer integration of physical infrastructure and transport with the digital world is already afoot. Traditional supply and demand models, and global value chains are being broken down and re-engineered using technologies that allow increased efficiencies or participation at different points. Technology-based companies (for example Google, Uber or Amazon) are now a familiar, rather than disruptive, presence in discussions on the future of transport. Traditional transport giants are adapting quickly. GM (in the US) recently acquired ride-sharing service Sidecar, and announced its own car sharing service Maven, on the back of a reported US$500 million

[4] See Chapter 2 on Enabling Services, Australian Industry Report 2015. http://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/AIR2015.pdf

investment in ride-sharing company Lyft – enhancing the potential to reap digital reward, and perhaps diversifying their position and reducing the risk of being left behind.

As businesses diversify and collaborate, the integration of the transport and technology sectors are becoming a driving force in creating value and new opportunities for business and public benefit. Perhaps the biggest area for where this integration will transform productivity is in greater digitisation, and the increasing availability and use of data – now growing in orders of magnitude, available in real time and collected from a multitude of sources. Seizing the digital opportunities here will be vital for improving productivity, safety, security and environmental outcomes across the country.

While this submission covers only a selection of transport technologies, the rapid pace of change is revealing both opportunities and challenges for governments and industry alike. To this end, the digital integration in transport assets and services needs to be reflected in the policy process. Policy makers and regulators need to engage and collaborate with industry, research groups, and the community, to support dynamic use of technology in order to best facilitate infrastructure planning and investment, and foster efficient, sustainable, and competitive transport systems.

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