Intelligent Communities

Intersecting Economic Development, Social Capital and Technology

A discussion paper from the SAP Institute for Digital Government (SIDG)

Released 16 March 2017

InnovationAus.com Intelligent Communities 2017, Melbourne Forum

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Acknowledgements

This paper is published by the SAP Institute for Digital Government. The authors are responsible for opinions and conclusions expressed in this discussion paper. The authors' views do not represent a point of view of SAP SE or an SAP affiliate company.

The discussion paper was developed in close consultation with the Australian Local Government Association (ALGA). Collaboration with ALGA was led by Clare Sullivan, Director of Government Relations and National Events, and John Pritchard, Executive Director of Policy and Research.

The authors thank Professor Rachel Davey Health Research Institute University of Canberra, Dr Girija Chetty University of Canberra, Dr Leonie Pearson Regional Australia Institute, John Morrissey Commonwealth Scientific and Industrial Research Organisation, Peter Hylands National Institute of Economic and Industry Research, and Gregor Mews Urban Synergies Group, who provided commentary and review during the development of this discussion paper. They challenged our thinking which raised the quality of this discussion paper.

We are also grateful to Rolf Fenner from ALGA and our SIDG Associates Thomas Boulton and Kylie Watson who moderated development of the paper and provided deep insights to local government issues.

Photos throughout the document provided by the Australian Local Government Association from Dubbo City Council and the City of Mount Gambier. Case studies included in this report are included for illustrative purposes related to the content of this discussion paper and should not be regarded as endorsements of products, organisations or business processes.

SAP Institute for Digital Government

Overview

The term smart cities is often aligned to the deployment of smart technology such as Internet of Things (IoT) devices such as sensors to improve efficiency, leading to improvements in overall liveability. Real-time traffic management, real-time energy consumption management, integrated public transport networks and data collecting sensors are examples of smart technology contributing to the efficiency of a modern city. These technology based networks generate large volumes of data which is analysed and leveraged in real-time decision making.

The Australian Department of Prime Minister and Cabinet amongst others, defines smart cities to include, “support for productive, accessible, liveable cities that encourage innovation and create jobs and growth, with a commitment in both regional and metropolitan areas for smart investment, smart policy, and smart technology” (PM&C, 2016).

InnovationAus.com provides another perspective using the term intelligent community which includes “all forms of infrastructure and data analytics, knowledge creation, talent attraction and digital inclusion, “intelligent communities” create collaborative innovation ecosystems that encompass environmental, economic and social sustainability, as well as good governance and citizen participation in the community’s planning and development” (InnovationAus.com, 2016). The phrase “create collaborative innovation ecosystems” takes the networking dimension beyond technology to include people and communities.

In this discussion paper, we propose to expand the “intelligent community” narrative by incorporating the technology aspects of a smart city, with parallel investment in social capital and liveability factors contributing to better outcomes through a virtuous circle effect. An intelligent community leverages data for business insight leading to innovation which is business and people driven rather than technology led.

The challenge for many communities is the lack of capacity and capability to derive value from data assets for innovation to occur. Higher levels of governance can generate value for all communities through investment in common platforms for hosting open data. This would empower communities to leverage publicly accessible data assets to derive business insight needed to enable community initiated innovation.

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A New Intelligent Communities Narrative

While there are many definitions for a smart city addressing the domains of social, economic, governance and environmental matters, there has been a coalescence around technology related solutions to address the issues of modern urban living (Townsend, 2013). This results in a smart cities narrative which can be narrowly focused on issues where industrial scale technology based solutions can be applied i.e. mass transportation, energy and water management and asset maintenance.

It is a challenging environment for public policy makers as they work through the maze of high-tech solutions on offer, each targeting various aspects of complex problems facing communities. A top-down approach can stall within traditional governance structures established around multiple layers of competence where lines of accountability and responsibility are not clear and/or overlap. A bottom-up approach to innovation for addressing complex community problems is similarly challenged. Governance looms large as a barrier to enabling communities in looking forward to create opportunity for growth, e.g. upskilling for the jobs of tomorrow, rather than permanently locked into solutions for today's problems e.g. traffic congestion.

For the technology industry, there is an important role to play in enabling this bottom-up innovation. Innovation occurs at the intersection of business insight and technology (Donofrio, 2006). Business insight comes through leveraging data. While there is an avalanche of new data emerging to drive new insights leading to innovation, what is lacking is the capability and capacity at a community level to make effective use of it. Rather than just addressing problems, innovation creates opportunities for progress leading to improvements in liveability and social capital.

A new narrative for an intelligent community is proposed which brings the focus back to the interlocking domains of social, economic, environmental and governance. An intelligent community leverages its resources, including data, to promote innovation for building community capacity.

Technology is the enabler for innovation through data for the deep insight to generate ideas and for the products and services to make these ideas become a reality.

An intelligent community narrative suits the Australian context with its relatively stable and highly urbanised population, coupled with smaller communities spread over a vast landmass, administered through a three tiered system of government – federal, state and local. An intelligent community narrative is globally relevant as it is not tied the rate of urbanisation which varies between countries. Communities are by definition inclusive whereas cities are exclusive to large urbanised populations. Communities are not necessarily bounded by formal government areas of responsibility. Within cities, communities can be a neighbourhoods or even a single street while in rural areas a community may be a village or commune. Small communities will associate with similar, like minded communities to form larger communities which may or may not align to formal government administrative areas.

For the purposes of this paper the definition of "community" is kept as place based. Characteristic based communities, such as sporting associations, trade unions and schools, crossover place based boundaries and individuals can be members of one or more of these groupings.

Urbanisation continues around the world with masses of people migrating to cities for employment opportunities and lifestyle. Meanwhile, the significant number of people remaining in the urban fringes, smaller towns, and rural areas, for example in Australia, can feel left behind as public policy attention is drawn towards the well documented problems of larger urban centres. As cities expand however, they are dependent on a growing ecosystem of communities (urban and non-urban) that are mutually reliant in supplying labour, produce, raw materials, goods and services. An intelligent community understands and manages its contribution and what it receives through the ecosystem. It is focused on making their community visible as an attractive place to live through good governance and a commitment to economic, social and environmental sustainability.

The paper examines an intelligent community in the context of liveability. A guide is provided for public

policy makers to consider an intelligent community across the dimensions of social capital (which for this paper is an amalgam of attributes spanning the social, economic, governance and environmental domains) and enabling technology.

This approach provides a framework to examine communities, large through to small, in terms of their current state and for establishing a pathway for innovation to occur leading to an intelligent community.

A Trend Towards Inequality – The 2016 State of the Regions Report

Over the last four years the Sydney region, Australia's largest city with approximately 5 million inhabitants making up just over 20% of the national population, has been increasing its share of national population and employment, and improving its productivity and income differentials compared to the rest of the nation.

As would be expected, the regions with the largest increases in productivity, as reflected in relative growth in earnings per hour, are in the main regions which have contributed the most to Australia's overall GDP growth over recent years. Over the 2014-2016 timeframe, the Sydney Central region contributed 19.8 per cent to Australia's overall GDP growth. During this period the Sydney metropolitan area also contributed just under a third of the increase in national GDP.

Between 2014 and 2016, two thirds of Australia's economic growth occurred in the Sydney, Melbourne, Perth and Pilbara-Kimberley regions. While the Melbourne region's current contribution to growth equals its share of national GDP, the Sydney region is significantly increasing its share.

For most other regions the contribution to national GDP growth between 2014 and 2016 was less than their contribution between 2000 and 2012. This is particularly true for the Queensland regions. The current contribution of Brisbane City to national GDP growth is less than 15 per cent of its contribution from 2000 to 2012.

The unequal distribution of economic growth inevitably leads to rising levels of income inequality and social disadvantage between regions. However, as evidenced by Sydney, is there a case for making Sydney an even larger city for the sake of national GDP growth, or is this a wake-up call to ensure other regions are encouraged and supported to contribute to productivity and GDP growth or face a growing inequality gap? While Sydney is contributing a growing share of national GDP growth, it is coming at a cost which could eventually see growth stall or even decline. This is evidenced by rapidly declining levels of housing affordability which is now a significant social, economic and political issue. Intelligent communities will have to recognise emerging and rising inequality, as both a social and economic issue, and take steps to address it.

This report can be found on ALGA's website: http://alga.asn.au/?ID=165.

Intelligent Rather Than Just Smart

Much of the broader smart cities narrative revolves around commonly quoted statistics demonstrating the seemingly inevitable shift of the global population to cities. For example, in 2014 54% of the world's population lived in urban areas. By 2050, this statistic will be around 70% (UN, 2014). However, for countries like Australia and the United States, where the rates of urbanisation are already in the 80-90% range (CIA, 2015), these broader statistics are not so relevant (see *Figure 1* for Australia's urbanised population trend).

These statistics are often positioned as a burning platform for action focused on addressing the problems resulting from this rapid and at times uncontrolled growth. However, for developed countries like Australia where the urbanisation rates are more stable, there is more scope for an innovation led approach for making communities intelligent, from the largest through to the smallest. While the smart city agenda often concentrates on the issues of mass urbanisation, there remains a significant number of people in countries like Australia who are not living in cities.

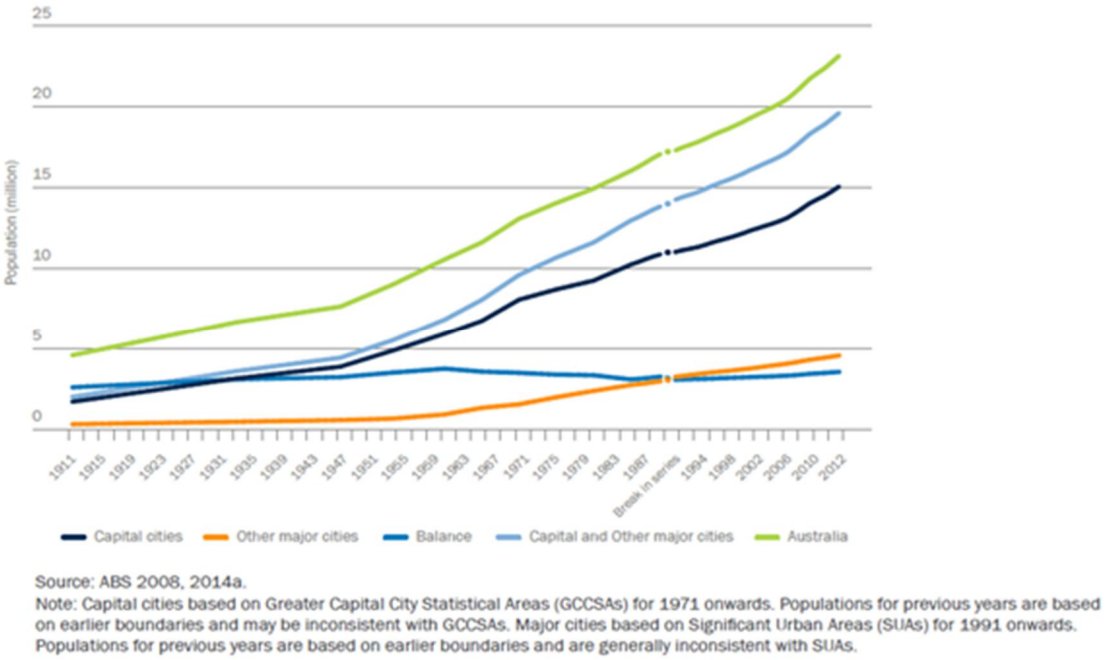
While small in percentage terms, they still constitute a major grouping of people albeit spread over a wide area of the country. As major cities grow, the viability of these potentially excluded communities becomes important as they contribute to an ecosystem of communities supplying labour, goods and services to support the larger population centres.

Smart city initiatives give rise to significant governance issues as they often involve multiple layers of competency within agencies from across the different levels of government. These initiatives seek to improve things such as transportation systems, energy efficiency, water quality, public safety, emergency management and housing affordability, all with the aim to provide a higher quality of life and to increase the attractiveness of a city for investment (Tachizawa, Alvarez-Gil & Montes-Sancho, 2015).

Within the smart city narrative, cities are often portrayed as a form of autonomous governing units in competition with one another. This leads to a quasi-competitive environment with public officials declaring an aspiration for their city to be "the smartest" in a region, a country or in some cases, the world. For any city rated the smartest or the most liveable, there is likely to be no shortage of people living in these cities that would beg to differ – not just individuals but whole communities experiencing various forms of disadvantage or exclusion.

However, a smart city is a function of the efficiency of the supply chains within the ecosystem of communities within the city and beyond, subject to varying layers and types of governance. This ecosystem represents the cultural, economic and environmental diversity of a country or regional area. This diversity results in a degree of uniqueness for every community, making statements of becoming the smartest city, in comparison to others, overly simplistic.

The competitive aspect of the smart city agenda is frequently represented by showcasing cities/regions as gold standards to be shadowed by others. This approach fails to recognise each city as unique due to factors such as location, governance, population and the natural resource base. As the context for each city is unique, their individual characteristics should be leveraged to optimise the well-being of the communities that make up the city.



Source: ABS 2008, 2014a.
Note: Capital cities based on Greater Capital City Statistical Areas (GCCSAs) for 1971 onwards. Populations for previous years are based on earlier boundaries and may be inconsistent with GCCSAs. Major cities based on Significant Urban Areas (SUAs) for 1991 onwards. Populations for previous years are based on earlier boundaries and are generally inconsistent with SUAs.

Figure 1. Australia's urbanised population trends 1911-2013 (Department of Infrastructure, 2015).

Intelligent Communities in the Context of Decentralised Systems of Governance

The question arises, how relevant is this dominant smart city narrative in the context of a developed country like Australia? Australia is made up of 530 diverse local government bodies of which approximately 400 are classified as regional or rural (Australian Local Government Association, 2017). In a country as diverse as Australia, from large cities such as Sydney and Melbourne through to small country towns and rural communities, a one-size-fits-all approach towards a smarter city will not be effective nor efficient. The investment path towards an intelligent community needs to be tailored by the community according to their individual needs and circumstances, taking into consideration the aspirations of the community and/or groups of communities that make-up the urban centres.

The 21st century smart city concept, often dominated by a technology centred agenda, carries a risk of overlooking vital aspects of what makes communities viable in Australia: population, employment opportunities and social capital. While digital technology will be important in transforming the way cities and communities function, the determinants of success lie within the overarching political, economic, and social factors.

What makes a community intelligent will be determined by its investment in social capital and technology infrastructure, coupled with deep insight into the unique contribution of a community to the supply chain of goods, services and labour within the ecosystem of communities they are connected with. The value and sustainability of these supply chains is a product of the collective intelligence of the communities involved. The leveraging of data to identify where investment is required, according to the needs, strengths and weaknesses across the domains of social capital and technology infrastructure, ultimately determines the resilience and intelligence of a community.

Therein lies a problem - how can evidence be gathered to make informed decisions across the domains of social capital and technology infrastructure, to become an intelligent community? This requires innovation in public policy making where

business insight leverages the ongoing developments in smart technology.

For many communities across Australia, there is a lack of skills and capability to derive insight from the digital data that exists today, let alone the mountains of new data coming on stream, in particular from the Internet of Things (IoT). Digital disruption of the workforce and the ongoing shift to a knowledge and services economy creates additional hurdles to overcome. For many communities, it is a question of where to start.

Federal and state governments, who rely on a bottom up effort from communities to develop evidence-based investment proposals, may consider fostering the development of new public policy skills within local government administrations which leverage digital data for deep business insight.

Networks of People and Technology to Form an Ecosystem

Cities are centres of population, commerce, and culture while communities are groups of people living in the same place or having a particular set of characteristics in common. Think city and you may be drawn to cities such as Sydney and Melbourne, or to cities within these capital cities such as Parramatta or Frankston. Take a more regional perspective and cities like Bendigo and Albury come to mind. Change context from city to community and some people will "think big" and consider Sydney a community, while others "think small" and consider community to be the street they live on.

The place based perspective of communities presents challenges from a governance perspective – what body is accountable and responsible for making a community intelligent? Governance within a smart cities framework is often focused around a city council. The council, along with state and federal agencies, considers investments in smart technology and social capital for the city as a whole.

There is a governance risk in demonstrating a deep understanding of community needs and following through with adaptable solutions with people at the centre.

In considering an intelligent community agenda, we need to recognise that communities come in many shapes and sizes. No matter the size, a determinant of sustainability is how individual communities associate with other communities to form ecosystems.

Communities are often seen as proximity-bound, independent entities, but in reality they form ecosystems where symbiotic relationships ensure their mutual sustainability. This happens by trading labour, goods and services. This trading culture depends on efficient infrastructure to enable effective supply chains. The supply chains leverage investment in transportation, telecommunications, utilities and essential services such as health and policing. This trade-enabling infrastructure falls to the level of governance with accountability for social and economic development across all communities.

For the communities within an ecosystem to be intelligent, a level of self-awareness of their function and role in the ecosystem is required. An intelligent community seeks to influence infrastructure related investment decisions which, at a minimum, protect and grow its value proposition to the overall sustainability of the ecosystem.

OECD research from 2012 on "Promoting Growth in All Regions," found that "broader-based inclusive growth brings other benefits to countries in terms of equity, resilience and fiscal health." Focusing investment on thriving communities and regions and ignoring those which are struggling to figure out what they contribute to the ecosystem is an error of judgement. "When policy makers focus only on the leading regions, they miss a crucial opportunity to improve aggregate performance." If we accept the OECD point of view, public policy makers must address capability gaps within non-thriving communities to help make them resilient and mutually sustainable.

Due to population size and the benefits of agglomeration, cities are often seen as more valuable parts of the economic model as they contribute a larger proportion of GDP on per-capita basis compared to the contribution from those living outside the cities. However, this view undermines the true value, such as primary production, added by the smaller regions, including the suburban fringes, which the economic success of the cities is dependent upon.

While not every community can be a tourism hotspot or the next Silicon Valley, they have people living in them and they can be innovative by leveraging their community assets. Innovation is a function of the capability and investment in business insight leading to ideas for asset based growth. These ideas leverage the smart infrastructure investments made by higher levels of governance. Business insight comes from data analysis. Mutual sustainability of community ecosystems depends on the trading of data, the raw ingredient for business insight.

Communities need capacity building support to leverage data created within their ecosystem and beyond. This requires collaboration between

communities, all levels of government and industry. Collaboration is dependent on a culture of openness and transparency towards data.

Some communities may feel hesitant in sharing data as this may be seen as detrimental for competitive advantage. The potential for community level innovation to occur as a result of data sharing, including aggregation and linkage, can outweigh the downside risks. Insight gained from data analysis, not the data itself, stimulates innovation, creates social capital and enhances social inclusion.

Liveability, Jobs and the Workforce of the Future

If work isn't the cornerstone of our society, then why so much focus on the jobs of the future and the impact of the digital economy? Labour mobility is a characteristic of a modern, thriving economy. Jobs can attract people to a community; liveability makes them stay.

Holding down a job within a vibrant labour market, underpinned by a strong safety net for those who cannot work, is a key social and economic pillar within modern societies. It is reasonable to assume this will remain so for the foreseeable future, notwithstanding what is regarded as the norm in terms of working life is constantly changing. While there is much debate on the future of work due to digital disruption, work remains central to how communities and individuals function, survive and thrive.

Automation, however, continues to disrupt labour markets with predictions that more than five million Australian jobs, or 40% of jobs which currently exist, will disappear in the next fifteen years due to technology (ABC, 2016). As manufacturing, agriculture and mining jobs are made redundant as a result of automation, the service or knowledge based economy is growing leading to many new jobs. The concept of the knowledge economy involves the view that information and knowledge are key drivers of economic growth and development, and the ability for individuals to effectively produce and use information is a vital skill (OECD, 2001). Innovation and technological change are driving the development of the knowledge based economy through their effects on economic structure, production methods, and consumption patterns (OECD, 2001).

Jobs and liveability go hand-in-hand. Economic activity within a community underpins investment in social capital related initiatives and strong social capital is a stabiliser to the negative effects of economic cycles. The flow-on effects of improving liveability and economic activity can trigger a virtuous circle effect leading to sustainable communities and resilience.

On the other side of the coin, if economic activity slows (i.e. jobs disappear), investment in liveability may decline and put community sustainability at risk. Communities often have limited capacity to influence the macro economic issues which determine labour markets and attract jobs. However, they have a level of control over liveability factors such as open space, public safety and recreational activities. In periods of economic slowdown, the focus on social capital related initiatives contributes to resilience thereby increasing capacity to influence economic activity.

Planning for the Future in Wangaratta

Wangaratta is a small rural city with a population of approximately 27,000 people (2015) located in North East Victoria. In 2008, the city in consultation with the community, developed a 2030 vision detailing what they would like the city to look like in the long-term, and how they plan to get there.

A strong focus on liveability factors, such as health services, learning options, social engagement and transport, underpins the 2030 plan. As a measure to build resilience the community is promoting diversification of the local economy while continuing to support current industries (manufacturing, agriculture, service industry sectors). The community demonstrates an understanding of the ecosystem of communities by priding itself in its location which is far enough away for major cities to be rural, and close enough to access them when needed. The plan outlines criteria for success through the following statement:

"Part of our success as a community has been the commitment to think, innovate and be bold to take unprecedented steps into the future. We have created and embraced opportunities as they have arisen. We have learnt from others and been quick to follow in the footsteps of other progressive communities. We openly share what we have done, what we have learnt and endeavour to help others to achieve their visions. This is part of our spirit."

To see the 2030 vision of Wangaratta or find out more about the region, visit: http://www.wangaratta.vic.gov.au/.

Tradable and Non-Tradable Jobs

The new economy is putting a spotlight on the concept of tradable and non-tradable jobs as explained by Enrico Moretti in his book, "The New Geography of Jobs." A tradable job creates goods or services which can be exported to other regions, e.g. knowledge or manufacturing jobs. Non-tradable jobs are usually the local jobs which support people in the tradable jobs, e.g. retail, health services and education. According to Moretti, "a healthy traded sector benefits the local economy directly, as it generates well-paid jobs, and indirectly, as it creates additional jobs in the non-traded sector."

At the macro level, attracting traditional tradable industries such as manufacturing is beyond the reach of many communities. To do so will often require significant infrastructure investment either as an incentive or in response to an industry relocating to their community and this carries considerable risk. However, the new economy provides opportunities to attract or upskill to a new class of tradable jobs at a lower investment risk – the knowledge workers. Knowledge workers have higher average incomes, are mobile and well-educated with a life perspective beyond the community they live in.

When clustered within communities with other knowledge workers there is potential to engage and leverage existing social capital assets of the community to enable innovation, leading to new jobs with higher levels of job satisfaction. Increasing the pool of knowledge workers within a community lifts demand for local services in the non-tradeable sector – the multiplier effect.

Knowledge workers by virtue of their mobility, have opportunity to exercise choice in where they live. Communities can leverage liveability factors to retain newly upskilled workers and attract new knowledge workers.

While major cities are better positioned for the knowledge economy through population and skills clustering, multiple factors have made the transition for rural communities much more difficult, such as dispersed, small populations and lack of knowledge based infrastructure i.e. high speed broadband. As the demand for knowledge workers increases, the pressure on rural communities to become "knowledge communities" rises. Jobs within knowledge based industries typically include intensive services reliant on the use of technology such as finance, insurance, business, communication and community and social and personal services.

Positioning for the Future Workforce – Goulburn

Workspace 2580 is a joint initiative of Community Plus Inc. and the Goulburn Mulwaree Council, with the aim to develop strong and sustainable social infrastructure in the community. As an inland local government area located in southern NSW with a population of 29,550 (2015), the Council identified the following service gaps:

- Access to community and adult learning
- Building community capacity for social engagement
- Strengthening the social capital and social infrastructure
- Access to consulting services in social and cultural planning, community engagement, project and program evaluation
- Safe and appropriate facilities for professional and outreach service providers working alone or in potentially vulnerable situations.
- Opportunities for informal collaboration, networking and mentoring start-ups and entrepreneurs
- Access to better information technology connection to support online businesses and e-learning.

To address these gaps, the Workspace 2580 initiative is a community funded facility providing co-working spaces for micro business and start-ups, serviced offices and education and training facilities. Workspace 2580 is collaborating with the University of Canberra to provide an ongoing higher education presence. The University is examining opportunities for residents through off-campus workshops, tutorials and video access to lectures.

Co-working hubs with high quality broadband connectivity such as Workspace 2580 can enable small businesses to significantly expand their influence, overcoming "tyranny of distance" issues to connect with local, regional and international markets. A critical success factor is the digital connectivity to harness creativity and share ideas.

To find out more about Workspace 2580, visit: https://workspace2580.cobot.me/.

Towards a Virtuous Circle of Growth

A three-year study (2010-12) conducted by Gallup and the Knight Foundation of 26 communities across the United States, "The Knight Soul of the Community," examined the factors that attach residents to their communities and the role of community attachment in an area's economic growth and well-being. This study revealed three dominant factors – aesthetics, openness and social offerings.

Kick-starting a virtuous circle of growth in employment and liveability is contingent upon a rich source of data and the capability to turn data into information for business insight. Information informs community leaders in making targeted investment decisions addressing social capital factors proven to have a positive impact on tradable job prospects.

Community leaders face a unique challenge; the levers they have most control over are not necessarily the most direct in terms of creating jobs. However, the liveability levers they do control can have a significant impact on creating the environmental conditions for innovation amongst knowledge workers. The economic value created will empower communities to invest further in social capital initiatives.

An intelligent community will adapt to the needs of the modern labour market, while positioning itself to provide jobs for future generations through innovation. An intelligent community will need to manage the risks of over investing in the jobs and workforce aligned to today's economy or the new economy, as the future is hard to predict and picking winners and losers will be challenging. An intelligent community will continue to invest in social capital and liveability factors as these are stabilising forces to mitigate the negative effects of the labour market changes.

Leveraging Assets to Kick-Start a Virtuous Circle

The town of Temora in the south-east of New South Wales has a population of around 7000 (2014) people and a reputation as the state's "friendliest town." The area is predominantly known for its wheat production and Aviation Museum which creates an attraction for domestic and international tourists and locals every second weekend when the historic war planes are flown.

Temora's aviation history dates back to 1941 when the Royal Australian Air Force set up the No. 10 Elementary Training School there. Although this training school is no longer running, a museum has been set-up in its place.

Temora Shire Council is taking advantage of its growing reputation as an aviation friendly town through the development of an Airpark Estate which includes a residential estate and commercial aviation business. Council has created the Airpark Estate to attract recreational pilots and commercial and aircraft related industries to relocate for work and lifestyle.

The investment focus on aviation related industries is having spin-off effects for the Temora community. The population of Temora has grown significantly since 2011, as new residents are drawn to the Airpark Estate.

The most recent Warbirds Downunder event at the Temora Aviation Museum in 2015 attracted 20,000 visitors to Temora, providing both a local and regional tourism boost. The economic benefit of this event to the local and regional economy was $6.4million.

The rural town of Temora's focus on aviation is an example of a community leveraging pre-existing assets (aviation history) for economic and social growth.

To find out more about Temora and its aviation industry, visit: http://www.temora.nsw.gov.au/.

Social Capital Development

European nations are often stood up as good practice examples of social capital investment, underpinned by the principle of solidarity within their respective social protection models. Local government in most European nations has a relatively strong level of governance with competency in areas such as health, social protection and education in addition to the traditional municipal functions of providing and managing locally based infrastructure. For example, in the Nordic countries local governments are delivering assistive technology, including robotics and sensor technology, for people with disabilities and the elderly, and this has already proven to be successful (Søndergård, 2014).

The wide ranging social and economic impacts of the Global Financial Crisis (GFC) on Europe are well documented, including the negative impacts on local government budgets. At the European Social Network's Annual Conference held in The Hague, June 2016, Frédéric Vallier, Secretary General of the Council for European Municipalities and Regions, lamented that as local governments faced budget cuts impacting on community-based services, municipalities were beginning to focus exclusively on their statutory duties rather than prevention and community building (European Social Network, 2016).

Instead of succumbing to these external forces for retreat from social investment, Ahmed Aboutaleb, the Mayor of Rotterdam said during his keynote address that communities need a strong government that nurtures people's talent and empowers individuals to be active in shaping their local communities, "We are aiming to build a broad, strong common ground with social networks in every neighbourhood … built around the idea of a 'community of practice'" (European Social Network, 2016).

Mayor Aboutaleb, a Moroccan immigrant to the Netherlands, is an inspiration for communities across Europe. His approach recognises that it is more than just geographical proximity that contributes to the dynamics of a community; it is the social ties, quality of life, and sense of identity that determines a community's liveability and functionality. His focus on empowering individuals encourages a people centric model promoting co-creation to address inequality and inclusiveness.

Social Capital within Community Ecosystems

Social capital can be described as the "relationships, attitudes, values and norms that guide interactions amongst citizens and contributes to the quantity and quality of cooperation, and economic and social development of a community" (Iyer, Kitson & Toh, 2005).

If we accept the notion of a liveable city as a function of the efficiency of contributions to the ecosystem and supply chains of communities within the city and beyond to towns and rural areas, there needs to be a focus on the social capital and liveability of these smaller communities, including employment, education and health. Making smaller communities more liveable could enable an equilibrium point of sufficient populations within and outside cities, forming the all-important ecosystem for cities to be sustainable.

Social cohesion and social identities are vital aspects of a community. Without them, a diminished sense of belonging throughout the community will lead to social exclusion and isolation. In communities where isolation and social capital are an issue, the overall prosperity and economic output of communities is affected.

For all communities, large and small, addressing the social determinants of health in a proactive manner through social capital building initiatives can provide more economic value to communities (higher productivity and output of healthier populations) than

the traditional provision of health services in a reactive manner. For example, people using wearable devices such as smart watches can opt-in and share their health and activity data for common good. This data can inform a choice architecture to encourage people towards living healthier lifestyles - the nudge approach derived from behavioral economics theory (Thaler & Sunstein, 2008).

Communities low in social capital can focus on jobs, healthcare, playgrounds, sporting and social clubs, and education, increasing functionality of public spaces and adding an element of security to build resilience, contribute to the ecosystem, and ultimately achieve economic development and intelligence (Debertin, 1996).

Addressing the Social Determinants of Health to Improve Liveability

The Public Health Intelligence (PHI) Hub is proposed as the expert agency for collating nationally gathered data related to, or potentially related to, the health of the Australian public. An initiative of the Health Research Institute within the University of Canberra, the PHI will focus on locality-based gathering of information and the locality-based responses needed in the places where people live. The aim is to use big data, data science and cutting edge analysis to understand and influence current trends in health in Australia. This will be a valuable resource for communities as they examine ways to increase liveability and build social capital.

In a recent article accepted by the international journal, Preventive Medicine for publication in June 2017, researchers associated with the PHI initiative conducted a first assessment of the relationship between neighbourhood walkability and hospital treatment costs – "Neighbourhood walkability and hospital treatment costs: A first assessment" (Yu et al., 2017).

Walkability is based on Walk Score® - a publicly accessible index to measure neighbourhood walkability (Walk Score®, 2015). Based on a range of data sources such as Google, it calculates the shortest network distance to amenities in each of 13 categories that include stores, restaurants, entertainment, schools and parks.

By associating the Walk Score® of Canberra suburbs with hospital admission costs for four chronic diseases, the researchers found:

- Nearly 80% of the neighbourhoods in the study population were rated car-dependent
- A 20-unit increase in Walk Score® was associated with 12.1% lower hospital cost
- A 20-unit increase in Walk Score® was associated with 12.5% fewer admissions

The researchers noted further study was required to identify the mechanisms linking neighbourhood walkability and hospital costs (causality). Notwithstanding, this research provides scientific evidence to support community investment in walk friendly neighbourhoods and towns, leading to potentially significant community and societal wide benefits from a healthier population with fewer (expensive) hospital admissions.

This study can be found at: https://www.canberra.edu.au/research/institutes/health-research-institute/annual-reports/reports/Influence-of-Neighbourhood-on-the-Burden-of-Non-Communicable-Diseases-in-the-Australian-Capital-Territory.pdf

Targeting Investment in Asset Based Growth

Targeted investment in social capital factors and technology infrastructure are equally as vital to the functionality and liveability of a community. However, over emphasis on one dimension potentially leaves the other neglected. In order to achieve optimal economic output and quality of life, targeted investment decisions have to be supported by an evidence base. Technology enables communities to collect and leverage digital data to build the evidence base leading to informed investment proposals.

One model to address social capital issues is Asset-Based Community Development (ABCD) (Nurture Development, 2017). ABCD challenges the traditional approach to solving community development problems, which has tended to focus on needs and deficiencies of individuals, neighbourhoods, towns, villages and schools to name a few. Rather than focusing on these deficits, asset-based approaches demonstrate that community assets and individual strengths are key building blocks in ensuring people have a life of their own choosing. This strengths based approach builds on community assets and culture.

In Australia, the Canberra based "Think and Do" tank Urban Synergies Group (UrbanSynergies Group, 2016) pursues the "Right to the City" approach (Lefebvre, 1967), a holistic way of improving the

quality of life in cities. This approach explores pathways towards enhanced engagement of the citizens towards improved health and well-being, leading to better economic outcomes.

A common element of the ABCD and the Right to the City approaches are community engagement for co-creation and decision making which respects and leverages deep local knowledge. Better economic outcomes are dependent on the community becoming engaged in addressing the issues they can control (liveability and social capital), taking advantage of externalities (e.g. a nearby tertiary education facility) and seeking influence over matters of community importance (e.g. generating tradable jobs).

Building an Intelligent Community through Digital Data

More co-operation across all levels of government is needed to address the issues faced by communities to align top-down major projects and infrastructure initiatives and community led bottom-up approaches towards establishing intelligent communities. Setting the transformation path, as aforementioned, requires public policy makers to have a more comprehensive evidence base to optimise their investments in addressing immediate and long terms issues.

Being the leader of a community and making decisions to address social and economic challenges while leveraging capital intensive infrastructure investments within the communities reach such as new hospitals, universities, public transport systems and telecommunications infrastructure, may seem like a gambler rolling the dice. You know you have to place bets with no control over how the dice will fall. The gambler analogy represents the uncertainty facing community decision makers. Uncertainty is a function of multiple factors, many of which are outside their direct control such as macroeconomic conditions and the timing of major projects.

For example, to address the issue of traffic congestion, the root cause needs to be addressed - where is the traffic coming from and why? While real time traffic monitoring can help to address the problem in the short term i.e. people knowing the best times to avoid the congestion, reducing the volume the traffic coming into a city or passing through a community requires more creative thinking. From a technology point of view, this manifests itself through the effective use of data from multiple sources over an extended period to develop an evidence base for effective decision making.

Of the many worthy ideas on the table, which will lead to a return on investment in terms of liveability (social capital) and/or economic value? Which are short terms fixes and which are those that attack root causes? Which may serve as a catalyst for a virtuous circle of community growth? Developing sustainable and resilient communities is not a game of chance; innovative proposals requiring bold investment decisions carry risk. There is renewed focus in public policy making for risk mitigation through an evidence based approach.

Promoting Public Data

The Onkaparinga region in South Australia is located just south of Adelaide and is home to approximately 169,000 people (2015). The region places a strong focus on social capital and liveability factors, as well as enabling economic drivers.

The economy of Onkaparinga is built on a number of diverse industries which include wine, food and tourism, but is also beginning to support successful niche industries in technology fields such as medical devices, cosmetics, water, environmental products and advanced manufacturing.

Via the Onkaparinga website, regional data on topics such as employment, wellbeing and economic trends is publically available. This data is structured in a simple and usable manner, including a download function, and can be used to support evidence-based decisions.

To find out more about Onkaparinga or view the data sets, visit: http://www.communityprofile.com.au/onkaparinga

Evidence-Based Management

Evidence-based practice as proposed by the Netherlands based Center for Evidence-Based Management (CEBM) is that "good-quality decisions should be based on a combination of critical thinking and the best available evidence." Access to "the best available evidence," while relative, is an underlying principle of evidence-based management. Community leaders are adept at making do with evidence which satisfies the best available test, however, they should aim to expand these sources of evidence to increase reliability. The rapidly growing repositories of digital data is a source all communities need better access to.

A solid evidence base, according to the CEBM, is a combination of data from internal and external sources (customer data, transactional data), scientific data (academic reports, field studies), stakeholder data (community, business consultation, impact analysis) and professional expertise. Professional expertise is the personal experience of decision makers and community leaders.

Digital data is an evidence source exploding in terms of volume, veracity and velocity. Sifting through raw data to make it usable to generate business insight is challenging. As billions of internet of things devices (IoT) are deployed sensing any imaginable activity, this unprecedented scaling up of digital data production is difficult to comprehend, let alone prepare for, in order to derive value.

Common Use Data Platforms

While a smart city lays out infrastructure to collect data, intelligent communities will develop the capability to make productive use of it. Realising data's value requires a robust technology platform to enable simplicity in integration and analysis across multiple sources.

It's not practical for every community to make the large scale technology investments that major cities can undertake. However, this should not deny them the opportunity to enhance the evidence base they have for community level decision making. There is already large amounts of digital data with more coming on stream through smart city infrastructure investments made by larger communities and higher levels of government. Community leaders need access to this data and they need capability to make good use of it.

Governments at all levels around the world are becoming aware of the potential of releasing data traditionally kept within the purview of government or simply the agency that created it. Termed "Open Data," the potential is for government data to unleash significant economic and social benefits if made freely available. However, government data is only part of the picture - the value will rise significantly if it can be linked and compared to data held by the private and community sectors.

The issue is that simply making data available is not enough. Not all government held data is appropriate to be released and the default position for most government agencies is to be naturally conservative. This conservatism is an appropriate approach given the potential risks arising from breaches of personal information, information release not in the national interest, and misuse or misinterpretation of data.

Data released to the public domain within the category of Open Data (refer Figure 2) is often difficult to manage, difficult to locate, inadequately structured and described, or is simply dumped in silos across separate portals and not readily published in easily linkable formats. This situation is exacerbated when the data is not collected with a view that it will become "open" at some future date. At times it may seem that government agencies are complying with a centralised mandate for providing open data without due consideration to providing a service for value creation.

Commercial operators are emerging to capitalise on the opportunity to aggregate publicly available government data.

There will be challenges moving forward in finding the right balance in making data open and available via common use platforms in the public interest, while keeping incentives for a viable commercial market providing value-add services.

As the market grows, regulatory and compliance regimes will need to keep pace to ensure data and its derivatives (i.e. products from the refinement of raw data through linkage and combination with other data sources) is managed and protected in a manner that retains public trust in the process.

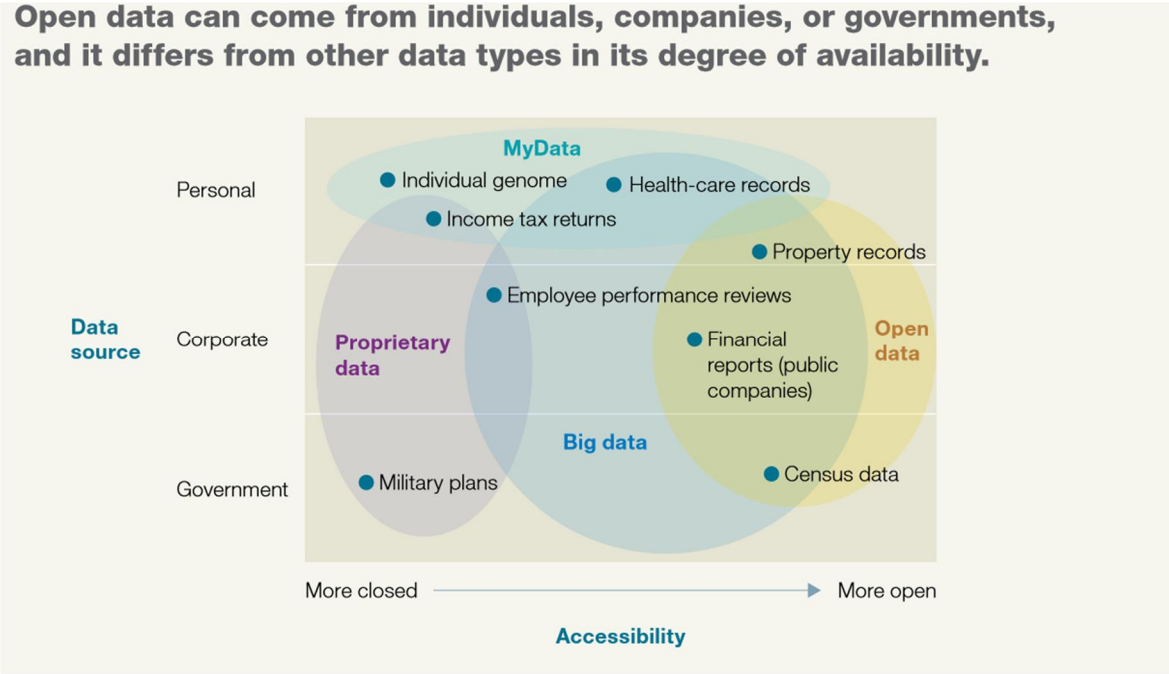


Figure 2. Innovation in Local Government: Open Data and Information Technology (McKinsey, 2014).

Data produced and collected by government agencies is a community asset to be valued and shared - how this is done requires common use data platforms with capabilities that include:

- The ability to access common language libraries or data "ontologies" that describe how data should be stored and represented making it easier to link datasets together across different domains and topics;
- Complex search functionality that will allow users to navigate the growing volume of data as a rich, organic web in a similar way that we are currently able to search documents;
- Analytical applications and software, including machine learning technology, that apply intelligent algorithms and perform analysis of large amounts of data to generate insights that inform evidence-based decision-making and the evaluation of programs;
- Visualisation tools bringing data to life in a flexible manner enabling project teams, decision makers and community leaders to perform ad-hoc queries in real-time across various data sources and perform what-if simulations;

- The ability to apply a methodology to identify value in any collection of datasets and help users generate new opportunities and form new insights from the data;
- Coding and programming tools that enable users of the platform to build new solutions with existing data e.g. apps, websites, new services, new products;
- Dynamic updates as new data becomes available, with automated version control and retention of historical datasets to support the development of longitudinal datasets;
- Embedded rules that take into account policy and legislation requirements such as those related to privacy, security, access and confidentiality to protect data published on the platform, including protections against using data to re-identify individuals;
- The ability to capture data from individuals who opt-in to provide health and activity information via wearable devices and sensors.

Delivering an open data platform with the above capabilities for communities to leverage requires a significant investment addressing government's role as a data provider, user, policy maker and the catalyst for the open community to form - ideally through national, state level collaboration (Chiu et al, 2014). If openness is complemented with resource governance, capabilities in society and technical connectivity, use of open government data will stimulate the generation of economic and social value through four different archetypical mechanisms: efficiency, innovation, transparency and participation (Jetzek et al, 2013).

Using Non-Traditional Data Sources to Inform Planning

The Regional Australia Institute (RAI) partnered with social media company LinkedIn to review jobs and skills markets in regional Australian cities. They focused on five key regional cities – Townsville, the Sunshine Coast and Noosa, Newcastle, Wollongong and Launceston.

Using the RAI's "Great Small Cities" data and LinkedIn's data on its member networks, the RAI was able to start measuring emerging skills trends in real-time. They were able to identify the current skills position of each city through a mix of internal and external connections, industry and skills strengths, mobility of skilled workers, and the skill needs that are emerging.

Visit http://www.regionalaustralia.org.au/home/ to learn more about the RAI and to read this study.

Investing in Skills to Turn Data into Insight

There is a community-wide shortage of skills, resources and capabilities in using data effectively to underpin innovation. While there are strong pockets of expertise, the high skilled knowledge workers who can manage open data to information and insight are in short supply.

When using open data, it needs to be assessed in terms of its validity, relevance, and trust. Most data was not collected for the purpose of making it open, so there are challenges when using data for other purposes. Dealing with this complexity does not mean every community leader should have to be a data scientist, an open data expert nor a technology infrastructure specialist. Intelligent communities will find ways to access these high order technology and business skills to turn data into simple to use evidence.

Figure 3 is a schematic of the open data platform as the enabler for converting data to information leading to business insight for innovation. As the knowledge base of information and insight develops, machine learning technology can support decision makers as they seek to combine this deep learned insight with the technology and infrastructure layers such as a network of IoT sensors. Innovation, as the intersection business insight and invention, is the product of this process.

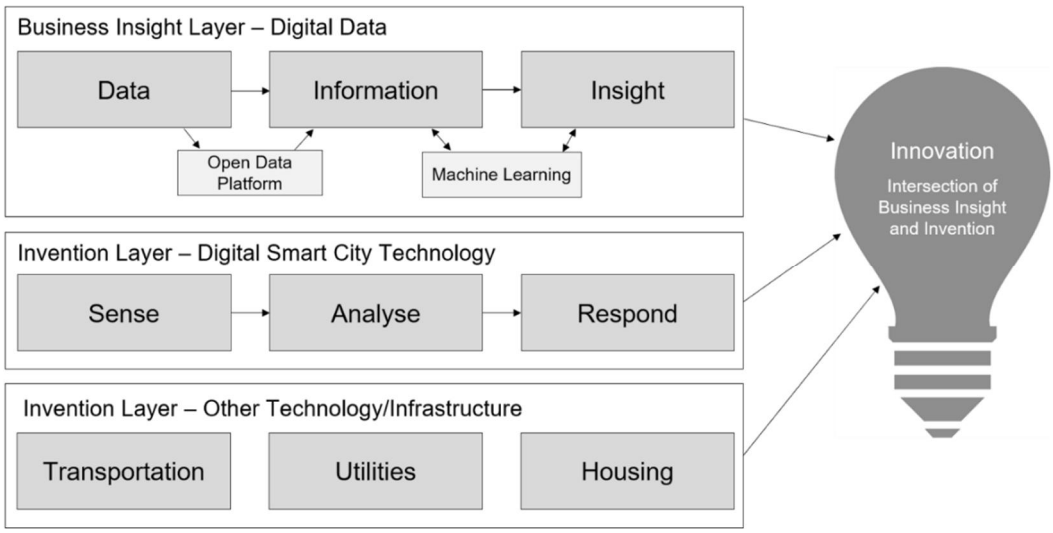


Figure 3. Community Led Innovation: Creating Opportunity.

Capacity and capability building within communities to turn digital data into insight, is an area for the levels of government with accountability for community wide development to address.

Provisioning community level data management infrastructure on an open data platform commons would be a major step forward towards empowering communities to enhance their evidence base for community based decision making. The business of government could be well served by building capacity and capability within communities for this to happen.

Data analysis skills combined with easy-to-use technology platforms to gain insight from digital data are prerequisites for transformation to an intelligent community. Digital shared services provisioned by larger communities including cities, can enable smaller communities and community ecosystems.

Leveraging Data Aggregation

The City of Greater Bendigo in Victoria has a population of 108,000 (2015), and is known as the home of community bank, the Bendigo Bank, and for its rich gold mining history.

Bendigo has been partnering with a data aggregator specialising in information related to funding grants across all levels of government. The Bendigo specific website is a tailored version of the data aggregator's public offering, "GrantGuru." By localising the offering, businesses are able to more quickly find grants they may be eligible for. The City's Economic Development Unit have driven this initiative to assist local businesses to attract funding to the city.

To view the Bendigo Funding Finder, visit: http://bendigo.grantguru.com.au/.

A Guiding Framework towards an Intelligent Community

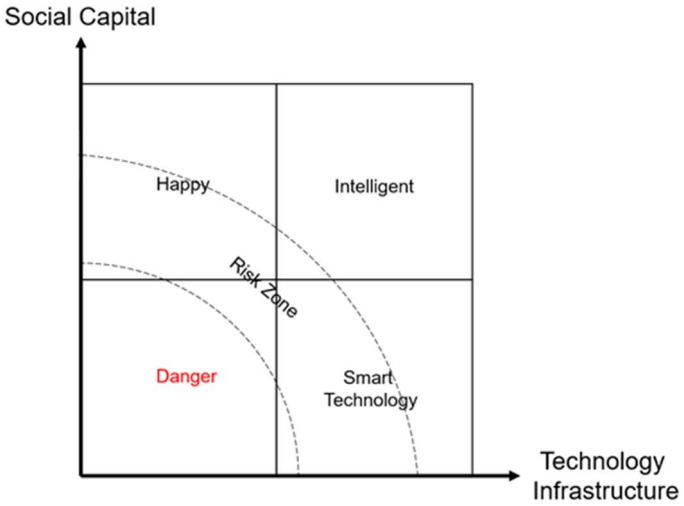
The challenge to becoming an intelligent community is knowing where a community currently stands, deciding where they want to go, configuring the path to get there and finally, execution. As no two communities are the same, these elements vary across communities: there is no one-size-fits-all model.

Calling out a community as intelligent is largely a relative and subjective statement and needs to be used with caution. As communities have so many variables to deal with and while some have significant natural advantages associated with location and resources, it is more valuable for individual communities to focus on demonstrating progress towards their goals rather than participating in an arbitrary competitive process.

Community consultation is key to goal setting, which should be informed by an understanding of the current situation. There is a common saying along the lines of "shoot for the stars and land on the moon" (not attributed). This aspirational turn of phrase seems to imply you know you are standing on earth to start with. For communities considering aspirational goals for becoming an intelligent community, how well do they understand their starting or reference point? While the collective term intelligent community is relative, the attributes of an intelligent community are measurable in quantitative and qualitative terms.

In examining the many attributes of an intelligent community, the next challenge is aggregating the measurable data in a manner that is simple and informative for community members. There is an asymmetric level of knowledge between community leaders and community members and this must be addressed as part of the change management process. Ongoing communication starting with the aspirations through planning to execution and achievement is essential for securing community members' engagement in a co-creation journey towards an intelligent community. The common data platform and associated infrastructure along the lines outlined in the previous section of this paper, provides opportunity for community leaders to address this information asymmetry.

At *Figure 4* (below), is a simple visualisation framework for positioning an intelligent community in terms of where it currently stands and where it is aspiring to be. This visualisation represents the intersection of an index (not defined) of social capital and smart technology infrastructure attributes.



For illustration we have defined four quadrants representing stages of maturity towards becoming an intelligent community i.e. happy, smart technology, danger, intelligent. Definitions for each quadrant are briefly described in *Table 1*. As the framework is conceptual, the quadrant descriptions are indicative only.

Figure 4. Visualisation path to an Intelligent Community.

Quadrant	Description
Happy	High social capital and social identity throughout the community but low economic output and contribution to the ecosystem and supply chain.
Smart Technology	High investment in technology infrastructure, interested in optimising efficiency for citizens through technology such as IoT for traffic management, but without a similar priority of investment in liveability and social capital factors.
Danger	A declining community with low investment in technology infrastructure and investment in social capital is declining.
Intelligent	Targeting investment decisions leading to high social capital and leveraging technology infrastructure, including an understanding of value contribution/position within the ecosystem/supply chain. Well prepared for the knowledge economy and workforce of the future.
Risk Zone	Communities operating at a satisfactory level in terms of today's needs but are at risk of decline - targeted invested in limited social capital and/or smart technology infrastructure may be the catalyst for a virtuous circle effect.

Table 1. Intelligent Community Index.

For the framework to be used beyond an internal planning tool by a community and/or comparative analysis between communities, the components for the social capital and smart technology infrastructure indices would need to be defined and measured. This requires on-going research.

Seven Key Decision Points

Intelligent communities demand a shared focus on social capital development and technology infrastructure. The investment requirements for social capital development or technology infrastructure varies from community to community and there is no one-size-fits-all approach. Creating a roadmap which leads to an intelligent community is a complex governance and public policy question for all arms of government holding accountability and responsibility for community development.

To achieve this requires a sound understanding of where an individual community stands in terms of social capital and technology infrastructure and the investment path from the current state to a prospective state. In this discussion paper we have proposed a simple framework approach to assist policy makers in examining the current state of their communities, large through to small.

Smart technology infrastructure and associated solutions offer many potential benefits for communities. The extent to which each community can take advantage of smart technology infrastructure is dependent upon their resources and capability. The transformation to intelligent communities will follow many different paths. The following seven decision points however, are relevant to all communities, large and small.

The seven decision points for planning an intelligent community:

1. ***Stocktake assets -*** using the intelligent community visualisation framework as a starting point, assess the social capital and smart technology assets and determine the current state of the community - happy, smart technology, danger, intelligent and proximity to the danger zone. Focus on identifying community assets including data assets rather than emphasising the deficits. More research is required to define benchmarks and indices within the framework for comparative analysis between communities. For the time being, communities can use this concept to for a self-assessment approach.
2. ***Position within the ecosystem -*** identify the ecosystems you are part of and the value of what you are currently contributing and receiving. Community ecosystems are additional components to the stocktake of assets. Ecosystems are fluid as community fortunes rise and fall and as such positioning in terms of value exchange may need to change. Be open to change and prepared to rapidly amend the community alignment with other communities to form new ecosystems.
3. ***Co-create with community members -*** develop an ambitious plan through engaging with the community - consult and collaborate with the aim to co-create the catalysts for a virtuous circle effect. Ambition kept realistic based on evidence by leveraging data in line with where the community currently sits as per the visualisation framework.
4. ***Promote with stakeholders -*** The bottom-up evidenced based plan is promoted to stakeholders (community ecosystem members) and other layers of government to secure support and to identify opportunities to leverage and capitalise other investment initiatives that are beyond the community/ecosystem.
5. ***Agile governance -*** explore ways for making governance more agile, notwithstanding there are legislative and administrative constraints to work within, to keep the community, stakeholders and all layers of government engaged and informed of progress and issues. An example of such an approach would to be use sentiment analysis of social media to measure the mood of the community and to be proactive in responding.
6. ***Evidence-based investment -*** invest for success by basing decisions on an evidence based framework that incorporates different sources, including expertise and experience of community leaders.

7. ***De-risk the journey -*** risk mitigation through rapid evaluation of initiatives including the use of predictive techniques taking advantage of digital data - be agile in changing direction according to the evaluation evidence.

Making sense from the mountains of data already available and what comes on stream as more investment is made via smart based technology, will challenge even the most intelligent of communities. However, what makes this challenging are the governance issues involved - who owns the data, what data can be shared and who invests versus who gains value from an open data common platform within the different layers of government.

A prerequisite for opening up the possibility of a successful transformation journey for all communities across the nation is investment in skills and relevant technology platforms. Empowering communities with these prerequisite capabilities can keep them out of the “danger quadrant” or the “risk zone” of the visualisation framework, and place them on the path to an intelligent community, as defined by them and owned by them.

Moving Forward

Making an intelligent community involves investment in initiatives addressing social capital and economic development objectives within an environmentally sustainable envelope. It is not a case of one versus the other, nor does it mean investment has to be balanced at all times. Investment in digital and smart city technologies will continue to enable better outcomes in both the social and economic domains. Accountability for decision making and responsibility for execution and delivery rests within the governance structures spanning the various layers of competence. Decisions for moving forward, will be informed based on the best available evidence.

The value adding solutions and initiatives arising from these decisions can be high tech or involve no technology at all – what matters is the innovation arising from the insight gained through digital data. We have introduced two new components to enable this, namely:

1. The intelligent communication visualisation framework – social capital and smart technology infrastructure
2. The common use data platform

We have described these components in high level terms within this paper and more work is required to expand these concepts into detailed options for consideration. This work would include feasibility assessments addressing risk, governance, development and ongoing maintenance costs. Funding sources could include a combination of government, industry and communities. The initial work could potentially be funded through the Smart Cities and Suburbs Program (PM&C, 2017).

We recommend approaching a small number of communities demonstrating solid progress towards becoming intelligent communities. These would be offered the opportunity to be lighthouse communities (pilot sites) by demonstrating the art of the possible in terms of innovation through better use of digital data.

As a first step we recommend an existing intergovernmental forum, along with invited industry representatives and communities, to examine this “moving forward” proposal via a working group or roundtable forum.

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"Smarter cities are inherently about intelligent communities. We need to be clear that technology remains a tool to restore the balance between the three spaces (the lived, conceived and perceived spaces (Lefebvre, 1991)) and to create solid bridges. Bridges that serve to connect Intelligent Communities need to embrace an ethical code of conduct, which is based on trust and equity. Only if those well-connected and committed islands become the global majority by sharing their wisdom and resources, only then advancements to planetary health and wellbeing outcomes for civilisations is possible."

- Gregor Mews, Urban Synergies Group