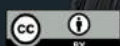A CAIRNS INSTITUTE POLICY - FOCUSED REPORT
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Connectivity and digital inclusion in Far North Queensland's agricultural communities: Policy-focused report

Cairns
Singapore
Townsville

JAMES COOK UNIVERSITY
AUSTRALIA

Contact details

The Cairns Institute – Building D3

James Cook University Smithfield QLD 4870

PO Box 6811 Cairns QLD 4870 Australia

Phone: +61 7 42321888

Email: cairnsinstitute@jcu.edu.au

Web: www.cairnsinstitute.jcu.edu.au

Twitter: @CairnsInstitute

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Connectivity and digital inclusion in Far North Queensland's agricultural communities: Policy-focused report

Dr Amber Marshall [1, 2] | Prof Allan Dale [1] | Prof Hurriyet Babacan [1] |Michael Dezuanni [2]

[1] The Cairns Institute, James Cook University
[2] Digital Media Research Centre, Queensland University of Technology

Amber Marshall

Dr Amber Marshall is an Adjunct Research Fellow at James Cook University and Research Fellow at QUT's Digital Media Research Centre. As an early career researcher, Amber's work is focused on digital inclusion. Having lived and worked in Central Australia and Far North Queensland, Amber has a passion for digital inclusion in regional, rural and remote contexts. She was awarded her PhD from the University of Queensland Business School in 2016.

Allan Dale

Professor Allan Dale has a strong interest in integrated natural resource policy and management in northern Australia. He has both extensive research and policy expertise in governance systems and integrated natural resource management. He is Chair of Regional Development Australia Far North Queensland and Torres Strait. His past research helped inform the policy and investment foundations for the nation's regional natural resource management system, and he was also responsible for natural resource policy in the Queensland Government. Allan has also been the CEO of the Wet Tropics Regional NRM Body before returning to this International research role. As Leader – Tropical Regional Development at The Cairns Institute, JCU, he also accesses an international network of research expertise in the governance field, with particularly strong linkages throughout Charles Darwin University, Griffith University and CSIRO.

Hurriyet Babacan

Professor Hurriyet Babacan is a Research Fellow at Rural Economies Centre of Excellence based at the Cairns Institute, JCU. She has a proven track record of achievement in senior leadership and strategic management roles across different sectors including higher education and the public sector. Hurriyet has worked in Far North Queensland and Northern Australia over the last 15 years and lead projects with many industries in the region including agriculture, mining, and health services. She has a distinguished record in research and scholarship across the world and has published widely in national and international publications relating to economic and social development. She has been recognised for her achievements through the Order of Australia, Bi-Centennial Medal by the Prime Minister and Telstra Business Women's Award.

Michael Dezuanni

Associate Professor Michael Dezuanni undertakes research about digital media, literacies and learning in home, school and community contexts. He is the Associate Director of QUT's Digital Media Research Centre which produces world-leading research for a creative, inclusive and fair digital media environment. Michael has been a chief investigator on five ARC Linkage projects with a focus on digital literacy and learning at school, the use of digital games in the classroom, digital inclusion in regional and rural Australia, and the use of screen content in formal and informal learning. Recent projects have focused on how young Australians access, perceive and are affected by the news and he has led the development of the Queensland report for the Australian Digital Inclusion Index.

Executive summary

Internet connectivity is essential for prosperity and development in all societies. This policy-focussed report is the culmination of a qualitative study of digital connectivity and telecommunications in rural Far North Queensland (FNQ). In particular, the research investigated the lived experience of digital inclusion – a combination of internet access, affordability of technology, and digital ability - in agricultural households and communities the Northern Gulf region. The Australian Digital Inclusion Index (ADII) shows that North West Queensland (which takes in the Gulf Savannah) is one of Australia's least digitally included regions. The ADII further suggests that farmers and farm managers tend to score more poorly in the Index than others in comparable circumstances, particularly on the digital ability sub-index. This research aimed to unpack how these quantitative insights 'play out' in the context of rural FNQ, thereby shedding light on the nuanced and context-specific factors that impact digital participation of farming households and communities.

In 2018, with funding from the Australian Communications Consumer Action Network (ACCAN), James Cook University partnered with Northern Gulf Resource Management Group to complete three week-long data fieldtrips to towns and properties across the Gulf Savannah. The lead researcher, Dr Amber Marshall, attended and presented at rural events, undertook interviews and focus groups, and conducted three case studies of cattle properties. These activities provided real world context for the policy analysis undertaken in this report. This cross-level, cross-sector policy analysis was undertaken to determine the laws and strategies that impact rural and remote internet access, reliability and affordability, along with digital ability and capacity building frameworks.

Executive summary (cont.)

The findings (11 in total) address issues ranging from barriers to connection (such as lack of continuity in the telecommunications network); social factors impacting digital resource allocation and consumption (such as intergenerational and gender-related circumstances); threats to agricultural industry (such as the need to preserve product integrity and to attract/train workers); and consumer-level insights (such as population heterogeneity and expectations of fairness).

These comprehensive findings give rise to several recommendations for federal, state and local governments in partnership with community and industry organisations. These include:

- Improve basic infrastructure and services at local scales, including diversifying service plans to meet specific needs

- Embrace alternative connectivity infrastructure, whereby state and federal government partners with the regions to collaboratively fill infrastructure and service gaps

- Redefine affordability at the federal level, to ensure the true cost of being connected in the bush is realised and accommodated

- Deliver targeted digital capability building programs to address many farmers' thirst for digital skills

- Develop digital mentors, support brokers and upskill remote workers, to help ensure digital skills programs are relevant and rolled out in situ

- Empower rural local governments and community organisations to plan and deliver through strategic linkages with the broader national digital inclusion ecosystem

- Adopt principles for a holistic approach to digital inclusion policy that recognises the critical role of digital capacity building to social and economic development in rural and agricultural Australia.

This final recommendation essentially underpins achievement of the preceding recommendations.

Introduction

Telecommunications and internet infrastructure and services are increasingly an essential part of social and economic life in Australia. Digital infrastructure and services are needed to provide communications connectivity and capacity in all Australian households, businesses, supply chains and communities. Digital connectivity enables people to earn a living, have social contact, access businesses and services, and participate in civic life. However, many Australians are being left behind owing to lack of access to affordable internet and low levels of digital ability to put the internet to work in daily life. Digital exclusion can have substantial social and economic consequences for communities such as poorer education, employment and health outcomes.

Australia's first and most comprehensive snapshot of digital inclusion is the Australian Digital Inclusion Index (ADII), which is based on an annual national survey of 50,000, from which a of subset of 16,000 also complete a survey booklet. The ADII compiles numerous variables into a score ranging from 0 to 100, with a 'perfectly included' individual scoring 100 (Thomas et. al 2018). Data from the ADII – which will be outlined in the next section – forms the point of departure for the present research. Furthermore, our research is motivated by the understanding that digital inclusion is a means to improving lives and livelihoods.

Digital inclusion is not just about computers, the internet or even technology. It is about using technology as a channel to improve skills, to enhance quality of life, to drive education and to promote economic well-being across all elements of society (Australian Digital Inclusion Index, 2018).

The concept of digital inclusion is deeply intertwined with social inclusion in two ways (Helsper 2008). First, social disadvantage based on geography, gender, race, income, education and other factors is often an antecedent to digital exclusion. For example, people in rural and remote areas are more likely to lack access to affordable internet and relevant digital skills to participate in society. Second, low levels of digital inclusion can compound social disadvantage. For example, because rural and remote residents are often unable to access and use digital technologies, their capacity to attain knowledge, skills and support to improve their social and/ or economic circumstances is thwarted. Indeed, remoteness is a strong indicator of digital exclusion in Australia (Park 2015, p.399) and there is also evidence that this 'city-country divide' is widening (ADII). Furthermore, ADII reports (Thomas et al. 2017) explicitly suggest that more work is needed to understand the needs, issues, challenges and opportunities for digital inclusion in rural and remote areas. The present policy-focussed research is a direct response to this call.
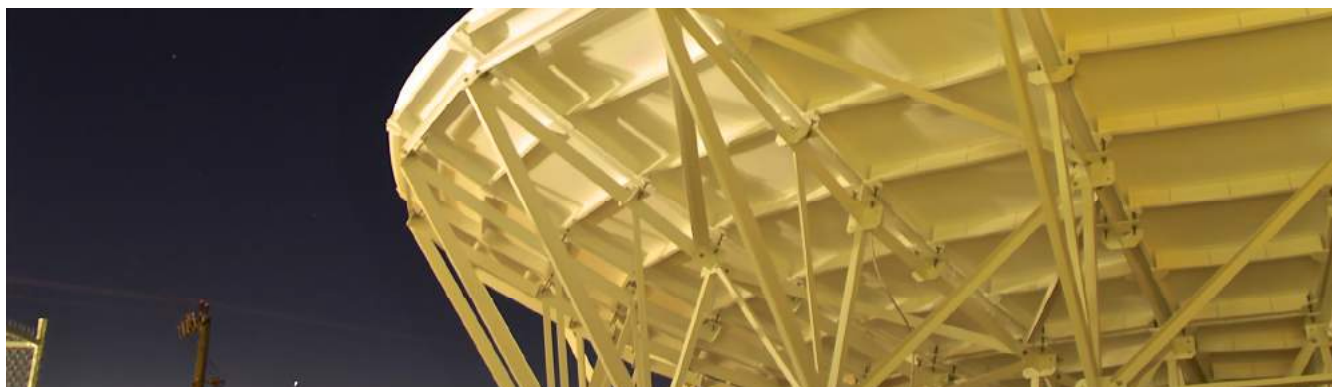
Lower levels of digital inclusion in non-urban Australia can be explained somewhat by the comparative lack of telecommunications infrastructure to support internet access and telecommunications services across our vast continent (Willis and Tranter 2006). This has been compounded by instability in telecommunication and internet policy and operations in Australia, including in Far North Queensland. For example, the Universal Service Obligation (USO), a promise by the federal government that all Australians will have access to telecommunications, has been updated many times but continues to be contentious (Freeman & Park 2015). Furthermore, the design and rollout of the National Broadband Network (NBN) – which sought to provide fast broadband Australia wide – has been fraught, particularly in sparsely populated areas. As a rule, the fixed line services offered in urban areas are faster, more reliable and cheaper than NBN's rural and remote technologies: fixed wireless and satellite. As such, access, availability, affordability and quality of internet services in Australia – the underpinnings of digital inclusion – significantly depend on where you live.

Agricultural communities in FNQ operate in an uncertain policy and physical environment. Several economic, social and environmental issues underpin the challenges residents face in getting and staying connected in the bush: drought, fires, attraction/retention of workers, and industry regulations all put financial, physical and emotional pressure of families, businesses and communities. More specific insights into the opportunities and challenges facing the rural Far North can be garnered by looking specifically at the regional centre of Mareeba Shire's Socioeconomic Profile (Cunningham-Reid, 2018). For example, even though overall population has grown in recent years, those aged 15-39 comprise just 27.3%, which reportedly lowers the earning capacity of the community. In the context of this study, an aging population may also impede uptake of digital technologies that could bolster innovation and productivity. Finally, the recent hundred-year flood event in North West Queensland (which occurred after data collection, but did impact some participants in this research) highlights and exacerbates the need for rural and remote people to be connected to each other and the outside world in times of crisis.

In summary, the ADII shows us that, at a high contextual level, rural and remote Australians experience digital/social exclusion owing to a range of interwoven social, economic, and demographic factors which seem to converge in isolated geographic areas. This project aimed to deep dive into and unpack the antecedents, impacts and lived experience of low levels of digital inclusion in rural and remote individuals, families and communities across all aspects of life: business, social and cultural life, education and health, specifically in rural FNQ.
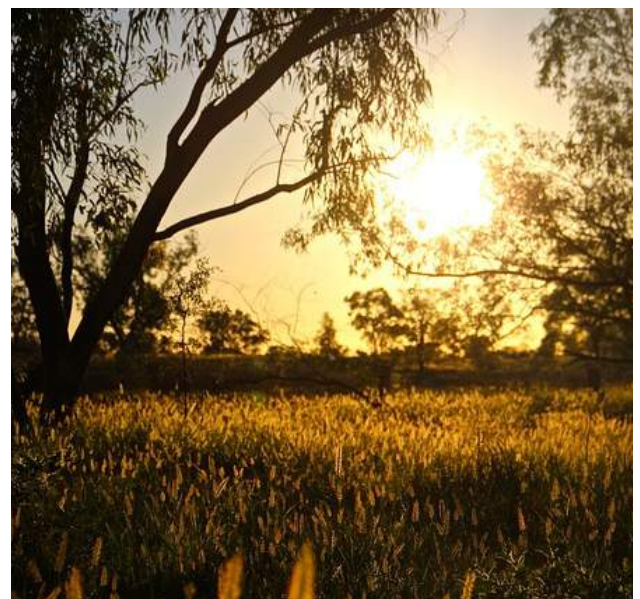
Agricultural communities in the digital age

This research focused on beef producers who comprise a large but not exclusive portion of rural Far North Queensland. While grazing lands comprise 90% of the North Gulf region it is also home to Indigenous people, tourism providers, retirees and primary service providers (e.g. health, education, police). It is also the home of a significant and largely itinerant workforce. In today's fast-paced digital economy, it stands to reason that the FNQ beef industry is at risk of falling behind, and in some cases already is, owing to wide-spread lack of reliable internet access, high cost of digital devices and internet plans, and low levels of digital ability. Failing to capitalise on the opportunities afforded by digital technologies – such as achieving supply chain efficiencies, attracting and retaining skilled workers, and increasing productivity – will make it very difficult for FNQ graziers to compete with tech-savvy operators in the national and international market. The Australian Farmers Federation says their vision for agriculture to be a $100 billion industry by 2030 can only be achieved if there is widespread adoption of agtech in all its forms. In beef production, this includes animal sensors, drones, GIS and much more, which are largely enabled by internet connectivity.

Research commissioned by the CSIRO's 'Accelerating Precision Agriculture to Decision Agriculture' (P2D) program provides deeper insight into the challenges faced by cattle farmers in the digital age. Lamb's (2017, pi) *Review of on-farm telecommunications challenge and opportunities in supporting a digital agriculture future for Australia* reports that "in the period 2010-2014 the notion of telecommunications as a 'critical infrastructure' for rural and regional Australia, and in particular in agriculture has well and truly taken root". Lamb makes several further observations that motivate the present research and echo some of its findings:

- Farmers feel that their existing telecommunications challenges (such as unreliability of services) are not being acknowledged, nor responded to, by network operators or at the industry or national strategic level;

- Owing to lack of access, but also education, farmers are often unable to implement technology solutions to keep up with rapidly evolving market trends; and

- There has been a significant increase in demand for 'second-tier' telecommunications providers that offer their own transmission backhaul capability (and sometimes cloud-based services) to extend existing NBN and mobile telecommunications networks.

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[1]The proportionately older population in many parts of regional Australia can result in some income distortions, as the pension is a fraction of the average income, which can skew the statistics relating to the actual income of working adults.

Also from the P2D program, Zhang et. al. (2017) investigated the needs and drivers for the present and future of digital agriculture in Australia. Namely, a cross-industry producer survey was undertaken in relation to *precision agriculture* (using computers and sensors to help manage in-field variability, usually in cropping) and *decision agriculture* (data-driven approaches to farm management enabled by Internet of Things (IoT), big data, cloud computing, robotics and sensors). Key findings regarding telecommunications infrastructure, on-farm data collection, and attitudes towards data, which are of interest to present research, are as follows:

- The vast majority of respondents (94%) across all forms of agriculture had an internet connection for their business, with landline and mobile phone networks the most prevalent connection options;

- Nearly half (49%) of the respondents did not have any specific on-farm telecommunication infrastructure and had no plans to install;

- Respondents had very limited knowledge about the options available to connect devices on their farm, with 61% of respondents reporting that they knew nothing at all or very little;

- Approximately half of the respondents (53%) relied on themselves to sort out communication needs, including choosing devices and services, and trouble-shooting;

- Among livestock industries, 91% of respondents collected at least one type of data, led by financial data (79%), veterinary medicine record (63%), animal breeding data (57%), and individual animal or herd production data (56%), which were also rated amongst the most useful for on-farm decision making; and

- Respondents were more willing sharing data with other farmers and research institutions, and felt least comfortable sharing with technology and service providers. Furthermore, respondents were more hesitant to share information which involved their farming operations than other data such as weather and soil test data.

Some of the above-mentioned telecommunications and data issues are exacerbated on large remote cattle properties in FNQ owing to specific factors that are revealed by the qualitative approach taken in this research. For example, the reality that half of all farmers trouble-shoot in isolation without help from anyone else has implications for technical knowledge acquisition and learning for the entire household. Namely, in the face of challenges, no one in a particular family would have an opportunity to expand their knowledge beyond what it already known or can be 'figured out' amongst a very limited group. This could have implications for intergenerational digital exclusion. This problem may be further exacerbated by some farmers' suspicion of third parties with whom they do not feel comfortable sharing their data.

Digital inclusion of farmers in Far North Queensland

Having looked at contextual factors that impact rural agricultural communities in the digital age, we now address the 'state of play' for digital inclusion in FNQ agricultural communities by examining several data sets from the Australian Digital Inclusion Index (ADII).

The ADII reveals that rural Australians score lower than average on all three indices of digital inclusion – access, affordability and digital ability (see these and their sub-indices in Figure 1). In 2018 the average Australian scored 60.2 on the ADII, with rural Australians scoring 53.9 (-6.3) and capital-dwellers scoring 62.4 (+2.2). Longitude ADII data from 2014-2018 suggests that this 'city-country divide' is widening.

2018	Australia	Capitals	Rural
ACCESS			
Internet Access	87.1	88.8	82.5
Internet Technology	78.7	79.9	74.8
Internet Data Allowance	54.4	56.5	47.9
	73.4	**75.1**	**68.4**
AFFORDABILITY			
Relative Expenditure	54.3	56.8	47.2
Value of Expenditure	60.9	63.3	53.5
	57.6	**60.0**	**50.4**
DIGITAL ABILITY			
Attitudes	51.0	53.1	45.3
Basic Skills	56.7	59.3	49.6
Activities	41.0	43.8	33.6
	49.5	**52.1**	**42.9**
DIGITAL INCLUSION INDEX	**60.2**	**62.4**	**53.9**

Source: Roy Morgan, April 2017–March 2018

Figure 1: ADII scores comparing the Australian average with capital cities and rural areas.

The research has focused on digital inclusion in rural, agricultural households and communities in Far North Queensland (FNQ). As defined by the Australian Digital Inclusion Index (ADII), FNQ forms part of the North West Queensland region. In 2017, North West Queenslanders scored 45.9, making them the second least digitally included region in Australia (the most excluded was Burnie and Western Tasmania (44.1)). In 2018 the North West's score rose to 52.8 (+6.9) but was still well below the state and national scores of 58.9 and 60.2, respectively.

QLD Regions ADII scores
QLD ADII score: 58.9

Cairns **59.7**

Townsville **58.6**

North West QLD **52.8***

Coastal QLD **52.6**

Central & SW QLD **54.1**

Sunshine Coast **58.3**
City & North Brisbane **62.2**
West Brisbane **64.7**
East Brisbane **63.1**
Gold Coast **59.5**
Outer Brisbane **52.9***
South Brisbane **60.4**

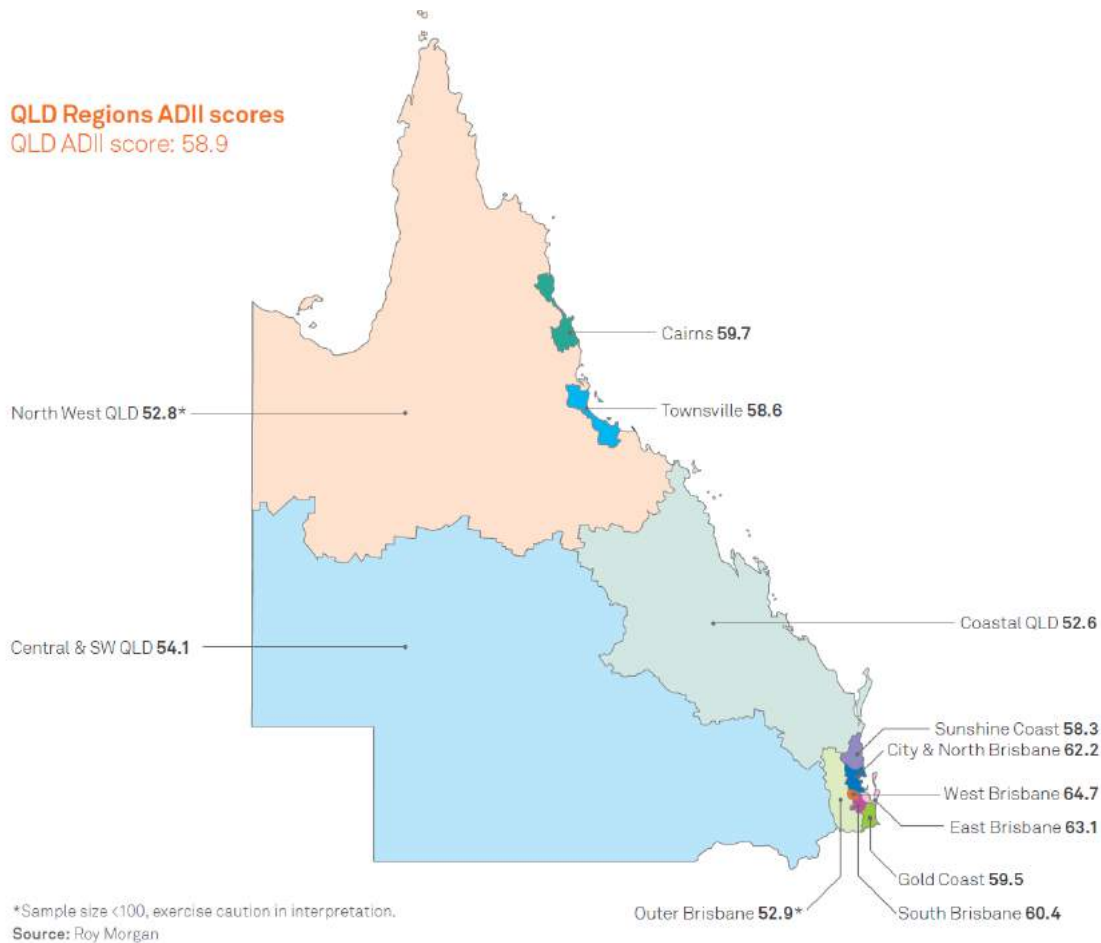*Sample size <100, exercise caution in interpretation.
Source: Roy Morgan

Figure 2: Australian Digital Inclusion Index scores in Queensland, 2018.

Greater insight into digital inclusion in this region – which is predominantly grazing land occupied by cattle farmers – can be garnered by considering digital inclusion scores of Australian farmers and rural Australians side-by-side. In 2017, the average Australian scored 56.5, while rural Australians scored 50.7 (-5.8) and farmers and farm managers scored just 42.5 (-14.0). As shown in Table 1, rural residents and farmers/farm managers – which largely represent the population under investigation - score lower on every measure of digital inclusion: access, affordability and digital ability.

2017	Farmers & Farm Managers (Australia)	Australia	Rural Australia
ACCESS			
Internet Access	72.9	85.3	80.8
Internet Technology	60.9	72.1	67.1
Internet Data Allowance	37.9	51.2	44.5
	57.2	**69.6**	**64.1**
AFFORDABILITY			
Relative Expenditure	37.2	46.8	43.2
Value of Expenditure	37.0	58.5	49.8
	37.1	**52.7**	**46.5**
DIGITAL ABILITY			
Attitudes	36.8	50.1	44.7
Basic Skills	39.4	53.3	46.9
Activities	23.5	38.4	33.0
	33.2	**47.3**	**41.5**
DIGITAL INCLUSION INDEX	42.5	56.5	50.7

Figure 3. Comparison of scores across Farmers, Rural Australia and the whole Australian population.

Other research provides some insight on this digital exclusion of rural farming communities such as those in FNQ. Namely, key findings of the 'Information and communication technology use in Australian agriculture' survey (2018) paint a mixed picture of digital inclusion in agriculture:

- The overwhelming majority (96 per cent) of Australian farmers owned and used ICT assets, and 95 per cent were connected to the internet;
- Farmers used ICT for production activities, internet commerce, obtaining information and household purposes;

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[2] The sample size for 'farmers and farm managers' in the 2018 data was too small to be indicative of the greater population.

- Larger farms were more likely to invest in and use ICT than their smaller counterparts;
- ICT assets represented a relatively small share of total capital assets on most farms;
- ICT applications on farms varied between industries;
- Reported obstacles to adoption of ICT included skills, internet access, cost and availability of useful new technologies. The relative importance of these constraints varied with industry and farm size. For example, a lack of skills was most commonly reported as an impediment by the owners of small farms, particularly those in the livestock industry;
- The availability and quality of internet services influences farmers' access to/use of ICT; and
- Farmers in relatively remote areas using mobile phone or satellite-based internet connections were more likely to report inadequate internet access as an impediment to their use of ICT and to the operation of their businesses more generally.

This is reflective of the disparity between the concept of the 'tech savvy farmer' that is making its way into the mainstream media discourse, and the stark reality revealed in the ADII statistics. One contributing factor may be that the risk/reward trade-off for smaller farmers - where the cost of failure is high for any given investment, not just in technology - may be precluding them from making these investments.

Other findings from this survey give insight into digital inclusion, specifically on large remote cattle farms, which is reflective of the target group for our research. Farmers on large properties who produce vegetables, grains and dairy invest more in ICT infrastructure than large cattle and sheep farms. Across all industries, farmers with mobile and satellite internet connections were more likely to report internet access as an impediment to their uptake of new technologies than those with digital or fixed line connections, suggesting that it is the nature of the internet connection, rather than an industry-specific connection issue, that is causing the impediment to uptake of ICT. Approximately one-third of farmers reported that a lack of skills was a constraint on their uptake of new ICT tools. Lack of digital skills as a barrier to adopting new ICT is most prevalent on beef and sheet farms. Furthermore, acquiring skills or becoming familiar with new technologies is time-consuming and can be a barrier to adoption of innovations, and an important means of acquiring these skills and knowledge is the use of farm advisors and farmer networks (Australian Bureau of Agricultural and Resource Economics and Sciences, 2018).

Taken together, the above-reviewed research suggests that there are contextual factors which impact digital inclusion – access, affordability and digital ability - in rural agricultural communities (like those in FNQ) that require further investigation. This research aims to uncover on-the-ground challenges faced by cattle farmers to become digitally included.

This research aims to provide nuanced, qualitative insights into the type

Methodology

of challenges rural and remote Queenslanders and Australians face when accessing internet and telecommunications, along with the cost and perceived value of such services, and barriers to gaining digital ability to put the internet to work to improve lives and livelihoods.

The target group for this research was Far North Queensland cattle producers, specifically in the Northern Gulf region. As indicated (approximately) by the green area in Figure 4 (below), the Northern Gulf region spans from Mt Molloy in the east (inland from Cairns) and Normanton in the west (on the Gulf of Carpentaria). It includes the following Local Government Areas: Mareeba Shire (part), Croydon Shire, Etheridge Shire, Cook Shire (part), Carpentaria Shire (part) and Kowanyama Shire. Most of this region is grazing lands and is dominated by broad hectare pastoral leases (Northern Gulf Resource Management Group, 2018).

The Cairns Institute partnered with Northern Gulf Resource Management Group (NGRMG), a local community-based NRM organisation working with property owners to balance economic, cultural, and environmental interests in managing land in the region. Between June and October 2018, the researcher shadowed NGRMG's Drought Ambassador at social and educational events across the Gulf Savannah, primarily in Mareeba, Chillagoe, Almaden, Mount Surprise and Georgetown. We also reviewed input and support from A/Prof Michael Dezuanni from the Digital Media Research Centre at Queensland University of Technology.

Figure 4: The Northern Gulf region
(Northern Gulf Resource Management Group, 2018).

Through open-ended interviews, focus groups, participant observation and ad hoc conversations, the researcher gained deep insight into on-farm connectivity setups and how households and businesses rely on and use internet in the bush. The researcher also visited several properties, including Sugarbag Yards, Wetherby Station and Pinnarendi Station which provided the basis for three case studies that accompany this report. Data were analysed using thematic analysis (Flick, 2006) to draw out themes about the lived experience of bush internet and telecommunications in the Northern Gulf.

Findings

Through an iterative process of moving back and forth between the data and policy context (reviewed in detail later), we arrived at the following 11 key findings.

Finding 1: Connection and congestion issues remain

Consumers in rural FNQ connect to the internet using various devices (e.g. mobile phone, desktop computer, tablet) to access various internet services (e.g. 3G/4G, satellite, fixed wireless) through many different providers (e.g. Telstra, Optus, Activ8Me, Habour ISP). Many households employ a complex combination of these digital technologies and services in ways that are largely determined by geographic location. The research suggests two typical arrangements.

Rural households are close to town (within about 5-10km) and generally have 3G or 4G mobile coverage (albeit intermittent/unreliable in places) and/or access to NBN fixed wireless, and sometimes an ADSL connection.

Remote households are situated out of town (sometimes hundreds of kilometres) and are out of proximity to mobile and fixed wireless coverage. People in these regions principally access the internet via satellite and use mobile phones when in range.

Both rural and remote residents expressed frustration with unreliable internet connections, slow speeds, data capping and shaping, comparative cost of plans, and lack of technical support and installation delays, which have previously been documented (by Better Internet for Rural, Regional and remote Australia (BIRRR) and others). These residents also continue to rely on more traditional telecommunications such as landlines, two-way radios and satellite phones/sleeves for day-to-day living and business operations.

Congestion on internet networks (namely, mobile and NBN SkyMuster) during peak times was a recurring point of contention, because it forces consumers to do essential (and non-essential) tasks at unconventional hours. For example, some farmers reported paying wages in the middle of night because the web-based system is inaccessible in daylight hours. Others download Netflix programs when they wake up in the early morning so they can watch them during peak time. This points to a mismatch between the terms and conditions of internet plans and the routine uses of internet in rural and remote households and businesses. NBN Co Limited has, however, recently made some changes to its SkyMuster plans to better meet the needs of rural and remote consumers. In 2017 NBN Co Limited doubled the peak data that service providers can offer to a Sky Muster end users from 75GB/month to 150GB/month, and in 2018 the Sky Muster Plus product was launched, which provides unmetered data for essential daily tasks such as web browsing, email and software updates (NBN Co Limited, 2018).

Finding 2: Consumers 'layer-up' services and devices

Contrary to expectations, the research found that the most disgruntled consumers are often not restricted to the most remote households. In very remote areas where there is no promise of mobile service or fixed wireless, consumers were relatively content with satellite internet, notwithstanding data caps and speed issues. In contrast, rural households on the cusp of towns expressed greater frustration with poor service and higher costs.

More specifically, rural households 'layer-up' on several services - including one or more mobile accounts, fixed wireless, ADSL and landline phones - in the hope that one of them will work at any given time. Rural households therefore often pay for multiple plans which they must access through multiple devices, which also cost money. These consumers also deal with several internet providers because there is no 'one stop shop' for internet service provision (e.g. Telstra does not offer satellite plans). Therefore, not only do rural households generally pay more for less (in terms of data, speed, reliability and service), they do this for several devices with several providers.

This layering-up has been identified, although not explicitly, in other documents. For example, in its submission to the NBN Joint Standing Committee (Report 2) BIRRR proposed that NBN's Fair Use Policy resulted in many regional, rural and remote residents paying for two connections (Sky Muster and mobile broadband) to meet their data needs. Layering-up has also been observed in other disadvantaged populations, such as the disability sector. For example, people in the deaf and hard of hearing community invest heavily in digital technologies that require uninterrupted internet connection and generous data allowances (ADII 2018).

Finding 3: Data is a contested resource

Regardless of the type of internet connection participants had, almost all expressed frustration with data caps, costs, and the times at which data is available. Data is most scarce in remote households with only satellite connection. Unlike the unlimited NBN plans available urban areas, SkyMuster plans are capped and often more than half of the data is only available off-peak times (e.g. 12 midnight to 7am). Under these conditions, data management becomes complex and contested.

Accordingly, rural and remote households must manage their data as a finite resource across several people (e.g. adults, kids, workers, visitors) and priorities (social life, business, schooling). The decision of what internet plan is suitable – and therefore what data package should suffice for household operations – is often at the discretion of the bill payer. If the bill payer does not place importance on digital activities, other family members can be digitally isolated, which may compound their sense of physical isolation. Furthermore, in instances where decision makers lack the will and/or skills to actively monitor use, data can be used up inadvertently - and very quickly - by visitors (family, kids, workers) who may take the Wi-Fi connection for granted.

Rural and remote consumers in FNQ have developed elaborate, frugal and creative ways to allocate and monitor data use over the course of the month. For example, one mother of two said she allocates specific amounts of data to the farm business, kids' education, and social life of the parents, and then allows her kids to "go nuts" on YouTube on the 7th of every month before the new cycle begins (if there is any data left). This highlights another layer of complexity in consumption of bush internet that is often not acknowledged by policy makers.

Finding 4: Critical operations rely on internet services

Agricultural markets, trends, policies, regulation and processes are all changing rapidly, and most of the information, services and products needed to operate and compete in the digital economy rely on digital technologies and internet access. For example, industry updates are published on websites (e.g. Agforce), training videos are posted on YouTube, and animal auctions are conducted online (in tandem with the physical event). Furthermore, government services are increasingly going digital (e.g. myTax).

Accordingly, FNQ cattle producers' need digital connectivity to meet legal and industry obligations. For example, to comply with LPA accreditation requirements in various topics (e.g. biosecurity, livestock transport, animal welfare) farmers must complete online modules, which presents obvious and significant challenges. There are also new vegetation clearing laws in Queensland, whose property and vegetation maps are only easily available online.

The implication of moving these processes online is that producers can become non-compliant. Farmers struggle to gain access to the internet, log in to a suitable device, and navigate the online platforms and complete the training. These problems are experienced to a greater or lesser extent depending on where people live, the types of exposure to digital technologies they have had, and their interest in getting online.

The research also found that some farmers are resisting digitalisation of the National Livestock Identification System (NLIS), which is used to track the movement of cattle nationally and is essential for biosecurity, meat safety, product integrity and market access. Consequent breeches to the NLIS system could have catastrophic consequences for the beef industry and the Australian economy. These findings point to serious concerns of national interest. A breach to biosecurity, for example, could lead to a freeze on the wider movement of cattle.

Finally, lack of connectivity inhibits farmers' competitiveness in both national and international markets. The three case studies undertaken in conjunction with this research demonstrate difficulties farmers facing to maintain, diversify or expand their business. Leveraging communications to achieve any level of progress is essential to prevent decline in population, economic resilience (through diversification) and economic expansion, but ultimately none of these objectives can be satisfied under conditions of poor connectivity.

[3] It is not yet compulsory to have electronic NLIS, may be in the foreseeable future.

Finding 5: The network is essential

Rural FNQ households are increasingly reliant on mobile and internet coverage across properties and between townships for several activities including coordinating school drop off and pick up and responding to emergencies (e.g. vehicle accident or bush fire). Many rural consumers still rely on two-way radios, which require users to be in range and on the same channel. This limits the network of emergency respondents to those in physical proximity to the incident.

The volatility of the mobile networks in FNQ was experienced by the researcher in trying to carry out the project. During data collection in Almaden, Chillagoe and Mount Surprise, Telstra mobile services were often down, sometimes for hours or days (both planned and unplanned outages). This can also be caused by interruptions to power. Unlike in urban areas, critical power and telecommunications infrastructure are also sometimes combined, including reliance on generators which can fail.

Farmers and their families reported that they need to (but often cannot) share Wi-Fi across several devices in the home, workers in the field need to communicate across the whole property (hundreds or thousands of acres), and businesses need to communicate and coordinate from and between townships. However, in many instances, participants could only access reliable internet from their house, making them largely uncontactable if they were in the paddock or on the road.

This highlights that, in so far as internet connectivity is essential to lives and livelihoods, it is the network that is critical. Having an internet-connected PC in the home or office is insufficient, as is mobile broadband coverage in townships separated by enormous black spots. New solutions are needed to supplement on-farm technology to beam Wi-Fi substantial distances from the house, and new means to deliver mobile service that transcend atrial road routes and town boundaries.

Finding 6: Consumers are transient

The research revealed a group of consumers who are almost always in transit. Contract mustering teams – complete with people, horses, vehicles and equipment - move around North Queensland, Northern Territory and Western Australia during the dry season mustering cattle in some of the most remote parts of Northern Australia. Mustering teams of 8 to 10 people - who may be contracted from 2 weeks to 4 months at a time - often include young families, couples, and single men and women of varied ages. These people do not inhabit conventional households during the season; they live and work in camps out the back of large cattle stations, often many kilometres from the homestead.

Telecommunications and internet access for this group is intermittent. Some larger commercial operations provide Wi-Fi hot spots for their staff via a satellite connection, sometimes with a ticketing system for data which is very limited. However, teams often rely solely on a satellite phone for communications with the outside world. In a case of emergency, a satellite phone or a landline at the homestead is used. Contract musterers said that, if someone needs to go into town for supplies during a job, they often take several mobile phones so that text messages can come through.

For many contract musterers, their only means of connecting to the internet is via mobile phone. The Australian Digital Inclusion Index recognises that mobile-only users are at a disadvantage because the functionality of apps on phones is substantially less than full websites on computers (Thomas et. al. 2017). It can therefore be much more difficult for mobile-only users – particularly those who spend large amounts of time out of range – to access online services, such as Centrelink or Medicare.

Persistent lack of internet access (and poor digital skills) can greatly impact individuals and families in these mustering teams - who are seasonal, casual workers - in several ways. First, they may be unable to access essential health services. One participant spoke of her pregnant daughter who was working as a jillaroo on a remote property without phone or internet access. Not only could she not reach her daughter to check on her, but her daughter could not make medical appointments unless the team was in mobile range or she took time off work (unpaid) to travel to the nearby town for mobile phone reception. Second, somewhat ironically, social media is widely used to recruit mustering teams, for example via the Ringers from the Top End Facebook page. Therefore, lack of connectivity directly translates into less opportunity for employment, which has social and economic knock-on effects for individuals and families.

Finally, to obtain the best deal with phones included, these consumers purchase one- or two- year contracts with unlimited data, calls and texts (one participant quoted $130/month). These consumers only use the mobile regularly 3-4 months of the year, but unlimited plans are needed because when they are in range they furiously reconnect with family and friends. The way mobile plans are structured does not accommodate for this heavy use in short periods.

Finding 7: Gender plays a role

In rural and remote households where traditional western gender roles can be prevalent, women often have the responsibility of prioritising domestic resources, which often includes internet. The research found that many rural FNQ women prioritise the needs of the business and children over their own digital connections and opportunities. On the other hand, when there is enough data to go around (usually on properties closer to town and infrastructure) many women thrive through their connections on the internet. For example, during data collection the researcher spoke with several emerging female entrepreneurs from across the Northern Gulf who are attempting (with mixed results) to build businesses online to supplement farming income.

The research suggested that older men, on the other hand, can often demonstrate a disinterest in digital technologies. Many of these men, who have spent their whole lives in the paddock, have had little opportunity to go to school; they therefore can often have poor general literacy, which further inhibits digitally literacy. Furthermore, lack of exposure to digital technologies has meant they can have a limited understanding of the opportunities connectivity could afford families, businesses, communities and themselves. For these men it can be easier to ask other family members – such and their wife or children – to complete essential tasks online on their behalf, including just answering emails. Accordingly, there can also be a potential perception that computer work is "women's work". It is often this necessary exposure to digital activities that provides rural and remote women with the skills and impetuous pursue economic and social connections online.

While the research found that rural and remote men and women experience digital exclusion in different ways, there is little acknowledgement of this in digital inclusion-related policies at all levels (reviewed later on). There are, however, several women's' programs and networks offered at national (e.g. AWiA, NRWC) and state (e.g. QWRRRN, WIRE) levels to support these women, which could be built upon in future policies. NGRMG also supports several local initiatives including a Bush Business program.

Finding 8: Attitudes and abilities vary across generations

Properties in FNQ often house several generations who hold different attitudes toward digital technologies. On many properties, there is a hierarchy of residents: farm owners, their adult children, their kids, and workers. As a rule, farm owners are older and, while they are still active on the farm, have handed much of daily operation to their adult children. These adults – some who have returned to the land after attaining their secondary and tertiary qualifications – have their own school-aged children. Workers may be permanent and/ or seasonal. The different levels of digital ability (or digital literacy) of these consumers adds to the overall complexity of how digital technologies are viewed, acquired, used and maintained.

Typically, farm owners in their 60s and 70s are less interested and digitally literate than their adult children who have been exposed to the opportunities afforded by digital technologies and have acquired the skills to use them, perhaps at university. Some of these adults who have entrepreneurial drive struggle to convince farm owners to invest in digital technologies – such as weigh stations, drones and sensors – particularly in tough economic times where outlay for capital is risky. This can cause tension amongst family members, especially in relation to succession planning.

School-aged children on properties also have varying levels of digital ability, which they acquire at school in town, via school of the air or homeschooling, or through mentoring by their parents/families. Children's capacity to develop digital skills can be impeded by underling issues relating to access and affordability, and some children receive little or no digital mentoring at home. Lack of digital ability will significantly thwart kids' opportunities to work outside the family business or to evolve that business to improve productivity and compete in the digital economy.

There are virtually no digital literacy programs in rural FNQ apart from ad hoc sessions run by regional organisations, community groups and councils. Emerging positive programs have often been limited by short term or episodic funding arrangements. Programs of this kind are usually held in rural centres like Mareeba and Atherton, which means attendees must travel hundreds of kilometres and leave properties unattended in

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[1]The proportionately older population in many parts of regional Australia can result in some income distortions, as the pension is a fraction of the average income, which can skew the statistics relating to the actual income of working adults.

order to participate, which is often not possible. Furthermore, self-led online courses are largely inaccessible because they are too data heavy (e.g. videos cannot be viewed or downloaded), and programs that are readily available to city-dwellers are not often rolled out in remote communities, such as Be Connected and Digital Springboard (although Tech Savvy Seniors was designed to be a regional program).

Participants said they try to teach themselves or ask others to help. However, they are hampered by a lack of fundamental understanding of the logic of computing and the internet, such as how to use a folder structure, browse the web, and populate an online form. If much needed digital ability programs were able to be rolled out in rural and remote areas, they would need to cater to the full spectrum of interest and ability in digital technologies.

Finding 9: Threats to industry reputation

Contentious agricultural issues – such as drought assistance and animal welfare – are often raised and debated in the national (and international) media, including social media. Several participants expressed frustration with the spreading of misinformation about farming practices on Twitter and Facebook, where people from all sectors and walks of life weigh in on agricultural issues. Unfortunately, those at the coal face of the issues often cannot or do not participate in the conversation. Lack of digital access and digital skills excludes many FNQ farmers from participating in the debates that impact them. As such, there is a risk that views can be formed, and decisions made about the beef industry without proper understanding or consultation. Several participants cited the live export ban of 2011 as an example of this.

At a workshop attended by the researcher, Fiona Lake, an outback photographer and activist, suggested that property owners should help protect the reputation of their industry by actively participating in online debate. She further stressed the need for property owners to have social media policies to provide guidance on appropriate sharing of photos, videos, opinions and other content. There is a real risk that a photo posted online out of context (e.g. a calving complication) could go viral very quickly, with damaging social and economic consequences to the reputations of industry, communities, families and individuals.

A key challenge is considering how FNQ cattle producers can acquire the skills to meaningfully and constructively participate online. It should not be taken for granted that people know how to actively manage their social media presence to help steer debate and combat inaccurate stereotypes (e.g. that farmers are uneducated, ultra conservative, environmental vandals, etc.). National and state industry such as the National Farmers Federation (NFF) and AgForce contribute sustainably to public debate and policy making with regard to telecommunications. This research suggests that the role these organisations play as a strong voice for rural and remote farmers is particularly pertinent given that they can't always speak for themselves. There is, however, some disparity between the image of the 'tech savvy farmer' presented by some industry groups and the evidence of this research (supported by ADII statistics) that farmers in rural and remote Australia do struggle with digital skills.
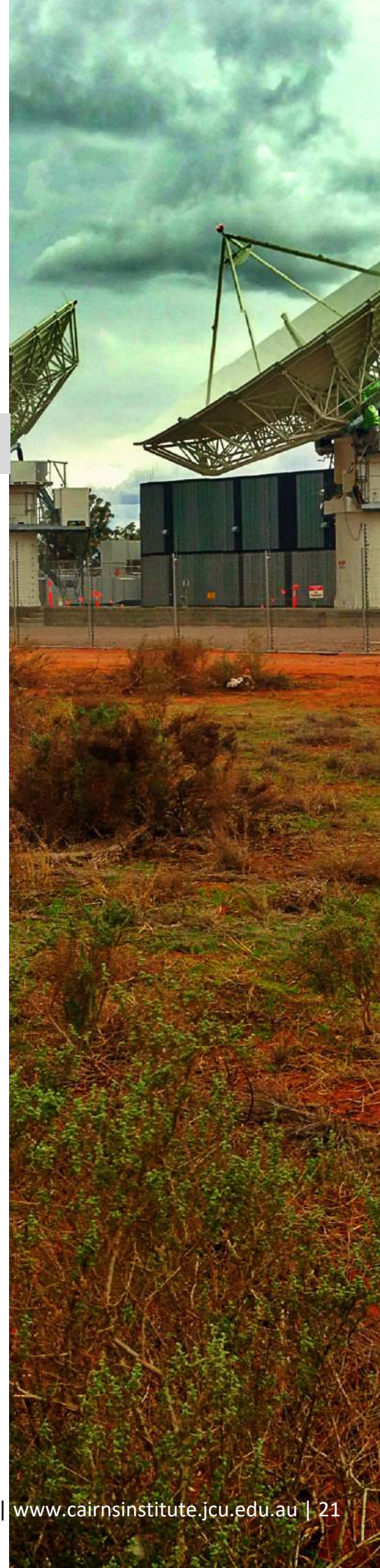
Finding 10: Heterogeneity of consumers

Many reports, policies and programs (including this study) are focused on farmers and farm managers (this is how collect data is collected for the group in the Australian census and ADII). This participant group exhibited some common characteristics that also reflect ABS statistics for rural Australia, such as lower income, lower levels of education, older and of Anglo-Saxon heritage (Australian Bureau of Statistics, 2016).

The research gives more nuanced insight into the diversity of telecommunications consumers (see Figure 5) in rural and remote FNQ. Each group has different attitudes, issues and needs with regard to digital inclusion, which has implications for product and policy development.

GROUP	DEMOGRAPHIC	ATTITUDES	ISSUES	NEEDS
Farming women	Female, middle aged, mothers, high literacy, fair digitally literacy	Thirst for connection, knowledge and skills	Domestic relationships	Places to be and learn Social support
Patriarchs	Older, lower literacy, lower digital literacy	Less interest or capability in technology Don't know what they don't know	Hard to reach They hold the purse strings	Outreach and education Basic digital literacy – the why of tech.
Contract musterers	Young, female and male, single (some families)	Just cope with it (don't know what they don't know)	Social isolation	Persistent connections with family, health care, education, etc.
Entrepreneurs	Young, tertiary educated, high literacy, fair digital literacy.	Keen but frustrated	Hamstrung by lack of connectivity and resistance from property owners (parents)	Further upskilling

Figure 5: Heterogeneity of rural and remote FNQ telecommunications and internet consumers

The research also showed that not all FNQ residents are interested in joining the fast-paced digital world. For some, the internet is a threat to their quiet lifestyle and 'tried and true' farming practices that have sustained them for generations. For example, installation of some small cell 4G mobile phones towers in a very small town (which previously did not have 3 or 4G connection) required some disgruntled residents to spend money upgrading their mobile phones to be able to access the local service (they were happy with their old phones that work on the 3G network when they go into the rural centre).

This more detailed understanding of the needs and attitudes of this heterogeneous consumer group could inform more effective telecommunications policies and service plans.

Finding 11: Consumers expect fairness

Despite the many issues (which have been addressed above), the research found that for a modest household of 2-4 people that uses the internet for basic services only (e.g. email, banking, basic web-browsing), their current connection is sufficient. This positive sentiment has steadily increased over the last few years with improvement to services, notably the stabilization of NBN SkyMuster and the ongoing investment in the Mobile Black Spot Program.

Issues arise, however, when property owners wish to extend their businesses, children's education, or social participation beyond mere survival mode. In particular, participants expressed frustration that the limited data, slow speeds and unreliability of internet prevented them from seizing economic opportunities, including investing in digital technologies, developing local and international markets, and upskilling through (online) training and networking. It also seems that the gradual moving of critical services and processes to online platforms has been undertaken by state and federal government (e.g. myGov) with little consideration for how they can be accessed and used by audiences in rural and remote areas.

Rural and remote residents do not expect the same internet options or services as city-dwellers. In the face of challenges, participants overwhelmingly displayed a culture of "getting on with it" by coping with outages, adapting their working times around on-peak and off-peak times, and actively managing data consumption around the clock. Participants understand and accept that telecommunications infrastructure is difficult and expensive to build and maintain, and that return on investment is difficult for companies to achieve in sparsely populated areas. On the other hand, people think that government has a role to play in ensuring all citizens receive essential services and in educating across the city-country digital divide.

There was, however, a general sentiment amongst participants – particularly those on the fringes of urban areas – that internet service providers promise much but deliver little. Participants reported that telcos (telecommunication companies) often insist that – according to their service maps – there is comprehensive 3G/4G coverage, but in reality service can only often be obtained is certain corners of the house or property. The problem is not only that there are interruptions to connection; it is that when problems are reported, consumers do not always feel believed. Participants also reported that, if they request support, technicians can take weeks or months to arrive.

Overall, the research found that many rural and remote consumers would be content with a restricted service, if it is reliable, affordable, provided value for money, and is comparable to the service quality originally promised to them.

Policy context

Digital inclusion of rural households and communities lies at the intersection of regional development; digital advancement; and agricultural industry. In the age of the digital economy, these areas clearly overlap. For example, the Accelerating Precision to Decision Agriculture (P2D) project was focused (among other things) on facilitating the development of digital technology in Australian agriculture across all levels of government and the economy (federal, state and local).

Key documents (legislation, policies, strategies, whitepapers, reports etc.) have been selected from within this policy context for consideration in relation to digital inclusion in rural Australia in general, and in FNQ agricultural communities in particular (see Figure 6). This is not an exhaustive list of relevant documents, but rather a first cut and generalised cross-section of some of the most current policies that provide the backdrop to the findings and recommendations of this report.

	AUTHOR	DOCUMENT	LEVEL	POLICY FOCUS
1	Australian Government	Legislation and regulation - *Telstra Corporation Act* (1991) - *Telecommunications Act* (1997) - *Competition and Consumer Act* (2010)	Federal	Top-tier legislation that governs telecommunications operators in Australia, and the regulatory bodies that enforce these laws.
2	Australian Government, House of Representatives Select Committee on Regional Development and Decentralisation	*Regions at the Ready* (2018) & *Government response* (2019)	Federal	An independent report and recommendations to invigorate Australia's regions through economic and social development.
3	Australian Government, Dept of Industry, Innovation & Science	*Australia's Tech Future* (2018)	Federal	A nation-wide strategy for embracing digital technologies to advance industry, education, employment and community.
4	Australian Government, Office of Northern Australia	*Our North, Our Future: Whitepaper on Developing Northern Australia* (2015), including Implementations reports (2017 (ink?) & 2018)	Federal	A broad, bilaterally agreed strategy seeking to facilitate the economic development of northern Australia. Its commutations focus is on improving agricultural supply chains, access to health services, and Indigenous-led business.
5	Australian Government, Dept of Regional Services, Sport, Local Government and Decentralisation	*Regional Telecommunications Review* (2018)	Federal	An independent review of the state of telecommunications infrastructure and services in regional, rural and remote areas which canvassed broad input from industry, government, community organisations and advocacy groups at all levels.

6	Australia Government, Joint Standing Committee	*The rollout of the NBN in rural and regional areas (2018)*	Federal	An update on the progress of the NBN rollout in the bush published by the Liberal-National Coalition government of the time.
7	Queensland Government, Department of Agriculture and Fisheries (Advance Queensland)	*Queensland Agriculture and Food Research, Development and Extension: A 10-Year Roadmap and Action Plan (2018)*	State	One of several 10-year industry roadmaps released by State Government to grow business through capitalising on innovation and market opportunities.
8	Queensland Government, Department of the Premier and Cabinet	*Advancing North Queensland Investing in the future of the North (2016), including progress reports (2016 & 2017)*	State	The State Government's strategic contribution to the national Developing the North agenda.
9	Queensland Government Department of Science, Information Technology and Innovation	*Digital1st: Advancing our digital future, Digital strategy (2017-2021) and supporting strategies*	State	A state-wide strategy for embracing digital technologies to advance industry, education, employment and community.
10	Queensland Government, Economic Development Queensland	*Advancing our cities and regions strategy (2019)*	State	A place-based strategy to review, renew and repurpose underutilised and surplus government assets to deliver economic, community and financial outcomes.
11	Queensland Government, Business Queensland	*Advance Queensland (2015-2019)*	State	A multi-year suite of programs and funding to accelerate innovation across Queensland, including the Advancing Regional Innovation Program.
12	Etheridge Shire Council	*Corporate plan (2018-2023)*	Local	A plan for Council to deliver essential services to its constituents in Georgetown, Forsayth, Einasleigh, Mt Surprise and Oak Park, and the Ewamian Indigenous lands.
13	Mareeba Shire Council	*Corporate plan (2018-2022)*	Local	A plan for Council to deliver essential services to its constituents in Kuranda, Koah, Speewah, Biboohra, Mt Molloy, Julatten, Mt Carbine, Mutchilba, Dimbulah, Irvinebank, Watsonville, Almaden and Chillagoe.
14	Croydon Shire Council	*Corporate plan (2017-2023)*	Local	A plan for Council to deliver essential services to its constituents in Croydon and surrounding large cattle stations.
15	Regional Development Australia Far North Queensland & Torres Strait Inc (RDA FNQ&TS)	*Priority areas and goals (2019)*	Local	High-level priorities published on a website in lieu of the outdated RDA FNQ&TS Regional Roadmap (2013-2016)
16	Northern Gulf Resource Management Group (NGRMG)	*Northern Gulf NRM Plan (2016-2021)*	Local	Strategic Plan for Northern Gulf NRM region in Far North Queensland.

Figure 6: Key policy documents reviewed in this report related to digital inclusion in agricultural Far North Queensland.

Federal level policy

Over recent years there have been concerted efforts from the Australian Government to address digital inclusion in rural and remote area, including in agricultural communities. This occurs within the context on legislation and regulation, which is reviewed below.

Legislation & Regulation

In Australia, there are two groups of telecommunications operators:

1. Carriers - those who operate key telecommunications facilities

2. Service providers - those who use carriers' facilities to provide phone, internet services and/or content services, such as Pay TV, to the public.

As shown in Figure 7, these operators are governed by several Acts, including the Telstra Corporation Act (1991), Telecommunications Act (1997), and Competition and Consumer Act (2010). These Acts are enforced by two regulators: Australia Communications and Media Authority (ACMA) the Australian Competition and

ACT	RELEVANT INCLUSIONS	REGULATOR
Telstra Corporation Act (1991)	Universal Service Obligation (USO) Customer Service Guarantee (CSG)	Australia Communications and Media Authority (ACMA)
Telecommunications Act (1997)	Technical and other matters (such as carrier and service provider licensing, and number portability)	Australia Communications and Media Authority (ACMA)
Competition and Consumer Act (2010)	Competition and Consumer Act Part XIB—The Telecommunications Industry: Anti-competitive conduct and record-keeping rules	Australian Competition and Consumer Commission (ACCC)

Figure 7: Relevant federal legislation and regulators.

The Telstra Corporation Act (1991) remains in force today. It includes two key sections in relation to obligatory telecommunications provision in Australia:

1.   The **Universal Service Obligation** (USO) which stipulates that all people in Australia, wherever they reside or carry on business, will continue to have reasonable access, on an equitable basis, to standard telephone services and payphones and that this service should be fulfilled as efficiently and economically as practicable; and

2.   The **Customer Service Guarantee** (CSG) which stipulates that ACMA will hold carriage service operators to performance standards, including ensuring damages are paid to customers for contravention.

The Productivity Commission recently undertook an inquiry (Australian Government, 2017) into the relevance of the current USO (which was developed in the 1990s) to modern Australia. In its response to this inquiry, the Australian Government said there will be no change to the USO until:

- broadband services are available to 100% of Australian premises, on request, at the completion of the NBN rollout in 2020;

- voice services are available to 100% of Australian premises on request;

- any proposed new service delivery arrangements are more cost effective than the existing USO contract (including any transitional costs); and

- a new consumer safeguards framework is in place following a review and associated public consultation process.

This decision – particularly the continued provision of copper landlines in rural and remote areas until reliable voice over internet protocol (VOIP) options are available – was welcomed by significant industry groups, such as the National Farmers Federation.

In relation to mobile phone service, in 2017, the ACCC (which administers the Competition and Consumer Act) decided not to declare domestic mobile roaming because it determined that it would likely not lead to lower prices or better coverage or quality of services for regional Australians (ACCC, 2017a). Such a declaration would have meant that domestic mobile roaming would have become regulated by the ACCC. Once declared, a service must be supplied, on request, to other providers. Instead, the ACCC called for better transparency about network coverage, quality, expansions and improvements, and measures to improve the costs of deploying and improving networks. The ACCC's proposed actions included asking industry to do more, including developing metrics that could be used to provide more accurate assessment of mobile tower performance. The ACCC also proposed that federal and state governments could more adequately deal with competition considerations when designing subsidy programs to expand coverage of or to improve telecommunications networks (ACCC 2017b).

NBN in rural and regional areas

The National Broadband Network (NBN) rollout promised high speed broadband in every Australian household. However, rollout has at time been fraught, particularly in rural and remote areas. Since the NBN company was announced in 2009, successive governments have changed the strategic direction of the rollout, including the technology mix for internet infrastructure. Challenges associated with NBN solutions for rural and remote areas – satellite and fixed wireless technologies – are well documented (See Better Internet for Rural, Regional and Remote Australia (BIRRR). Consumers who switched from the interim satellite situation (ISS), which was shut down in February 2017, to NBN SkyMuster, suffered particularly unreliable service.

In November 2018, the Joint Standing Committee on the National Broadband Network released its second report (Australian Government, 2018e) on the rollout of the NBN in rural and regional areas. Relevant highlights from the report – which were largely informed by submissions from the agricultural industry – are as follows:

- **NBN rollout in regional areas is more advanced than in the metropolitan areas**: 90% of premises outside major urban areas are either able to order NBN services or with NBN construction underway by mid-March 2018;

- **Improvements have been made** in services, and in NBN Co's engagement with stakeholders, over the previous 12 months. In particular, SkyMuster had become much more reliable;

- **Concerns remain about the cost and performance of services**, the reliability of satellite services, and congestion in the fixed wireless network;

- There is concern over limited **visibility in the NBN Co's decision-making process** for delivering satellite, fixed wire or fixed line service for delivery in specific regional, rural and remote locations;

- While the satellite technology was intended to connect the last 3% of remote premises in Australia (400,000 premises), **projected uptake of SkyMuster far exceeds** this because it is also being used to make expensive connections on the metropolitan fringes where installation if the planned technology is proving difficult; and

- There is a **proliferation of alternative arrangements to meet the ever-growing broadband needs** of regional, rural and remote Australia, including strategic partnerships, independent wireless internet service providers (WISPs), and organisations building their own networks or providing third parties access to their existing broadband networks.

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[4] The original NBN plan sought to provide broadband to 97% of Australians.

Regarding this last point, BIRRR (2018, p.4) identifies several NBN access shortfalls that these alterative arrangements aim to overcome, including:

- **(Un)reliability of regional connections** including no 'back-up' or alternative options for consumers during the frequent outages (sometimes caused by poor weather for satellite and power outages for other services);

- **High latency of satellite connection** is causing issues for consumers when they require cloud and remote desktop programs or applications requiring low latency (e.g., VoIP, Skype, telehealth applications, share trading);

- **Lack of information** on alternative or complementary technology, such as antennas, boosters and equipment to improve signal reception; and

- **Delayed repairs** of voice and broadband services due to location.

Further concerns about the NBN in rural and regional areas related to affordability and digital ability were highlighted by BIRRR in their submission the Regional Telecommunications Independent Review Committee (2018):

- **High costs of data when compared to metropolitan connections**, owing to inability to bundle plans due to limited, smaller providers, high cost of mobile broadband due to only one carrier in many areas, no business plans on NBN Sky Muster or ability to purchase more data under the Fair Use Policy (FUP); and

- **Lack of consumer digital knowledge** and independent advice on how to get connected and stay connected, including confusion with telecommunications in the current climate and unawareness of consumer rights under the existing Universal Service Obligation (USO).

The NBN rollout is stated to be on track for completion in 2020. However, the lived experience of 'broadband for all' in the bush has many challenges that are not necessarily known or understood by policy makers.

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[5] The USO continues to guarantee voice (landlines, payphones) services as a backup, but in terms of broadband access and data allocation the USG has yet to be finalised.

Regional Telecommunications Review

Also in 2018, the much-anticipated Regional Telecommunications Review, undertaken by an independent committee, was released. It states that "much has happened since the 2015 review – more than 96% of premises in regional Australia can now access the NBN or have construction underway" and "over 600 Mobile Black Spot Program towers have been deployed" (p.1). On the other hand, "SkyMuster satellite service data limitations, congestion on the fixed wireless network, and poor mobile coverage are creating significant disparities for these (rural and remote) Australians". The review concludes that "if we truly aspire to regional Australia being the prosperous and innovative economic powerhouse it has the potential to be, more needs to be done" (p.3).

Unlike the other relevant policy documents, this Review extends the conversation to include digital inclusion, social inclusion and digital literacy. The Committee makes the following pertinent observations:

- The higher proportion of **low-income households** in regional and remote Australia makes digital **affordability a key barrier** to digital inclusion;

- Governments and industry must **reduce barriers to people engaging with essential services online**, including un-metering data for access to government sites; and

- There is a **crisis of confidence when it comes to using and understanding digital technology**, namely people often lack the knowledge or experience of how to use different technology, what it can be used for, and how to troubleshoot issues.

While these insights are refreshing, the Committee's consequent recommendations are modest, particularly as they relate to 'access to infrastructure' and 'consumer protections'. For example, Recommendation 3 suggests no changes to the USO until a fit-for-purpose alternative voice options for those consumers served by the Sky Muster satellite service (which was adopted by the Australian Government), however, it makes no recommendation as to how voice options could be progressed.

Recommendations related to digital inclusion and digital literacy – where fresh ground could have been broken – are also rudimentary. In particular, Recommendation 10 states that the Government should commit to improving digital literacy in regional, rural and remote Australia by:

- Developing an **online technology 'hub'** to provide independent and factual information to help support people to build up the skills to solve telecommunications issues;

- Deploying **technical advisers on a short-term basis** across regional, rural and remote Australia to provide on-the-ground support to help people get connected and stay connected, using technologies that are suitable to their individual needs; and

- Encouraging the **agriculture sector to provide industry-specific advice** about the Internet of Things and

Developing Northern Australia

The Developing North Australia Whitepaper (2015) was the first holistic strategy to address economic development across Northern Western Australia, the Northern Territory, and North Queensland. Astonishingly, it does not mention the internet or digital technologies anywhere in the full report. In its implementation, however, the Developing Northern Australia strategy has embraced digital connectivity as a means to achieve some of its objectives. The 2017 Implementation Report states that "with CRC support, investors, innovators and businesses will collaborate to apply digital technologies and expertise to solve food, agriculture and supply chain challenges, harnessing for example, sensors, robotics and advanced genetics" (p. 22). Also, recently the Cooperative Research Centre for Northern Australia (CRCNA) – which has been established by the Office of Northern Australia – announced funding for a year-long project for a consortium of universities and industry partners to conduct a 'communications analysis' culminating in a directions paper for digital inclusion in Northern Australia, with a focus on agricultural and health industries. Consequently, the Developing the North agenda presents great opportunities for progressing digital inclusion in rural and remote areas for social and economic prosperity if fundamental access, affordability and ability challenges can be overcome.

Regions at the Ready

Regions at the Ready (2018) is a report in which physical and digital connectivity are addressed together and positioned as integral to almost every aspect of regional development. Twelve principles are proposed for building and sustaining regional Australia that challenge some traditional governmental approaches. Among them are several principles that directly relate to digital inclusion:

- **Regional Australia requires a long term, flexible strategy and commitment to meet the needs of a modern, globally connected and changing environment**. In relation to digital inclusion, this means future-proofing industry by pre-empting the digital infrastructure that will be required into the future (which NBN SkyMuster satellite will not deliver) and upskilling people in the regions to be ready for digital jobs;

- **All Australians should have access to reasonable services including health, education, transport and connectivity.** In relation to digital inclusion, this means making sure people have the affordable access, and digital skills, to reap the benefits of digital government; and

- **The Commonwealth Government has an obligation to create conditions for the private sector to thrive and to invest in regional Australia, including the provision of enabling infrastructure.** In relation to digital inclusion, this means establishing robust digital networks that link the regions to the rest of Australia and the world.

Australia's Tech Future (2018) sets out an ambitious vision for a "strong, safe and inclusive digital economy" that sees "Australians enjoy an enhanced quality of life and share in the opportunities of a growing, globally competitive modern economy, enabled by technology" (p.6). In the report, agricultural industries are said to benefit from adoption of digital technologies, including global positioning systems (GPS), drones, satellite, and blockchain. Furthermore, the report suggests that the ability to access everyday services online (such as myGov and myTax) is particularly important for Australians living in rural and remote areas. The Report further sets out an agenda for how Australia can maximise opportunities of technological change in four categories: people, services, digital assets, and the enabling environment. In relation to the concept of digital inclusion, areas of particular interest include:

- A strong emphasis on **digital skills** development so that individuals and businesses can thrive into the future;

- A commitment to **inclusion** of all Australians in the digital economy, including disadvantaged and underrepresented groups;

- A vision for Australians to have world-class **digital infrastructure** in their personal and working lives; and

- Encouragement of Australians, businesses and governments to use high-quality, well-managed **data** to help deliver economic and social benefits

This is one of the only policies to grasp that digital inclusion – in the holistic sense – is critical to Australia' economic development. However, given current telecommunications and industry-related challenges facing rural and remote Australians, realising Australia's Tech Future in areas like agricultural Far North Queensland could be problematic.

State level policy

Advancing Our Cities and Regions Strategy

Advancing our Cities and Regions (2018) is a state-wide strategy for Queensland to review, renew and repurpose underutilised and surplus government assets to deliver economic, community and financial outcomes. It is one of the state government's new suite of highly collaborative, placed-based strategies that aim to link the efforts of all community stakeholders to improve the social, economic and physical wellbeing of a defined geographical location. This particular strategy focuses on eight 'zones' including: (1) Cross River Rail innovation and economic development corridor; (2) Cross River Rail-related economic development opportunities; (3) South East Queensland urban renewal precincts; (4) Regional cities urban renewal precincts; (5) Health and knowledge precincts; (6) Housing renewal and integration precincts; (7) Queensland renewable energy sites; and (8) Regional liveability precincts.

Unfortunately, Far North Queensland (except for Cairns city) does not feature in any of the government's priority projects. The move to a placed-based approach, however, could be a suitable model for addressing connectivity challenges in rural and remote FNQ. Indeed, as reviewed below, some programs offered by Advance Queensland could be (and in some instances are already) driven by a philosophy of empowering the regions to solve their own context-specific problems with appropriate support from state government and industry.

Advance Queensland

Advance Queensland (2018) is the Queensland government's innovation initiative consisting of "a suite of programs designed to create the knowledge-based jobs of the future, drive productivity improvements and help position the state as an attractive investment destination with a strong innovation and entrepreneurial culture". Advance Queensland was launched in July 2015 with initial funding of $180 million, and funding has been increased to $650 million in 2018. Advance Queensland reports that through supporting thousands of innovators and projects 12,000 jobs have been created across the state.

Of particular relevance to this research is the Advancing Regional Innovation Program (ARIP), which provided twelve non-city regions across Queensland $500,000 each to foster placed-based innovation in their communities. In 2018, the Far North Queensland region established Ignite FNQ, a network of local partners to "connect and empower diverse FNQ communities by fostering innovation to build social, economic and environmental prosperity". Ignite FNQ employs as 'hub and spoke' model whereby innovation support and resources hosted in the 'core' location of Cairns and Atherton are shared in rural and remote areas by network partners in 'outreach locations' such as Port Douglas, Cook Shire and the Gulf Savannah. Ignite FNQ have been active for approximately one year (of three) and its achievements have been modest to date.

Queensland Government Digital Strategy

The more recent 'Queensland Government digital strategy - DIGITAL1ST: Advancing our digital future' sets out a vision for "a government that puts people at the heart of its digital services". The plan is built on four principles: people, collaboration, trust and connectivity. Queensland Government states:

> Queensland is a big state—and the only truly decentralised state in Australia, in which over half the population live outside of the capital city. We need to take a planned approach to build better connections and digital infrastructure for all our communities. This is not an easy problem to solve and it means we need to work with all tiers of government, communities and industry to deliver the best connection solutions for Queenslanders. Current solutions will not support the services that our communities need, nor the connectivity required for our businesses to compete globally (Queensland Government 2017a, p.9).

The strategy reports that in recent years Queensland Government has made progress towards improving digital connectivity in rural and remote areas, including: an audit of digital infrastructure in Queensland and an analysis of future demand; the ongoing Mobile Black Spot Program; and rollout of an optic fibre network in Barcoo-Diamantina region in central western Queensland. The Queensland Government now plans to develop a Digital Infrastructure Plan to guide investment into digital connectivity infrastructure in regional communities, ensuring local issues are incorporated into strategic planning. While these are welcome initiatives, they focus almost entirely on the access component of digital inclusion, and give little attention to affordability and digital ability, which are also crucial for advancing the rural and remote areas.

Advancing North Queensland

In the context of the federal Developing Northern Australia Whitepaper, the Queensland Government has its own Advancing North Queensland (2016) strategy. In the opening remarks of the document, Premier Palaszczuk and Minister O'Rourke state:

> We have heard the message loud and clear. North Queenslanders want to increase the region's connectivity and investment by improving infrastructure—in particular road and water infrastructure—to develop supply chains and address water security. You also told us you want to see more innovation to encourage new industries and make existing industries more competitive (Queensland Government 2016, p.1).

The strategy goes on to name the five priority areas as: roads infrastructure; water scarcity; research and innovation; tourism, trade and investment; and North Queensland Stadium. Where the agricultural industry is concerned, the strategy focuses on drought resilience, food supply chains, and biosecurity. While these are indeed vital areas for development to ensure the future of the North, so too are telecommunications and internet infrastructure, yet there is no mention of them in the strategy. This is surprising, given the opportunities agtech, big data, internet of things (IoT), drones, automation and other digital technologies could provide North Queensland which is predominantly grazing land.

Queensland Agriculture and Food RD&E Extension 10-Year Roadmap and Action Plan

The Queensland Agriculture and Food Research, Development and Extension (RD&E) 10-Year Roadmap and Action Plan (2018) cites increased use of technology as a current strength of the agricultural sector. For example, precision agriculture involving remotely operated sensors, vehicles and robots are already used on Queensland farms for soil and land mapping, decision support and pest management. Furthermore, farm businesses are increasingly engaging in ecommerce. The Roadmap contends that "all of this depends on improving connectivity – which is occurring as the National Broadband Network brings improved bandwidth to rural areas" (p.6).

The Roadmap outlines how the Government is investing in technology-enabled innovation. However, it does not address crucial underlying issues of digital exclusion. Namely, for a significant portion of Queensland's agricultural population such opportunities are out of reach owing to lack of reliable, affordable access to robust internet (including for many FNQ cattle farmers). Furthermore, the broader state-level policy framework does not offer the necessary scaffolding to anchor digital innovation initiatives in local contexts. Overall, with regard to state digital inclusion policy, there seems to be a commitment to investing in digital connectivity and infrastructure, but it fails to consider some crucial aspects:

• State-level investment doesn't always trickle into the regions;

• The specific needs of rural areas are not accommodated in state-wide policy;

• Telecommunications are not treated as critical infrastructure like water or roads; and

• Digital skills are not seen as critical for work skills development.

Local level policy

Local corporate plans

In relation to this study, the corporate plans of three local governments were reviewed: Mareeba Shire, Etheridge Shire and Croydon Shire. As indicated in the shires' stated priorities (see Figure 8), these plans largely focus on developing and maintaining fundamental infrastructure (such as roads and water), managing natural assets, and community cohesion.

MAREEBA	ETHERIDGE	CROYDON
Financial sustainability	Transport infrastructure and road connectivity	Economic development and infrastructure
Community	Potable water and irrigation	Environmental stability
Transport and Council infrastructure	Natural assets management	Corporate governance and leadership
Economy and environment	Equitable social infrastructure	Community wellbeing and resilience
Governance	Communications infrastructure	
	Commercial services	
	Organisational excellence	

Figure 8: Rural FNQ local government stated priorities

Etheridge Shire Council names communications infrastructure as a key priority, naming several strategies as follows.

- Advocate and facilitate the provision of telecommunication services, telemetry and media.

- Review and update the comprehensive asset management strategy to support the maintenance, replacement and enhancement of council's communication assets.

- Maintain radio re-transmission services for Mt Surprise, Forsayth and Einasleigh. Assist 4KZ to introduce local radio services.

- Maintain Council's internet and internal technology capabilities.

- Use appropriate social media to promote civil and respectful discussion and participation in relevant issues.

Croydon Shires also recognises the importance of communications infrastructure to their constituents, as reflected in Figure 9 below.

OBJECTIVE	ACTION	MEASURE
1.10 Telecommunication services are fast and reliable and there is equitable access to information and communications technology	1.10.1 Lobby to ensure telecommunications infrastructure and coverage is continually upgraded to provide reliable emergency, business and social communications 1.10.2 Programs to enhance access to internet services are delivered	• Increased coverage and reliability of telecommunications during wet season, disaster events and emergencies • ABS data showing increased percentage of households with internet access • Council's community and visitor facilities provide public internet access opportunities

Figure 9: Croydon Shire Council's telecommunications-related objective, actions and measures

Finally, Mareeba Shire refers to digital connectivity is relation it its Transport and Council Infrastructure priority area as follows.

• Sustainable infrastructure for the future will be realised through supporting and improving Council's business performance using appropriate information and communication technologies

• A safe and effective transport network will be realised through advocating for improved and enhanced connectivity through the State and Federal governments.

While these three local governments recognise the need for digital connectivity, they do not position it as a broad enabler of economic and social development. Rather, internet and information and communications technology (ICT) are seen to be standalone assets to be maintained in their current form and/or advocated for at the state and federal level. The lack of self-determination of these local governments in relation to digital connectivity points to recommendations at the conclusion of the report and opportunities for further research, investment and programs.

Regional development plans

The relevant Regional Development Australia Board (RDA) and Natural Resource Management (NRM) groups also play an important role in community-level policy and strategic direction in FNQ.

While RDA Far North Queensland & Torres Strait's Regional Roadmap (2013-2016) is now outdated and to be revised, the organisation's website lists its 6 priority areas as:

1. **Economic vitality** by fostering a diverse, prosperous and resilient economy

2. World class sustainable natural and cultural resource management through regionally-agreed targets and adaptive management

3. **Visionary and enabling built infrastructure** that strengthens culture and economy while minimising ecological impact

4. **Inclusive planning and delivery of community services** to improve equity between southern Australia and the FNQ&TS region

5. **Empowered people through knowledge and skills** that attract and retain workers and investment from across northern Australia and the Asia-Pacific

6. **Reconceptualising regionalism** to create appropriate solutions and bring decision making to home turf.

Interestingly, these priorities did recognise internet connectivity, and other programs suggest that digital inclusion has been seen as an important aspect of infrastructure and service delivery. In 2015 the RDA established and championed the establishment and operation of the successful Dive Into Digital program in the region. The program was only able to survive within a limited funding window. Figure 10 shows that these priorities pertain to the three shire councils mentioned above.

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[2]The sample size for 'farmers and farm managers' in the 2018 data was too small to be indicative of the greater population.
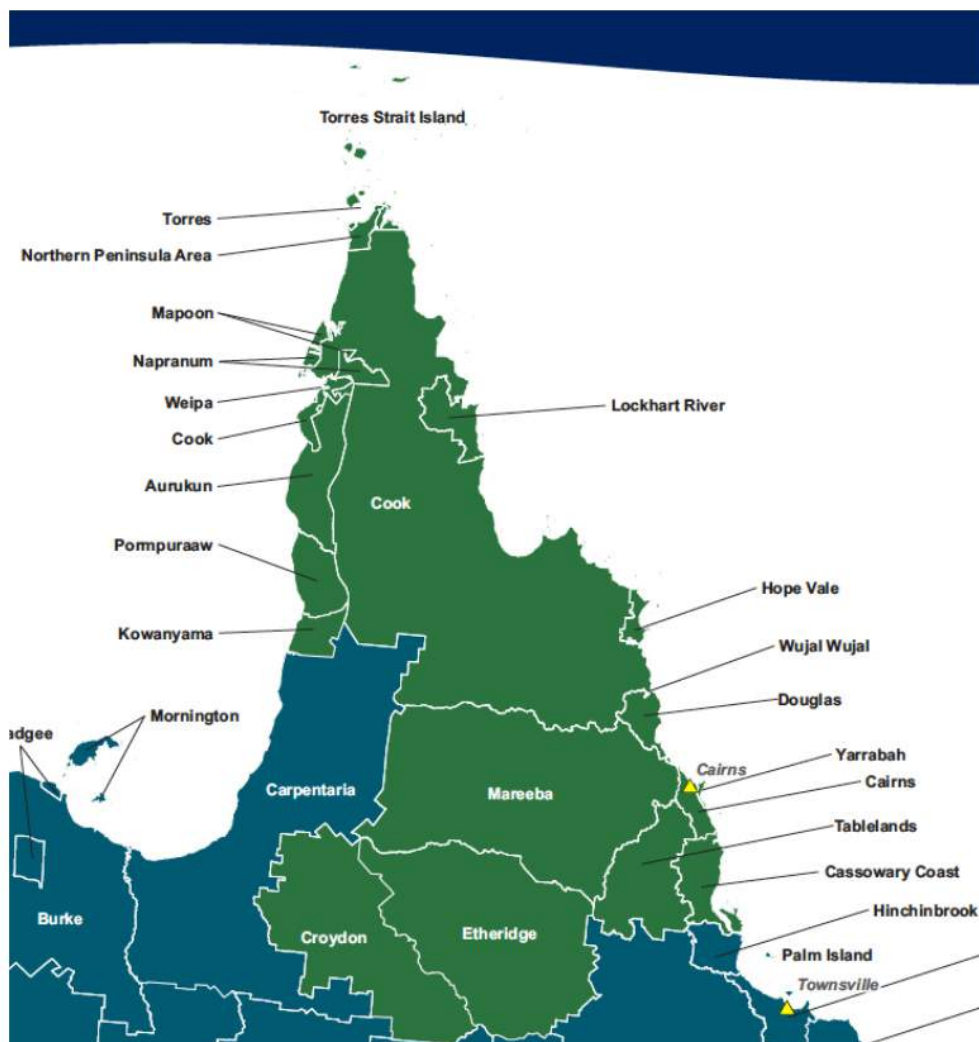
Figure 10: RDA FNQ&TS incorporates Croydon, Etheridge and Mareeba Shires in the Northern Gulf

Northern Gulf Resource Management Group's NRM Plan (2016-2021) divides its strategy into three sub-regions: Northern Tablelands, Gulf Coast and Grazing Lands which is by far the largest and most relevant to this research. Priorities for the grazing lands include drought resilience, sustainable land management, biosecurity, fire, emerging economies, biodiversity, Indigenous values, education and water resource development. Like other plans reviewed above, internet connectivity and digital ability are integrated with other priorities rather than as standalone focus area (e.g. remote sensing and GIS will be used to support biosecurity and biodiversity efforts). Having said that, this NRM group lists one-on-one GIS training, for example, as a means to upskill farmers and help ensure the success of strategic activities.

The above-reviewed cross-jurisdictional plans of councils, the RDA, NRM groups and others (e.g. FNQ Regional Organisation of Councils) are linked but not particularly well coordinated in the absence of any over-arching reginal planning framework within FNQ. In its Far North Queensland Regional Plan 2009–2031, the Queensland Government sets out its coordinated, comprehensive plan for: natural environment, regional landscapes and natural resources, strong communities, urban development, economic growth, infrastructure, water management and transport. While this plan aims to resolve conflicts between state and local planning policies at a regional level, its approach to telecommunications is that its hands are tied. It states:

> The Australian Government has principal responsibility for the policy and regulatory environment of the telecommunications industry. State and local governments are constrained in the range of actions available to them to influence investment in telecommunications infrastructure. The regional plan has a limited role in this regard (Queensland Government, 2009, p.112).

Broad analysis of the Policy Context

The above review of telecommunications policy in rural and remote areas – particularly agricultural communities – reveals some trends and issues that will be revisited in the findings and recommendations of this report.

1. There is a strong focus on federal policy that does not necessarily 'trickle down' to consumers in rural and remote areas. Furthermore, there are comparatively far fewer subsidiary policy approaches at state, regional and local levels, which may contribute to lower levels of digital inclusion in agricultural regions.

2. There is a tendency towards monopolistic, nationally developed infrastructure systems, such as the Telstra network and the NBN. Even though these services do not meet the connectivity needs of all Australians, it is difficult for other operators to compete in order to meet that need. We note, however, that a free-market solution would pose other service and financial risks, and that regional, rural and remote telecommunications is subsidised in various ways (e.g. Telecommunications (Regional Broadband Scheme) Charge Bill 2017).

3. There is little policy and service delivery focus on lifting digital capacity (with the exception of Australia's Tech Future, 2018). There seems to be an assumption that digital innovation (such as agtech) will naturally flow from improving the connectivity of infrastructure. This, however, will not be the case if digital ability - critical sills to make effective use of the internet - is not strategically addressed.

4. Local governments and other key regional organisations do not always highlight digital connectivity as a strategic priority. While other infrastructure (e.g. roads, water) and capacity-building efforts (e.g. employment, education) is vital, it is essential that internet-enabled opportunities are equally factored in these plans.

5. There is a disconnect between federal, state and local level policies related to digital infrastructure provision and inclusion. As this report will argue, there needs to be a coordinated strategy and approach across all levels of government to address access, affordability and digital ability and rural and remote Australia. This includes thinking about novel ways that governments can partner with industry to devise new solutions.

Policy discussion and recommendations

We now present further discussion of digital infrastructure and inclusion policy in rural and remote agricultural Australia, and based on this research, provide recommendations for reform across all levels of government, in conjunction with industry and community organisations, under the three pillars of internet access, affordability, and digital ability.

Internet access

Not surprisingly, most policy progress has been made in relation to internet access in rural and remote Australia. The Australian Government's current policy stance – as it relates to rural and remote consumers – is summarised in Australia's Tech Future (2018):

- The newest version of the USO retained the requirement for landlines and payphones to be provided in remote areas;

- A new Universal Service Guarantee (USG) will ensure all Australians have access to voice and broadband services into the future, regardless of their location;

- The Mobile Black Spot Program is being enhanced; and

- The Government is working with NBN Co Limited to design new products using the Sky Muster service for those groups with particular needs in regional and rural Australia, including enterprise satellite services to support business applications, mobility solution, enhanced services such as multicast, and Wi Fi solutions for remote Indigenous communities.

Our policy review has revealed that local governments, through their corporate plans, are seeking to substantially advocate for further advancements to be made at the federal level, as they have little control of or influence on the telecommunications infrastructure and services that impact local communities. State Government, with access to more funds and resources, has a role to play in helping to bridge the gap between national infrastructure and under-resourced, isolated communities. This leads us to Recommendations 1 and 2.

Recommendation 1: Improve basic infrastructure and services at local scales

NBN Co Limited and telecommunications companies operating in rural and remote areas need to continue to strive to improve existing services to better meet the growing demand and fill gaps in the market. Furthermore, as part of the federal government's economic and social planning, we need to invest in next generation digital infrastructure (e.g. 5G) that can support emerging technologies (e.g. virtual reality, self-driving vehicles) to future-proof industries such as agriculture.

Incremental steps are already being made to find alternatives to the existing services, but more could be done. The NBN Joint Standing Committee's (Report 2) Recommendations 1, 2 and 7 suggest that NBN should expand its 'Layer 3' capabilities to better utilise satellite and fixed wireless capacity and improve the customer experience, including increasing monthly satellite data allowances (which has somewhat been addressed already) and better traffic management systems. Further, Recommendation 14 pertains to identifying and better servicing consumers of the cusp of satellite and fixed wireless services. We recommend adoption of these recommendations, and more.

Despite incremental improvements, rural and remote communities must largely work within existing infrastructure and find ways to leverage and improve the quality of overall services and the network. Local councils can do their part by prioritising internet access, as means to social and economic participation, in their corporate plans. Then they can demonstrate alignment to similar priorities of regional, state and federal level government and industry decision makers.

Relatedly, more needs to be done to provide a more comprehensive overview of the infrastructure and services that are already available in order to identify and fill gaps. Our research did not reveal much public information about all the telecommunications services in (rural and remote) Australia. We did, however, note that in the interests of bolstering competition in Australia's free telecommunication market, the Australian Government has developed a Telecommunications Development Map for carriers to identify who is servicing a new development. However, it does not detail coverage, only the footprint of physical infrastructure.

A one-stop helicopter view of all services available to consumers in particular locations would help individuals, industry and government to assess and address service shortages. This would be of particular use to small, nimble service providers (e.g. Habour ISP, SkyMesh, Activ8Me) who are filling gaps in the market not met by large telecommunications companies ('telcos'), further promoting healthy competition and helping future-proof telecommunications in remote areas. Indeed, we support the NBN Joint Standing Committee's Recommendation (Recommendation 8) that non-NBN carriers explore opportunities with NBN Co Limited to provide cost effective access to existing fibre backhaul with the aim to reduce current and future congestion on fixed-wireless cells.

We further support policy at all levels (federal, state, regional and local) that aims to facilitate joint ventures (between public and private sectors), that are established in local contexts to solve local problems, thereby minimising reliance on a single source for infrastructure development. This could include investment in digital technologies, user-centred design, and reusable components, which are at the heart of innovation in service delivery.

Recommendation 2: Embrace alternative connectivity infrastructure

To fill further gaps in existing service, investment should be made into alternative, innovative connectivity solutions that are reliable and cost effective in rural and remote areas. The standardised offerings of NBN Co Limited and large telecommunications companies are not meeting the needs of rural families and businesses right now. Yet the 'free market' does tend to be dominated by these same operators.

Some rural and remote communities have already invested in their own telecommunications infrastructure. For example, farmers have partnered with the WA state government to connect 50 properties within a 100km radius to the NBN fibre optic network though a base station. Smaller scale, relatively cheap alternative technologies that can also make a difference include on-property towers that can harness internet services from neighbouring towns and/or provide on-property networking of sensors, cameras, testers and devices (e.g. St George, South East Queensland).

Further investment could also be made into Long-Term Evolution (LTE) technology which distributes and amplifies existing connections (such as satellite) over greater distances (e.g. LTE trials in WA). These solutions may not support data-hungry big data, IoT and precision farming in the long term, but they will support basic on-property connectivity to enable localised networks that will support critical operations and safety. Finally, the research showed that DIY improvements to connectivity (such as Yagis) are often ineffective in remote areas and cause more frustration for consumers.

Our recommendation is that the Queensland Government should increasingly establish partnerships with regional and local communities and industry to analyse, plan for, and devise specific, place-based connectivity solutions. The optic fibre network in Barcoo-Diamantina region in central western Queensland is a great start or emergent example. Queensland Government also intends to undertake due diligence assessment of the viability of providing access to spare capacity in its own optical fibre network. There is also opportunity to employ the state government's placed-based approaches to find more innovative ways to overcome challenges associated with fragility of energy and telecommunications infrastructures and services in remote areas[6].

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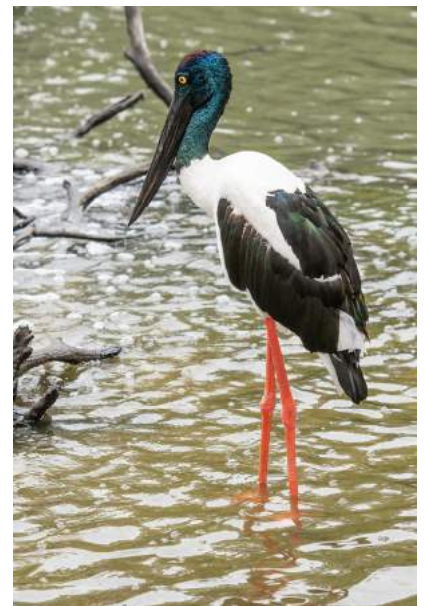
[6] The co-dependency of energy and communications is emerging as an issue more broadly in Australia as part of the switch to NBN. Previously the copper network worked without relying on the energy grid, but this is no longer the case in some instances due to technology changes.

Affordability

Less attention has been paid to how we might produce better affordability policy. Recently, ACCAN (2019) shone a light on affordability issues through its #netnecessity policy and campaign. It contends that there are "one million Australian households that are at risk of not switching over to the NBN because of the cost. This limits the opportunities of these households, and threatens the underlying economics of the NBN, by reducing take-up of services".

The Regional Telecommunications Review (2018) also addressed affordability issues. It states that "the concentration of low-income households in regional, rural and remote Australia makes digital affordability a key barrier to digital inclusion and a major cause for concern" (p.62). In particular, the Review made comment on the high costs of mobile phone and data plans that rural businesses often rely upon.

The additional costs of running a business in regional Australia can be significant. Although there is national pricing for mobile plans, for those people in areas of marginal mobile coverage, the additional costs of equipment that can legally help to improve mobile signal strength can be a significant burden or, for many, is simply unaffordable (p.46).

The present research, however, pointed to further problems with how affordability is defined for research and program development. Namely, current understandings are somewhat mismatched with how affordability plays out on the ground in rural agricultural households, leading to the following recommendation.

Recommendation 3: Redefine affordability at the federal level

We need to redefine and better support affordability to include the 'layering up' phenomenon when developing telecommunications policy at all levels and doing research. Current methods to determine affordability do not accurately depict the true cost and value for money of digital connectivity in rural areas. For example, the Affordability sub-index of the ADII has two components: Relative Expenditure (share of household income spent on internet access); and Value of Expenditure (total internet data allowance per dollar of expenditure). These measures do not, however, include the cost to purchase and maintain hardware and software for the several devices that are necessary to access 'layered up' services. Nor do they factor in the cost to businesses of delayed or lost opportunities owing to unreliable or inadequate internet service.

Furthermore, as affordability is intrinsically linked with competition in the market, telcos could incorporate more localised understandings of how telecommunications is consumed, and what constitutes value for money, for rural and remote consumers into their products and services. For example, they could offer mobile plans for intermittently heavy data users (e.g. contract musterers) who are out of range for large periods of time. This could also be factored into legislation that governs competition. Also, subsidies could be made available to particular industries, such as agriculture and health, to reduce financial barriers to establishing robust connections.

Digital Ability

Digital ability is beginning to receive attention from state and federal governments. For example, at the community level, the [Be Connected](#) program helps older Australians participate in their communities, including in the workforce, by improving their digital confidence, skills and online safety. At the industry-level, digital innovation programs are being offered by the state and federal governments. For example, [Innovate Queensland](#) "delivers workshops, webinars, collaboration activities and My Innovation Advisor consultation services that help innovative small to medium enterprises (SMEs) to develop the skills, knowledge and networks required to commercialise new products and services, develop winning business strategies and grow".

These programs, however, often do not 'make it' into regional, rural and remote areas, perhaps because they are more difficult and expensive to rollout. While Be Connected has funded several remote community groups to deliver digital ability programs, questions remain as to the applicability of resources created for urban areas to rural and remote audiences, and the capacity if locals to deliver them. Furthermore, the accessibility of the Innovate Queensland webinars and their applicability to rural and remotes SMEs may be questioned.

The research gave nuanced insight to low levels of digital ability in rural and remote areas, particularly in farming occupations. It showed how that these populations have varying attitudes to technology (e.g. its value and place in rural life), exposure to literacy and e-literacy skill development (e.g. school-based and adult education, including self-directed learning), and means to apply digital skills in their immediate context (e.g. ability to access and invest in digital technology). This gives rise to the following recommendations.

Recommendation 4: Deliver targeted digital capability building programs

We need targeted digital ability programs to be delivered in rural agricultural communities that meet the specific needs of households and businesses. By targeted, we mean they should be delivered in local places, by local people, on local topics.

At a federal level, programs like Be Connected need to be accompanied with rural and remote rollout plans that cater to the unique and specific challenges of bush internet consumption. They should also be delivered in situ, such as libraries or town halls on the Savannah Way (e.g. Chillagoe, Georgetown, Mount Surprise) and facilitated by familiar community organisations (e.g. Gulf Cattleman's Association). Furthermore, these digital ability program rollouts need to be adequately resources and funded, and fully integrated in the regional plans, and not left up to local councils and organisations to adapt to their needs.

The Regional Telecommunications Review's (2018) Recommendation 10a of an online technology 'hub' to provide information to support people to build up digital skills to solve issues duplicates existing resources (e.g. BIRRR) and does not address the core barriers to digital ability uncovered by this research, such as poor general literacy and lack of interest in technology. Furthermore, Recommendation 10b suggests that technical advisors should be deployed (presumably from urban areas) in a short-term basis to provide on-the- ground support is also a flawed plan. Rather than building local capacity to leverage digital technologies in the long term, it will provide one-off trouble shooting support only.

The research showed that some digital ability workshops are being conducted in an ad hoc fashion in FNQ. For example, NGRMG has partnered with Mareeba Shire Council to deliver Bush Business (a rural entrepreneurship program). However, a more strategic, informed and resourced approach is needed to address complex digital ability challenges in rural agricultural communities. In particular, we suggest that industry and advocacy bodies (such as NFF at federal level, Agforce at state level, and Gulf Cattleman's Association at local level) partner with communities to develop and deliver digital literacy programs that are founded in immediately useful knowledge and skills. This is already happening organically in places, but more scalable programs are needed.

Recommendation 5: Develop digital mentors, support brokers and upskill remote workers

In tandem with digital ability programs, digital mentors need to be recruited, developed and supported in rural and remote communities. These digital mentors could perform both formal and informal mentoring, including on-on-one and group sessions. Digital mentoring is a growing practice in urban areas (e.g. the Australian Seniors Computer Clubs Association has over 140 computer clubs across Australia). However, again, these programs have largely failed to trickle down into rural and remote areas. We recommend that the state government help facilitate partnerships between local communities and industry whereby people already visiting rural and remote areas are upskilled to incorporate the internet and technology into discussions they already have with property owners. For example, Landmark consultants could assist clients to access online weed management databases and help people apply for permits or grants online. The research showed that this is already happening in a limited way in FNQ, but upskilling remote consultants on a broad scale is needed for effective digital capacity building. Digital mentoring is also occurring more broadly in the state of Queensland, and could be further expanded into rural and remote areas.

At this local level councils and organisations could employ staff and/or volunteers to mentor their peers in topics and skills that matter to their constituents, for example accessing essential government information (e.g. Landmark weed management tips), using social media for business and social life (e.g. advertising for workers on Facebook), and staying abreast of industry news and trends (e.g. reading NRM newsletters). Librarians, rural financial counsellors, drought ambassadress, NRM workers and post office workers could help others in their communities to access and use digital technologies to assist them in everyday life.

There is also a role for education providers to play in preparing remote workers for using digital technologies day-to-day and assisting others. More broadly, digital skills are now essential to be competitive in the job market, including in agriculture, and should form part of any rural-based skill-provision service.

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[1]The proportionately older population in many parts of regional Australia can result in some income distortions, as the pension is a fraction of the average income, which can skew the statistics relating to the actual income of working adults.

Overall digital inclusion

Recommendation 6: Empower rural local governments and community organisations to plan and deliver

This research has demonstrated that rural and remote households and communities face specific challenges and opportunities in relation to digital inclusion. Local governments (and community organisations such as chambers of commerce, country women's associations, and advocacy groups) are best placed to understand and support locals to overcome barriers to access, affordability and digital ability, but are vastly under-resourced compared to state and federal governments.

The state and federal government could work with regional and local stakeholders to devise a Rural and Remote Digital Inclusion Strategy. Adopting Queensland Government's placed-based approach, this strategy could be developed to assist small rural councils to best support their communities towards digital inclusion, linking community leaders (e.g. councillors) with resources for access (including alternative/complementary infrastructure options), affordability (supplier options/offerings in rural areas), and digital ability (relevant to rural populations). It could also provide a template for effectively partnering with industry and advocacy organisations.

This strategy could be developed in conjunction with other state and federal policy, programs and funding designed to support regional development, for example, the Regions at the Ready's (2018) call for Regional Development Australia (RDA) Committees. Namely, its call for development of a coordinated regional strategic plan (Recommendations 2), and for the Federal Government to strengthen the role of the RDA program.

Finally, local governments could be supported to help establish a network within the Northern Gulf and/or broader FNQ region to pursue greater digital inclusion for rural and remote farmers. Perhaps facilitated by Ignite FNQ (FNQ's ARIP program), this FNQ digital inclusion network could enable people to share resources, programs, knowledge and tips specific to the unique needs and issues facing FNQ residents. This digital network could be established in tandem with existing relationships between organisations and link in with existing state and national advocacy groups such as BIRRR.

Recommendation 7: Principles for a holistic digital inclusion policy

A holistic, cross-scale approach to policy making is needed to make meaningful improvements to digital inclusion in rural and remote areas. The above recommendations address specific gaps in the existing policy context, within our current understanding of digital inclusion. What is needed, however, is fresh approach that recognised the critical role of digital inclusion in regional and industry development. As a first step towards such a unified approach, we propose seven principles for digital inclusion policy making in rural and remote Australia, particularly in agricultural communities, across all levels of government and into other sectors such as industry and education.

1. **We need people in rural and remote areas** – Policy makers, industry representatives and everyday citizens should recognise that Australia needs people to live and work in rural and remote areas, including very hard-to-get-to places. Rural and remote residents feed the nation, contribute significantly to GDP, and help to define our national identity, and they need to be supported and incentivised to stay.

2. **Telecommunications are an essential service** – Decision makers need to truly accept that competing in the digital economy without connectivity is akin to trucking cattle interstate without highways. Where we need people and industry, we need roads, water, power and internet, and they must be affordable. Telecommunications are also essential for attracting and retaining a skilled and younger workforce.

3. **All Australians have a right to digital citizenship** – Digital connectivity is not just an economic imperative, it is social one. All Australians have the right to access services and participate in civic life, which nowadays is principally achieved through the internet. Furthermore, we must prioritise digital inclusion in the bush as a means to overcome various forms of social disadvantage that are prevalent in rural and remote areas.

4. **People deserve to get what they are promised** – Rural consumers do not expect unlimited data and fast internet speed that many city-dwellers have come to take for granted. But these consumers deserve to be told the truth about their internet options and for the chosen option to be delivered upon.

5. **Most (but not all) want to be connected** – We should seek to understand what rural and remote farmers want and need from internet connectivity, and respect the varying extent to which people wish to be connected. Governments should ensure people receive the education and options necessary to make informed choices about if and how they connect to the internet.

6. **Digital skills are key** – Affordable access to internet services needs to be accompanied by digital skills so that people can put the internet to work to improve lives and livelihoods. Digital skills programs and resources need to be tailored to individuals' needs and be delivered in communities, by communities.

7. **Prioritise the network, not just connections** – A single point of connection in remote house provides limited scope for internal-based activities. The power of digital participation is in real-time and sustained connections being made across distance, so that people can be responsive to opportunities and challenges.

8. **Blanket policies for regional, rural and remote areas are insufficient** – Rural and remote consumers are not a homogenous consumer group. As the research found, farming households and communities experience specific challenges to digital inclusion because of their culture (e.g. work ethic, gender roles), not just their geographic location.

These principles somewhat echo the ethos of the Regions at the Ready report which we feel provided one of the most inclusive conceptions of digital inclusion in the policy landscape. Not only did it address physical and digital connectivity side-by-side as essential infrastructure and services, it treated digital inclusion as an integral to all aspects of life in the regions. It also provided compelling evidence that investing in digital inclusion in rural and remote areas – and taking a holistic approach to doing so – will improve social and economic outcomes for Australia more broadly.

All seven recommendations are summarised in Figure 11.

	ACCESS	AFFORDABILITY	DIGITAL ABILITY
FEDERAL	*Recommendation 1:* Improve basic infrastructure and services	*Recommendation 3:* Redefine affordability at the federal level	*Recommendation 4:* Deliver targeted digital capability building programs
STATE	*Recommendation 2:* Embrace alternative connectivity infrastructure		*Recommendation 5:* Develop digital mentors, support brokers and upskill remote workers
LOCAL	*Recommendation 6:* Empower rural local governments and community organisations to plan and deliver		
	Recommendation 7: Principles for a holistic approach to digital inclusion policy		

Figure 11: Recommendations for digital inclusion in rural, agricultural communities

Limitations

Through the data collection and analysis, several challenges were encountered that point to limitations of the study and opportunities of future research.

1. Limited reference to health services, including telehealth and mental health.

In conducting the study, the researcher took an open approach to engaging people. Interview questions were opened ended, allowing for participants to discuss what they felt was important, rather than having the research agenda imposed upon them.

Few participants expressed concern that lack of affordable access or digital skills prevented them from attaining medical services (except for in emergency situations). Furthermore, telehealth – which is available in some rural health clinics – did not feature in conversations with people. This is surprising, given that mental health in rural areas is an area of concern for governments (Queensland Government, 2017b).

Research (Bradford, Caffery & Smith, 2016; Moffatt & Eley, 2010) about telehealth in rural Australia has already been undertaken. Queensland Health also has a telehealth service and portal which can be accessed from rural clinics and from people homes. Perhaps, however, these interventions are not reaching some FNQ cattle prodcuers, who are amongst the most remote and difficult to reach. There are therefore opportunities to investigate how to better connect these populations with. This could lead to recommendations about psychological access, particularly for those who are at risk of being left behind.

2. Lack of Indigenous engagement

While some of the farming families or workers may have identified as Aboriginal or Torres Strait Islanders, Indigenous populations were not the focus of the this research. Indigenous communities are an important remote Australian consumer group that has received some attention from researchers and policy makers in relation to digital inclusion. As the Northern Gulf area is primarily occupied by graziers, Indigenous participants in the research were incidental to data collection methods.

Policies addressing digital inclusion in rural and remote areas necessarily should include how to best support Indigenous communities to get connected and use the internet to improve their lives. Such strategies, such as the Regional Telecommunications Review's (2018) Recommendation 8 of an Indigenous Digital Inclusion program, should be developed in conjunction with policy and programs as recommended by this report.

Conclusion

This research has exposed some of the underlying barriers to affordable access to reliable internet and low levels of digital ability amongst some of Queensland and Australia's most digitally excluded consumers. It has also given insight into the lived experience and impacts of bush internet that may not be known or understood by policy makers. Overall, this research has highlighted a disjointed approach to policy making at all levels of government. This has led to some of the key finding of this research in relation to access, affordability and ability:

- There are gaps in internet service provision owing (in part) to ad hoc infrastructure installation by multiple and sometimes competing stakeholders;

- There is a narrow understanding of affordability that does not the capture the reality of bush internet experiences; and

- There is deep lack of digital capacity and ability building initiatives that are desperately needed for rural and remote residents to participate in today's digital world across business, education, health, and social and civic life.

Taken together, the recommendations call for a coordinated, strategic approach to digital inclusion policy that spans across federal, state and local governments. Coordinated, placed-based digital inclusion policy and programs would enable rural and remote agricultural communities, including FNQ, to:

- invest in telecommunication infrastructure, filling important services gaps;

- respond faster to change needs, emerging opportunities and immanent challenges;

- increase grassroots economic growth by improving productivity, adopting new technologies and innovating in context;

- bolster social and civic participation by connecting people with services, information and each other; and

- develop home-grown digitally savvy workers, and attract and retain others from urban centres, thereby contributing to regional to population growth.

Overall, the aim is to achieve synergy and in situ problem solving, rather than duplication and siloed activity, across access, affordability and digital ability. Principally, this is about democratising the process of decision-making about connectivity in rural and remote areas, recognising the value that can be added at all levels, and the collaboration that is necessary to identity and address gaps in services, resources, programs and funding for digital inclusion.

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