National Committee for Information and Communication Sciences

A committee of the Australian Academy of Science

8 July 2015

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

House Standing Committee on Infrastructure and Communications
Inquiry on the role of smart information and communication technology (ICT) in the design and planning of infrastructure

Dear Committee

The Australian Academy of Science's National Committee for Information and Communication Sciences (NCICS) has examined the terms of reference of the House Standing Committee on Infrastructure and Communications Inquiry on the role of smart information and communication technology (ICT) in the design and planning of infrastructure.

The attached document provides detailed comments and recommendations to the Inquiry.

The National Committee for Information and Communication Sciences will be pleased to provide further assistance to the committee by participating in future public hearings related to this Inquiry.

Yours sincerely,

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Chair, National Committee for information and Communication Sciences

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Submission to House Standing Committee on Infrastructure and Communications

Inquiry on the role of smart information and communication technology (ICT) in the design and planning of infrastructure

The Australian Academy of Science's National Committee for Information and Communication Sciences (NCICS) provides strategic science policy advice to the Academy, to Government and other Australian organisations. NCICS has examined the terms of reference of the above Inquiry and offers the following comments and recommendations to the Inquiry.

Terminology

The term "smart ICT", as used in the Terms of Reference, is unconventional and potentially confusing. ICT is smart by its very nature. In common technological usage (and dictionary definitions) of the adjective, "smart" describes something that uses ICT. Sometimes the word "smart" is replaced with "intelligent". Typical examples of this usage are: smart meters, smart grids or intelligent electricity networks, smart cities, intelligent lighting, smart highways, smart infrastructure, and so on. The key point is that ICT enables otherwise "dumb" technologies, systems and infrastructure to adapt to changing circumstances and dynamically improve efficiency and other performance factors.

In the context of smart infrastructure, the term "smart" can also imply that the infrastructure has been designed to optimise some characteristic (e.g., minimise power consumption, maximise profits, minimise water wastage etc.) and the "smarts" could be either in the design of the infrastructure itself, or in the way in which people interact with that infrastructure.

Recommendation 1: NCICS recommends a change of terminology to assist in clarifying the Inquiry's goals and objectives. Specifically, NCICS recommends that the Inquiry's report's title be revised to: "The role of information and communication technology (ICT) in the design and planning of *smart* infrastructure".

In the remainder of this submission, we comment on each of the dot points in the terms of Reference. We have changed the wording of relevant Terms to what we believe is more appropriate usage of the word "smart", and perhaps closer to what was originally intended when the terms of reference were drafted.

(a) *Identifying innovative technology for mapping, modelling, design and operation of smart infrastructure:*

Comment: NCICS believes that a full mapping of all innovative technologies for smart infrastructure would be a significant task, and probably lies outside the capabilities of an Inquiry of this type. “Infrastructure” is a very broad term and covers an enormous range of systems technologies. Engineers and scientists involved in the mapping, modelling, design and operation of infrastructure use thousands or even tens of thousands of software design packages, items of instrumentation, and operating systems.

Having said this, there may be some value in mapping technologies for a limited range of key infrastructure that will potentially play a role in improving the lives of Australians and improving national productivity. For example: smart highways or the Internet of Things (IoT; see comments in relation to Item 3).

Recommendation 2: NCICS recommends that the Inquiry identify, scope and prioritise the infrastructure that is of particular importance to Australia.

(b) *Identifying the new capabilities ICT will provide in enabling smart infrastructure:*

Comment: NCICS believes that this is an important part of the Terms of Reference, but like Item a above, it could also involve a very substantial amount of work.

In broad terms, new technologies such as the IoT will be critically important to the advancement of smart infrastructure. The IoT will involve millions or perhaps billions of sensors that are embedded strategically in infrastructure and provide data on key aspects of the operation of that infrastructure. Through appropriate computing and control algorithms, and by feedback to actuators in and around the infrastructure, many aspects of the infrastructure’s operation can be adapted and optimised.

Other important smart infrastructure developments will include so-called smart grids for improved efficiency and stability of the power network as a greater variety of energy sources are connected to the network; smart highways for improved traffic flow and safety; smart cities (including smart public transport, smart offices and smart homes and smart public health systems); and smart agriculture and irrigation.

NCICS believes that Australia is well positioned to play a leading role in the development of smart infrastructure technologies in these and other key areas. Australia has an advanced mobile wireless network, and the National Broadband Network will provide improved fixed wired and wireless connectivity.

There are a number of strong Australian research programs in key areas including:

- technologies relating to the physical infrastructure of the IoT;
- technologies that provide data security; and
- the processing of so-called big data that is generated by the IoT.
- automated (smart) agriculture and disaster management.

Recommendation 3: NCICS recommends that government consider appropriate mechanisms for engaging with the research community to leverage existing expertise to expose and explore new, innovative and sustainable capability for ICT enablement of smart infrastructure.

(c) *Examining the productivity benefits of smart infrastructure*

Comment: As per Item b, NCICS feels that this exercise could become a large task. However, if targeted at strategically important areas as identified previously, this exercise could provide valuable input into decision making processes regarding strategic investment in smart infrastructure in Australia. NCICS believes that at present there is little strategic investment in smart infrastructure research and development in Australia and that this investment is critically important for Australia's economic growth in the digital era and for Australia to maintain and enhance its position as a research leader in the international context

Recommendation 4: NCICS recommends that the Inquiry should focus this activity on a limited set of strategically-important infrastructure domains, as identified in the comment on Item b.

(d) *Harmonising data formats and creating nationally consistent arrangements for data storage and access*

Comment: NCICS strongly supports the importance of this activity, particularly in the area of health but also in many other domains. It should be noted that there are a number of national and international initiatives underway that are seeking to address this issue, and any recommendations of the Inquiry should be made in the context of those activities.

(e) *Identifying international best practice in the use of ICT in the design and planning of infrastructure;*

Comment: This is closely related to Item b, and is possibly redundant.

(f) *Considering the use of ICT in related fields, such as disaster planning and remediation;*

Comment: NCICS believes that this is an important part of the Inquiry's activities. Some work has already been done in this area in the Bushfire and Natural Hazards CRC.

(g) *Considering means, including legislative and administrative action, by which government can promote smart infrastructure to increase economic productivity*

Comments:

- **Government incentives:** The Standing Committee may want to think about devising government incentives or legislation to improve adoption of smart infrastructure in key

strategic areas. Examples of possible incentives could include action that encourages more use of the full set of features of smart meters in homes and the incorporation of smart meters into a more effective smart grid; require car manufacturers to include smart navigation and collision-avoidance technologies in all new vehicles; and encouragement of local government to use smart technologies for data gathering on infrastructure for effective and timely maintenance and efficient delivery of services. At the same time the Inquiry should consider whether the existing legislative framework is sufficient to protect privacy in an Internet of Things age.

- **Education:** Widespread adoption of smart infrastructure across Australia will require a supply of skilled professionals with expertise in Science Technology, Engineering, and Mathematics (STEM), and more specifically in ICT and its application to infrastructure. NCICS is concerned that there is a growing shortage of ICT professionals in Australia, and as smarter infrastructure is developed and implemented, this shortfall could increase. This shortage of ICT professionals could hold back the growth of smart infrastructure.

- **Entrepreneurship**: Linked to the issue of STEM skills, NCICS believes that more work needs to be done to encourage entrepreneurship in ICT technologies and in the application of ICT to smart infrastructure. There are bounteous opportunities for innovative new products and services in the smart infrastructure domain, and Australia could be well positioned to capitalize on these opportunities. The Internet of Things is today at a very early stage of development, which is arguably similar to the stage the Internet was in the late 1980s or early 1990s. If Australia cultivated innovators and entrepreneurs focused on applications of the Internet of Things and smart infrastructure, large economic benefits would flow to the nation.

- **Broadband**: NCICS believes that world-class wired broadband connectivity to homes and businesses and wireless connectivity to mobile devices are both key enablers of increased usage of ICT across business and the community. These wired and mobile networks will underpin smart infrastructure, with the inevitable flow through to increased economic productivity. While not all smart infrastructure technologies require high connection speed, a high-speed network will be needed for many smart infrastructure technologies and applications.

  A world-class broadband network in Australia will provide a foundation for an ecosystem of innovative digital entrepreneurship, which will help to drive the introduction of smart infrastructure. But based on broadband connection speeds, Australia is currently ranked at 47th in the world in terms of wired broadband quality.

  The National Broadband Network (NBN) will hopefully provide a short-term improvement in Australia's broadband capabilities in relation to other advanced nations and its trading partners. But the fibre-to-the-node (FTTN) architecture about to be rolled out in Australia will have a limited useful life compared to the superior fibre-to-the-premises (FTTP) architecture. A FTTN network and will hold Australia back from becoming a long-term global leader in broadband internet connectivity. NCICS considers it essential that Australia develop a plan to build a world-class FTTP broadband access network across all urban areas, and with as broad a reach as possible into regional areas.

Recommendation 5: NCICS recommends that legislative and administrative action will be an important tool to speed the introduction of smart infrastructure in Australia. Work needs to be done to attract students in to STEM streams in schools and universities and to stimulate entrepreneurship to help drive a thriving local industry in technologies for smart infrastructure. In addition, we recommend that Australia should plan for a future world-class FTTP broadband network infrastructure to underpin digital innovation and the advancement of smart infrastructure.