ATSE

SUBMISSION TO THE

House of Representatives Standing Committee on Infrastructure and Communications Inquiry into the role of Smart ICT in the design and planning of infrastructure

JULY 2015

AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING (ATSE)

Australian Academy of Technological Sciences and Engineering
Level 1, 1 Bowen Crescent, Melbourne Vic 3004
GPO Box 4055, Melbourne, Vic 3001, Australia
T+61 3 9864 0900 F+61 3 9864 0930 www.atse.org.au
Australian Academy of Technological Sciences and Engineering Limited – Incorporated ACT ACN 008 520 394 ABN 58 008 520 394

President
Dr Alan Finkel AO FTSE

House of Representatives Standing Committee on Infrastructure and Communications
PO Box 6021
Parliament House
Canberra ACT 2600

10 July 2015

The role of Smart ICT in the design and planning of Infrastructure

The Australian Academy of Technological Sciences and Engineering (ATSE)[1] welcomes the opportunity to provide its response to the Terms of Reference for the inquiry into the role of smart ICT in the design and planning of infrastructure.

Effective infrastructure planning is a critical issue for Australia, particularly as our population continues to grow. Infrastructure - notably transport, water, energy and communications - is vital for driving productivity, underpinning prosperity and our way of life. It impacts on all aspects of our society.

Information Communications Technology (ICT) is an enabler, and when used in smart ways, it has the potential to increase efficiencies and productivity in a range of sectors and when doing so, could be referred to as 'smart ICT'. National ICT Australia (NICTA) have defined the term 'smart ICT' as *"a range of tools and techniques that include advanced (ICT) such as data analytics, optimisation, modelling & software systems, networked sensors, and integration with mobile devices and new ways of gathering data, such as social media and crowd-sourcing."*[2] The use of ICT to transform existing infrastructure systems into so-called smart or intelligent infrastructure will provide enormous opportunities for Australia. Not only will ICT-enabled smart infrastructure provide improved efficiencies and service delivery, it will also improve public safety. In addition, there will be rich opportunities for Australian companies to develop the ICT and other technologies needed to underpin smart infrastructure.

The benefits of smart infrastructure will flow only if it is widely adopted and applied. For example, ICT will be central to smart health systems, smart road and transport infrastructure,

[1] ATSE advocates for a future in which technological sciences, engineering and innovation contribute significantly to Australia's social, economic and environmental wellbeing. The Academy is empowered in its mission by some 800 Fellows drawn from industry, academia, research institutes and government, who represent the brightest and the best in technological sciences and engineering in Australia. The Academy provides robust, independent and trusted evidence-based advice on technological issues of national importance. ATSE fosters national and international collaboration and encourages technology transfer for economic, social and environmental benefit. www.atse.org.au

[2] NICTA Response to the Public Infrastructure Productivity Commission Issues Paper and Draft Report, 2014.

smart agriculture and energy networks, and is critically important to the growth of existing and future Australian businesses and industries. In the pages below, we have highlighted some of the benefits that will flow in five key areas: smart health care systems, smart transport, smart agriculture, smart grids and energy systems, smart cities, and industry.

The benefits of using ICT to enable smart infrastructure will come from proactive adoption of technology, and government can facilitate this adoption and encouragement through regulation and proactive adoption as technology penetrates every aspect of business[3].

In the health sector, despite large national investments in health ICT very little policy work has been undertaken in Australia in deploying telecare and telehealth as a solution to the increasing demands and costs of managing chronic disease.

Establishing robust infrastructure plans is critical. Weaknesses in those plans impose economic costs that are usually difficult and expensive to correct. Use of ICT capabilities, such as 'big data', allow for greater consideration of the issues in the planning stage of all types of infrastructure plans and offers efficiencies in life-time management of investments. The use of 'big data', referring to the exponential growth, volume and variety of large collections of data for analytical purposes, offers the opportunity to capture and apply information to improve the operational efficiency of numerous networks and make better decisions based on an understanding of user behaviours and preferences[4] .

Health

Globally, the trend for healthcare costs is increasing, largely due to an ageing population, with one of the key metrics being the ratio of healthcare cost to GDP. The healthcare sector aims to reduce costs and increase productivity. While in the past, ICT has been central to the transformation in medical sciences, from mapping the human genome to the development of medical devices, ICT also has a strong future in transforming the healthcare system to reduce accident and emergency admissions, reduce hospital bed-days, and decrease mortality rates[5,6]. However, further investment in improving ICT infrastructure and coordinated uptake assisted by aligned incentives is critical to reap the many benefits.

Healthcare providers need the necessary ICT infrastructure to store, mine and systematically integrate specific information with other medical data. The successful integration and analysis of data will drive beneficial health outcomes and inform public health policy, while security and privacy measures are tightly regulated. Fundamentally, this will require electronic patient records to be exchanged easily between healthcare providers.

'Big data' is already playing a major role in medical treatments in the United States. An open - source platform, Informatics for Integrating Biology and the Bedside (i2b2), was used to create the Shared Health Research Information Network that allows physicians to use an online search tool to access aggregate numbers of patients seen at participating hospitals who meet criteria of interest. The de-identified data allows physicians to study what treatments were used and

[3] Business Council of Australia (2014). Building Australia's Comparative Advantages.
[4] Australian Infrastructure Audit Report 2015
[5] Whole System Demonstrator Programme Headline Findings – December 2011, Department of Health, UK.
[6] Tegart, G, Harvey, E, Livingstone, A, Martin, C, Ozanne, E and Soar, J (2014). '*Assistive Health Technologies for Independent Living'*, A report for the Australian Council of Learned Academies.

what the outcomes were. Currently, the i2b2 platform has been adopted by more than 100 medical institutions around the world. The United States Government is now funding research using SHRINE.

As highlighted in ATSE's Action Statement 'Deploy assistive technologies for the aged and people with disability to improve quality of life[7]', telecare and telehealth services delivered at home via ICT have been demonstrated to deliver cost effective, timely and improved access to quality care. They also reduce social dislocation and enhance the quality of life within these communities by allowing chronically ill, aged and disabled people to stay in their homes and communities longer[6].

Transport

Intelligent Transport Systems (involving Autonomous Vehicles and V2X communications – vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-human) have the potential to significantly improve traffic flow and the demand for road constructions. These benefits would be welcomed by many Australians, particularly those who are spending more and more time in traffic, where this time will increase as the population continues to grow.

The planning and development of roads is expensive and occurs over long time periods, often across multiple terms of government. Integration and use of 'big data' and autonomous car technologies can make a substantial contribution to ensuring efficient and best use of our current infrastructure, potentially reducing the need for future large investments in new roads.

Globally, several companies are using technological and algorithmic advances to develop autonomous cars, and making them a viable part of current infrastructure (e.g. Audi, Volvo and Google). Pilot studies are taking place all over the world and it is thought that while the technology is there, government legislation and regulation is a limiting factor. Specifically, the introduction of autonomous vehicles on our roads will bring the largest benefits only if there are changes to the regulations surrounding current car ownership and use. Implementation of Auto-Restricted Zones that prohibit cars from specific areas, time-specific restrictions or car-share only areas are some examples of government interventions to reduce the number of cars on the roads. A reduction of car numbers on the roads, combined with electric and autonomous vehicles in the future, could have a significant effect on emissions and reduce environmental impact.

While these cars are not being developed here in Australia, Australia could use its competitive strengths - a highly qualified workforce with car manufacturing expertise and ICT capabilities - to develop the necessary components to transform the car of 2015 into an autonomous vehicle of the future.

Agriculture

The development of ICT systems can also be applied to Australia's agricultural sector to place Australia in a competitive position as a global producer. The sector faces pressures on the availability of natural resources for agricultural production, due to drought, changing land

[7] ATSE Action Statement (2014). *'Deploy assistive technologies for the aged and people with disability to improve quality of life'*.

and water use patterns, competition from other industries, increased input costs (e.g. energy and nutrients), and environmental degradation[8].

Improved natural resource management will require the support of reliable and timely information through integrated databases and improved ICT infrastructure. Specifically, ICT use can assist in the development and use of innovative farm management techniques and technologies, including robotics and sensor networks, precision tracking systems; and post-farm gate techniques and technologies, including in food processing, transport and storage[9].

Recent advances in technology now make the management of soil on an industrial scale possible. In the near future, 'big data' analysis, combined with a range of soil sensing technologies and 3D soil mapping, will provide farmers with a view of the soil system in their paddocks in real time. While the scientific and technical capability to achieve this largely exists already, government planning and investment to link up relevant information systems, education for farmers and a regulatory framework for data management will be needed.

Unmanned aerial vehicles or drones are already used in the agricultural sector to collect information relating to soil type boundaries, 3D profiles and crop vigour, among others. The power of the data generated lies in the analysis. Communication technologies and the necessary infrastructure that underpin field robotics applications will be a major limiting factor in the use of Australia's innovative technologies at home and globally.

Energy

The 2014 ATSE Action Statement 'Intelligent electricity networks for the future' states that Australia needs intelligent electricity networks and enabling policy frameworks to ensure that future electricity supply systems provide efficient, affordable and low-emission energy to the Australian economy[10]. Specifically, intelligent networks (sometimes called smart grids) will contribute to improved network utilisation, including demand management (both opportunities and effectiveness), in the electricity network. The need to acquire, store and use large sets of data to model a more complex network and predict its operation increasingly in real time relies heavily on ICT. The utilisation of ICT provides the basis for the evolution of more intelligent and increasingly self-managing networks, generating large-scale efficiencies and an efficient way to supply energy for some remote communities in Australia.

In addition, smart grids enable the deployment of distributed energy generation. For example, a 2014 report from UBS and Navigant Research[11] stated that the cost of solar plus battery generation is anticipated to fall below that of conventional power generation around the end of this decade. This would allow households to become affordably energy self-sufficient with clean generation.

Industry growth

Information and communication technologies are also a platform for innovation, where new products and services can deliver better outcomes for Australians and the economy. Australia

[8] ATSE Position Statement (2014). '*Enabling growth in agriculture'.*
[9] Securing Australia's Future: Project 7 (2015). '*Australia's Agricultural Future'.* A report for the Australian Council of Learned Academies.
[10] ATSE Action Statement (2014). *'Intelligent electricity networks for the future'.*
[11] Clean Technica: http://cleantechnica.com/2014/10/13/battery-costs-may-drop-100kwh/

has the opportunity to use its highly-skilled researchers and access to technology to commercialise innovations for future benefits. Specifically, there are opportunities for Australia's research and development sector to apply ICT systems in the manufacturing sector to develop niche products and markets that are attractive globally[12].

To ensure Australia can capitalise on ICT-driven innovations, education providers must ensure that ICT is a focus in all education levels, particularly within the science, technology, engineering and mathematics disciplines, to boost capability and skills. It is encouraging to see that both major Australian political parties have detailed policies to improve STEM education and coding in schools[13].

Cities

The application of ICT technologies and examples in the topics raised above also showcase the role that ICT has in significantly improving the quality of urban life. Cities such as Seoul, Rio de Janeiro, Amsterdam and Barcelona are leading the way in using digital technologies and networks to create efficient and sustainable urban environments. The application of ICT can improve transport mobility; contribute to a cleaner and functional urban environment to assist waste management facilities maintenance through facilities maintenance; and provide energy efficiencies through intelligent lighting. These are few of many examples. In Australia there are a large number of Smart City (and Smart Communities) initiatives involving government, city councils, industry associations, ICT companies and research organisations.

Concluding remarks

Ubiquitous access to high-speed broadband is a key enabler in all of the themes raised in this submission. It will be important for Australia to constantly innovate and upgrade its broadband network so citizens, communities, cities and its infrastructure is connected to one another through the "Internet of Everything" to gain maximum benefits now and in the future.

Further to the comments raised in this submission, ATSE would be pleased to offer its considerable expertise. If ATSE can be of any assistance, please contact Ms Sarah Parker, Senior Research and Policy Officer at sarah.parker@atse.org.au or 03 9864 0914.

Yours sincerely,

Dr Alan Finkel

[12] Bell, J, Frater, B, Butterfield, L, Cunningham, S, Dodgson, M, Fox, K, Spurling, T and Webster, E (2014). The role of science, research and technology in lifting Australian productivity. Report for the Australian Council of learned Academies.

[13] Australian Government 2015 *Vision for a Science Nation;* Australian Labor Party 2015 *Future Smart Schools* available at http://www.alp.org.au/futuresmartschools.