



ADVISORY PAPER (INTERIM REPORT) FOR BUILDING A SMART CITY IN HONG KONG



STRATEGIC PARTNER:



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1. Executive Summary

According to the World Health Organisation, it is estimated that six out of ten people will live in cities in 2030, implying that there will have an ever greater impact on our planet, especially on resource consumption, carbon emission, transportations and safety problems. In 1997, the Swedish Parliament firstly initiated "Vision Zero" policy that requires fatalities and serious injuries to be reduced to zero by 2020. Later on, the concept of "Vision Zero" prevailed in Europe and became a significant step change in transport policy all over the world. In January 2014, New York City Mayor Bill de Blasio announced the City's adoption of Vision Zero to reduce fatal accidents in the City's streets. In Asia, a Vision Zero movement aims to encourage safe and healthy workforce was launched in Singapore last year. As for Hong Kong, we believe that Vision Zero is not only a concept applying to transportation and traffic, but also a mindset embraced by all and should be treated as our ultimate and long term goal in developing a smart city.

In developing a smart city in Hong Kong, Smart City Consortium (SCC) pledges to provide support to the Government to take the lead in developing the digital framework and standards as mentioned in the 2016 Policy Address, and to build a world class smart city, to foster knowledge-based economy, and to enhance quality of life and create a vibrant eco-system by using Information Technology and promoting more effective resource management.

To build a smart city successfully, we need the participation of various stakeholders in the society, of which, public engagement is essential. In view of this, SCC has been promoting smart city education to arouse public awareness of the topic, we serve as the platform to advocate and educate the public about the Smart City agenda.

Smart City development is a multi-disciplinary topic that requires the engagement of city managers from many different Government departments. It is a huge challenge for the Government to underwrite such a big assignment. Therefore, SCC suggests the Government to establish a high-level body to champion the smart city agenda and to ensure an integrated policy planning, development and implementation, with the full support of the Chief Executive and all departments. We also believe that a smart city coordinator should be appointed under the Innovation and Technology Bureau to accelerate communication and information exchange among the Government officials and Bureaus. Concurrently, SCC will continue to promote the concept of "Smart City" throughout the community and connect with international Smart City advocacy groups and organizations to facilitate communication and information exchange.

In this paper, we are going to present an interim report that reflects the above mentioned key points and also covers expertise advice and summary of a series of responses and suggestions collected from our public consultation. We also

consolidated the collected views and categorized them in different areas, including Spatial-data, Energy-Management and Green Technologies, FinTech Innovations, Open Data, Innovation & Entrepreneurship, Smart Government and Smart Economy, Smart Living Environment, Electronic Identities (eID), Electronic Health Records (eHR), Cyber Security and Smart Mobility. We hope that the sharing of the views and opinions could facilitate and enhance the Government's planning of smart city development in Hong Kong.

SCC will continue to maintain a transparent platform for the Government, technology partners, academia and commercial organizations to collaborate and exchange ideas related to Smart City issues so that a "public-private partnership" can be worked out effectively for building a smart city in Hong Kong. Together we can co-create a plan to make our city smarter and bringing our vision of Smarter Hong Kong, Smarter Living closer and finally co-create a better future to the whole community.

2. Background

With the rapid development of the Internet, Information and Communication Technologies (ICT) have been broadly applied in our daily lives. Today, when we look at the global trend of building ‘Smart City’; we can see the worldwide practice of taking ICT as a core consideration to city development and management. The concept of ‘Smart City’ relates to ICT at all times; it covers almost every aspect of society and people’s livelihood. According to Dr. Boyd Cohen, an internationally renowned expert in the industry, the term Smart City consists of six major components:¹, namely *Smart Economy*, *Smart Environment*, *Smart People*, *Smart Mobility*, *Smart Living* and *Smart Government*.

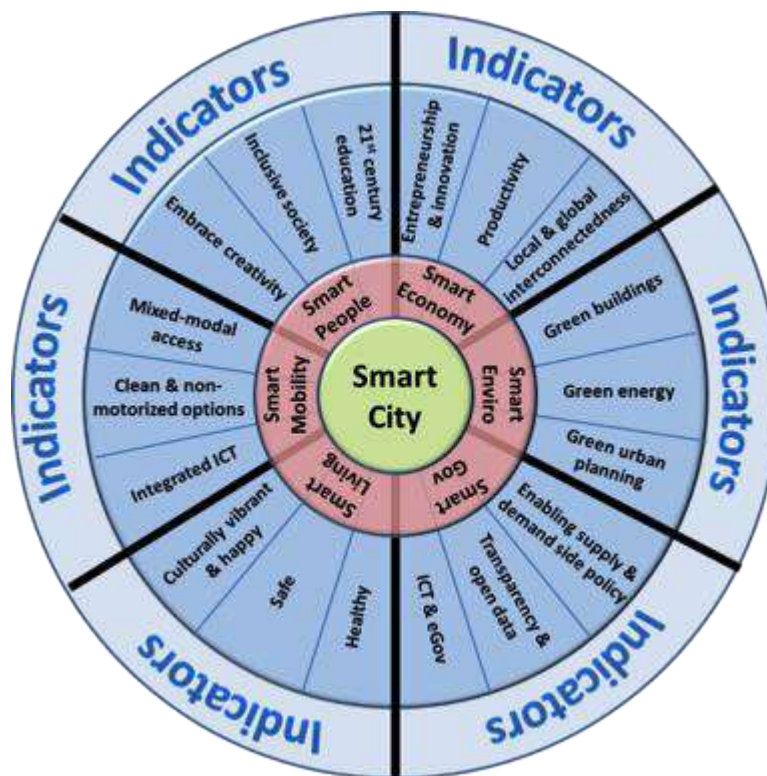


Figure 1. Smart City Wheel (Source: Enterra Solutions)

Over the past 10 years, different countries have been devoting resources and efforts for Smart City development. In Hong Kong, according to the 2016 Policy Address, the Innovation & Technology Bureau (ITB) will study the development of a “Smart City” in collaboration with research institutions as well as public and private organizations. The ITB will then formulate a digital framework and standards for the development of a “Smart City”. In view of this, the Smart City Consortium (SCC) is set up to offer our expertise and advice and views together with professional bodies to assist the Government to build a Smart City, so as to achieve the goal of “Smarter Hong Kong, Smarter Living”.

¹ <https://www.fastcoexist.com/3038818/the-smartest-cities-in-the-world-2015-methodology>

SCC as an open and dedicated platform to discuss Smart City developments in Hong Kong

The SCC was formed in March 2016 by a group of professionals from different corporations and organizations, it aims to provide opinions and suggestions to the Government for formulating related policies and standards in the development of Hong Kong as a world-class Smart City. The SCC is also involved in creating advocacy groups and arranging public engagement opportunities to engage various stakeholders involved in the planning and implementation of Smart City initiatives. We encourage worldwide collaboration with different stakeholders to create a collaborative ecosystem, which fosters innovation and sustainable economic growth for Hong Kong. Currently, The SCC is registered as a NGO and is governed by the board with supervision from the steering committee (see below); and the organization to date has formulated six committees and six special interest groups (SIG). The have also invited professional managers and subject-matter experts to volunteer and take the lead in moderating, advocating, co-creating and formulating strategies in the Smart City agenda.

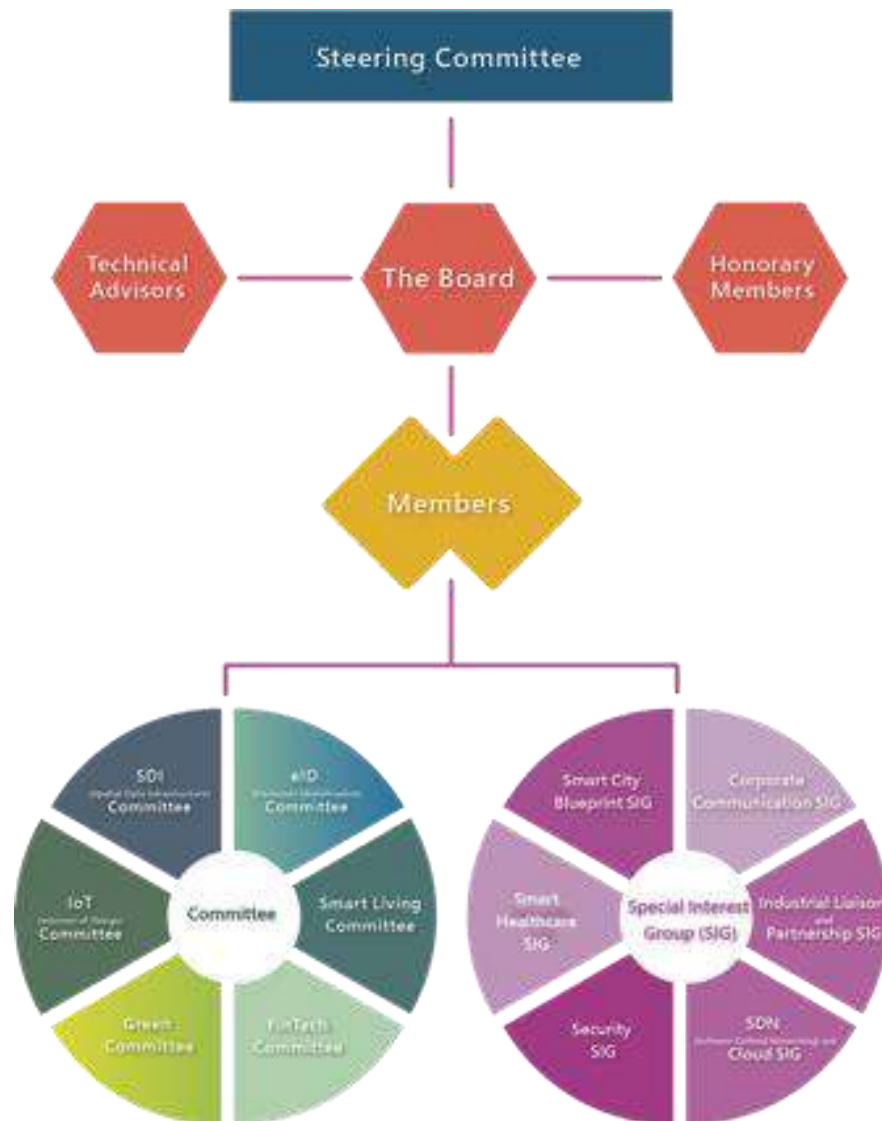


Figure 2. Smart City Consortium organization structure

The SCC has a mission to promote Hong Kong as the world's leading Smart City and become a key voice for the public and for the industry to provide related opinions and suggestions based on our members' professional knowledge and public engagement. The SCC has defined its objectives as below:

- i) *Assist the Government in building Hong Kong as the leading Smart City in the region;*
- ii) *Advise the Government on formulating policies and standards related to Smart City development;*
- iii) *Provide a platform of choice to the Government, technology partners, academia and commercial organizations to collaborate and exchange ideas of Smart City issues;*
- iv) *Conduct Smart City related policy research;*
- v) *Promote public awareness and adoption of the technologies leading to a Smart City;*
- vi) *Connect with international circle of Smart City advocacy groups and organizations to facilitate communication and information exchange.*

Defining the Smart City development for Hong Kong

In Hong Kong, the Government has defined its road-map since 1998 as to accelerate and to enable both the Government and the public to adopt various new ICT technologies with the Digital 21 Strategy and other related policies.



Figure 3. From Digital city to Smart City – HKSAR

Many would attest that the adoption of the latest innovations in Information Communication Technologies (ICT) plays a big part in the 'Smart City'. Dameri & Rosenthal-Sabroux (2014) defines the objectives of 'Smart City' as to leverage ICT

technologies to improve the quality of life of citizens, optimize resource usage, and maintain sustainable development; Ojo et al (2014) defines that 'Smart Cities' are urban innovation and transformation initiatives which aim to harness physical infrastructures, ICT, knowledge resources, and social infrastructure for economic regeneration, social cohesion, better city administration, and infrastructure management. Hollands (2008) posits that 'Smart Cities' are specifically concerned with the transformation of life and work of the city's inhabitants.

Notwithstanding this ongoing effort to accelerate the adoption of ICT in Hong Kong, there are still a great number of challenges the Government, business enterprises and the citizens at large have to deal with; where the use of ICT and latest technologies alone could not be the only solution to make our city smarter. Challenges can be found anywhere from issues like dealing with human rights, personal privacy, climate change, housing problems, jobs creation, education, policy making, health, public safety, pollution and various mega infrastructure projects. Many of these are tied to the need for the Government to play a leading role to in promoting a culture of sustainable consumption and to set standards in the drive for adopting new technologies.

There are many ways to interpret what constitutes the meaning of a 'Smart City's' development or its initiatives. Although the Government, through the Central Policy Unit's *Research Report on Smart City*, has cited the Smart City wheel conceived by Dr. Boyd Cohen which identifies the six major areas, Thus SCC is of the opinion that the true definition of Smart City development should be multi-disciplinary in nature, constantly evolving and often grounded with the notions that public engagement is an integral part of the development.

The next chapter will describe our vision of how Hong Kong could become a city where the Government is willing to instill a collaborative culture with its people to co-create the Smart City Blueprint for a Smarter Hong Kong.

3. Our Vision for Smart City 3.0

The SCC has a vision to develop Hong Kong as the world's leading Smart City to foster a knowledge-based economy, to enhance the quality of life and to create a vibrant ecosystem leveraging relevant ICT and adopting effective resources management strategies.

At the SCC, there is a vast reserve of talent with intellectual and social capital for which the Government can leverage to co-create the road-map for future Smart City initiatives. It is imperative that the SCC, its members and professional volunteers continue to collaborate and participate in this advocacy effort by hosting various public engagement exercises, open forums and joint events with other industry associations, professional organizations and corporate communities.

At the SCC, we strongly believe the various discourses carried out thus far by the Government officials with the SCC, the Chamber and other professional organizations and the general public is very meaningful. This foundation will prove to be productive as the Government starts to place emphasis on co-creating the Smart City blueprint and policy framework for a Smarter Hong Kong.

Advocacy and Public engagement and smart community are desirable for enhancing our Smart City initiatives



Figure 4. The evolution of Smart City initiatives

According to Dr. Boyd Cohen, there seems to be three distinct phases of how cities have embraced technology and development, moving from technology- driven, to city-Government driven, and finally to citizen driven. (Boyd Cohen, 2015). At the SCC, we believe Hong Kong will benefit a lot from public-private-partnerships and the spirit of co-creation where actions and decisions could also engage Hong Kong's citizens. Successful examples of such Smart City 3.0 effort could be found in Vancouver, which successfully engaged over 30,000 citizens in the programme of the *Vancouver Greenest City 2020 Action Plan*. In another example, researchers in Jakarta have developed a real-time map of flooding by crowd sourcing flood reports from Twitter to monitor severe flooding during the rainy season. These successful Smart City initiatives illustrate the growing potential of collaboration and citizen engagement.

The SCC values the opportunities to have established an open dialogue with the Government at various levels - whether these are the new Smart City projects in Energizing Kowloon East², discussing the latest financial technologies (FinTech) topics like, block chain and Stored-Value Facilities (SVF) licenses³, responding to

² http://www.ekeo.gov.hk/en/smart_city/index.html

³ <http://www.hkma.gov.hk/eng/key-functions/international-financial-centre/regulatory-regime-for-svf-and-rps/regulation-of-svf.shtml>

public consultation in Trade Single Window⁴ (SW) by the Commerce and Economic Development Bureau (CEDB), the development of smart building and spatial data infrastructure and other open data initiatives. As the only non-Governmental organization (NGO) dedicated to openly discuss the Smart City agenda, SCC pledges to continue to serve as the advocate and platform between the Government, the SCC's members and the public. The SCC will uphold this important professional role and maintain an open dialogue with the Government.

Since its inauguration in March 2016, the SCC has forged collaborations with various organizations in Hong Kong and overseas to explore topics in standardization, knowledge sharing and technology transfer. SCC has also raised the public awareness about the Smart City agenda through setting up various committees and special interest groups to openly discuss various topics critical to Smart City development. The SCC has also partnered with other organizations to host or to speak at various public events (see table 1 below). On Aug 4th, the SCC has also opened up its platform officially for receiving views and feedback through a public consultation exercise and the SCC has received numerous responses from the public and various parties and organisations.

Date	Description	Type
29/9/16	Business Opportunities in the Belt-and-Road Region for SME	Event
27/9/16	Smart City Forum 2016: A Smart City - What's Hong Kong Waiting For?	Event
23/9/16	The Trend of Electronic Identity Development	Event
19/8/16	TUS-HOLDINGS CO. LTD	MoU
19/8/16	Smart Green Forum cum Networking	Event
4/8/16	Public Consultation Forum on an Advisory Paper for the Smart City Blueprint in Hong Kong	Event
28/7/16	Smart City Expo Beijing Tour 28-30/7	Delegation
8/7/16	Smart Data, Smart Government – Fostering a Smart City Model in Hong Kong	Event
7/7/16	Smart City & Smart Identity under Belt & Road Initiative – Innovation Progress in PKI and Authentication International Symposium	Event
6/7/16	Asia Pacific Electronic Health Records Conference 2016	Speech
24/6/16	Meeting with Mr. Paul Chan, Secretary for Development, for sharing on the Smart City and the recent trip to the APEC High-level Urbanization Forum 2016 in Ningbo	Event
22/6/16	Meeting with Energizing Kowloon East Office	Event
21/6/16	IngDan	MoU
21/6/16	The first SCC FinTech Forum cum Networking	Event
21/6/16	HK IoT Conference 2016	Speech
15/6/16	Technology Voucher, Other InnoTech Initiatives: Opportunities Ahead	Event
14/6/16	Consultation Session on Cyber-security Fortification Initiative with the Hong Kong Monetary Authority	Event
6/6/16	Environment Day Forum: Hong Kong – Road to Zero Carbon	Event
31/5/16	Smart City Forum: Opportunities & Challenges	Event
30/5/16	Meeting with Secretary for Environment KS Wong for Smart Energy View Exchange	Event
24/5/16	ISACA Seminar	Speech
24/3/16	Smart City Development Alliance (SDCA) – China	MoU
15/3/16	Inauguration of Smart City Consortium	Event
26/1/16	Austrian Technology Corporation	MoU

Table 1. Events and Collaboration MoU signed

⁴ http://www.cedb.gov.hk/citb/en/Hot_Topic/trade_single_window.html

4. The Hong Kong Edge

Hong Kong is very unique and fortunate in many ways: benefiting from a very talented pool of workforce, enterprising professionals, a high-quality education system, a sound legal and banking system, an efficient trade port, and last but not least, a stable Government regime in managing various infrastructure and development projects. Coming of age from a small fishing port to a metropolis that houses over 7.34 million people and maintaining a high GDP of USD 42,100 per capita⁵ is indeed a testament of Hong Kong being a land of opportunity. It is, however, also fair to say that Hong Kong has its fair share of growing pains, such as, the SARS epidemic in 2003 and the street protest in 2014 - both of which dented the economy and its international reputation to a certain extent.

In the last few years, a variety of research reports covering the topic of Smart City have provided both qualitative and quantitative data about how cities around the world are performing as a Smart City. As of recent, a report titled *Smart City Development Index 2016 review* by IDC (See figure 5) has clearly put Hong Kong in a stalemate position. The report indicates that our neighboring cities like Taipei, Incheon, Singapore, Shanghai and Beijing have all done better than Hong Kong in one way or the other.⁶



Figure 5. Smart City Development Index (source: IDC)

In another survey titled *Would Smart Technologies Smarten up Hong Kong*⁷ conducted in July 2016 by the Hong Kong Internet Registrations Corporation Limited⁸ (HKIRC), there were more than 1,322 local Internet users interviewed.

⁵ HKTDC research data - <http://hong-kong-economy-research.hktdc.com/business-news/article/Market-Environment/Economic-and-Trade-Information-on-Hong-Kong/etihk/en/1/1X000000/1X09OVUL.htm>

⁶ IDC - <http://www.idc.asia/microsites/SmartCity/awards.html>

⁷ HKIRC - https://www.hkirc.hk/content.jsp?id=43#!/64&in=/company_info/pressrelease.jsp?item=512

⁸ HKIRC is a NGO and non-statutory corporation designated by the HKSAR Government to administer the registration of country level Internet domain names,

Over 50% of the respondents think it is important for the Government to transform Hong Kong into a Smart City, and that a Smart City would help them save time (79.6%), enhance quality of life (77.4%) and live green (62.4%).

According to the HKIRC, it cites the need for the city to improve specific areas despite this there is seemingly strong support on Smart City development and its socio-economic impact to Hong Kong. Specifically, the respondents think the quality, breadth and depth of products and services in the following areas still have plenty of room for improvements - Smart Government (36.1%), Smart Living (21.3%), Smart Mobility (20.8%) and Smart Economy (16.8%) respectively. It is therefore imperative that any new Smart City initiatives led by the Government in the upcoming blueprint development really take into consideration of the high expectations of its citizens and various stakeholders.

In 2011, Dr. Boyd Cohen ranked Hong Kong 9th in his Top Ten Smart Cities trailing behind Tokyo⁹; and in 2016, another global study conducted by IESE Business School ranked Hong Kong 4th in the Asia Pacific region in their *IESE Cities in Motion Index 2016*¹⁰. In this report, Hong Kong is trailing behind cities like Tokyo, Singapore and Seoul.

Singapore, Seoul, Tokyo and some of the mainland Chinese cities, which picked up top awards in the region with their respective Smart City initiatives, are useful case studies for which our policymakers, solution providers, business enterprises and entrepreneurs in Hong Kong or from overseas could learn from for developing the Smart City blueprint in Hong Kong. Some of these initiatives or pilot projects were able to demonstrate how emerging Smart City development projects could indeed elevate residents' quality of life.

Broadly speaking, these reports and findings have clearly suggested the notion that Hong Kong is falling behind in the race to be the smartest city. While it is not meaningful to discuss whether this is true, it begs us to ask the question whether Hong Kong is losing its stamina in its own race to serve the needs of its citizens or is Hong Kong losing its "*Lion Rock spirit*" that was so instrumental to the history of growth in Hong Kong as smart port in the 60's and 70's. The purpose of this paper does not intend to take any side of these views but rather invites the public stakeholders to openly explore these issues and highlight these issues to the attention of the policy makers, city administrators, corporations and entrepreneurs with the intent of finding the most meaningful way to manage the Smart City initiatives for a smarter Hong Kong.

The recent public consultation on retirement protection¹¹ by the Commission of Poverty has attracted overwhelming attention from the public. While there is no doubt that a reliable and balanced retirement scheme is important to our society's social well-being, it is equally crucial for the Government to support a technological drive for a better and more resilient economy. In this way, Hong Kong and its people will be better equipped to face a host of challenges. Irrespective of what position or ranking these independent research reports place Hong Kong in the future; the Government and its people should come together to solve some of city's the pressing problems.

Is Hong Kong losing its stamina in its own race to serve its citizens?

⁹ <https://www.fastcoexist.com/1679127/the-top-10-smart-cities-on-the-planet>

¹⁰ <http://www.iese.edu/research/pdfs/ST-0396-E.pdf>

¹¹ <http://www.rp.gov.hk/en/index.php>

5. Towards a GIS and Spatial-data enabled Smart City

In the 2016-7 Budget announcement by our Financial Secretary – Mr. John Tsang has suggested how to refine the existing Geographical Information System (GIS) and explore ways to align and integrate the spatial data for better city planning and administration. This call by our Financial Secretary echoed the keynote speech by Prof. Ding Xaioli of Polytechnic University's at the 2014 annual conference titled “Our Smart City in the next 30 years” organized by The Hong Kong Institute of Surveyors where Professor Ding articulated the importance that spatial data infrastructure and how its spatial information should be enabled and utilized to become relevant in any Smart City initiative.

GIS is a system designed to capture, store, manipulate, analyze, manage and present all types of spatial data (Maguire, 1991) according to Kuhn, Spatial Data Infrastructure (SDI) is defined as a coordinated series of agreements on technology standards, institutional arrangements, and policies that enable the discovery and use of geospatial information by users and for purposes other than those it was created for (Kuhn, 2005).

SDI is an important foundation for building a Smart City as SDI refers to a framework that collects, processes and manages a series of spatial data and geographic information about the city.

Many countries have recognized Geo-spatial data as an important digital asset and foundation for success in Smart City development. The United States started its development of a national SDI in 2003. Different geographic information was integrated through GeoPlatform.gov with application programming interfaces (API) available for the general public. Europe and Singapore also have similar projects, called Infrastructure for Spatial Information in European Community (INSPIRE) and the Singapore Geospatial Collaborative Environment (SG-SPACE) respectively. Another example is how the Los Angeles Government has also launched GeoHub¹², a city-level SDI that contains more than 500 kinds of public geographic information. It aims to improve public awareness of community issues, and also enhances Government departments' efficiency, transparency and cooperation. GeoHub currently collects information like public road works, traffic black spots from public and private sectors. Services similar to GeoHub promote STEM education, creativity, innovation and entrepreneurship in the society.

In Hong Kong, different Government departments like the Lands Department, Highways Department, Civil Engineering and Development Department have their dedicated GIS. However, they rarely share data with each other, nor make available such information to the public. Currently, the GeoInfo Map (see figure 6) developed by the Lands Department contains over 180 kinds of spatial data provided by 26 Government departments. This is a good example of the Government departments collaborating to offer geographic information for public use. The service could still be improved further and offer their data through the data.gov.hk with application programming interfaces (APIs), which is the foundation for the public and startup community to develop applications that interact with spatial data. Without opening up the APIs of the GeoInfo Map¹³, the public cannot take advantage and integrate the spatial data in their applications to benefit society.

SDI is an important foundation for building a Smart City as SDI refers to a framework that collects, processes and manages a series of spatial data and

¹² GeoHub in Los Angeles - <http://geohub.lacity.org/>

¹³ GeoInfo Map at <http://www1.map.gov.hk/gih3/view/index.jsp>

geographic information related science and technologies, policies and systems. One of the major components within this foundation is the management of the Application Programming Interface (API) and the data governance model. Through sharing of the data and APIs, the private sector or individuals that are familiar with programming can utilize the geographic information, like real-time traffic conditions, road works, building inspections as well as business statistics to create their own applications or new value-added services.



Figure 6. GeolInfo Map web portal

The SCC strongly believes that such a well-developed SDI could only be possible with the support of a sound legal institutional and technological framework to facilitate its functions. Masser et al (2008) has outlined the three major strategic challenges for the development of an efficient and effective SDI, and they are:

- (i) Inclusive implementation approach — involving a large number of stakeholders from all levels of Government, private sector (including the NGOs and the public at large), as well as the research community (including universities and other research institutes);
- (ii) Emphasis on data sharing between different kinds of organizations — to gain easy data access and to minimize efforts in collecting and maintaining data; and
- (iii) Development of effective GIS platforms to facilitate easy and convenient access to information (both spatial and textual data) and related services — taking advantage of SDI as an infrastructure for linking data users and data providers through data sharing (Masser et al, 2008).

The aims of the future SDI of Hong Kong are to exploit new technologies especially GIS technologies to maintain sustainable growth in the economic, environmental and social aspects of Hong Kong. Open data and availability of APIs should be the

basic standard in information services provided by the authority and all Government services should be 'digital by default'.

To achieve those objectives, it is the key that the Government should take the lead in the development of SDI – by collaborating with various departments, and across to the private sectors to define the level of service and clearly articulate the roadmap. The Government plays an important role as both the initiator and the facilitator in the planning and implementation of SDI.

A high-level Government body to lead the standardization effort in implementing SDI.

A high-level Government body should be set up to coordinate the major tasks, including standardization of data and the setting up of a framework to develop guidelines for data definition, collection and processing. In addition, the Government should identify and review the relevant laws and regulations for the development of technologies, usage of data, particularly protection of privacy and personal information. The purpose is to ensure that the prevailing and proposed ordinances are flexible enough to accommodate technological changes and overcome potential risks. To achieve good results, policy-makers should implement the development processes in a holistic manner.

Major components of the SDI that govern fundamental interaction between people and data are: access network, policies and standards (Rajabifard et al, 2003) and it is important to also consider developing a classification of building elements and its related site work similar to those proposed by the National Institutes of Standards and Technologies. This classification of the data catalogs within the city is analogous to a big data dictionary of all the components mentioned before.

In addition to SDI, Building information modeling (BIM), open data models and standardized file formats (e.g. buildingSMART¹⁴) and new tools which help to define a city as a digital representation of physical and functional characteristics of a facility, is a crucial aspect of the complete information data warehouse constituting the whole city. In order to be complete, information of man-built structures should be integrated with environmental and natural geographical data. As a vision of GIS and BIM, the entire built environment of Hong Kong is digitized in open APIs and data formats to allow accessibility for various stakeholders. Energy consumption data, building maintenance data, location-based services, 3D models, and hazardous gas detection and waste management could all be further processed and the possibilities are truly endless.

¹⁴ <http://buildingsmart.org/>

6. Climate Change, Energy-Management and Green Technologies

Climate change is now a global agenda and the threat it poses is real. Hong Kong is part of the C40.org organization. At the recent C40 Green Forum held at the Open University of Hong Kong, the Chairman of Friends of the Earth HK, Dr. Vivian Wong, reiterated the need for “sustainable consumption” in all types of electricity and resources. It is therefore imperative that Hong Kong embark on a low-carbon strategy, adopting new green technologies for both the supply and demand side of our electricity usage to help reduce greenhouse gas (GHG) emission.

According to the Environmental Bureau and EMSD, electricity generation is the largest source of local GHG emissions, accounting for about 68% of the total in 2012 and the single largest category of electricity consumption in Hong Kong in both the commercial and the residential sector is in air conditioning.

In the 2016 Policy Address, the Government committed a reduction target of 40% in energy intensity by 2025 in the *Energy Saving Plan for Hong Kong's Built Environment 2015~2025+*.¹⁵ A number of key actions have also been earmarked as part of the strategy - including the Mandatory Energy Efficiency Labeling Scheme, the use of a district cooling system (DCS) to serve the buildings at the Kai Tak Development and the adoption of BEAM+ building and construction for new buildings.

While the adoption of new building technologies in new development areas is important to the road-map in constructing new buildings, the SCC recommends that the Government and the Environment Bureau should also investigate how to achieve energy savings with the rest of the old buildings scattered across the cities. According to the Buildings Department, over 85% of the buildings are 10 years or older¹⁶ and hence many of which will require some form of retrofitting technologies that could be installed to achieve the energy saving objectives. In Hong Kong, residential use of air conditioning contributes to 34% of the consumption of electricity, and to help solve this problem, some Hong Kong enterprising companies have developed award-winning solutions like Ambi Climate¹⁷ and SmartAirCon¹⁸ to specifically target at eliminating the peak demand of electricity, reducing greenhouse gas (GHG) emission and reducing the electricity bill. Similar product innovations in energy management like smart thermostats (e.g. Google's Nest) are even subsidized by the local utility company in the United States. At the SCC, we also believe that the utility companies in Hong Kong could follow suite by subsidizing the installation of these smart IoT devices to help achieve energy saving, reduce electricity bills - thus bringing direct benefit to the people of Hong Kong.

The SCC has been able to work collaboratively with the industry and research community in formulating a strategy to support the Government's pledge to the Climate Change Plan 2016. In response to a recent invitation by the Secretary for the Environment, Mr. Wong Kam-sing, JP, the SCC has formed a task force and submitted a proposal for consideration for incorporation into the Post-COP21 Climate Change Plan 2016 of the Environment Bureau. The proposal is an effort of co-creation with collective thoughts and initiatives from the industry and research

¹⁵ <http://www.enb.gov.hk/en/energysavingplan.html>

¹⁶ http://www.legco.gov.hk/yr09-10/english/hc/sub_leg/sc05/papers/sc050209cb1-1163-1-e.pdf

¹⁷ Ambi Climate is the winner of GS1IoT award winner from Ambi Labs

¹⁸ SmartAirCon is the winner of HKIE's Smart City IoT Competition in 2016 from Remotec Technology Limited

Over 85% of the buildings are 10 years or older and require some form of retrofitting technologies that could be installed to achieve the energy saving objectives.

community to support the Government on the green aspects of Smart City development. Of particular interests are the areas of (i) energy and climate change, (ii) air, (iii) waste, and (iv) nature conservation.

Within the proposal, the SCC's Green Committee has articulated a new approach - a community-led urban energy initiative, called City Action Platform for Climate Resilience and Energy (CAPCARE). Based on open data architecture, CAPCARE puts advanced data analytics into the hands of communities and empower social action delivering community energy initiatives, also with also capacity to develop a platform to collate environmental datasets such as air pollution, waste and nature conservation.

The CAPCARE proposal has detailed two phases for which the first phase will be dedicated to creating an electronic platform equipped with an unique mix of datasets along with standard data exchange protocol. Examples of datasets could be comprised of satellite, aerial, open and proprietary energy and social-economic data. The notion of aggregating a variety of datasets will allow for scalability and adaptable to energy needs of different stakeholders. The second phase of CAPCARE includes development of applications based on the Phase I electronic platform, for better management of air quality, waste and biodiversity, by adopting the appropriate information, communication technologies, environmental and clean technologies and social technologies.

Some of these advanced green building technologies, innovative business models, smart home appliances, open data platform, sharing economy, cloud-based artificial intelligence are either already deployed or under development by some of the vibrant Hong Kong-based business enterprises and entrepreneurs at large and could certainly be taken into consideration when formulating the Smart City Blueprint that helps achieve the targets set by the Government's pledge in the Post-COP21 Climate Change plan. The SCC welcomes the Government's Smart City Blueprint task force to further investigate some of the problems identified and also the solutions presented in CAPCARE (Appendix A).

7. FinTech innovations beyond e-Wallet and e-Check

On Aug 25th, 2016, the Hong Kong Monetary Authority announced that they have finally granted new Stored Value Facilities (SVF) licenses to five mobile e-wallet service providers. It is great to see that one of the SVF licenses had been issued to a startup company incubated by Hong Kong's very own tech cluster incubator - Hong Kong Cyberport Management Limited. Other licensees are mostly backed by conglomerates and they are namely Alipay Financial, HKT Payment, Money Data that operates WeChat Pay and Octopus Cards.

This piece of news is exciting as this means that there will soon be more competition in the mobile e-Wallet marketplace. Consumers could enjoy the convenience in innovative e-Wallet mobile payment. Small merchants and even charity organizations could conveniently use mobile payment to facilitate their transactions without high cost of renting machines from Octopus or credit card companies. At the present moment, renting an Octopus terminal or credit card terminal to process electronic payment is a very inconvenient and expensive ordeal.

It is also promising to see that there is now over 130 retail-banking institutions that could process the e-check services in Hong Kong. In addition, Jetco has also just launched a peer-to-peer interbank platform. With the payment systems ordinance introduced last year, people have high expectations for these new mobile payment technologies in Hong Kong – some of these services have been thriving on the mainland for a number of years. In spite of these promising indicators for Hong Kong, there is still much room for improvement; potential application and innovative use cases in e-Wallet services could further be explored within the boundary of the current SVF license terms and conditions.

Hong Kong is a major financial hub supported by a sound legal and banking system. As trading hub, many trade-related banking transactions have been using institutional facilities in the form of a letter of credit or other forms to ensure payment for goods traded could be received by the vendor. This industry could be due for disruption; and for traditional banks to stay competitive, the opportunity and technology innovations (e.g. block chain) lies ahead will be something that they would explore. In the insurance industry, this crypto currency technology could also bring along significant changes.

In some of the recent consultancy reports or whitepapers, consulting firms such as Accenture,¹⁹ McKinsey²⁰ and Boston Consulting Group²¹ have all articulated that the use of block chain could offer an opportunity for the players in the sector to upgrade the current infrastructure of international payments, trade finance, insurance industry. Barclays Bank²² has also prepared a whitepaper to explain to its customers about the up and coming disruptive technologies of using block chain which promise new opportunities and scope for cost savings.

As the regulator in Hong Kong, the Hong Kong Monetary Authority (HKMA) should look beyond today's challenges in regulating new technologies rather than just

*Out of the box
and regulator
Sandbox
environment for
fostering
FinTech
innovations*

¹⁹ <https://www.accenture.com/us-en/insight-trade-finance-capital-markets>

²⁰ <http://www.mckinsey.com/industries/financial-services/our-insights/blockchain-in-insurance-opportunity-or-threat>

²¹ <https://www.swift.com/node/17246>

²² <https://www.barclayscorporate.com/content/dam/corppublic/corporate/Documents/product/Banks-Trading-Up-Q1-2016.pdf>

taking a risk-adverse and technology-neutral approach to these various disruptive technologies as well as innovative business models.²³

In addition to working closely with technology solution providers to exchange information on these technologies, HKMA should encourage and develop some framework to lower the entry barrier for enterprising companies to start smaller projects or pilot tests and be ready to step in and mitigate between traditional licensed banking institutions with the new solutions providers. The developments of all these new FinTech innovations and new business models (e.g. sharing economies) have much reliance on HKMA to take a giant leap forward.

Take an example of how United Kingdom manages innovations within the FinTech sector, the Financial Conduct Authority²⁴ has created what they called a *Regulatory Sandbox* environment - a safe place for testing innovative services, products, business models and technologies without the immediately incurring all the normal regulatory consequences of engaging in them activity in question. And closer to Asia, the Money Authority of Singapore²⁵ has also recently concluded a consultation process regarding the use of a *Regulatory Sandbox* for FinTech projects.

²³ <http://www.hkma.gov.hk/eng/key-information/insight/20160321.shtml>

²⁴ <https://www.fca.org.uk/firms/fintech-and-innovative-businesses>

²⁵ <http://www.mas.gov.sg/News-and-Publications/Media-Releases/2016/MAS-Proposes-a-Regulatory-Sandbox-for-FinTech-Experiments.aspx>

8. Open Data initiatives driven by Government-led policies

As described earlier in Chapter 5, we highlighted the importance of spatial data infrastructure and the availability of open data to the public for both better city planning and further innovations. In reality, the type of datasets, the form in which these data are to be made available to the public, the frequency of updates and validity of the data are all key factors that drive and support other Smart City initiatives.

To take an example from our neighboring city Singapore, they have orchestrated their GovTech initiatives and placed a strong emphasis on the implementation on how to open up their Government data as well as enforcing that public utilities follow suite. These activities have placed importance in their road-map for success. One of the unique value proposition which is not available in Hong Kong is to enable the citizens to become the sources of data, MyConection²⁶ allows a mobile application that utilizes voluntary crowdsourcing to improve the quality of experience for mobile broadband users. My Connection SG gathers the usage experience from users' mobile phones, such as broadband speed, latency and coverage on mobile cellular networks such as 3G, 4G, and Wi-Fi networks. This will allow the government and telecom operators to have a better understanding of mobile broadband performance and take measures to improve consumers' usage experience.

Government should drive to open and share more government and city data, and improve the accessibility of these datasets

Since March 2015, the Public Sector Information Portal (PSI) has been upgraded and currently there are over 6000 datasets in 18 categories available on the data.gov.hk website.²⁷ The overall trend to become digitally connected with our city's resources has much reliance on a Government-led effort to not only introduce more datasets, but to also improve the accessibility of the datasets. At the SCC, we have received numerous feedback from the public consultations about various datasets only available in PDF or EXCEL forms making those datasets not very usable, labour intensive and error prone and not updated as frequently as it could be. Improvements in these areas are certainly called for to ensure that the objectives for open data are achieved.

In Hong Kong, the *Open Data studio* project led by the Hong Kong Science & Technology Park (HKSTP) is one of the most promising efforts thus far to bring private enterprises into the supply chain and contributing their data to be shared by other application developers and companies to further create value-added services. This in effect is a sample case study of how a public-private partnership (PPP) shown in the Appendix A, could be run and potentially one that could develop further added value downstream.

In the 2014-2015 Budget Speech, our Financial Secretary – Mr. John Tsang highlighted the need to develop Hong Kong into a smart city and open data is one of the most important initiatives. Widespread use of open data does not only deliver a range of benefits to the Government, citizens and organizations but also stimulates innovations and in the end helps the build-up of a smarter city and create positive social, environmental, economic and financial impact.

²⁶ <https://www.ida.gov.sg/Learning/Technology-You/MyConnection-SG>

²⁷ http://www.ogcio.gov.hk/en/facts/doc/Fact_Sheet-OGCIO-EN.pdf

9. Trade Single Window for Smart Government and Smart Economy

Hong Kong has always been phrased as one of the dragons in Asia because of its free port, talented workforce, efficient logistics and container shipping competitive with other trading economies and to fulfill the demand for better quality services, many cities and countries have upgraded their procedures and systems to serve businesses in trading with something called Trade Single Window (SW). According to the Trade and Industry Department²⁸, there are around 321,000 small and medium enterprises (SMEs) in Hong Kong which accounted for over 98% of the total business units, providing jobs to nearly 1.3 million persons. Over 50% of these SMEs are actually actively involved in import and export trading or wholesale.

Over 50% of the SMEs in Hong Kong actively involved in import, export and trades, could benefit from Trade Single Window.

In Apr 2016, the Commerce & Economic Development Bureau (CEDB) together with the Customs and Excise Department (C&ED) has jointly conducted a public consultation of the SW platform. The SCC had been following the development of this and the SCC has also sent in our response to the CEDB and C&ED. According to the consultation paper, Hong Kong is currently trailing behind some of the regional economies in terms of facilitating business-to-government and government-to-government as shown in figure 7 below. The SW will provide a single ICT platform for the one-stop lodging of all documents from the trade to the Government in relation to importing and exporting goods.

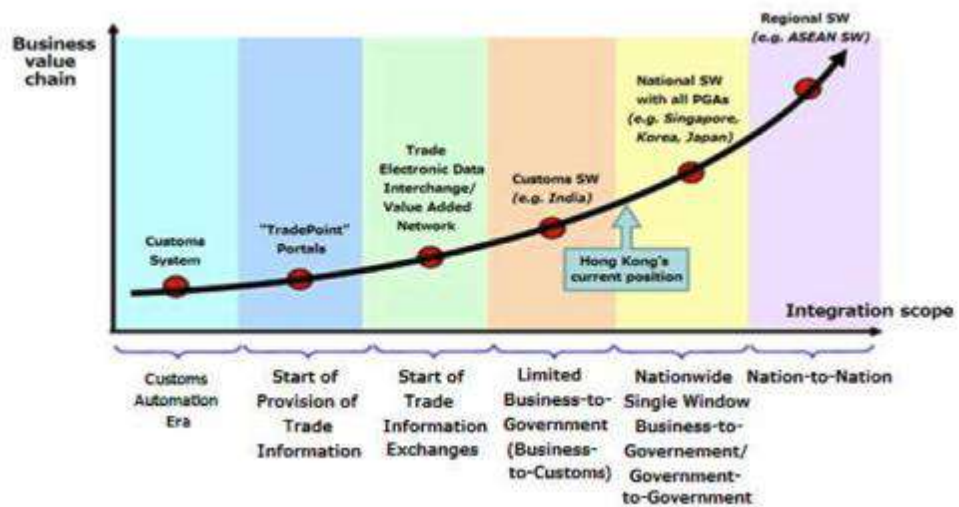


Figure 7. Evolution of SW (source: CEDB Consultation Paper)

Closely related to *Smart Economy*, the introduction of value-added service providers (VASPs) model are anticipated within the SW thereby increasing the quality of services through open competition, fostering entrepreneurship, increasing SMEs' productivity and enhancing the data systems connectivity and transparency with local SMEs, Banks, Government departments and international trading partners. At the SCC, we believe the new VASPs will create new job opportunities for ICT graduates and existing ICT practitioners.

Related to *Smart Government*, there will be a need for the future SW platform to be able to support different levels of open data initiatives that could further spark new

²⁸ https://www.success.tid.gov.hk/english/aboutus/sme/service_detail_6863.html

innovations. Open data initiatives could help SME's and VASPs to better understand their data needs and to design better data management software systems that create a positive impact on productivity, transparency, compliance and supply chain risk management.

During our public consultation period, we have also received a response from the Department of Management Science of the City University of Hong Kong that has conducted a survey with the Hong Kong Apparel Society (HKAS). Their survey reveals that the many of the HKAS members are supportive of the implementation of SW and welcome the benefits of one-stop lodging of all trade documents and the paperless approach. Specifically, the respondents suggested that new SW platform should offer automatic electronic notifications and online checking of license & permit processing status, duties and tax payments and having connections to SWs of other economies.

Closely related to the implementation of SW, the ability for various Government departmental system to also recognize the Electronic Identities (eID) of an organization is also very important. This topic will be discussed later in Chapter 12. In addition to eID, the successful implementation of the SW will require the exchange of data and information among different parties in import-export trade, thus relying on the electronic data interchange (EDI) across computer systems owned by the different parties and hence calling for the need of standardized API for data input/output which facilitates efficient exchange of trade data amongst different parties.

Monitoring the progress in implementing of Trade Single Window is necessary to ensure success.

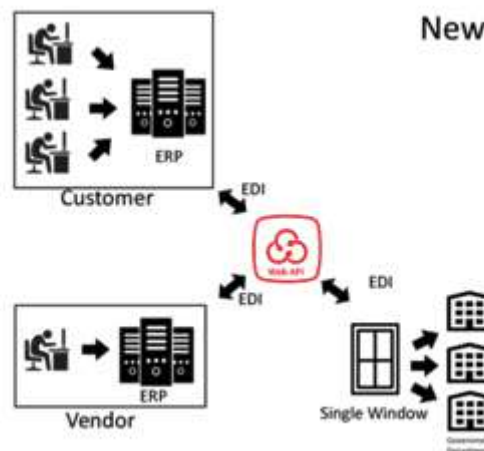


Figure 8. Application Programming Interface for SW

The SCC is of the opinion that the upcoming Smart City Blueprint should actively monitor and coordinate with the project management office (PMO) of C&ED which will be managing the implementation of the SW to ensure that there are plans to work with the business community and various Government departments to agree on some standards in API and open data. In the next five to ten years, the successful implementation of this SW platform will inevitably allow Hong Kong to become a competitive smarter trading economy again – with increased productivity and simplified trade declaration procedures. Above all, the successful implementation of SW will create numerous new job opportunities and will keep SMEs in business – building resilience within our city.

10. Talent Development, Creativity, Innovation & Entrepreneurship

In a SCMP article²⁹ written by the SCC's Founder and Chairman of the Steering Committee - Dr. Winnie Tang, JP, Dr. Tang has made the recommendations that Government should direct its annual policy making and budget to turn Hong Kong into a smarter city by boosting ICT education and by creating more favorable conditions for job creations, entrepreneurs and business startups alike. If Hong Kong is serious about raising its innovation and technology profile, and creating a 'Smart City', it must do more to draw talent into the industry and start thinking of building a pipeline of talent. The Government should lead the change to become "builders of talent" instead of "buyers of talent".

Through our joint public consultation with other parties, we have learnt that more and more citizens are seeing the need for Hong Kong to advance to become a smarter city. However, many responses received have also raised this critical question of whether Hong Kong has enough talent to support the goals to implement Smart City initiatives. The notion of having intelligent people is therefore a key success factor to a Smart City.

According to the OGCIO³⁰, there are 2,200 ICT graduates every year and an overall talent pool of 83,000 working in various industries. These two numbers are not meaningful if one doesn't look beyond and take a qualitative measurement on the need of what specific skills are required for the new millennial. Researchers studying what constitutes as a 21st century skills posit that Science Technology, Engineering and Mathematics (STEM) skills are increasingly desirable to empower and enable its workforce to be smart and productive.³¹ UNESCO in its report actually made a recommendation to member nations to "*widely cultivate ICT skills in its population or risk being excluded from today's technology-driven knowledge economy*". In a survey report titled *Realtime Generation Report 2106 - The Age of Digital Enlightenment*³² produced by the Logicalis³² in UK on ICT in education, it surveyed one thousand student aged 13-17 year, and apparently 43% reported that they are either already coding or would like to learn how; 52% would also consider choosing ICT & computer sciences as a choice of curriculum major.

For a long time, Hong Kong's engineering and technology faculties have had difficulty in enrolling top-grade high-school leavers. These students prefer to go into medicine, law or business, most likely because of the higher salaries. According to the University Grants Committee, the average annual salary of engineering and technology graduates was around HK\$200,000 in 2013/14, half that of graduates of medicine, dental care and nursing.

Some of the suggestions that we have received have advocated the need for a deeper training scheme for engineering research students who could jointly receive funding support from Small-Medium Enterprises (SME) as well as the Government's support when engaging in a research degree programme and co-develop intellectual property rights (IPR). By doing so, SMEs can excel, skillful engineers and professionals could be trained and equipped to a higher standard, and IPRs will

²⁹ <http://www.scmp.com/comment/insight-opinion/article/1899867/hong-kong-needs-tech-upgrade-diversify-its-ailing-economy>

³⁰ Fact Sheet http://www.ogcio.gov.hk/en/facts/doc/Fact_Sheet-HK_as_ICT_Hub-EN.pdf

³¹ <http://en.unesco.org/themes/education-21st-century>

³² <http://www.uk.logicalis.com/globalassets/united-kingdom/reports/real-time-generation-reports/realtime-generation-2016/logicalis-uk-realtime-generation-report-2016.pdf>

Deeper training scheme to be offered to research students; actively engage local enterprises to co-create intellectual property rights.

be generated. Many SMEs also have also the need to stay competitive by upgrading and transforming themselves through developing IPRs, and this deeper training scheme allows science and engineering research projects to be more aligned with industry expectations. One other benefit of this scheme is that research student candidates will already be on a job rather than having to look for a job after graduation as well as producing output for the SME, the industry and contributing to the GDP of Hong Kong.

The HKSAR Government should lead the effort to procure locally and support the adoption of latest technologies from local companies.

In Hong Kong, the effort to support startups, entrepreneur's activities, Research & Development and technology leadership should continue to be led by the Government. There is increasing evidence that some of the innovative products and technology solutions delivered by local SME enterprises and startups incubated by our two technology clusters – Hong Kong Cyberport and Hong Science & Technology Park are of world-class quality. In the past three years, we also observed a rapid increase in the number of accelerators, incubation programmes, co-working spaces and entrepreneur-related events, the SCC strongly believe that the Government should continue to support this technology drive.

The Government should also set as the lead example when it comes to procuring locally and support the adoption of these latest technologies from local companies and output from local research university and SME's. There are many successful cases of local technologies like the artificial intelligence (AI) project from the City University of Hong Kong for its Integrated System for Engineering Works Management built for Mass Transit Railway Corporation, which has helped bring safety to its more than five million passengers every day. Other projects like the Polytechnic University's electric vehicle project called "MyCar", the "Wisers" search project from the Chinese University, and the highly successful DJI, which specializes in easy-to-fly drones, from the Hong Kong University of Science and Technology. All these have demonstrated the potential of deeper science and engineering research; commercialization of these research projects are often challenging if there is a lack of follow-on support from both the local capital markets, local industry support and most importantly the Government.

As an example of how local private enterprises and their willingness to provide open data could spark off innovations with our future generations, over 100 local primary and secondary schools in Hong Kong have signed up in May for the free electronic learning (e-learning) programme offered by Environmental Systems Research Institute (ESRI) in Hong Kong. Similar programmes offered by the ESRI in USA have found successes. In this programme, the sponsored students can use GIS software and related professional map analysis tools originally developed for commercial use. This free Map in Learning (MiL) electronic education programme could allow students to use a cloud system on their smartphones, tablets and desktops anywhere. The programme hopes to improve students' problem solving abilities and to inspire our students in the STEM disciplines so that they may enjoy the learning process. This MiL Programme corresponds with the Education Bureau's "Life-wide Learning" paradigm, which prescribes student learning in real-life and authentic contexts. It provides students with a timely GIS analytical platform and relevant knowledge, trains students to take full advantage of geographic information and enriches their learning experience.

By allowing students to think big, to freely experiment, to learn to fail and to take risks, they could foster a resilience, meaning-making, collaborative and proprietary culture.

As suggested by the UNESCO report on 21st Century skills development, oHong Kong's future economy will depend on the capability of the students that are at schools today. If the ultimate goal is to develop Hong Kong into a knowledge-based economy – then, rebalancing the ICT curriculum in favour of nurturing creative thinking and problem solving skills – thus challenging the status quo and mindsets

of today's educators. Professor of Mobile Learning, Dr. John Traxler who was in Hong Kong in July speaking at the Open University of Hong Kong³³ cited the importance of educators to understand the need to disrupt the formal learning process and pedagogies thereby helping students to develop competency and to acquire skills needed for the 21st century. Creating a technology-enhanced learning environment that encourages innovation should be a priority for our younger ones at both primary and secondary school levels. Allowing the students to explore ideas, think big, to freely experiment, to take risks and learn to fail, this will bring along many benefits such as fostering resilience and meaning-making (Sitkin, 1992).

In this regard, the Government should therefore carry out a comprehensive review of its ICT education policies, to ensure sufficient numbers are attracted into technology sectors, to build a solid foundation for a Smart City. At the very least, the Government should consider putting more funding to encourage students to participate more in innovation projects, encouraging and challenging them to write, suggest, propose, or even design and build ideas. The money should not be given to schools or commercial entities as grants, but directly to students. The SCC would like to suggest the Smart City Blueprint to address a cross-discipline and cross-department review between the Education Department and professional organizations like the Hong Kong Computer Society and educational technologists to develop ICT courses, content and assessment to be offered to primary and secondary school aged students. This would contribute to the development of smart people within the scope of the Smart City blueprint.

³³ https://student.intranet.ouhk.edu.hk/ers/prod/urc_event_detail.jsp?eid=000518&lang=eng

11. Smart Living Environment with Healthy Aging and Well-being

When we are promoting smart living, there is an important indicator we can refer to – subjective well-being of the citizens. Diener and Chan (2011) explain subjective well-being as “*people’s evaluations of their lives, which can be judgments such as life satisfaction, evaluations based on feelings, including moods and emotions.*” Any solutions that are proposed to tackle issues relating to people’s living should have a positive impact on their well-being.

The core of the smart city vision is centered around people, the ultimate goal of these initiatives is to provide a better life for the people and allow them to attain a “smarter” living in the city. Living, is a general term that includes all aspects relating to people like mobility, convenience, health, social coherence, etc. The ability to understand a human’s needs and automatically respond to it is what makes something smart. Thus, smart living, represents the intelligence of the city to recognize its inhabitant’s demands and promptly react to them.

Numerous datasets being combined, creates and supports normal operations of the city that we live in, such as the geographical, building and utility information, social data etc. In order to provide smarter living for the citizens, we need to utilize these data in a more meaningful way, extracting the value from within these data. To become smart, data analytics is vital. A Smart City, should hence, be a people-oriented city that can self-sustain and automatically improve based on human needs, supporting the construction of a green and harmonized society.

In 2015, Hong Kong had 1.12 mil people aged over 65, 15% of which were over 85. The trend of the aging population is steep as baby boomers reach their retirement age. By 2040, one in every three people in Hong Kong will be over 65. Currently, there is a queue of 32,000 elderly citizens waiting for nursing homes. And equally alarming is that there are over 18,000 new cases of elderly citizens diagnosed with dementia each year.

Our current senior care and healthcare systems have been under an unprecedented amount of pressure. Meanwhile, aging with dignity is mere fantasy of most senior citizens. In order to facilitate healthy aging in Hong Kong, we believe there could be opportunities to create *Proactive, Predictive* and *Preventative* living environments with a holistic smart health system that links up families, neighbors, caregivers and doctors together, to keep our citizens safe, healthy and happy at home. By adopting these three pillars, we could improve the senior citizen’s well-being while distributing resources equitably to those in need. These three pillars are explained below.

- i) *Proactive Smart Health Monitoring* - An indoor and outdoor smart IoT network could be deployed to sense delta change of real-time individual’s health status, biometric measurements, living habit and social behaviors. These could be integrated into any smart home devices and ecosystem and could also link up with individual doctor’s clinic and hospital – providing comprehensive health data and knowledge management for each individual. Additional datasets like the amount of exercise being carried out, sleeping profile, dietary intake, would be also useful for health practitioners and for medical research.

In order to facilitate healthy aging, there could be opportunities to create Proactive, Predictive and Preventative plan to improve senior citizens’ well-being.

- ii) *Predictive Smart Health Analysis* - a big data analytic platform will be designed for digital healthcare professionals to share and discover correlations between environmental changes and associated health risks by integrating raw data and digital health records, with a proprietary algorithm developed to predict acute diseases and provide real-time advice for personalized medical treatment.
- iii) *Preventative Smart Health Community Network*: this intelligent ICT solution would involve Government emergency units, medical professionals, and the support from local community organizations. With the availability of electronic health records sharing to authorized professionals, tele-medical consultation could become feasible for patients with chronic illness at home, saving their time and effort to make regular visits to doctors. Precise and personalized medication will also be possible for medical diagnosis based on individuals' living habits. In the case of any emergency, the Smart Health community network could also deliver immediate alerts to the nearest neighbor to locate the person in need.

This strategy will trigger a paradigm shift for the Hong Kong healthcare system, by changing the traditional reactive medical care approach to a predictive and preventative monitoring. It encourages patients to seek medical advice in the early stages, and helps to alleviate pressure on frontline healthcare workers and reduces the overall cost of treatments.

The idea of implementing PPP, shown in the Appendix, could also be implemented with community-based social innovation projects such as the programme proposed by the Old-HK Foundation³⁴ which has proposed Hong Kong's first large-scale cross-generational co-housing facility in which interaction among neighbours are facilitated for social, health and practical benefits.

The idea of implementing PPP, could also be implemented with community-based social innovation projects



Figure 9. Old-HK Foundation's proposed Co-Housing facility for the aged.

The SCC welcomes the opportunity to discuss how these 3 pillars of Proactive, Predictive, Preventative care could further enhance the well-being of its people.

³⁴ Old-HK Foundation's s community programme for the aging population <http://www.old-hk.org/>

12. The Road ahead for Electronic Identities (eID)

A paradigm shift is happening around the world in the development and application of electronic identities.

A paradigm shift is happening around the world in the development and application of electronic identities and transactional records in social security and healthcare. Hong Kong has been one of the early adopters in using a digital smart card – chipbased identity card and many public services (e.g. library and leisure services) count on the use of these identity cards and since 2003, the Government has also implemented the use of digital certificates through the Electronic Transaction Ordinance³⁵ (Cap. 553) (“ETO”) which could work with the existing identity card. Under this ETO, the Hong Kong Post Certification Authority is a recognized certification authority by virtue of the ETO. A commercially run certification authority could also apply to the Government Chief Information Officer to become a recognized certification authority on a voluntary basis (e.g. Digi-Sign). The results thusfar for the adoption of the digital certificates in Hong Kong is not as widespread as once thought with around a total of 109,787 digital certificates issued³⁶. With the proliferation of the uses of mobile devices and Internet, the increasing use of Electronic Government (eGov) services and commercial transactional activities, there is a high expectation from the public that the new electronic identity could become really useful for citizens in Hong Kong. Currently, the Immigration Department (ImmD) and the OGCIO is co-ordinating the next generation Multi-Application Smart Identity Card (MASC) scheme³⁷ whereby a personal e-Cert can be stored on the smart HKIC for performing electronic transactions for commercial and other purposes under ETO.



Figure 10 . ETO Certification Authority in Hong Kong (Source: OGCIO)

In July, 2016, the OGCIO published a discussion paper titled *Review of the Development and Usage of Digital Certificates in Hong Kong* inviting the committee members of the Digital 21 Strategy Advisory Committee to provide feedback. In this context, the SCC believes there should be opportunities for further citizen engagement to participate in this review as the topic of eID involves both individuals and organizations.

Similar to the identity card (for persons) and business registration (for companies) being used for authentication in the physical world, Electronic Identity is the counterpart in the online world. There are plenty of secure Electronic Identity

³⁵ <http://www.ogcio.gov.hk/en/regulation/eto/>

³⁶ http://www.digital21.gov.hk/eng/D21SAC/attachments/D21SAC_paper_5-2016.pdf

³⁷ <http://www.legco.gov.hk/yr14-15/english/panels/se/papers/se20150106cb2-534-3-e.pdf>

Interoperability, backward compatibility and secure PKI infrastructure are some of the key considerations for implementing eID in Hong Kong

solutions available nowadays. Recognized digital certificates are one of the most mature ones because in addition to authentication it can be used to sign electronic documents with a digital signature. The SCC also opined that, in view of legal considerations, eID should be one of the Government provided services to general public. If we still rely on service providers to issue credentials to the subscribers (for redemption or admission) or rely on commercial firms to offer private identification and membership service (for the use under contractual coverage), it would defeat the purpose of a society-wide identity device as a whole. Transactions like tax payment, financial management, online purchase and other electronic government services will rely heavily on this eID. Online services in all forms could adopt the use of the new eID infrastructure and services could streamline the current social security and health care services.

The SCC also believes that the new electronic identification regime should follow both an international standard and have the ability to be recognized by the mainland authorities. Specific considerations for the implementation are also listed below for further discussion.

- i) Interoperability amongst different Government departments;
- ii) Backward compatibility to existing digital certificates regime;
- iii) Secure PKI infrastructure
- iv) Personal data privacy
- v) Biometric and fingerprint data accuracy

The widespread use of eIDs in trade, commerce, and in Governments will be also highly relevant with the SW platform presented in Chapter 10.

Furthermore, the widespread use of eIDs is not only beneficial for its use within Hong Kong. It will also strengthen our competitiveness through cross-border collaboration with Mainland China. Through the Mainland and Hong Kong Closer Economic Partnership Arrangement (“CEPA”), it is possible for eIDs to potentially facilitate many local businesses to capitalize on cross-border online commerce opportunities connecting with business and Government in mainland. An increase in cross-border commerce activities related to the use of eID is already happening, it is therefore imperative that both OGCI, ImmD, C&ED managing the new eID infrastructure to also consider the use of the latest technologies that conforms to international standards. Other innovative technologies like biometric data capture is also increasingly important for supporting digital identification as described in the EyeVerify technology solution, reported in SCMP³⁸.

The SCC is of the opinion that as Government departments and financial institutions become more engaged in the use of the latest authentication process and technologies for recognizing electronic identities, there will inevitably be a need for a new regulatory regime that could grandfather older legislations and ordinances, but yet be flexible enough to accommodate new business processes, service delivery methods and new security measures.

³⁸ <http://www.scmp.com/tech/china-tech/article/2019127/alipay-operator-ant-financial-services-snaps-us-biometric-security>

13. Electronic Health Records (eHR)

Just as important as electronic identities, electronic health records sharing can facilitate information transfer and collaboration across clinics, pharmacies, and hospitals. In Hong Kong, the Government has adopted the approach of eHR Engagement Initiative³⁹ (EEI) to engage healthcare providers and the IT sector. Stakeholders were invited to submit eHR partnership proposals for participations in the development of an eHR Sharing System. To support the implementation of eHR Sharing, the Government formulated a legal framework to protect data privacy and system security since 2009. The eHR Bill was introduced to Legislative Council in April 2014 and after the Third Read Debates, the legislative proposal for eHR Sharing System was endorsed and the legislation was completed in July 2015. The eHR Sharing System Ordinance has become effective since 2 December 2015.⁴⁰

Application Programming Interface (API) is needed for efficient electronic health records sharing.

Currently, the eHR Sharing System (eHRSS) Ordinance comprises of the definitions of key terms, establishment and functions of the eHR Commissioner, registration of healthcare recipients, prescribed healthcare providers, use of eHR, access control and data governance. While the current eHRSS acts as a framework which covers the application framework, the ICT infrastructure, and the repositories; there is a need to look beyond the current system architecture using what the authorities referred to as “CMS⁴¹ On-Ramp modules” in order to maximize the return of the datasets through the use of application programming interfaces (API),

As described earlier in Chapter 8 on open data, the data.gov.hk portal currently offers more than 6,000 datasets in 18 categories. In the health category, there are less than 30 datasets and only several datasets are in the interoperable XML format. In comparing to the US’s healthdata.gov portal which offers 2,800 health related datasets in the interoperable formats CSV, RDF, JSON and XML format, the current health-related dataset opened to the public and industry is far from enough. SCC suggested the Government develop more interoperable health-related datasets and standardized APIs to enable entrepreneurs and business innovators to create more applications, which could offer better utility value. Application developers could reduce the cost and complexity of integrating with other eHR systems and this will create job opportunities and accelerate the innovation in application development with open source development tools and resources.

The SCC understands that the Government has set a very clear vision and road-map for eHealth development. However, we also believe that the standardization in using API and the availability for these datasets for 3rd party uses within the bounds of the eHRSS ordinance is very critical for the long term sustainability for eHRSS that creates smarter healthcare and promotes innovations such as those presented in Chapter 11 related to Smart Living.

³⁹ http://www.ehealth.gov.hk/en/training_programme/eei/eei.html

⁴⁰ http://www.legislation.gov.hk/blis_ind.nsf/WebView?OpenAgent&cap=CurAllEngDoc*625

⁴¹ CMSOn-Ramp is a free clinic management system with the ability to share the clinical data of patients

14. Wi-Fi and IoT sensors everywhere with enhanced cyber security

*Building a
citywide
network of IoT
Sensors could
enhance the
quality of living*

In many Smart City projects around the world, one of the hotly debated topics is how a city could raise its level of service through the deployment of various sensors and the Internet of Things (IoT) devices in a citywide network. In our public consultation, we have received numerous suggestions regarding the need for a citywide IoT sensor network that is connected to the Internet. These services could be related to the ability of the Government to deliver or monitor municipal services, public health hazards, transport emergency and public safety or even new innovative services such as, *intelligent homes* as suggested by the Innovation and Technology Bureau (ITB). Juniper Research indicated that consumer spend on smart home services, including health and energy will reach \$100 billion by 2020⁴², double the estimated expenditures of \$43 billion in 2015. It is also observed that there are tremendous economic opportunities in developing IoT technologies in a city and bringing direct benefit to the people and finally improving the quality of living.

The fundamental issue in developing IoT technologies in a city is the deployment of IoT sensors. There are a variety of IoT sensors and they are often heterogeneous in nature and are application-specific (e.g. RFID sensors as used in smart parking and high-definition camera in detection of traffic flow). In terms of monitoring our living environment, CO₂ sensors, humidity sensors or temperature sensors are very often required in an IoT development project. Other examples like water level monitor sensor, smoke detectors, air and water quality indicator sensors for public safety, etc. Even an installation of remote control sensors in the office or at home can offer convenience and control. Combination of motion sensors and temperature sensor can provide rough estimation of people inside a room-based environment and in turn automatically adjust the temperature upward and downward via the air-conditioning to achieve the optimum comfort environment and energy management.

⁴² [http://www.juniperresearch.com/press/press-releases/smart-home-revenues-to-reach-\\$100-billion-by-2020](http://www.juniperresearch.com/press/press-releases/smart-home-revenues-to-reach-$100-billion-by-2020)

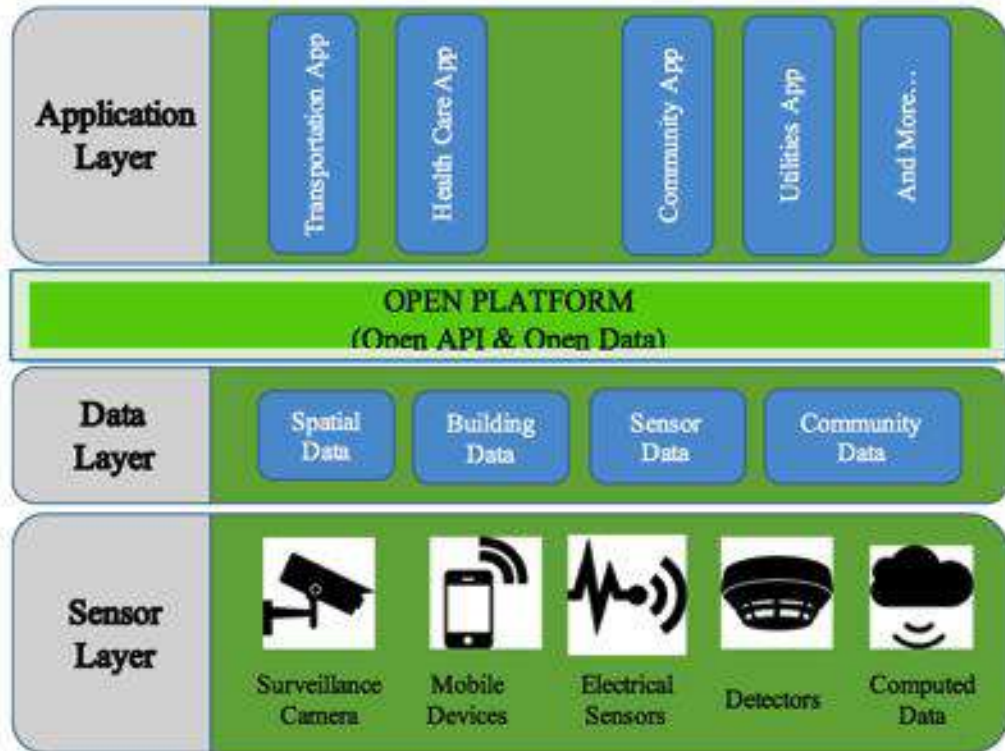


Figure 11. IoT Sensors Layer, Data Layer and Application Layer Framework

Through mobile applications, real-time spatial, community and transport information can be shared as well as collected. A simplified framework is illustrated in Figure 11 on how different sets of data can build up the foundation for the development of a smart city. The framework consists of 3 major layers: (1) Sensor layer, (2) Data Layer and (3) Application Layer; each layer consists of multiple constituents. The sensor layer includes all the sensing data that is collected through different devices such as mobile devices, implanted sensors and detectors.

The deployment of multiple sensors to form a citywide IoT sensor network will have its own challenges like radio frequency allocation and application development. If done right in Hong Kong, the people could enjoy data sharing or monitoring from everywhere and an improved level of various municipal services. Hong Kong is rich in talent and the SCC has been collaborating with many industry experts and potential ICT and Engineering graduates to fulfill the demand for high quality IoT sensors. The SCC would urge the Government to take an active stance forward to show their determination for developing this IoT network.

In the area of improving our city-wide Wi-Fi infrastructure, the Government could consider adopting using PPP models, shown in the Appendix A, to engage innovative startup companies to provide smart kiosks installed in bus stations, government premises, and other public areas. Apart from the experience of LinkNYC⁴³ providing public Wi-Fi in New York City which started in late 2015, the smart kiosks could be operated by a PPP model providing commercial services like touch screen type vending machine, advertising panel, etc. For sustainability, the smart kiosk vendor and the landlord could share the profits. Furthermore, the vending machine could also be sustainable in areas like government premises and public parks; and for those unavailable for advertisement displays. These touch screen panels could extend their service to provide various public information

Deploying multiple IoT sensors to form a citywide IoT sensor network will have its own challenges. Frequency allocation could be one of them.

⁴³ <https://www.link.nyc/>

services such as location based travel information, public transport information, and weather information, news and public announcements.

We have received numerous responses from technology experts and we have the following input for what constitutes a holistic approach to using a city-wide IoT sensor network and to guard against potential cyber security attacks. As the city improves its services deploying thousands of new sensors connected to the network, there will be an intrinsic need to mitigate risk, simplify the compliance model and trust building within the network infrastructure. A variety of solutions are being developed by many vendors and specific issues such as policies, mitigation and detection of distributed denial-of-service (DDoS), control access of IoT sensors and devices based on user and device identity, misconfigurations prevention, threat and visibility management, etc.

In Hong Kong, ASTRI (one of the eight authorized research centers) has already put in place an ASTRI Security Lab (ASL) to conduct research and to develop solutions in Cyber-threat intelligence sharing platform, Cyber-threat assessment, Cyber-security research and training systems, advanced cloud security, encryption and various authentication technologies. We believe the Government through the OGCI should develop some form of fully funded industry engagement programmes thereby creating new job opportunities for local ICT and engineering graduates to help a wider range of enterprises to benefit from these tools and technologies.

At the SCC, we believe the suggestions we received on following international best practices and standards like ISO/IEC 15408-1:2009 Common Criteria. ISO15408 is also note worthy. Furthermore, the Government through the OGCI should also consider building its own IoT Security Certification Centre that follows ISO/IEC 15408-1:2009 Common Criteria. In addition to the existing legislation, the SCC believes that the Government should continue to create new categories and to broaden the coverage of possible cyber crime offences by perfecting the Telecommunications Ordinance (Cap. 106), Crimes Ordinance (Cap. 200) and Theft Ordinance (Cap. 210)

In addition to the responses received from our public consultation regarding the IoT network and cyber security issues, we have also heard from one respondent that the use of frequency for deploying Low-Power Wide Area Network (LoWAN) in Hong Kong is not compatible with what is being used overseas (e.g. SigFox) and a review of the roadmap for frequency allocation should be initiated by the OGCI with the support of the Office of the Communications Authority (OFCA).

15. Mobility with Smart Street, Electric Vehicles and MobileEye ADAS

Smarter parking and smarter street technologies could make cars, trains, buses or trams travel and park much more effectively in the city.

As mentioned earlier in Chapter 5 and Chapter 8, the benefits of opening some of the spatial and building data can simplify the connection between citizens and tourists with the local government. Managing traffic-related data could be very beneficial for road users and pedestrians alike. There are better way to manage the flow of citizens' traffic within the city by deploying smart street technologies⁴⁴. Smarter parking and smarter streets could make cars, trains, buses or trams travel much more effectively by way of connecting sensors installed at traffic lights at car parks, intersections, bus stops and tram stops. As a bus or a tram begins its route, the connected traffic network can monitor its progress, and change the timing of traffic lights to give the bus as many greens as possible. Such notion of mixed mobility doesn't end with buses or trams either; optimizing traffic flow within the city also makes streets more pedestrian-friendly and makes it easier for cyclists to commute safely and quickly.

The legalizing of electric scooters like Singapore's recommendation on Personal Mobility Devices⁴⁵ and some states in the United States should also be explored by the Government in the Blueprint since these could potentially reduce the number of people using cars or motorcycles - promoting the use of public transport. Currently, all electric-powered scooters (except for motorized wheelchairs for disability use) are being treated as a motor vehicle by the Transport Department.

Along with improving the mobility of the city and its citizens, some of the responses we received through other organisations have specifically mentioned the use of a smart traffic light system, a mandatory vehicle GPS sensor to thwart traffic violations and illegal parking as well as a parking lot signage with empty space indication. With the IoT sensor technologies deployed in citywide network, available parking spaces are monitored by sensors and drivers are guided to the nearest available parking space, car owners could also pay for the exact time that they have occupied the use of the parking space using electronic payment.

Solving the traffic problem in Hong Kong is not easy; the Government has commissioned the Transport Advisory Committee to conduct a study of road traffic congestion in 2014. The report focused on researching the recurrent causes of road traffic congestion while ignoring all non-recurring events like traffic accidents - causing traffic congestion and creating other problems like injury, death, pressure on medical help in hospitals and environmental issues. In light of this, reducing the accident rate of road vehicles should also be discussed in the Smart Mobility agenda. Intelligent system such as the MobileEye Advance Driver Assistance System (ADAS)⁴⁶ deployed in London and Singapore proves useful as the systems provides real time alerts and warnings that detects possible frontal, headway collisions, pedestrians and speeding. In Singapore, the Transport Department even offers grant and subsidies to help companies in funding the installation of these MobileEye ADAS system. At the SCC, we believe the Government should study the feasibility of using similar technology in Hong Kong and assess whether it is financially feasible for subsidizing in many of the fleet vehicles in Hong Kong making our roads safer for the people.

⁴⁴ http://www.sustainablecitiescollective.com/kurtis-mcbride/1244562/smarter-streets-make-sustainable-cities?utm_source=feedburner&utm_medium=feed&utm_campaign=Sustainable+Cities+Collective+%28all+posts%29

⁴⁵ [https://www.lta.gov.sg/data/apps/news/press/2016/20160317_AMAPPPanelReport\(final\).pdf](https://www.lta.gov.sg/data/apps/news/press/2016/20160317_AMAPPPanelReport(final).pdf)

⁴⁶ <https://www.london.gov.uk/press-releases/mayoral/road-safety-technology>

A compact city and a steady electricity supply network positions Hong Kong favorably adoption of Electrical Vehicles (EV). Fast growth has been recorded since 2013 largely due to the Government concession on EV's first registration tax. Currently, the lack of choice in longer range EVs and inadequate EV charging infrastructure may impede further growth.

The rising trend of EV in Hong Kong must be addressed in the discussions of the Smart City initiatives, in particular, expectations regarding the installation of EV charging facilities at parking spaces in existing residential and commercial premises. The availability of public and private chargers for EV has become the key factor in influencing the take up of EV. It would be useful for the Government to consider some of the following priority matters and related Government policies:

- i. Policies for town planning and building development to allow a higher portion of charging parking slots upfront in the planning and design stages;
- ii. The Government, property owners and management to facilitate vendors, service providers and car owners on matters and processes in relation to the provisioning and installation of appropriate chargers (in accordance with appropriate electrical safety guidelines);
- iii. Active assistance and participation from the two power companies and associated experts on electrical infrastructure to resolve technical and procedural matters on the provisioning and installation of chargers;
- iv. Participation from industries and professionals to provide consulting, management and maintenance support and testing to ensure safety and functionality the EV charging facility and compliance with EV charging standards.
- v. Continuing the incentive at first registration of EV, and introduce other incentives to encourage drivers to switch from petrol cars to EV.

16. Conclusion

As Asia's world city, Hong Kong should quickly get into tune with global trends in Smart City development by encouraging sustainable consumption, reducing carbon footprint, fostering innovative and entrepreneurial culture, addressing the problems of an ageing population, adopting new ICT technologies and facilitating a better trading and business environment.

In developing Hong Kong as a world-class smart city, it is imperative for us to adopt Vision Zero as our ultimate and long term goal. SCC will provide support to the Government to take the lead in developing the relevant digital framework and standards as mentioned in the 2016 Policy Address. While public engagement is essential for a successful implementation of smart city plans, we shall promote education to the public about the Government's smart city agenda. For the Government to take up such big project, we believe that there is need to establish a powerful and high-level government body to champion the smart city agenda, and to ensure an integrated policy planning, development and implementation. Last but not least, a smart city coordinator should be appointed under the Innovation and Technology Bureau to enhance the communication, coordination and collaboration among the Government officials and Bureaus.

Looking into the future, SCC will uphold our vision and mission to promote smart city development in Hong Kong. We can co-create with different stakeholders by bringing innovation and new ideas together from both the private and public sectors to explore how Hong Kong can capitalize on our edges to build a smarter Hong Kong to meet public needs. We will continue to provide support in the development of Hong Kong's knowledge-based economy, enhance quality of life by increasing global cooperation in building smart city. Last but not the least, we can achieve the vision of "*Smarter Hong Kong, Smarter Living*" closer and finally co-create a better future for our next generation.

17. Reference

- Dameri, R.P. & Rosenthal-Sabroux, C. (2014), *Smart City: How to Create Public and Economic Value with High Technology in Urban Space*, Switzerland, Springer International Publishing.
- Diener, E., & Chan, M. Y. (2011). Happy people live longer: Subjective well-being contributes to health and longevity. *Applied Psychology: Health and Well-Being*, 3(1), 1-43.
- Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?. *City*, 12(3), 303-320.
- Janssen, M., Scholl, H., Wimmer, M., & Tan, Y. H. (2011). Electronic Government. In *10th IFIP WG 8.5 International Conference, EGOV 2011*.
- Kuhn, W (2005), "Introduction to Spatial Data Infrastructures", Presentation held on March, 2005.
- Maguire, D. J. (1991). An overview and definition of GIS. *Geographical information systems: Principles and applications*, 1, 9-20.
- Masser, I., Rajabifard, A. & Williamson, I. (2008), "Spatially Enabling Governments through SDI Implementation", *International Journal of Geographical Information Science*, Volume 22, Issue 1, 2008.
- Ojo, A., Curry, E., & Janowski, T. (2014). Designing next generation Smart City initiatives-harnessing findings and lessons from a study of ten Smart City programs.
- Sitkin, S. B. (1992). Learning Through Failure: The Strategy or Small Losses L. *Research in organizational behavior*, 14, 231-266.

18. Appendix A

The following briefly describes some examples of Smart City Technologies and Applications which are based on Public Private Partnership.



智慧城市聯盟
Smart City Consortium


Smarter City, Smarter Hong Kong

Examples of Smart City Technologies and Applications based on Public Private Partnership

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1

Public Private Partnership PPP Model



TP: Technology Partner

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2

PPP Implementation Structure

Body	Role	Responsibilities
Bureau & Department, HKSARG	Project Owner / Partner	Providing financial support and steer for the project; Providing support for the project
OGCIO / ITB, HKSARG	ICT Advisor & Coordinator	Providing ICT Advice for the project
EKEO / DEVB, HKSARG	Site Partner	Providing site support
NGO / Industry, Community & Academy Entities	Project Partner	Providing advice, coordination and support for the project
Technology Partners	Implementation Body	Providing technology in-kind support & project Implementation.

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3

Examples of Smart City Technologies & Applications

Smart Environment / Green

- 1 City Action Platform for Climate Change & Energy Saving (CAPCARE) (e.g. Indoor energy management / Smart Air-conditioning)
- 2 Smart City Tree
- 3 Smart Plastic Recycling
- 4 Smart Refuse Collection
- 5 Smart Lighting and Parking

Smart Living / Healthy Aging

- 6 Smart Health Sense, Learn & Connect
- 7 Smart Medicine Taking
- 8 Smart Bus Stop & Phone Booth

Smart Mobility

- 9 Smart Real Time Traffic

Smart People

- 10 Deeper Training, Smarter Talents

And more...

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City Action Platform for Climate Change & Energy Saving (CAPCARE)



1. A GIS platform for integrating various environmental, climate and energy data based on **open data architecture**
2. Support CityGML (ISO TC 211) for data exchange
3. Focused in Energy, Biodiversity, Waste, Air and Sound
4. Helps to reduce energy and carbon dioxide intensity from 2005 level by 40% by 2025 and 60-65% by 2030 respectively
5. Helps to reduce Municipal Solid Waste MSW disposal rate by 40% on a capita basis by 2022

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1. **Renewable energy** optimization tool - Support decision making by providing the relationship of terrain, solar radiation and wind characteristics
2. **Biodiversity info hub** - A standardized biodiversity information exchange platform
3. **Indoor climate and energy management** - Assimilate human perceptions and responses; Smart-control related HVAC elements Build envelope to save energy
4. **School Resource & Waste Management** - An Internet of Things (IoT) network for Track and benchmark energy, water, resource and waste consumptions
5. **Environmental Sound Quality Experiencing** - The soundscape design processes taking onboard the psycho-acoustical elements using VR
6. **PM2.5 air quality monitoring micro-grid network** - Collect big data of CO₂, NO_x, SO_x, and noise levels

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Smart City Tree

- Biotechnology solution with power to reduce air pollution as effectively as 200+ trees
- Self-efficient power supply and irrigation with no soil supplements & mowing
- Dynamic interactions with passers by

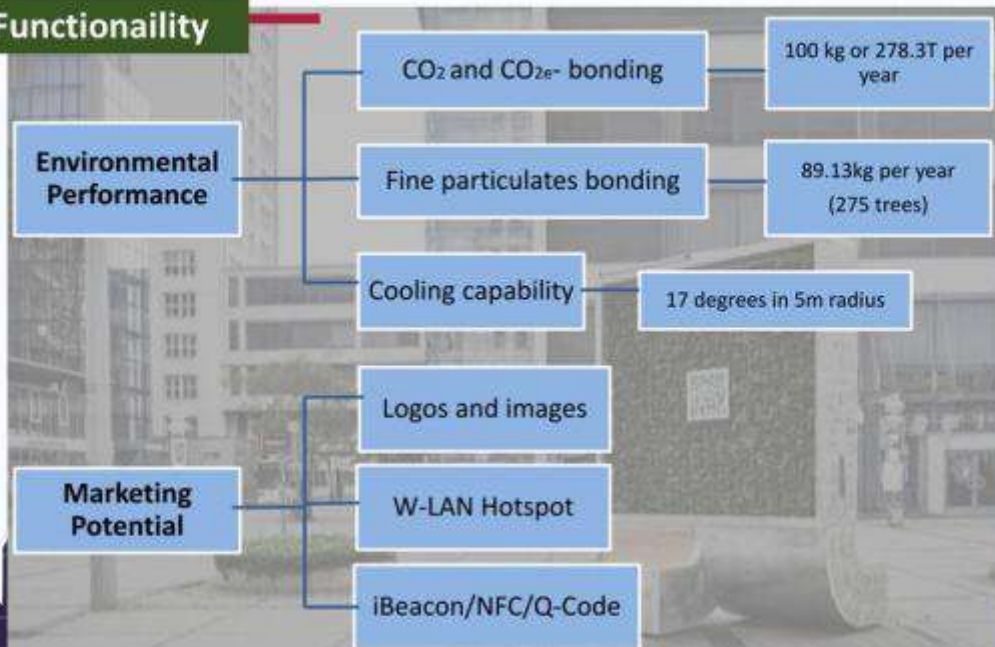
Equipped by: Solar panel, Water pipe, water pump, water tank, water level sensors and soil moist sensors for rain collection and irrigation, Humidity, temperature, PM sensor & controller

More applications: WIFI Hub, Climate Change tackling by environmental and climate data collection, Public and educational information dissemination



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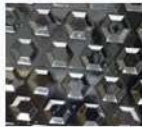
Functionality

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3

Smart Plastic Recycling



Challenge - Local Recycling Capacity is Limited: 5.28 million PET bottle-waste each day; Landfill for Waste Disposal nearly reaches full capacity before 2020

Smart Recycling Facilities for PET Bottle – A Swiss Award-Winning Production Technology to turn PET Bottles to High-Performance Temperature-controlled Unique Logistics and Storage Solution; Use Aluminum Nano Coating in Honeycomb Structure and Fail Safe Cooling Technology to suppress heat transfer effectively

Properties - Scalable insulation performance; Nano Coating reflects 96% of heat radiation; Ease of installation (cutting and welding); Humidity independent performance; No vapour barrier required; No thermal bridges and Non-flammable; 100% recyclable

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Smart Plastic Recycling

Greener ways of temperature controlled applications:

- **Applying in fridges** - runs for more than 1 week without electricity
- **Applying in rail container** - protecting commodities from extreme heat / cold without electricity
- **Applying in Insulated Farm** - solar roof with positive energy consumption in less than 2 months
- **Applying in Long Distance Hot Water Heating** - significant lower loss in energy and longer life cycle



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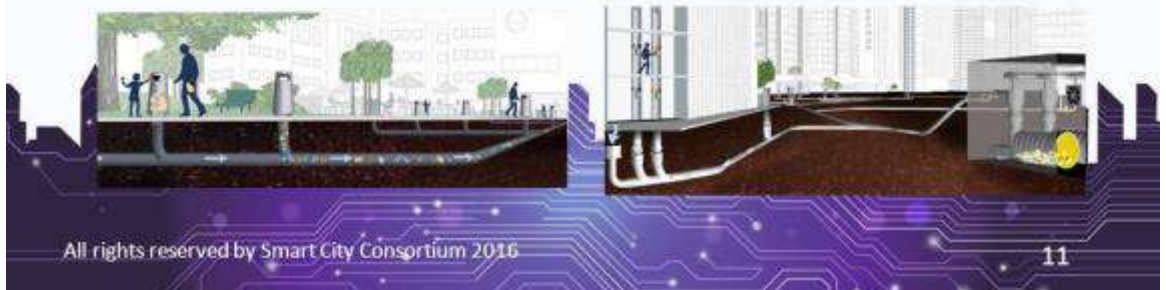
Smart Refuse Collection

Traditional Waste Collection - Waste Bin on every floor and around corner in staircase; Waste Transportation from floors to ground, from building to refuse station; Nuisances regarding smell, noise and hygiene jeopardize the living environment every day



Smart Refuse Collection & Management

Applies the principle of vacuum cleaners making use of air to transfer refuses from various locations via pipe net to the central refuse collection station without involvement of manpower. No smell, refuse or liquid can leak from any step of refuse collection process. Work 24-hour a day, 7-day a week and 365-day a year



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Smart Refuse Collection

Cope with Future Waste Charging Scheme

1. Dump wastes directly into the outdoor disposal inlet door when they reach the street level with refuse bags
2. Each disposal inlet door having appropriate sensors
3. Smart user's card / smartphone and specialized refuse bags can activate the sensor to open inlet door
4. Additional outdoor disposal inlets for waste separation at source

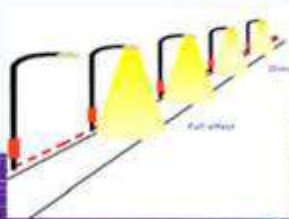


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**Smarting Lighting**

1. Cloud Control
2. Dynamically blend lighting coverage over time
3. Dims lights during low-traffic hours
4. Monitors lighting failures automatically
5. Intelligent Energy Metering

**Smart Parking**

1. Detect and report payment and overstay violation
2. Detect and report no-parking zone/loading zone violations
3. Payment using smartphones
4. Search for parking spaces on point of interest and preferences
5. Distinguish normal cars from cars with special permits



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Advantages

1. Longer lifespan and fewer maintenance requirements for light poles
2. Improve response to emergencies, quicker identification of crisis scene
3. Optimize the use of parking slots
4. Improve success rates in parking-ticket disputes through enforcement applications
5. Generate additional revenue through demand-based parking pricing and more accurate ticketing of parking violations
6. Reduce carbon dioxide released



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6

Smart Health Sense, Learn & Connect

Challenge - Health problem in aging population



Smart Health Sense, Learn and Connect - 24x7 proactive sensing, learning, connecting and caring solution; Pioneer of community-based healthcare network

Intelligent Connection & Detection Algorithm - Connected health sensors, Sleep Sensor, Behavior Sensor, Door Exit Sensor, Wireless Portable Panic Buttons, Cloud Data Gateway & Smartphone Application



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6

Smart Health Sense, Learn & Connect

Smart Use of Health Big Data

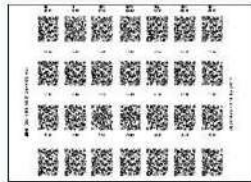
1. Smart use of Health Data
2. Consent for use of data
3. Incorporate environmental factors & behavioral patterns
4. Forecast potential health risks
5. Interoperable with eHealth Record Sharing System



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Smart Health Management System



1. Intelligent medication / supplements dispensing, taking and recording technology and mechanism
2. Patented tray with 7x4 pockets for holding 7 day medication / supplements for 4 dispensing per day
3. Medication / supplements labelled with QR code
4. Smart healthcare giver medicine dispensing and recording workflow facilitated by smart healthcare tools
5. Management of prescription for residents based on health data
6. Intelligent resident management including admission and discharge records, healthcare record for follow up
7. Smart sensor to monitor movement of residents for better health management

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8

Smart Bus Stop & Phone Booth



1. Touch Screen Type Vending Machine
2. Internet Connected with Wireless Payment Function (e.g. Octopus, Apply Pay, Android Pay)
3. 4G & WIFI Spot
4. Public Service - District Map, Point of Interest Navigation, Air Pollution Monitoring, Weather and Public Information

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Current situation of real-time traffic information capturing

1. CCTV & induction loop - Infrastructure cost is high
2. GPS location data from smartphone - Coverage is limited



Smart Real Time Traffic - Multiple Big Data Sources

1. Smart Fusion and Analysis of Multiple Big Data Sources
2. GPS devices and GPS enabled phone based flow data derived from large commercial fleets and leading connected navigation providers
3. Cellular signaling based flow data collected from leading cellular operators
4. More cost-effective



Advantages

1. Location data collected anonymously
2. Highly protect the privacy
3. 24/7 Full Coverage
4. Congestions Identification
5. Long term predictions of the traffic status

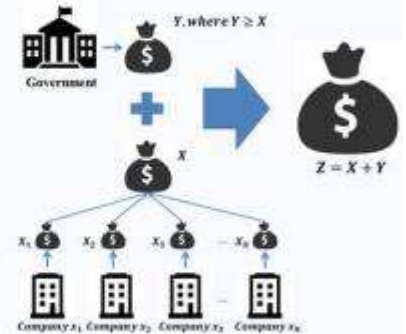


Challenge - Shortage of smarter talent in HK; Pleasing environment for technology development and IPRs enforcement are lacked for the growth of smarter talent.



Deeper Training Scheme

1. Training & IPR Pool
2. Pull the training funds into a central pool
3. Government pulls Y amount to create a Z amount
4. SMEs excel skillful talent
5. IPRs enforced
6. More innovative technologies fostered, more smarter talent which makes HK more innovative and smarter



and more



And more examples of smart city technologies and applications

Kowloon East > Whole Hong Kong

- Kowloon East As Pilot Site for Smart City technologies & applications
- More Smart City Technologies & Applications for whole HK



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