SPARSE STATE -
THE DEATH OF DISTANCE

Prepared by a working group of the **Smart State Council**

November 2007

Smart State Council

An initiative of the Queensland Government

Smart State Council

Dear Premier

Please find attached the Smart State Council working group report on *Sparse State – the Death of Distance*.

The report offers a framework for using broadband connectivity and intersectoral collaboration to transform the challenges of a sparsely populated State into enhanced industrial productivity, expanded export opportunities, and reinvigorated social and cultural networks for rural and regional Queenslanders.

I commend it to you.

Professor Peter Andrews
Queensland Chief Scientist and
Chair, Standing Committee
Smart State Council

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SMART STATE COUNCIL

The Smart State Council was established in June 2005 as a central advisory body to provide high level advice to the Queensland Government on emerging Smart State issues and trends, and to propose measures to position Queensland to respond to challenges and opportunities.

The Smart State Council is chaired by the Premier of Queensland and comprises Government Ministers, the Queensland Chief Scientist and representatives from Queensland's business and research communities.

This paper was prepared by an independent working group for the Smart State Council. The views expressed in this paper are those of the group and do not represent Queensland Government policy.

EXECUTIVE SUMMARY

Throughout the world governments have increasingly devoted more of their attention to servicing expanding metropolitan populations. This urbanisation of society has directed attention and resources away from the social, economic and environmental needs of sparse communities. Here in Queensland, regional development has largely been driven by industry. Many industries and organisations operating within and across sparse domains have applied advanced technologies to defy distance, coalesce their dispersed assets and improve competitiveness.

Getting more done with existing resources

Investigations of core industries and services located in sparse domains such as transport, energy, agriculture and water, as well as Emergency Services, indicate that existing technology advancements can produce substantial performance improvements. Some parts of the commodities transportation and agricultural industries expect productivity gains of up to 20%. Significantly, at the systems level, these savings can be achieved with minimal additional infrastructure expenditure. It is more about tasking the assets smarter than providing more of them. Clearly, there is enormous potential for these initiatives to contribute more broadly to other regional areas.

We are doing well with technologies but we can do even better.

So far, there has been limited potential for shared knowledge, economies of scale, or cumulative advantage because initiatives have mostly been implemented in isolation or, at best, pockets of effort. Exacerbating this situation are entrenched social, systemic and bureaucratic impediments, which actively work against sharing knowledge and achieving the collective action that underpins maximum competitive advantage and social development.

Tribalism impacts on outcomes.

By developing a more systematic integration of advanced skills and technologies, Queensland can enhance its existing economic foundations and develop new sources of economic prosperity. It can also contribute to improvements in the social context of rural and regional communities through a transformation in social services delivery, the creation of social and cultural networks and by ensuring long-term environmental sustainability. Such an integrated technology system will not only improve the performance of large, geographically-dispersed, asset-rich organisations, it will spawn new information-rich business opportunities.

Queensland can become a world leader in exporting knowledge and products that assist in maintaining and growing the prosperity of sparse regions. At the same time the State can turn sparsity into an iconic competitive advantage that

can be exported to regions facing similar geographic, population and climatic conditions. By transforming the challenges of sparsity into opportunities the vision for a smart sparse State can be realised.

Queensland is a world leader in the use of advanced technologies, expertise and skills that create social and economic advantage in sparsely populated regions.

Fundamental to this vision, though, is the establishment of a state-wide, very high-speed broadband network tied to an integrated platform for systems connection, data collection and fusion. Broadband is a key enabler for the uptake and application of advanced technologies such as Global Positioning Systems (GPS), satellites, sensor networks and unmanned vehicles, which will facilitate superior decision making. It also connects and links remote citizens to wider social, cultural and educational opportunities.

Connectivity is the death of distance.

In recognition of the centrality of broadband to economic growth and development in regional Queensland, several initiatives are currently under consideration. However, this fragmentation of roles and responsibilities works against a clear direction for action and spreads resources which, if aggregated, would provide a solid foundation to implement what is a critical infrastructure. A systematic overarching infrastructure that enables interoperability between systems, technologies and processes is also important.

There is no common platform: we have to build on the bits in common and work out how to make these bits talk to each other.

Being connected by technology is only part of the equation. Increasingly organisations are using their collaborative advantage as a basis for competitive advantage.

Collaboration is the way forward.

Queensland must capitalise on the momentum of the advanced skilled technologies applied in its sparse regions. High-speed broadband connectivity is the key enabling infrastructure which, when coupled with collaborative know-how and practices, can transform rural and regional industries and communities into the power houses of the State's future.

Table of Contents

INTRODUCTION

Many industries are using advanced technology to overcome the challenges of operating within a geographically-vast and population-dispersed region. Leveraging from these initiatives will assist industries and communities in regional and remote districts to be economically and socially resilient. High-speed broadband connectivity and collaboration are key to Queensland becoming a smart sparse state because they can enhance existing economic situations, facilitate the development of new sources of economic prosperity, and create a locale of excellence centred on advanced information technology capacity and innovative solutions. The specialist expertise, knowledge and capacity developed through taming sparseness can be exported to other regions facing similar challenges.

THE SMART SPARSE STATE CONTEXT

Queensland is a vast and relatively sparsely populated State. Much of its land mass is semi-arid and inhospitable. Current and projected trends indicate the bulk of the population will continue to reside in the south east corner of the State and along the eastern coast line, while western and remote regions will remain much less densely populated.

The State is currently experiencing a period of significant and prolonged economic growth. Much of this growth has been fuelled by industries located within the remote and less populated regions. To sustain and build on this growth, significant investment in infrastructure development has occurred across a number of key and support industries. To genuinely advance the Smart State agenda and secure maximum competitive advantage, Queensland must harness and leverage all its resources including the rich and often underutilised assets of organisations and industries located in geographically-dispersed and population-sparse districts.

Also driving the case for a smarter sparse state are changing demographics and government operating contexts. Queensland has an aging population, particularly in remote communities.

Citizens are more sophisticated and have higher expectations of services. There is historically low unemployment, coupled with a shrinking specialist workforce, and government budgets are increasingly restrained.

All of these factors are challenging current modes of service delivery in regional areas and demanding transformations in the management and mobilisation of assets.

Together these factors push Queensland to move beyond continuous infrastructure development to a more aggressive adoption of advanced technologies; that is, to find smarter ways of doing things.

At the crossroads of this change, and representing the building blocks for future growth, are major industries such as ports, rail and road transport, mining, energy, water and agriculture. The next section examines three of these elements - commodities transportation, energy distribution and agriculture - to distil their engagement with advanced technologies and innovative practices and forecast areas of emergent competitive advantage.

An extensive suite of interviews has informed the construction of the case studies. Pertinent quotations are used to support the findings and are presented in italics.

COMMODITIES TRANSPORTATION

Much of Queensland's current prosperity is derived from strong bulk commodity sales and export. Many of these commodities have to be transported long distances from their point of production to their end customers. Commodities transportation generally involves the use of multiple carriers or transportation types during a single journey. It can involve road, rail and sea, and often in multiples. Accordingly, an efficient and effective transport system is vital. The vast dimensions of the State have encouraged the adoption of advanced transport technology. Intelligent Transport Systems (ITS) allow for the integrated application of advanced technologies such as computer and communication technologies focused on improving efficiencies and safety[1].

A number of ITS and other technologies are in use across transport systems in Queensland. Within the rail system, sensors, computers and digital communications technologies have been introduced to facilitate train control and defect detection of both rolling stock and rail lines[2] . These also serve to better inform planning and scheduling processes, enhance safety and security and increase railroad capacity and asset utilisation.

[1] Booz Allen and Hamilton Australia (1998). Intelligent Transport Solutions in Australia. Summary Report (Intelligent Transport Systems Australia), Sydney, NSW) pp 17

[2] Queensland Rail (2006). *Annual Report* 2005/06, Brisbane Queensland

For the road transportation system there has been an implementation of computerised on-board route management and recording systems for continuous tracking, and vehicle and driver safety monitoring. This assists with evaluation of safety performance of vehicles and operations generally. Satellite systems are also being used for fleet management, on-board roadway environmental sensing and road/weather information systems[3].

The adoption of advanced technologies is acknowledged as contributing to increased productivity gains across the Queensland transport system.

We have just really scratched the surface of this [use of advanced technology] and still have a long way to go. But already there are good results.

To date much of the implementation of ITS effort appears to have occurred within the individual transport modes. In part, this independence is a result of a preference by organisations and sectors to control their own purchasing, maintenance, asset management and freight scheduling. Competition between the large players in each transport mode provides pressure to be innovative and to adopt new technologies to be more efficient and remain ahead of competitors. The result of this 'go it alone' tendency creates a disconnect between elements of the transport system - both within and across modes.

A stronger integration of information generated by the already applied technologies and higher levels of cross-mode interaction is presented as the way forward. It has the potential to build on and enhance existing achievements and create a space for innovation and opportunity within and across transport modes as well as to auxiliary industries.

Industry Opportunity – Dynamic and Integrated Intelligent Transport Systems

A more dynamic interaction between technologies will provide a higher level of situational awareness of where transport assets and commodities assets are located, their status and health, as well as mobility options. Enhanced situational awareness allows for better tasking of assets all along the transportation supply chain. Smarter tasking of the transportation system not only improves internal productivity, it also provides better tracking, handling and mobilisation of the commodities themselves. This expands the opportunities to quickly respond to changing market conditions – ensuring premium prices for commodities.

Within transport modes, a stronger connection between the actual data sources such as sensors and computers, the planning and scheduling sections and

[3] Queensland Government (1999). *4Seeable Futures: Transport Portfolio Scenario-based Planning for the Queensland Department of Transport and the Queensland Department of Main Roads 2000-2005*, Main Roads and Queensland Transport, Brisbane Queensland.

maintenance functions assists the ability to understand, manage and mobilise assets. It also facilitates as-required maintenance rather than costly conventional down-time maintenance processes or unnecessary replacement of assets.

Beyond enhancing existing operations, accessing and sharing of information also leads to increased opportunities for innovation and further efficiencies.

On the edge of the transport supply chain are a number of organisations involved in the construction and maintenance of transport infrastructure as well as broad service provision.

A more strategic coupling of these auxiliary entities into the real-time information loop would assist them to better align their services to the needs of the main modes. For example, mechanical businesses would be better placed to provide 'just-in-time' repairs rather than scheduled repairs which can be more cost and time expensive.

Reconfiguring schedules and identifying potential bottlenecks in transport systems will defer major infrastructure/capital expenditures.

Similarly, at the transport systems level a greater interoperability of systems, technologies and information will increase the optimal functionality and competitive advantage of the commodities industry. Specifically, it can enable greater economies of scale for the application of new technologies. Further, the cross-fertilisation of information will enhance the performance of individual modes as well as the overall performance of the industry.

Clearly, to achieve maximum gain intelligent transport technologies cannot be pursued as a collection of independent applications. Sector representatives estimate that a stronger integration of technologies and outputs across the commodities transportation supply chain can generate between 10% and 20% gains in performance.

A more ramped up, integrated approach [to transportation] will produce greater benefits!

High-speed broadband is a key enabler to the transformation to dynamic, integrated transport systems. Establishing a more dynamic integration of ITS technologies within and across transport modes provides each with a stronger capacity to undertake their own business and to contribute overall to a more competitive industry. Expanding information accessibility to all members of the transport supply chain would enable local businesses to create new, or reconfigure existing, business functions to capitalise on emergent opportunities such as 'just-in-time' maintenance. Furthermore, opening up access to additional data generated by ITS could be used to create new business opportunities related to inter-modal transportation information and services. In this way integrated ITS can build new transport capability centred on expertise in the efficient planning, tasking and handling of rich, remote assets.

ENERGY DISTRIBUTION

Driving Queensland growth and economic prosperity requires a reliable energy distribution system. Queensland has a significantly greater number of high energy users than any other state, and collectively they consume 31% of the total energy of the State.

Most of these consumer industries are located in regional Queensland and are predominantly from the resources sector, manufacturing sector or are export infrastructure such as ports and rail[4].

The centrality of electricity to the State's industries and development, and the vast areas covered, mean that Queensland's electricity distribution networks are extensive, with a total line length of approximately 200,000 kilometres.

Of this, ENERGEX, supplies south east Queensland, while Ergon Energy services the remaining rural and regional locales. Providing an efficient operation and maintenance program over this vast system requires comprehensive and sophisticated telecommunications systems.

Fibre optic broadband cable has been rolled out alongside the energy distribution networks to facilitate and support the internal communication requirements such as the linking of substations and data centres. This ramped up telecommunications system has also enabled the introduction of advanced technologies such as web-based remote computing, sensors, hand-held GPS and digital mapping[5]. These technologies enable dynamic interactions to produce enhanced real-time information for planning and adjustments to energy supplies and load management[6]. These developments augment and reinforce traditional forms of energy efficiency and assist in the control and monitoring of power quality. Emergent mechanisms such as Smart Sensors and Unmanned Aerial Vehicles (UAV) are also being considered to provide more detailed and faster information and imaging on the health and functionality of geographically-dispersed essential assets such as power lines.

The net effect of the combination of broadband communications and advanced technology is an enhanced capacity to forecast energy needs and problems, which has resulted in gains in reliability, capacity and customer service.

Local anecdotal estimates of productivity gains in excess of 10% have been attributed to the ongoing adoption of broadband and associated advanced technologies to the regional energy distribution network.

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[4] Department of Mines and Energy. *Electricity in Queensland*. www.energy.qld.gov.au, accessed 3/11/07

[5] Ergon Energy (2003). Annual Report 2002/03, Brisbane: Queensland

[6] B. Barker and L. Sanna. (2006). Turning on Energy Efficiency *Electric Power Research Institute Journal* (summer) http://my.epri.com/portal/server, accessed 29/10/07

This finding is supported by international experiences of advanced technology solutions to energy distribution networks[7].

Industry Opportunity – Hyper Communication Connectivity

It is about working together to connect and support regional communities.

As well as ENERGEX and Ergon Energy, a number of other Government owned Corporations (GoCs) such as QR and Powerlink have built independent broadband communications networks to support their core business.

In a bold initiative that is based on the establishment of close working relationships, these bodies have combined with Southern Cross Communications and Uecomm to make spare broadband capacity available to regional Queensland. The resulting collaborative endeavour, Nexium Telecommunications, operates as a subsidiary of Ergon Energy. The high-speed data connections made available on a non-exclusive wholesale basis through Nexium are enabling some regional Queensland businesses and institutions to access faster internet, email and video conferencing capabilities equal to that available in metropolitan areas of the State.

Regional Queensland industries have been quick to realise the advanced connectivity potentials offered by Nexium to improve their existing communication linkages and technology application. For example, working through Nexium, the telecommunications carrier Equant is connecting BMA's 14 Bowen Basin coal sites as well as other key office locations across the State[8]. Similarly, a desire for a more sophisticated and 'converged' IP network, led to Peabody Energy linking with IPSystems to utilise Nexium capacity to improve its mining operations in regional Queensland. Soft infrastructure organisations such as Queensland Health, Emergency Services and Police may also look to organisations such as Nexium to increase the geographic reach of existing communications capabilities to facilitate faster file transfers such as graphic and medical imaging, as well as provide faster disaster recovery services.

In this way the deregulation of the energy market together with emergent information and communication technologies has provided expanded business opportunities and processes for utilities. As well as selling a communication commodity, opportunities have emerged to add value to existing services and build up new businesses. The combinations of stronger broadband infrastructure capacity and collaboration provide a catalyst for continued enhanced opportunities in regional and remote industries and communities.

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[7] Barker et al (2006) ibid

[8] Equant Teams with Ergon Energy in 20M$ Contract http://www.beerfiles.com.au/content/view/672/43, accessed 30/10/07

AGRICULTURE

Technology is the new farming paradigm!

Queensland farmers have long been early adopters of emerging agricultural technology. Recent advances in computing have brought farmers and farm equipment to a new level of sophistication and are helping to produce crops in a more sustained manner. Advanced technologies such as GPS, satellites, aerial images, sensors and information management tools are being employed across a number of crops and products including cotton, wheat and sugar cane.[9] These technologies enable farmers to more accurately assess and understand land conditions and, in doing so, develop more situational-appropriate cropping and livestock practices. Specifically this information is used to more precisely determine optimal sowing density; better estimate water, fertiliser and other input needs; and more accurately predict crop yields.

In addition to, and drawing on, GPS technology and data is the controlled traffic (CT) approach to farming. In essence, CT farming is a technique where the movement of tractors is constrained to permanent 'tramlines' or wheel tracks. This maximises soil efficiency[10]. The introduction of CT to farming has been demonstrated to produce a number of productivity benefits as well as public environmental benefits such as reduced soil erosion, improved off-site water quality, reduced carbon emissions and better water use efficiency[11] .

Advanced technologies are also being used by livestock farmers. Among some of the initiatives applied are laser fences and UAV aerial vehicles to undertake stock control activities and monitor assets.

These are coupled with sensors to track cattle and monitor stock feed and water levels. They are also used as remote computerised controls to direct cattle movements. These technologies allow for more remote operation of the facilities and resources, presenting significant cost saving potentials.

Clearly there are many benefits to be gained from adopting advanced technologies within the agricultural arena.

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[9] C. Stewart, B. Boydell, B. and A. McBrathney (2005) *Precision Decisions for Quality Cotton: A Guide to Site Specific Cotton Crop Management*, University of Sydney and Cotton Research and Development Corporation (November)

[10] J. Tullberg, D. Yule and D. McGarry, D. (2003). On Track for Sustainable Cropping in Australia, *International Soil Tillage Research Organisation Conference* (Invited Plenary Paper) ISTRO Proceedings CD, University of Queensland.

[11] The Allen Consulting Group (2007). *The Economic Benefits of Making GPSnet Available to Victorian Agriculture* Final Report (Department of Sustainability and Environment)

In the Australian Cotton industry, the application of precision agriculture is estimated to yield a productivity gain of between 8% and 10%[12]. This result is confirmed by a recent cross crop meta analysis which indicates that technology has been demonstrated to increase crop yields by between 5% and 50%, depending on the crop type and growing conditions[13]. Based on these figures, an overall 10% productivity gain in agriculture could be claimed.

GPS-based technologies have also proven to be strong enabling technology for a number of additional industries including mining, commodities transport and construction. To expand, the mining industry reports productivity increases of as much as 30% by adopting GPS technologies[14]. Machine guidance technology has also been identified as a significant contributor to cost-effective bridge construction, generating savings of up to 30% in direct bridge costs compared to industry averages[15]. Public sector organisations such as transport, emergency services, environmental protection, defence and security are also drawing on the advanced technologies offered by GPS-associated technologies and expanded networks to deliver services more efficiently and effectively across different modes.

As the cost of technologies has declined the uptake level has increased. It is estimated that over one million hectares of farm land across Australia is under some form of CT farming[16] .

As an indication of the degree of penetration, the current level of technology-enhanced sugar cane cropping in Queensland is estimated at between 20 and 25%[17].

However, this uptake has not been evenly distributed. Rather it has been largely restricted to early-adopter regions mostly using stand-alone reference stations.

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[12] Stewart et al(2005), op cit.

[13] Schofield et al (2007), cited Allen Consulting Group (2007) op cit.

[14] M. Higgins (2007). Delivering Precise Positioning Services in Regional Areas, *International Global Navigations Systems Society IGNSS Symposium*, The University of New South Wales, Sydney 4-6 December.

[15] CRC Construction Innovation, BRITE Case Study 3: *Motorway Alliance Drives Performance Improvement*; K. Manley, A., Blayse, and S. McFallon (2005). 'Demonstrating the Benefits of Construction Innovation' *Creating an Entrepreneurial Economy: The Role of Enterprise and Innovation: International Research Conference*, University of Waikato, Hamilton, New Zealand, 7-8 July, pp. 9.

[16] Tullberg et al (2003) cited in Allen Consulting Group (2007)op cit.

[17] T. Wrigley and S. More (2006). *Public Environment Report*, Australian Canegrowers Council Ltd, Brisbane Queensland

The implications for this are that many farmers have not been able to take advantage of economies of scale and cost in the purchase of the equipment or to share information between farms. Moreover, this reliance on stand-alone

reference stations prevents opportunities to tap into more accurate data sets provided by networks of receiver stations.

A networked approach is more economical as it reduces the number of reference stations required to cover a district and delivers an improvement in the overall quality and of the data from metre to centimetre accuracy[18]. The redundancy offered by multiple nodes enables networked approaches to be more reliable as well as more accurate. Reliable data on crop availability and conditions is critical to deliver premium prices for time-critical commodities.

The agricultural sector has embraced advanced technologies as a central platform to its operation. In effect there has been a paradigm shift from a labour-intensive to a technology-directed way of working. There are currently a limited number of GPS networks in operation in Queensland. A more networked approach would build on and accentuate the benefits already achieved. This would occur through the greater level of accuracy and reliability offered by networks of reference stations.

Further, shared data sets and knowledge bases have been found to provide a strong basis for intra-and inter-modal learning and collaboration and stronger performance outcomes and sustainability in agriculture[19].

Breakthrough technology information is spread through farmer networks.

Industry Opportunity - Expanded Networks

The potential and expertise offered by GPS technologies and networks to Queensland industries will be extended and enhanced by the addition of six new satellite systems launched by the USA, China, Russia, European Union, Japan and India. The generic term adopted for all these systems is Global Navigation Satellite Systems (GNSS)[20].

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[18] J. Millner, H. Asmussen and R. Andrelola (2007). 'Networked Corrections', *Position, the Official Magazine of the Spatial Institute*, April-May No. 28 pp 58- 60.

[19] W. Walker, R. De Lai, A. Johnson and A. Leitch. (1999). *Collaborative GIS in a Rural Catchment: History and Achievements of the Herbert Resource Information Centre*, CSIRO

[20] Position One Consulting (2007). *Queensland The Global Navigation Smart State: Building an Internationally Significant Presence in The Global Navigation Satellite Systems (GNSS) Marketplace*, reported jointly commissioned by the Department of Natural Resources and Water and Department of State Development.

Department of Premier and Cabinet (2007). *Queensland Australia – the Smart Choice: Queensland's Satellite Navigation Industry Directory,* Brisbane, Queensland.

In South East Queensland, the SunPOZ network draws on GPS to deliver centimetre-accurate, three-dimensional positions in real-time to a growing number of industries[21].

Queensland is in an ideal position to leverage from the additional capacity offered by these satellites as each of their footprints will fall within the State's territory and functional reach.

The immediate advantage offered by GNSS to remote Queensland industries and communities is the ability to build expanded networks that deliver enhanced data, information and solutions. This will afford greater opportunities to access dynamic, real time information leading to situational-correct solutions. It also provides a framework from which other advanced technologies can interact, innovate and deliver value-added services and solutions within Queensland and across the globe.

The State's reputation in developing GNSS products and services for sparse environments, coupled with a strong existing industry base in this field, provides export potential to other regions confronted by vast distances, sparse populations and harsh climatic conditions[22].

FROM GREAT TO EXCELLENT

We need to move from good to great.

The three industry case examples show evidence of a wide range of advanced technologies such as satellite imaging, new generation GPS, unmanned vehicles and sensor networks being successfully applied to reduce the tyranny of distance and more efficiently task dispersed assets. Through such initiatives, the costs of distance and sparse populations have been reduced, economies of scale achieved without physical proximity, and real time information and data generated to enhance decision making.

An estimated productivity or performance gain in excess of 10% has been attributed to the adoption of smart technologies, practices and thinking in each of the three case studies. However, many of these initiatives have occurred in isolation or, at best, pockets of cooperative effort.

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[21] M. Higgins (2001). An Australian Pilot Project for a Real Time Kinematic GPS Network Using the Virtual Reference Station Concept, *New Technology for a New Century International Conference,* Seoul, Korea, 6-11 May.

[22] Position One Consulting (2007) op cit, p. 7

To move forward and secure stronger, overall social and economic gains for regional Queensland it is necessary to learn from and leverage off these initial gains.

KEY ENABLERS

Two key enablers – connectivity and collaboration - have been identified as central to the transformation of Queensland as a leader in advanced smart technology in regional areas to facilitate and sustain ongoing economic and social development.

CONNECTIVITY

Connectivity is the death of distance!

Human society is based on connection. People rely on interaction to maintain social bonds, access knowledge and to mobilise resources. At the industry level, there must be a capacity for reliable, timely and cheap transportation and communication connections. As the information age advances and the global and local meld more closely together, connectivity must transpire in a much faster and multimodal level.

In this way connectivity is a critical element in developing Queensland as a Smart State. Connectivity is the direct link to productivity[23].

A big broadband infrastructure is the backbone to connectivity. It's about better connecting people and places.

Very High-Speed Broadband

Broadband, similar to the road and rail networks of last century[24], is the catalyst for economic development and employment growth[25].

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[23] T. Friedman, T. (2000)The Lexus and the Olive Tree, London: Harper Collins.

[24] National Office for Information Economy (2003) *Australia's Broadband Connectivity, the Broadband Advisory Group's Report to Governmen*t, Australian Government: Canberra.

[25] Understanding Broadband Demand: A Review of Critical Issues, Office of Technology Policy US Department of Commerce, September 23, 2002.

Broadband-based technologies make a range of networked communications possible, many of which are not compatible with first-generation internet technologies.

With the ability to simultaneously transmit and view audio, video, images and multiple data sets at real time, broadband can change the way organisations operate and reshape the way people live and work. Importantly, in opening up new economic horizons and expanding societal connectivity, very high-speed broadband delivers benefits to regional as well as metropolitan areas.

Broadband communications technologies can also deliver substantial social benefits to the many regional and remote districts in Queensland[26].

In effect, broadband and associated technologies can facilitate the 'death of distance' by greatly increasing the quantity and quality of communication within and between regions, linking remote communities to other centres and their educational and social opportunities. In short, broadband provides a basis for integrating remote communities into economic, cultural and social life.

The current broadband infrastructure in Queensland is insufficient to drive the Smart State outcomes. Moreover, available infrastructure has been mainly restricted to the more densely populated coastal districts, leaving regional and rural Queenslanders with limited or no access.

A number of companies including GoCs like Ergon Energy (Nexium), Powerlink and QR have extended the broadband infrastructure to regional Queensland areas.

In recognition of the centrality of broadband to economic growth and development in metropolitan and regional Queensland, several initiatives are currently under development and consideration. These schemes sit alongside and look to leverage from the Australian Government and Opposition broadband proposals. However, the compartmentalisation of broadband roles and responsibilities across several agencies and Ministers, coupled with the shared responsibilities between state and federal governments has resulted in fragmentation of effort, which is manifest in a lack of clear direction. Furthermore, it has diluted effort and spread resources/funds which, if aggregated, would provide a solid foundation for the immediate implementation of what is now an emerging critical infrastructure.

To capitalise on the current broadband momentum and leverage from its opportunities, Queensland must quickly consolidate and accelerate its current efforts toward a state-wide roll out of very high-speed broadband systems. The imperative to act is strongest for regional and rural communities, which do not present as ideal investments for private telecommunications entities. Queensland

[26] Queensland Government (2006). *Blueprint for the Bush: A Year of Progress Annual Report 2006-07*, Brisbane, Queensland

has a number of options available to progress its broadband infrastructure. It can rely on existing private sector provision models and their derivatives, or it can build on and extend the excess broadband capacity offered by its utility assets that remain under government ownership. Given the private sector's reluctance to invest in regional broadband infrastructure, and the excess capacity available through GoCs, it could be argued that government has, at least, an initial role in providing equitable broadband capability. Subsequent to this, opportunities exist to examine alternative provision arrangements including public private partnerships and pure market modes. The case for an expanded broadband infrastructure for Queensland has been well made[27].

The State must seize the current momentum and quickly establish an enabling broadband infrastructure that enables regional and remote Queensland to advance and prosper.

The principle of connectivity also applies to underpinning information and communication technologies (ICT) infrastructures. The current Queensland ICT operating environment is comprised of a wide range of organisation and industry centric operating systems, technologies, softwares and processes. A systemic overarching infrastructure that enables disparate technologies to interact with each other is critical[28]. An alignment of current government ICT services and applications would also deliver significant savings[29].

There is no common platform: we have to build on the little bits in common and work out how to make these bits talk to each other.

Ongoing ICT developments have provided a basis for such interoperability. This has been enhanced by refinements of legislation and policies that support information sharing without undermining privacy protection. Human and organisational factors of culture and embedded systems are the remaining connectivity sticking points.

It is not technology that is preventing this – but people and culture and silos.

Being connected is only part of the equation. Organisations and industries do not and can not operate in splendid isolation. Increasingly, to secure competitive advantage, it is necessary to cease operating as single, self-interested entities and create a practice and culture of collaboration. The strong inter-relationships between connectivity and collaboration is demonstrated in Figure 1.

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[27] Synergies Economic Consulting (2007). *Economic Impacts of Broadband Networks*, Draft Report to the Inter-governmental Broadband Working Group, Queensland State Government, Brisbane Queensland.

[28] Information Security Institute (2007) *The Integration of Inter-Agency Federated Data: An Interim Report for Information Queensland*, ISI Queensland University of Technology

[29] Queensland Government (2006). *Report on Review ICT Governance in the Queensland Government,* Service Delivery and Performance Commission (September), Brisbane, pp.2

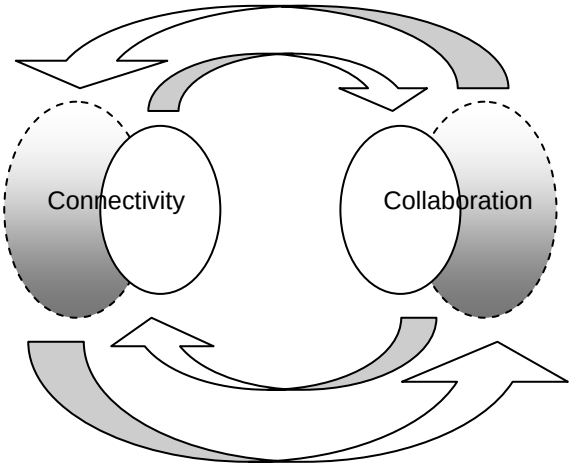

Figure 1: Connectivity/Collaboration Interface

This figure suggests that greater connectivity provides a basis for the formation of collaboration, while collaborative relations have a knock-on effect of greater connectivity. Ongoing iterations between the two spheres produce a multiplier effect.

COLLABORATION

We need to get into that horizontal white space for transformation of systems.

Collaboration broadly means working together[30]. It is a deeper form of connectivity: one that moves beyond merely linking and sharing general information to actively engaging in the sharing of tacit information, pooling resources and effort to achieve a common goal or systems change[31].

Higher levels of interactions and relationships characterised by trust and reciprocity allow for synergies or points of commonality to be identified and leveraged for new ideas and innovation[32].

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[30] C. Huxham, C. (1996). *Creating Collaborative Advantage* Sage: London.; C. Huxham, (2000). The Challenge of Collaborative Advantage *Public Management* 72 (2): 337-357.

[31] R. Keast, K. Brown, M. P. Mandell, M. and G. Woolcock (2004). Network Structures: Working Differently and Changing Expectations, *Public Administration Review* 64 (3): 363-371; W. Powell, (1990). Neither Market or Hierarchy: Network Forms of Organization, *Research In Organization Behavior* 12: 295-336.

[32] Powell, W, K. Koput and L. Smith-Doer (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology *Administrative Science Quarterly* 41: 116-145

By working outside their boundaries, organisations and industries can exploit their relational assets, enhance their own capacities, form clusters of innovative effort and engage in shared creation[33]. Through collaborative processes organisations, even competing organisations, can temporarily suspend their competitive relations and work together to expand the range of opportunities that are available to them. In this way, collaborative advantage drives competitive advantage[34].

Industry representatives clearly understood collaboration to be an important enabler for both connection and social and economic advantage.

Collaboration – working together – is the way forward.

Collaboration is not business as usual! Effective collaboration requires the sharing of resources, responsibilities and power as well as rewards and risks. It also requires mutual trust, time, effort and dedication[35].

Many of these elements are the antithesis to bureaucracy[36] - a point that was frequently acknowledged during the case reviews and is exemplified in the following statement:

Collaboration is critical, but it is not easy, it is not part of our current skill set.

Many organisations are pre-contemplative in regard to collaboration[37]. That is, they are cognisant of the need to collaborate to expand opportunities, create new market niches and gain competitive advantage, however they lack the necessary incentives and/or skills to take the additional step. Also working against genuine collaboration are the embedded systems and processes of bureaucracy evident in large organisations, particularly government departments that foster and perpetuate turf protection and silos.

Tribalism does impact on outcomes!

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[33] Gulati, R. (2007). *Managing Network Resources: Alliances, Affiliations and other Relational Assets,* Oxford University Press: New York.

[34] M. Porter (1998). Clusters and the New Economics of Competition, *Harvard Business Review* (November-December): 77-90.

[35] B. Cigler (2001) Multiorganizational, Multisector and Multi-community Organizations: Setting the Research Agenda, in M.P. Mandell (ed). Getting Results Through Collaboration: Networks and Network Structures for Public Policy and Management (pp. 71-88). Quorum Books: Westport.

[36] R. Agranoff and M. McGuire (2001). Big Questions in Public Network Management Research, *Journal of Public Administration Research and Theory* 11 (3): 295-326; T. Stallkamp (2005). *Score! A Better Way to Do Business: Moving From Conflict to Collaboration.* Wharton School Publishing, Pearson Education, New Jersey.

[37] W. Hebbert, R. Keast and K. Mohannak (2006). The Strategic Value of Oscillating Tie Strength in Technology Clusters, *Innovation: Management, Policy and Practice* 8 (4-5): 322-337

Collaboration, particularly between competing organisations, does not happen without a strong incentive. For industry this incentive is often a shared economic imperative. Mandate and influence strategies can be used to bring parties to the point of collaboration.

The present situation in Queensland, with respect to the broadband issue and maximising regional growth and competitive advantage, calls for a judicious mix of both. A mandate sets a coherent direction for change and can be used to drive the required actions for outcomes. In this context, Government must act as a sponsor by providing the imperative, legitimacy and funding for organisations to work together. By contrast, influencing relies on sharing and broadcasting the results of successful collaborative endeavours and modelling the required behaviour changes providing the motivation for collective action. Thus both sponsors and champions are required to drive collaborative actions[38] and embed a culture in which collective – rather than individualistic values and ethos – are the norm.

To reap the many benefits of collaboration organisations must become more sophisticated in their understanding of the skills, culture, processes, tools and technologies needed for working across organisations[39]. Failure to adjust behaviours between organisations and change systems of operation means that, at best, the result will be superficial collaboration and mediocre outcomes. There is also a greater potential for organisations to revert to more comfortable individual modes of operation.

Each of these enablers – connectivity and collaboration – must be activated to transform Queensland from a 'follower' or 'me too' State to a leader in the development of expertise to tame sparse domains.

OPPORTUNITIES

Establishing an enabling broadband infrastructure and collaborative culture will not only facilitate the establishment of a strong body of knowledge, expertise and enterprise in managing sparse assets, it can provide a foundation for a range of additional benefits to emerge for rural and remote communities disadvantaged by distance. Such benefits accrue at the following three areas:

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[38] J. Bryson (1995). *Strategic Planning for Public and Non-Profit Organizations*, Jossey-Bass: San Francisco

[39] C. Huxham and S. Vangen. (2001) (How Things Happen in a (not quite) Joined up World, *Academy of Management Journa*l 43 (6): 1159 - 1169.

Enhanced Asset Management and Services Delivery

Getting more done with existing resources.

Advanced technologies and a more holistic approach to industry and community functioning are creating a virtual information space where users have access to a consistent information set, which can be fused, reconfigured and tailored to meet specific operational needs. A more coherent knowledge of the location, health and functionality of assets helps organisations to task them more efficiently, gain maximum use out of existing resources and reduce the cost of their maintenance down time. Interoperability between components and sectors engenders a higher level of situational awareness that enables better informed decision-making, reducing time delays for action. Together these functions assist organisations to optimally respond to their operating environment and enhance their competitive advantage.

Worldwide advanced technologies facilitated by high-speed broadband are also facilitating more convenient and joined-up access to a range of government agencies and services[40].

Queensland has embraced the shift to a more seamless approach to government agencies and their services through the Smart Services Queensland initiative[41]. Greater linking and mobilisation of these assets will allow continued levels of service provision for similar costs and facilitate equal and enhanced service responses to regional communities[42]. Finally, the savings generated by a more coordinated approach to service resources and actions can be redirected to the creation of alternative forms of service delivery such as remote medical imaging and diagnosis, interactive video conferencing and on line educational programs.

New Economy

Smart technology opens up new business spaces.

The internet and accelerating technical capacities of computer and telecommunications have paved the way for a new economy based on knowledge exchanges and the transference of knowledge into new products and services. An expanded broadband capacity to sparse Queensland areas allows local businesses to tap into and exploit existing markets as well as open up new market niches for regional businesses. For example, regional tourism enterprises

[40] Booz, Allen Hamilton ((2006). Beyond e-Government: The World's Most Successful Technology Enabled Transformation, Instead: London.

[41] Department of Communities (2006). *Capability Statement: Smart Services Queensland,* Brisbane, Queensland; www.qld.gov.au/smartservice, accessed 20/09/07

[42] Queensland Government (2007). Blueprint for the Bush, op cit, p47

could benefit from increased information flows through regional networking and cooperative e-marketing and on line campaigns[43]

Industry-shared access to information and knowledge networks will enable greater synergies to occur which can be used to create specialist knowledge, competencies and resources in sparse locality operations. The accumulation of knowledge derived from applying smart technologies and solutions to sparse regions can be linked to R&D institutions to pave the way for the formation of centres of excellence linked to advanced technology capabilities such as simulation modelling, data fusion and analysis. In this way, advanced technologies and broadband can act as a fulcrum for high-tech business and research to spin out new initiatives and innovative products. Flow-on benefits of the new economy for regional Queensland would see local residents linked into new work prospects and the attraction of new residents, replacing the current pattern of coastal migration.

Iconic Queensland Export Prospect

Sparseness is a unique opportunity if managed – the difference is getting the right people, right resources and making the right connections.

Queensland's sparse geography has presented a unique set of challenges arising from the need to deliver services to a dispersed population, surveillances of a vast coastline, monitoring of vast land masses and sensitive environmental resources, management and protection of major infrastructure assets and providing logistics support in a number of industries. As this report has demonstrated, while overcoming the challenges of the 'tyranny of sparseness' can be burdensome, the solutions are often a source of innovation that can be exploited in a wider context.

Opportunities for sparse expertise transfer arise in a number of sectors, including transportation, mining, agriculture, health, energy, defence and emergency services.

Worldwide there is also a need to improve the operation of large, dispersed, asset rich, multiple transaction systems that have long supply chains spread over sparsely populated and climatically inhospitable regions.

Competitive advantage results from matching core competencies to opportunities. Through its expertise in harnessing sparse state resources and creating innovative solutions, Queensland can build an iconic competitive advantage that can be exported to regions facing similar challenges of long supply chains over vast distances, such as China, India, South America and Africa.

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[43] P. Braun (2006). Networking Tourism SMEs: e-Commerce and e-Marketing in Regional Australia *Information, Tourism and Technology* 5 (1): 13-23

MOVING FORWARD

The report evokes a vision for Queensland to be a world leader in sparse domains. This is both an essential and achievable goal: essential to ensuring that all Queenslanders can share in the benefits of a better connected and prosperous economy, and achievable provided a forward-looking mindset is developed that focuses on distilling key areas of competitive advantage and skills development. Taking the 'leap forward' to build strong expertise and capability in the taming of sparse regions requires coherent direction, commitment and adjustment in ways of thinking and working.

Driving and enabling.

Regional Queensland and its industries have a long history of innovation. The capabilities developed by mining, transport and agriculture, for example, are testament to this spirit of experimentation and innovation. The State is now well-placed with the expertise and reputation to leverage from these initiatives in the broader global domain. Driving the move forward is dependent on the provision of an enabling communications infrastructure. An enabling social environment must also be provided to encourages and facilitate linkages across jurisdictions. Establishing shared goals and driving collective action for mutually beneficial results are additional requirements. Central to this is the creation of a culture of collaboration and innovation within the State.

Building Advanced Skill Capacity

For the State to remain relevant and competitive in the world economy, there is an imperative to improve the skills base and innovative capacity of the people. Sponsoring and investing in skills development and training for emerging technologies is a priority. Further, there must be strategic linkages to and utilisation of the capabilities of existing R&D bodies and research institutions to provide creative solutions and bolster outcomes, and where necessary, work with industry and academia to provide the foundations for future research directions and opportunities.

Building technological capacity is only part of the answer. Building relationships is critical to the formation of successful partnerships and alliances that are now at the heart of innovation.

Effort must be directed to understanding not only how to build and maintain strategic relationships, but also how to manage these to drive required outcomes.

Transforming the geographically dispersed and asset-rich industries of regional and rural Queensland into smart sparse domains will benefit all of Queensland. Strong regions are the basis for a strong State.