

Challenges and Opportunities to Develop a Smart City: A Case Study of Gold Coast, Australia

Bhishna Bajracharya, David Cattell, Isara Khanjanasthiti

(Assoc Prof Bhishna Bajracharya, Bond University, Gold Coast Australia, bbajrach@bond.edu.au)

(Assoc Prof David Cattell, Bond University, Gold Coast Australia, dcattell@bond.edu.au)

(Mr Isara Khanjanasthiti, Bond University, Gold Coast, ikhanjan@bond.edu.au)

1 ABSTRACT

With the rapid growth of information and communication technologies, there is a growing interest in developing smart cities with a focus on the knowledge economy, use of sensors and mobile technologies to plan and manage cities. The proponents argue that these emerging technologies have potential application in efficiently managing the environment and infrastructure, promoting economic development and actively engaging the public, thus contributing to building safe, healthy, sustainable and resilient cities. However, are there other important elements in addition to technologies which can contribute to the creation of smart cities? What are some of the challenges and opportunities for developing a smart city?

This paper aims to answer these questions by developing a conceptual framework for smart cities. The framework is then applied to the city of Gold Coast to identify challenges and opportunities for developing the city into a 'smart city'. Gold Coast is a popular tourist city of about 600,000 populations in South East Queensland, Australia, at the southern end of the 240km long coastal conurbation that is centred by Brisbane. Recently, IBM has nominated Gold Coast as one of the three cities in Australia for its Smarter Cities Challenge Grant. The grant will provide the Gold Coast City Council with the opportunity to collaborate with a group of experts from IBM to develop strategies for enhancing its ICT arrangements for disaster response capabilities. Gold Coast, meanwhile, has potential to diversify its economy from being centred on tourism to a knowledge economy with focus on its educational institutions, investments in cultural precincts and high quality lifestyle amenities. These provide a unique opportunity for building Gold Coast as an important smart city in the region. As part of the research methodology, the paper will review relevant policies of the council. Finally, lessons will be drawn from the case study for other cities which seek to establish themselves as smart cities.

2 INTRODUCTION

With globalisation of cities, and move towards knowledge and information economy, a number of cities are now competing with one another to attract investments, knowledge workers and promoting themselves as smart and intelligent cities. Some of these cities are promoting themselves for attractive lifestyle (such as cultural and natural amenities), knowledge infrastructure (such as universities and businesses) and technologies (such as sensors, mobile technologies and Internet of things (IoT)). Larger cities such as Glasgow, Vienna, Edinburgh, Melbourne, Portland, and Seattle have been at the forefront of these trends (Deakin, 2014). However, now there are also a growing number of smaller cities such as Gold Coast which are showing interest in developing as smart cities. What are the challenges and opportunities for these small cities for developing them as smart cities? What are the competitive advantages they have in terms of manpower, amenities, governance, active private sector initiatives? Is this driven by technologies alone or more seen holistically in terms of people, resources as well as institutions? Is there a strong strategic focus on developing smart cities or are they part of opportunistic and ad-hoc approach to smart city development? These are some of the questions the paper aims to address.

The key objective of the paper is to identify the challenges and opportunities to develop a smart city using a case study of Gold Coast. Based on the review of literature on smart cities and local case study, the paper will develop a conceptual framework for developing smart cities. The paper is primarily an exploratory paper based on review of theoretical literature and policy documents of local government in Gold Coast.

3 TOWARDS A CONCEPTUAL FRAMEWORK FOR SMART CITIES

There has been extensive growth of literature on smart cities in the last two decades (Deakin, 2014; Townsend, 2013; Hollands, 2008; Castells, 1996; Mitchell, 1999; Florida, 2002; Florida, 2004; Graham and Marvin, 2001; Bajracharya and Allison, 2008). Hollands (2008) highlighted the importance of people and human capital rather than just application of information and communications technology (ICT) in improving and transforming cities. Although smart cities are 'wired cities', the use of ICT by itself does not

make cities smart. While the focus of smart cities in the past has been related to meeting corporate marketing needs, there is a need for the transition to utilising social intelligence for cities by grounding community led information and communication for cultural and environmental development (Deakin, 2014). Along with focus on technologies, there have been recent works by Landry (2008) and Florida (2002, 2004) who argued for a need to develop knowledge regions and creative cities. Deakin and Allwinkle (2007) summarised the evolution of smart cities from focus on static and limited information via city websites in the 1990s to dynamic and interactive services allowing service transactions to develop platforms for online citizen engagement in 2004/5. Since then, smart cities have focused on the development of digitally inclusive advanced visualisation and simulation. These developments illustrate an evolution from informational to intelligent to now smart city (Deakin, 2014). In recent years, there have been several technologies integrated into smart cities such as cloud computing, mobile devices, radio-frequency identification (RFID) and drones. There is now also a move towards data services being made more openly accessible, democratic and service-oriented around the needs of the local community.

There are a number of useful conceptual frameworks for developing smart cities. For example, Nam and Pardo (2011) identified three key dimensions of smart cities which include technology, people and institutions. They also argued for the need for integration of infrastructures and technology-mediated services, social learning for building human capital and governance for public participation and institutional capacity building. A pan-European research project IntelCities (Paskaleva, 2014) found that governance in terms of collaborative decision-making and action can play an important role in building a smart city and highlighted the importance of boosting local competitiveness by using knowledge networks and integrated e-services and governance. The current thinking is moving away from just a technological approach towards smart cities that utilise a more holistic concept of capitalising on social, cultural and environmental capital as well as higher education, creative talent and the knowledge workforce. Furthermore, local quality of life and local amenities for urban attractiveness and development have been proposed as smart city components (Rappaport, 2009).

Another useful concept comes from IBM's Smarter Planet, an initiative which proposes the use of smart meters, networks and data modelling for making city systems interconnected, instrumented and intelligent, thereby making them more efficient and effective (IBM, undated). It suggests the need for different parts of a city's system to be interconnected and able to communicate to one another. Likewise, it suggests the need for instrumentation of a city's system to be measurable with instruments and meters. Lastly, it suggests the need for intelligence to use the data gathered to automate many related services as well as develop predictive models of likely outcomes for better decision-making in the future. IBM is working with a number of local councils in different parts of the world, including three cities in Australia (Gold Coast, Geraldton and Townsville), through their Smarter Cities Challenge Grant, a philanthropic initiative. The areas they work on as part of the program include economic development, public safety, environment and public transport. IBM is pilot testing this concept and framework of instrumentation to reduce waste and develop energy efficiency. Like IBM, other multinational companies such as CISCO and Siemens are all developing projects for smart cities.

A number of cities have taken important steps towards developing smart city initiatives. For example, Amsterdam has emphasised collaboration between government, business and community to develop smart projects on energy savings. It uses instrumental intelligence through smart devices and wireless sensors for enabling citizens and organisations to optimise their practice (for activities such as energy consumption of appliances). It also initiated crowdsourcing, co-creation and open innovation to engage the community to develop solutions for public space and mobility. Southampton City Council has focussed on integrated e-services through the use of smart cards. Melbourne, on the other hand, has focused on developing knowledge precincts with advanced ICT infrastructure and business parks near universities as university-business-government partnerships (Yigitcanlar et. al 2008). Likewise, Hong Kong has developed Cyberport as an enterprize zone for nurturing local and global ICT start-ups and entrepreneurs. With more than 189 ICT incubatees in 2013, the development contains state-of-the-art ICT facilities, shopping mall and five star hotel as well as large residential complex and park with fibre optic and broadband connections (Hong Kong Cyberport Management Company Limited, 2014).

Smart cities have the prospect of being efficient, transparent, resilient, secure and sociable (Townsend, 2013). Townsend (2013) provided a number of suggestions regarding smart cities such as the need to connect

and crowdsource everyone with care. Townsend also dealt with issues associated with data such as privacy, data access by poorer communities versus commercial operators, and public ownership. According to him, we need to consider social sustainability in planning for smart services and benefits of open data should also extend to the poorer communities. As part of earlier debates on the ‘information age’, Castells (1996) argued that there could be growing concerns about the struggle between networked global economies and social identities of the people. Likewise, Graham and Marvin (2001) point out that emerging ICTs and private ownership can contribute to digital divide and splintering of urbanism.

Based on the literature review above, five key themes emerged as important considerations for creating smart cities. These include:

- (1) Cultural and Natural Amenities – local amenities that enhance quality of life
- (2) Technology – implementation of ICTs for improvement of city systems and functions
- (3) People and Skills – attraction and retention of and support for knowledge workforce and businesses
- (4) Knowledge and Innovation Precincts – facilities for attracting and generating knowledge workforce
- (5) Governance – arrangements and plans for creating smart cities

The five themes above, which are interrelated and not mutually exclusive, are summarised in Figure 1, along with potential factors applicable to each theme.

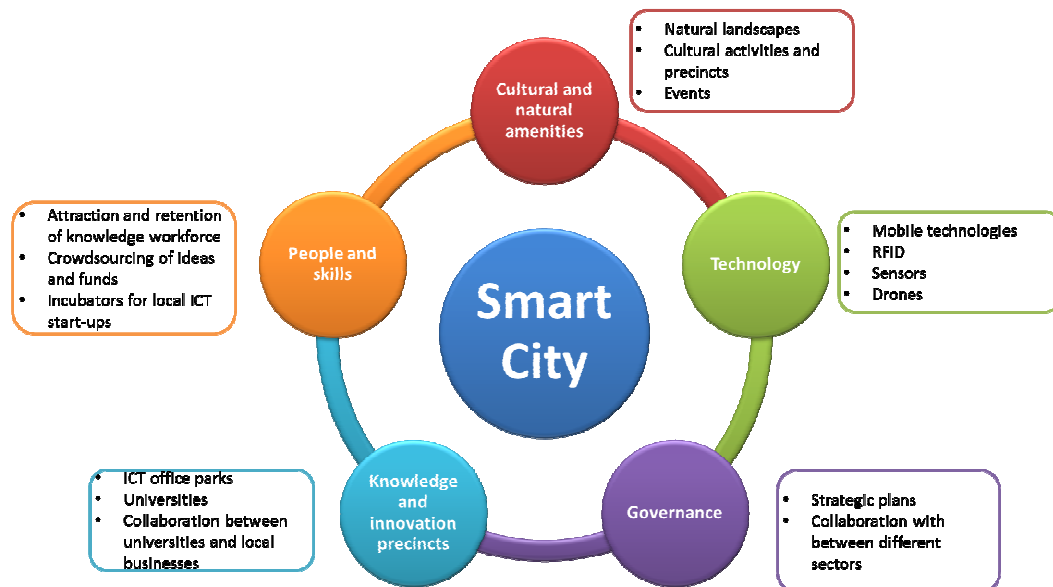


Fig. 1: Conceptual framework for smart cities

The paper now applies the framework to a case study of Gold Coast. Opportunities and challenges in developing the city as a smart city are presented based on the five themes articulated in the framework.

4 INTRODUCTION TO GOLD COAST

Located as part of the larger South East Queensland region with Brisbane and Sunshine Coast, Gold Coast is a coastal city with a population of about half a million. It is the sixth largest city in Australia with rapid growth of population in the past, which has slowed down slightly in recent years. The city’s population is expected to grow to about three quarter of a million by 2026. Its economy is primarily based on tourism and construction. Gold Coast promotes itself as a city with natural beauty and relaxed lifestyle as well as an ideal location to live, work and play. While tourism has been an important attraction of Gold Coast, the city also has a foothold in industries such as education, sports, film, marine and IT. As part of its economic development, the Gold Coast City Council (GCCC) aims “to make its mark on the world stage, where knowledge, innovation and commercialisation are the key drivers for growth” (GCCC, 2014). It sees itself as a ‘city of opportunity, on the cusp of a transformation change’ with the forthcoming hosting of the Commonwealth Games in 2018. To this end, the GCCC has recently begun its journey to develop Gold Coast into a smart city. Figure 2 shows an aerial view of Broadbeach and Surfers Paradise, key activity centres of Gold Coast (Gold Coast Convention and Exhibition Centre, 2014).



Fig. 2: Aerial view of Gold Coast

The paper now identifies key opportunities and challenges for developing Gold Coast into a smart city under the five identified themes of the smart city framework. The discussion below is based on critical understandings of the city's existing context as well as various policies of local and state governments.

5 CULTURAL AND NATURAL AMENITIES

The first theme is Cultural and Natural Amenities. It is associated with amenities, events and attractions which can enhance quality of life for local communities, thereby attracting knowledge and ICT workers.

5.1 Opportunities

5.1.1 Attractive Climate and Settings

Gold Coast has a subtropical climate with more than 80 kilometres of beaches on the eastern end and ecologically diverse national parks and hinterland on the western side. Gold Coast is home to several historically significant sites and World Heritage Listed rainforests, which are open to the public for visits. As a major tourist destination in Australia, Gold Coast also contains a range of entertainment facilities such as theme parks and wildlife sanctuaries. The city is also rich in sports and recreation facilities for activities such as go karting, skydiving, golf, surfing, ice skating and bowling.

5.1.2 Cultural Precinct and Facilities

The GCCC is facilitating the development of a Cultural Precinct in Surfers Paradise, the city's major tourist destination. The objective of the Cultural Precinct is to showcase local culture, arts and creativity of the Gold Coast community to the world. The project was initialised due to the recognition by the GCCC (2013d, p. 5) that the Commonwealth Games event in 2018, which will attract significant number of visitors to the city, is an opportunity for the city to culturally "shine on the world stage." In addition to the Cultural Precinct, expected to be completed by 2018, there are a number of existing art galleries and museums throughout Gold Coast, which have served as the city's attractions.

5.1.3 Variety of Events

Gold Coast is a city of events where events are organised on a weekly basis. In addition to smaller events which are free or low-cost, the city also holds a number of major events every month. These major events, regularly organised every year, encompass many themes and activities such as filming, sporting competitions, music festivals, animal expos, careers expos, and marathons. A key major event the city is set to host is the Commonwealth Games 2018, for which several programs have been put in place by the GCCC. These initiatives focus on better equipping the city additional transport and community infrastructure, including a light rail system, a Commonwealth Games residential village and additional sporting venues.

In addition to the wide range of events the city hosts, Gold Coast is also rich in event venues and spaces. Some of these venues include the Gold Coast Convention and Exhibition Centre, universities' and hotels' function centres, and sporting stadiums, which have hosted various events in addition to sporting matches.

5.2 Challenges

5.2.1 Public Safety during Events

Public safety during events, particularly major ones, has been a challenge for Gold Coast. One example of an event where public safety is a significant concern is Schoolies, an annual event spanning across three weeks during which more than 50,000 teenagers across Australia visit Gold Coast to celebrate their high school graduation. Schoolies on Gold Coast has been associated with activities such as illegal and excessive intake of alcohol and drugs as well as harmful behaviours (Lam et al., 2013).

5.2.2 Unaffordable Housing Market

According to the 10th Annual Demographia International Housing Affordability Survey, the housing market in Gold Coast is classified as “severely unaffordable” with a Median Multiple¹ figure of 7.7 (Bertaud, 2014, p. 2). Median weekly rent in Gold Coast, meanwhile, was \$350 in 2012, requiring young parents to pay up to 80% of their income on rent (Knight, 2012). The lack of affordable housing is a major barrier for Gold Coast to attract knowledge workers.

6 TECHNOLOGY

The paper now considers the Technology theme, which is related to the implementation of several ICTs to improve the manner in which the city functions. Technologies can also play a vital role in attracting knowledge and ICT workers to a city.

6.1 Opportunities

6.1.1 Integration of Smart Technologies

More than 600 wireless sensors have been installed at Springbrook National Park, a 6725-hectare World Heritage-listed rainforest in Gold Coast. The sensors have been monitoring a range of environmental variables in order to track biodiversity restoration progress in the area. The award-winning monitoring system was developed through a joint initiative between Queensland Government, CSIRO and other government agencies (Queensland Government, 2013).

The GCCC established a Safety Camera Network in 1998 to ensure Gold Coast would have a safer environment for local communities and visitors. With 150 cameras operating in key activity centres, the cameras are continually monitored to ensure crime is detected and reported in a timely manner. In 2013, the council funded a trial of mobile cameras to further improve the city’s public safety (Stolz, 2013). Moreover, Metricon and Cbus Super, two major sports stadiums in Gold Coast, may be incorporated with spy cameras in the near future. The cameras, which can automatically recognise banned sports audiences at the gate and promptly inform the security, are expected to improve public safety during events (Wilson & Rolfe, 2014).

Provision of better local parking management and infrastructure is one of the key actions in the Gold Coast City Transport Strategy 2031. The council is currently investigating models for integrating ICTs such as wireless sensors into the parking infrastructure throughout Gold Coast. It is expected that data generated from the integrated technologies will be made available to the public. By doing so, the council intends to encourage smartphone apps to be created by local communities for local communities (Tozer, 2014).

6.1.2 IBM’s Smarter City Challenge Grant

In 2013, Gold Coast was awarded with IBM’s Smarter City Challenge Grant. As part of the grant’s arrangement, six experts from IBM cooperated with the GCCC for three weeks. The collaboration is expected to lead to recommendations for improving the city’s public safety as well as disaster response capabilities through smarter use of technologies. As the third city in Australia to receive a Smarter Cities Challenge grant, the award is a key opportunity to improve the city’s ICT arrangements for public safety.

¹ Median Multiple is the ratio between median house price and gross annual median household income (Bertaud, 2014).

6.2 Challenges

6.2.1 Funding

With a current annual budget of AU\$1.1 billion, the majority of the council funds (79.25%) is planned to be spent on council's operating expenditure (GCCC, 2013a). The council, under the new leadership and system, has been reducing its yearly rate increase since 2012. Therefore, the GCCC's funds will be increasingly limited to services which "ratepayers can afford" (GCCC, 2013a). Implementation of ICTs for creating smart cities can be an expensive process (Bajracharya et al., 2013). As such, there may be limited funding available for developing Gold Coast into a smart city in the future.

6.2.2 Privacy and Security of Data

Data generated and collected from ICTs are subject to privacy and security concerns. Privacy, which arises from data pertaining to individuals, can affect not only personal identity, but also physical wellbeing, personal behaviour and personal communication (Bartoli et al., 2012). It is important to protect the privacy of data relating to individual community members as mishandling of personal information is taken as serious offence by both the government and community. Strict protocols and procedures will need to be employed in order to filter raw data from ICTs and ensure that privacy of individuals is protected.

Data are also susceptible to cyber-vandalism which can lead to inappropriate ownership and usage of personal or sensitive data (Hancke et al., 2013). Cisco has revealed that there has been significant growth in cyber attacks, which now pose a "threat to life" (ABC, 2014). Appropriate systems and procedures should therefore be applied to minimise the possibility of cyber-vandalism on any smart technologies implemented in Gold Coast. The GCCC has recognised the need to ensure privacy and security of data in their smart city vision (Tozer, 2014).

6.2.3 Technology Adaptations by community

As part of the smart city process, data can be crowdsourced from local residents and information products can be disseminated to communities through several ICTs such as smartphones and social media (Bajracharya et al., 2013). Adaptations to these technologies, however, can be a challenge. As a popular retirement destination, Gold Coast is experiencing ageing population. While senior residents aged at least 65 years accounts for 14.4 per cent of Gold Coast population, this figure is projected to increase to more than 20.2 per cent of the city's inhabitants by 2031 (GCCC, undated). Furthermore, due to Gold Coast high costs of living as well as the unaffordable housing market discussed previously, poverty is also an increasingly prominent issue affecting the city's residents (Kane, 2012). Ensuring adaptations to smart technologies among older and lower income groups within the local community in Gold Coast could be a challenge with digital divide in technology adaptation.

7 PEOPLE AND SKILLS

The third theme the paper now examines is People and Skills, which is related to the attraction and retention of knowledge workers and ICT businesses to a city.

7.1 Opportunities

7.1.1 Local Availability of ICT Businesses

A number of ICT start-ups and businesses are located on Gold Coast. As mentioned above, Anittel and CoastalCOMS are located in Gold Coast. CoastalCOMS has been collaborating with the GCCC in monitoring conditions of the city's beaches through the use of cameras, which show live images of the beaches on a web portal. The images are intended to show existing ocean and beach conditions, which assist local residents with planning their beach visits. The website provides real-time information on other environmental variables such as wind directions and temperature. It also collects and displays historical data on Gold Coast's beaches, thereby creating opportunities for future research projects (CoastalCOMS, 2010).

7.1.2 Support for ICT Start-Ups and Workers

Silicon Lakes, a non-profit organisation, is an incubator for ICT start-ups and provides co-working spaces as well as programs for supporting ICT entrepreneurs. It collaborates with other start-up incubators around the

world. The company seeks to promote Gold Coast as a “desirable location to start, develop and operate ICT applications, businesses and resources” (Silicon Lakes, 2014).

Gold Coast TechSpace provides workshops for community members to learn about different technologies such as robotics, green technology, hardware and software. Residents of all age groups are invited to join the workshops, which are run weekly. The company provides different levels of memberships to cater for different levels of interests and needs of the community (Gold Coast TechSpace, 2013). With the GCCC as a Founding Partner, TechSpace plays a vital role in creating local ICT workers for the city.

7.2 Challenges

7.2.1 Attracting and Retaining Knowledge Workers

Gold Coast has relatively limited employment opportunities and options. In 2011, Gold Coast’s unemployment rate was 7.4% in 2011 in comparison to the national average of 5.6%. Moreover, Gold Coast currently contains the highest number of inter-city commuters among all Australian cities, with more than 26,000 workers commuting to Brisbane, the capital city of the Queensland state, on a daily basis (KPMG, 2014). The limited employment opportunities in Gold Coast may affect the city’s ability to attract and retain tertiary students as well as knowledge and ICT workers.

7.2.2 Local Knowledge and Skill Base

According to the 2011 census data, 56.2% of Gold Coast population of at least 15 years of age had not acquired a post-school qualification.² Additionally, the majority of local workforce (27.5%) was employed as blue-collar workers, including: traders; machinery operators and drivers; and drivers (Australian Bureau of Statistics, 2011). Improving local knowledge and skill base among current and future generations of workers in Gold Coast is a challenge the city needs to address in its transition into a smart city.

8 KNOWLEDGE AND INNOVATION PRECINCTS

The fourth theme to be applied to the analysis of Gold Coast is Knowledge and Innovation Precincts, which are facilities for attracting and generating knowledge and ICT workers.

8.1 Opportunities

8.1.1 ICT Office Parks

Gold Coast currently offers several office parks which specifically cater for ICT businesses. As part of the GCCC’s Pacific Innovation Corridor strategy, Varsity Lakes, a master-planned community adjacent to Bond University has been designated as a specialised IT hub. To this end, it contains Varsity Central which provides offices and spaces for ICT businesses. Several ICT firms are now located in Varsity Central. Examples of IT-related firms in Varsity Central include Anittel, an ICT consultant company which provides IT support to organisations, and CoastalCOMS, which specialises in environmental monitoring via video content analytics. In addition to Varsity Lakes, Southport, the city’s Central Business District, has also been designated as a technology hub.

8.1.2 Gold Coast Health and Knowledge Precinct

The state government of Queensland implemented a project to establish the Gold Coast Health and Knowledge Precinct, comprising Gold Coast University Hospital and Griffith University, in Southport. The precinct, now completed and operational, offers cutting-edge healthcare services to local communities. It also provides opportunities for the university’s medical students to undertake hands-on training at the hospital. The health and knowledge precinct will not only promote Gold Coast as a desirable location to live for knowledge workers due to availability of high quality health services but also generate additional high quality knowledge workers in the healthcare industry.

² Post-school qualifications include qualifications at the following levels: certificate; diplomal; advanced diploma; bachelor degree; graduate diploma; graduate certificate; and postgraduate degree.

8.1.3 Links between Universities and Hospitals

In addition to the Gold Coast Health and Knowledge Precinct, the other two universities in the city are co-located with hospitals. Bond University, located in Robina, is situated in proximity to Robina Hospital, another major state hospital. Southern Cross University, meanwhile, is situated in close vicinity of John Flynn Private Hospital in Coolangatta and Tweed Hospital in Tweed Heads. These universities have been collaborating with the hospitals in providing practical training experience for medical students.

8.2 Challenges

8.2.1 Lack of Connectivity between Knowledge Precincts

As discussed above, the three major knowledge precincts in Gold Coast are located in Southport, Robina and Coolangatta. Due to the oriented design of Gold Coast transport infrastructure, there is currently lack of direct connectivity, particularly by walking, cycling and public transport, between these knowledge precincts (O'Hare et al., 2012). By strengthening transport links between these key precincts, greater links between universities and hospitals can be established.

8.2.2 Lack of Research and Development Collaboration

There is a need for the council to further collaborate with the three universities located in the city, namely Bond University, Griffith University and Southern Cross University. Currently, there is only single focus on one knowledge and health precinct around Griffith University in Southport, which concentrates on the field of health sciences. By collaborating with the universities, greater synergies between universities, local businesses and the council can be developed in order to stimulate the city's research and development (R&D) activities in various fields of knowledge.

9 GOVERNANCE

The paper now looks at the final theme of Governance, which relates to arrangements and plans for creating smart cities.

9.1 Opportunities

9.1.1 Council's Economic Strategies

The GCCC has adopted three primary strategies to promote Gold Coast as a smart and economically sustainable city. These strategies are Economic Development Strategy, Digital Strategy and Pacific Innovation Corridor. Through Economic Development Strategy, the council aims to promote the city as an international destination of choice for businesses. One of the key themes of the strategy is Innovation, which seeks to encourage establishment of new start-up businesses and utilise ICT as part of the city's systems more effectively. The strategy's Cultural theme, meanwhile, seeks to "attract new talent, knowledge workers and investment" by strengthening the city's unique culture (GCCC, 2013c, p. 17).

The GCCC has recognised that a focus on digital economy and strategy can lead to substantial economic benefits for a city. To this end, it has adopted a Digital Strategy, in which ways ICTs and advanced technologies can be integrated to the city's construction, manufacturing and tourism industries are identified. The strategy also outlines the council's approach to enhancing the city's ICT infrastructures.

Pacific Innovation Corridor is a long-term economic development program which has designated 13 precincts across the city as key economic centres. Technology focus has been given to three of the precincts, namely Robina, Southport and Varsity Lakes. Therefore, future planning and development in these communities will have strong emphasis on ICT infrastructure and services. All three strategies discussed above will provide Gold Coast with an attractive environment for ICT workers and businesses.

9.1.2 Digital Enterprise Program

The GCCC applied for and secured funding from the Australian Government to run Digital Enterprise Program workshops. The workshops, available and tailored to individuals and groups, aim to improve the manner in which organisations conduct businesses and deliver services online. The workshops cover a range of topics, including cloud services, teleworking, cyber security, and online presence (GCCC, 2013b). The program plays a vital role in supporting local businesses by capitalising on the potential that ICTs offer.

9.1.3 Open Data Access Project

The GCCC has “committed to publishing priority datasets, in an open manner that facilitates transparency and the development of solutions and tools by Gold Coasters for Gold Coasters” (IT Gold Coast Forum, 2014). To this end, the council has recently implemented an Open Data Access Project to establish a framework for distributing data collected by government authorities to the public. The project aims to ensure the data distribution will allow innovative information products to be available to local communities of Gold Coast. It also seeks to build local capabilities of ICT businesses and provides commercial opportunities for local ICT start-ups (GCCC, 2013e). In late 2013, the GCCC hosted an Open Data Forum, attended by data enthusiasts and developers. The event solicited innovative ideas on how locally collected data can be used and distributed. Another topic covered in the forum was the types of data that would be useful to local ICT businesses and local community members. There needs to be greater involvement of local community in this project, in terms of understanding their needs and concerns, as well as identifying ways in which they can contribute to the project.

9.1.4 Public-Private Collaboration

The GCCC has been actively collaborating with a number of private businesses to spearhead the development of the city’s ICT industry and infrastructure. As discussed previously, the council has been working with CoastalCOMS in monitoring beach conditions and acted as a Founding Partner for TechSpace. The Open Data Access Project also strongly involves the private industry in order to ensure appropriate types of data are available publically for the most innovative and useful outcomes for the community.

9.1.5 Opportunistic Approach for Smart City

The GCCC has displayed an opportunistic approach to promoting Gold Coast as a smart city. The council successfully applied for and secured the IBM’s Smarter City Challenge Grant to acquire input for its smart city initiatives from the private sector. The council also won the bid to host the 2018 Commonwealth Games, which represents a major prospect to promote the city’s profile as well as developing smart infrastructure for events. In 2013, Gold Coast hosted the Intelligent Cities Summit, a two-day conference on smart cities attended by academics, decision makers and corporate executives. The event promoted Gold Coast as one of the places “central to the creation and commercialization of innovative new products, processes, and services for global markets” including the development of ICT infrastructure and workers (Future Cities Institute, 2013).

9.2 Challenges

9.2.1 Ownership of Data

During the Open Data Forum, data ownership was identified by local ICT businesses as a major barrier to creating innovative information products. While some data on local environment conditions belonged to the local council, others were exclusively owned by state or federal governments. Due to the data ownership arrangements, local developers were unable to create smartphone apps which provide information such as weather warnings in real time. The ICT businesses also cited the need for all data to be available publically in real time in order to create useful products for local communities.

9.2.2 Lack of Strategic and Statutory Directions for Smart City

While the council has displayed an opportunistic and collaborative approach to establishing the city as a smart city, it has not incorporated its intention in this regard in its Corporate Plan 2009-2014, the document charting the city’s strategic directions. Likewise, the draft City Plan 2015, the new planning scheme which outlines statutory requirements for planning and development throughout the city, does not specifically mention developing the city as a smart city. As such, there is lack of strategic and statutory directions for creating Gold Coast as a smart city. Figure 3 summarises the challenges and opportunities for developing Gold Coast as a smart city.



Fig 3: Challenges and opportunities to develop Gold Coast as a smart city

10 CONCLUSION

With cities becoming increasingly globalised and competitive and moving towards knowledge and information economy, the concept of smart cities is attracting interest from city officials, the private sector, local communities and academics. This paper has examined the nature of smart cities through a literature review of the idea. The use of ICTs alone does not make cities smart – other dimensions including cultural and natural amenities, people and skills, knowledge precincts and governance are equally important. These factors were collectively integrated into a smart city framework, which was then applied to the case study of Gold Coast to identify challenges and opportunities in developing the city as a smart city.

Five key lessons for developing smart cities have emerged from the case study analysis. First, to attract and retain knowledge workers, public safety, housing affordability and employment opportunities are important considerations. Second, privacy and security concerns of the community associated with collected data need to be addressed when implementing ICTs for monitoring the built environment. Third, given universities create knowledge workers for the city they situate in, there is a need to establish collaborative links between these universities and other stakeholders, including local council and businesses. Such links can create opportunities for R&D activities and provide practical training to university students, thus providing them with effective transition from the academic environment to the industry. Fourth, data collected by ICTs should be publically available in real time to facilitate the creation of information products and services for local communities. Lastly, while programs and collaboration between the private sector and the public sector are important, smart city development should be embedded as a key objective in strategic and statutory plans for a city and local community needs to be actively engaged in the planning process. By doing so, not only will the transition of the city into a smart city become a planning priority, but the city's future development, driven by the private and community sector, will also be supportive of the smart city objectives.

11 REFERENCES

- ABC: Cyber terrorism a 'threat to life', 2014. [Internet: <http://goo.gl/wKZ7VV>].
- Australian Bureau of Statistics: 2011 Census Community Profiles – Gold Coast, 2011. [Online: <http://goo.gl/f1xHZ7>].
- Australian Rainforest Conservation Society Inc: Wireless sensor network providing data to support rainforest restoration at Springbrook. [Internet: <http://goo.gl/vH1xqq>].

- BAJRACHARYA, B.; ALLISON J.: Emerging role of ICT in knowledge-based urban development. In: Yigitcanlar, T.; Velibeyoglu, K.; Baum, S.: Knowledge-based urban development: Planning and applications in the information era. Hershey, USA, Ideas Group, 2008.
- BAJRACHARYA, B.; CATTELL, D.; MCPHEE, D.; TOO, L.; & KHANJANASTHITI, I.: Sense in the city: Making the Gold Coast an intelligent and sustainable city. In 38th Australian University Building Educators Association Conference. [Online: <http://goo.gl/TqwaVv>].
- BARTOLI, A.; HERNANDEZ-SERRANO, J.; SORIANO, M.; DOHLER, M.; KOUNTOURIS, A; BARTHEL, D.: On the ineffectiveness of today's privacy regulations for secure smart city networks, 2012. Washington, DC, Smart Cities Council. [Online: <http://goo.gl/pMHLgx>].
- BERTAUD, A.: 10th Annual Demographia International Housing Affordability Survey: 2014, 2014. [Online: <http://goo.gl/yIW46>].
- CASTELLS, M.: Rise of the network society: The information age. Cambridge, Blackwell, 1996.
- CoastalCOMS: Gold Coast City Council beach information portal, 2010. [Internet: <http://goo.gl/doZoRr>]
- DEAKIN, M.: Introduction (to smart cities). In: Deakin, M.: Smart cities – Governing, modeling and analysing the transition. New York, Routledge, 2014.
- DEAKIN, M.; ALLWINKLE, S.: Urban regeneration and sustainable communities: The role of networks, innovation and creativity in building successful partnerships. In: Journal of urban technology, Vol. 14, Issue 1, pp. 77-91, 2007.
- FLORIDA, R.: Cities and the creative class. London, Routledge, 2004.
- FLORIDA, R.: The rise of the creative class: And how it's transforming work, leisure, community and everyday life. New York, Basic Books, 2002.
- Future Cities Institute: Intelligent Cities Summit 2013, 2013. [Internet: <http://goo.gl/oqxgFL>].
- GCCC: City Budget 2013/14, 2013a. [Online: <http://goo.gl/Pccznu>].
- GCCC: Digital Enterprise Program, 2013b. [Internet: <http://goo.gl/oye3vF>]
- GCCC: Economic Development Strategy 2013-2023, 2013c. [Online: <http://goo.gl/h17ig9>]
- GCCC: Gold Coast Cultural Precinct design competition 2013, 2013d. [Online: <http://goo.gl/Wm9WKo>].
- GCCC: Gold Coast Open Data Project, 2013e. [Internet: <http://goo.gl/SxOLpM>].
- GCCC: Social research reports, undated. [Internet: <http://goo.gl/gVV0wn>].
- GCCC: The Gold Coast, 2014. [Internet: <http://goo.gl/ICz2jY>].
- Gold Coast Convention and Exhibition Centre, 2014. [Internet: <http://goo.gl/XRfAVy>].
- Gold Coast TechSpace: Gold Coast TechSpace, 2013. [Internet: <http://goo.gl/lht9Ci>].
- GRAHAM, S.; MARVIN, S.: Splintering urbanism. London, Routledge, 2001.
- HOLLANDS, R.: Will the real smart city stand up? In: City, Vol. 12, Issue 3, pp. 302-320, 2008.
- Hong Kong Cyberport Management Company Limited: About Cyberport, 2014. [Internet: <http://goo.gl/J1raQj>].
- IBM: What is a Smarter Planet?, undated. [Internet: <http://goo.gl/ZqPA5f>].
- IT Gold Coast Forum: Open Data Forum (City of Gold Coast), 2013. [Internet: <http://goo.gl/ppGmIQ>].
- KANE, C.: Gold Coast 'struggling' with poverty, 2012. [Internet: <http://goo.gl/2qXdIS>].
- KNIGHT, R.: The housing and support needs of young mothers on the Gold Coast: Statistics and stories, 2012. Gold Coast, Lifehouse Project Inc. [Online: <http://goo.gl/E98F75>].
- KPMG: Gold Coast's seductive lifestyle underpins the rise of extreme commuting, 2014. [Internet: <http://goo.gl/xHCMt4>].
- LAM, T.; LIANG, W.; CHIKRITZHS, T.; ALLSOP, S.: Alcohol and other drug use at school leavers' celebrations. In: Journal of Public Health, 2013. [Online: <http://goo.gl/OIVSAA>].
- LANDRY, C.: The creative city. London, Earthscan, 2008.
- MITCHELL, W.: E-topia: Urban life, jim but not as you know it. Cambridge, Massachusetts, MIT Press, 1999.
- NAM, T.; PARDO, T. A.: Conceptualizing smart city with dimensions of technology, people, and institutions. In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, pp. 292-291, 2011.
- O'HARE, D.; BAJRACHARYA, B.; KHANJANASTHITI, I.: Transforming the Tourist City into a Knowledge and Healthy City: Reinventing Australia's Gold Coast. In: 7th international forum of Knowledge, innovation and sustainability: Integrating micro and macro perspectives, 2012. [Online: <http://goo.gl/DvY8yR>].
- PASKALEVA, K.: E-governance as an enabler of the smart city. In: Deakin, M.: Smart cities – Governing, modeling and analysing the transition. New York, Routledge, 2014.
- Queensland Government: Wireless sensor network: Springbrook, 2013. [Internet: <http://goo.gl/NCNS7V>].
- RAPPAPORT, J.: The increasing importance of quality of life. In: Journal of Economic Geography, Vol. 9, Issue 6, pp. 779-804, 2009.
- Silicon Lakes: About us: Silicon Lakes, 2014. [Internet: <http://goo.gl/LzsFGN>].
- STOLZ, G.: Gold Coast Mayor Tom Tate's budget acts to save beaches and fight crime 'to deliver for ratepayers again', 2013. [Internet: <http://goo.gl/b2yZQw>].
- TOWNSEND, A.: Smart cities: Big data, civic hackers, and the quest for a new utopia. New York, W. W. Norton & Company, 2013.
- TOZER, G.: In Facebook [Fan Page], 2014. [Internet: <http://goo.gl/qWkrRx>].
- WILSON, T.; ROLFE, P.: Gold Coast major sporting stadiums could be fitted with spy cameras to catch banned fans and criminals, 2014. [Internet: <http://goo.gl/HNTwbO>].
- YIGITCANLAR, T.; O'CONNOR, K.; WESTERMAN, C.: The making of knowledge cities: Melbourne's knowledge-based urban development experience. In: Cities, Vol. 25, Issue 2, pp. 63-72, 2008.