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Commission on Strategic Development

Smart City

Introduction

With reference to the Central Policy Unit (CPU) research report on smart city (Annex A) and the paper on Government initiatives on Smart City Development (Annex B), this paper highlights the Government's strategy and key initiatives in further developing Hong Kong as a smart city and makes recommendations on the future direction.

2. The research report at Annex A introduces features and indicators of smart city which are commonly adopted internationally, including the concept of the Smart City Wheel which covers six major aspects of smart city development, namely Smart Economy, Smart Mobility, Smart Environment, Smart Citizen, Smart Living and Smart Government. The report also provides information on smart city development of Hong Kong as well as a number of Mainland and overseas cities, and gives some initial thoughts on the future direction for the development of Hong Kong as a smart city.

3. The paper at Annex B reports on the policies and measures related to smart city development implemented/planned by the various bureaux and departments of the HKSAR Government.

What is smart city?

4. According to IBM Institute for Business Value, smart cities use information and communications technology (ICT) to be more intelligent and efficient in the use of resources, resulting in cost and energy savings, improved service delivery and quality of life, and reduced environmental footprint, all supporting innovation and low-carbon economy. The Office

of the Government Chief Information Officer (OGCIO) defines smart city as one with wide application of new technologies such as sensors, Internet of Things (IoT), cloud computing, mobile technology and big data analytics to develop intelligent systems in city planning, construction and management, so as to achieve better allocation of resources, facilitate sustainable development, and enable better managed city operations for the benefits and quality living of citizens[1].

5. The specific functions of a smart city cover different aspects of society and people's livelihood, such as broadband and smartphone penetration, e-commerce, intelligent transport systems, monitoring of municipal facilities, building management, green community, public sector services, etc., which are applied and integrated by using ICT.

6. A smart city uses innovation and ICT in various aspects of city development to integrate the city's systems and services, thereby producing synergy and increased efficiency in the use of resources, with a view to enhancing the city's competitiveness and people's quality of life.

Hong Kong's smart city environment

7. Hong Kong's robust ICT infrastructure underpins its development as a smart city, with efficient telecommunications services at affordable prices. Hong Kong is one of the most Internet-ubiquitous cities in the world and our mobile penetration of 228% tops the world. Our Internet connection speed is among the fastest worldwide[2]. With over 30 000 Wi-Fi hotspots throughout the territory, Hong Kong is very well-connected. Our robust ICT infrastructure, coupled with Hong Kong people's readiness to use technology, provides a favourable environment for Hong Kong to take further strides as a smart city.

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[1] Information note provided by OGCIO for Focus Group Discussion on Smart City held at CPU on 25 June 2015.

[2] According to "The State of the Internet" (1st Quarter, 2015 Report) published by Akamai, Hong Kong's average peak Internet connection speed and average Internet connection speed are 92.6 megabites per second (Mbps) (2nd in the world) and 16.7 Mbps (3rd in the world) respectively.

8. In fact, Hong Kong is an early adopter of IoT technologies in municipal management, transport and logistics, trade and e-commerce, among others. To make Hong Kong smarter, the Government has been actively pioneering with innovative applications of IoT, big data, cloud and mobile technologies. The use of sensors and big data analytics enables the Government to detect risk and identify potential maintenance issues of city facilities and takes proactive action for better decisions to enhance safety, avoid service interruption, and improve quality of life.

Overview of HKSAR Government's strategy for developing Hong Kong as a smart city

9. The latest edition of the Digital 21 Strategy entitled "Smarter Hong Kong, Smarter Living" champions wider use of sensors, big data analytics and IoT technology to establish a smarter city infrastructure for more efficient, timely, responsive and informed municipal management.

10. In the 2014-15 Budget Speech, the Financial Secretary announced that in the fourth update of the Digital 21 Strategy, a series of initiatives under the theme of "Smarter Hong Kong, Smarter Living" had been proposed. These measures included the following:

(a) doubling the number of Wi-Fi hotspots with complete or time-limited free public access to 20,000 by the end of 2014 through public-private partnership to promote city-wide Wi-Fi for all;

(b) making all government information released for public consumption machine-readable in digital formats from 2015 onwards to provide more opportunities for the business sector;

(c) further digitalising government operations and actively implementing paperless solutions to enhance efficiency, facilitate information sharing and protect the environment;

(d) looking into the wider use of IoT, sensors and big data analytics to enhance our municipal management; and

(e) considering the provision of digital identity to all Hong Kong citizens in order to develop a common, shared and safe platform for the delivery of services such as electronic health records and e-cheques.

11. In the 2015 Policy Address, the Chief Executive stated that the latest Digital 21 Strategy envisioned that the Government would make wider use of sensors, IoT and big data analytics for better public services and sustainable social and economic growth. Moreover, he announced that the Government intended to use Kowloon East as a pilot area to explore the feasibility of developing a smart city[3].

12. Government bureaux and departments have already implemented/planned a wide range of initiatives related to smart city development. Details of the relevant policies and measures are set out in the paper at Annex B.

Key achievements in Hong Kong's smart city development

13. Some achievements in Hong Kong's smart city development are highlighted as follows:

(a) e-commerce

14. There has been considerable development in e-commerce in Hong Kong, with the best example being the Octopus which is widely used in various public and business services, such as public transport, retailing, online payment, parking facilities, recreational facilities, etc. There are now over 28 million Octopus cards in circulation, and based on research conducted in April 2014, 99% of Hong Kong people aged 15-64 possess an Octopus card. The Octopus processes over 13 million transactions a day, and daily transactions are valued at over HK$150 million.[4]

[3] Details about this Smart City Initiative in Kowloon East are set out in Appendix 5 to Annex B.
[4] Octopus website, "Benefits for your business". http://www.octopus.com.hk/octopus-for-businesses/benefits-for-your-business/en/

15. The EPS and PPS are also well-developed one-stop electronic payment platforms. Furthermore, there has been significant growth in the provision of banking services via websites and mobile applications. The Government has also been promoting e-commerce adoption by SMEs through the Sector-specific Programme and IT Training Programme for SMEs.

(b) Transport and logistics

16. The Transport Department (TD) conducted the first Intelligent Transport Systems (ITS) Strategy Review in 2000 to formulate the strategy to maximize the utilization of our limited road space through the application of innovative traffic management within the resources available. The TD has been implementing ITS strategy under two major areas, namely "Smart Way to Travel" and "Smart Way for Safety and Efficiency". "Smart Way to Travel" focuses on providing the public with real-time transport and traffic information, such as information on routing and public transport services. "Smart Way for Safety and Efficiency" focuses on providing comprehensive traffic control and surveillance coverage over the territory, as well as developing territory-wide coordination among control centres for traffic and incident management.

17. The baggage handling system used by the Hong Kong International Airport (HKIA), developed by the Airport Authority Hong Kong, adopts the radio frequency identification (RFID) technology. HKIA was one of the first airports in the world to begin using RFID in its baggage handling system. This system has resulted in significant enhancement in efficiency and reliability of the baggage handling process at HKIA.[5]

(c) Electronic public services

18. GovHK (www.gov.hk) is the one-stop portal of the HKSAR Government featuring the most sought-after public services and information to make them easier to be accessed and used by members of

[5] Hong Kong International Airport website "HKIA Boosts baggage Handling Efficiency with RFID Technology". https://www.hongkongairport.com/eng/media/press-releases/pr_914.html

the public. In addition, OGCIO has launched mobile apps to enhance the services provided by GovHK, such as EventHK, GovHK Notifications and GovHK Apps. EventHK provides a one-stop platform for citizens to find public events which are organised by government departments or held at government venues. GovHK Notifications provides a one-stop platform for citizens to receive Government notifications according to their choice. GovHK Apps acts as a centralised platform for citizens to download all Government mobile apps.

19. On the basis of the "1823" service which provides a round the clock, one-stop contact point to answer general enquiries for a wide range of departments and receiving complaints and suggestions about Government services, the Efficiency Unit has developed the "Tell me@1823" service for citizens to convey their enquiries, complaints or suggestions via multiple channels such as mobile application, e-form, email and telephone. Supplementary information in the form of text, voice recording, photos and short videos can also be submitted to facilitate follow-up by the departments concerned.

(d) Healthcare

20. The Food and Health Bureau (FHB) has been developing a territory-wide Electronic Health Record (eHR) Sharing System as a key infrastructure for Hong Kong's healthcare system to enhance the quality and efficiency of healthcare provided to the population. The Public-Private-Interface Electronic Patient Record Sharing Pilot Project (PPI-ePR), launched in 2006, allows participating private healthcare providers and other registered institutions to view the Hospital Authority's (HA) records subject to patients' consent. This pilot project has received positive responses from the public and private healthcare providers.

21. FHB's plan is to implement a two-stage programme to develop an efficient platform for both public and private healthcare providers (e.g. hospitals and clinics) to upload and access individuals' eHR for healthcare purposes, subject to the individual's consent. FHB will complete the final preparatory work for commencing operation of Stage 1 system by early 2016. Afterwards and subject to funding approval of the Finance

Committee of the Legislative Council, FHB will proceed with development of Stage 2 of the system to provide functional enhancements facilitating better continuity of care and better healthcare services.

(e) Release of Public Sector Information in digital formats

22. Public Sector Information (PSI) refers to the great quantity and variety of information collected, produced and disseminated by governments and public bodies (e.g. demographic, socio-economic, geographical, meteorological and municipal management data) in their day-to-day operations. Such data, if made available to the public in digital formats, can be creatively re-used to develop innovative products. PSI helps open up new business opportunities, bring convenience to the public, enhance the quality of life and even generate social benefits[6]. Many popular mobile apps in Hong Kong make use of PSI to deliver cherished information and services on user-friendly platforms. The most common data used include traffic snapshots, weather, air quality, etc. Through these apps, users can plan their routes based on real-time traffic situation or their activities based on weather and air quality information. So far, over 70 mobile applications or solutions using PSI have been developed and most of them are free for download.

23. To step up the release of PSI, the Financial Secretary announced in the 2015-16 Budget that from 2015 onwards, all free online government information will be released in digital formats. In order to provide a larger and more flexible platform for departments to release data, OGCIO launched the revamped PSI portal "data.gov.hk" earlier this year to encourage more creative re-use of data. The portal now provides more than 4 500 datasets in 18 broad categories such as weather, health, population and transport.

[6] Experience from other developed economies also shows that the widening access to PSI datasets can lead to positive social outcomes. For instance, in New York, application of PSI on hygiene inspections has led to a significant drop in food poisoning incidents by around 20%.

Hong Kong as a smart city

24. As Asia's world city, Hong Kong closely follows the international trend and is at a leading position in Internet infrastructure and ICT application. In a report titled "The Connected Harbour: How the Internet is Transforming Hong Kong's Economy" jointly published by Google and The Boston Consulting Group in 2011[7], it was pointed out that Hong Kong's Internet economy was growing rapidly and contributed 5.9% of GDP to Hong Kong's economy. Benefiting from the Mainland's exports, Hong Kong has been developing rapidly in e-commerce, online consumption and mobile communications, and is one of the world's leading digital cities. In 2013, Hong Kong was ranked by Forbes as the world's top "Tech Capital" to watch after Silicon Valley and New York[8]. In addition, Hong Kong was ranked fourth in the "10 Smartest Asia Pacific Cities"[9] published in 2013 by Boyd Cohen, an international prominent expert in smart city. Cohen remarked that Hong Kong scored the highest in its ranking for smart mobility because of the wide use of the Octopus in public transport and other business services in Hong Kong. The above indicates that Hong Kong has earned recognition as a smart city.

Recommendations on the further development of Hong Kong as a smart city

25. Overall speaking, Hong Kong has made great achievements in developing itself a smart city. We should continue to review and make improvements in various areas so that Hong Kong can enhance its comparative advantages in global competition. Some recommendations on the further development of Hong Kong as a smart city which the community and the Government may consider are as follows.

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[7] The Boston Consulting Group, "The Connected Harbour: How the Internet Is Transforming Hong Kong's Economy" (May 2011).

[8] Karsten Staruss, "The World's Top 4 Tech Capitals To Watch (after Silicon Valley and New York)" (20 Mar 2013).

[9] Boyd Cohen, "The 10 Smartest Asia/Pacific Cities" (21 Nov 2013).

(a) People-centric approach

26. The ultimate objective in the development of a smart city is to improve people's quality of life. Hong Kong should continue to adopt a people-centric approach in its smart city development which would enable smart, creative people to make use of technology and smart, creative businesses and public agencies to run themselves and provide their goods and services in ways that are more cost and resource efficient and better designed to meet the needs of the public.

(b) High-level coordination

27. In many cities worldwide, smart city initiatives are led by the Government at a strategic level. In Hong Kong, the Government may adopt a more proactive role in facilitating smart city development. The proposed Innovation and Technology Bureau, when established, should be well placed to take the lead in formulating strategies and coordinating inter-bureau efforts in smart city development to meet economic, environmental and social development needs.

(c) Overall and long-term strategy

28. An overall and long-term strategy and integrated framework for smart city development in Hong Kong should be formulated, building upon the existing Digital 21 Strategy, embracing the foundation established by efforts of various bureaux and departments and addressing the economic, environmental and social development needs. Specific goals and priorities may be set for various aspects of smart city development having regard to Hong Kong's strengths, characteristics and conditions. Establishing good new standards would help to integrate all the smart city efforts. Building effective platforms would also help to create crowd-sourced solutions and collective excellence.

(d) Participation by all sectors of society

29. To create a sustainable smart city environment, participation by all sectors is important. The Government should promote and facilitate

the overall development of smart city and set relevant standards, guidelines and practices to avoid unnecessary restrictions on new smart services/products. It should also seek to cooperate with NGOs and the business sector to create and integrate various smart city functions and services. The Government should facilitate collaboration between government departments, academic and research institutes, and the private sector on application of new technologies in Hong Kong.

30. The Government should also put more efforts in bridging the digital divide and assisting all citizens to acquire the necessary skills to make use of and benefit from smart facilities.

(e) Promotion of innovation and technological advancement

31. The Government should implement policies and measures that favour innovation and technological advancement as well as knowledge-driven growth, and encourage enterprises and talents to pursue their businesses and careers in Hong Kong. Continued efforts to nurture talent in innovation and technology in schools and universities in Hong Kong are important. Innovative ideas, for example, crowd funding, may be further explored where appropriate.

(f) Specific initiatives in the six major aspects

32. Some possible initiatives in the six major aspects of smart city development are proposed for consideration as follows:

Smart Economy

- An in-depth study may be conducted to examine whether Hong Kong's strategic partnership with Shenzhen can be enhanced for greater synergies by integrating both sides' respective edges in industry, academia and research through platforms such as the smart network linkage system.

- As a super-connector, Hong Kong may consider possible ways to foster cooperation for the "Belt and Road" Initiative, including the

establishment of an interconnected network for information exchange with governments of the countries and regions concerned.

- The Government may take the lead to promote the development of e-commerce, such as integrating the work of different departments, and providing a one-stop real-time government procurement and electronic billing system. The Government may also review the existing framework for governance and supervision of e-commerce, and discuss with the industry as to how to consolidate and then create a unified platform for electronic transactions.

- The Government should spearhead the development of e-finance, and promote the establishment of infrastructure such as payment systems, clearing and settlement systems, and information and risk management systems. This will help enhance the operational efficiency of financial services, and encourage financial innovation and development of financial technologies in areas such as innovative transaction authentication mechanisms, credit assessment algorithm for speedy loan approval, innovative integrated electronic transaction solutions, unified electronic transactions platform for insurance products, digital information exchange for enterprise's financial data, etc.

- Given that SMEs can hardly afford the substantial investments involved for setting up a data centre, the Government may consider making use of public resources where appropriate to facilitate and support the setting up of data centres.

- The Government should take the lead to adopt and promote cloud computing through such measures as further digitalisation of government data and files for processing by cloud services, with a view to facilitating market development for such services.

- The Government may strengthen its cooperation with the Mainland to set common standards of cloud computing in terms of security, interoperability and management. This, together with mutual recognition of e-Certificates issued by both sides, will help achieve

full connectivity and interoperability in customs, logistics and trade.

- The Government may consider providing technical and training support to local SMEs to help them employ advanced technologies such as Internet and cloud computing for the development of smart business solutions to enhance productivity and efficiency and to lower cost.

- The Government should continue to strengthen the release of open data in digital format for public consumption and develop the Application Programming Interface (API) to link up different government systems so that it would be easier for the community and the business sector to make use of relevant data for research and development of new products or services, with a view to improving quality of life and bringing about more business opportunities.

- The Government may take the lead to explore with stakeholders such as network service providers, shopping malls and chain enterprises the possibility of connecting their free Wi-Fi networks to form a free network with wider coverage, through which both Government and business information can be provided. The Government may consider selecting certain industries (such as tourism and logistics) for trial run and promotion, with a view to setting an example of success before extending the network to other industries.

- The global market of smart city industries is flourishing. The Government should provide appropriate support by putting in place policy measures that are conducive to technological advancement, innovation and knowledge-driven growth, and create a research- and development-friendly environment in order to encourage enterprises and talent to pursue their business and career in Hong Kong, as a move to facilitate smart city development.

<u>Smart Mobility</u>

- The promotion of intelligent transport systems to provide

consolidated real-time traffic information, route guidance and public transport availability to road users and the general public in Hong Kong should be expedited. Other measures such as bus stations with photovoltaic smart screen, intelligent parking space availability systems, as well as integrated electronic vehicle charging and smart car and bike sharing systems in overseas cities are worthy of reference to Hong Kong.

- The industry reflects that the launch of new intelligent products and services may contradict existing regulations or policy requirements. The Government may consider putting more efforts in policy coordination to enable enterprises to pursue business in intelligent technologies in a reasonable, socially responsible and lawful manner.

- Without compromising their respective power of clearance examination (including the maintenance of their own database) and within the limits of the law, the control points of the Mainland and Hong Kong may explore the feasibility of conducting co-location clearance through the use of cutting edge technologies, such as electronic data cards and an e-biometric identification system. That is to say, formal clearance can be conducted by one side, while pre-arrival clearance is carried out by the other side together with the establishment of a green express channel so that passengers and cargo can go through swiftly after passing pre-arrival clearance; formal clearance will only be conducted as and when necessary. The long-term goal is to provide one-stop clearance.

- The Government may take the lead to explore the development of a smart network system to the best interests of people with reduced mobility. For instance, an integrated public service supporting system may be explored such that those in need of the service are issued with a special smart card which, by means of a reading device set up at key locations, will enable service providers to understand their needs instantly, and provide appropriate services or extend the pedestrian green time of traffic lights to cater for their needs. The Government may also explore other feasible barrier-free measures, such as a network for hire of electric wheelchairs, or a network for

free ride offers by car owners.

Smart People

- On general education, on the basis of existing measures such as Student IT Corner and Enriched IT Programme in Secondary Schools, through implementing the Fourth Strategy on Information Technology in Education, the Government should provide primary and secondary school students with more comprehensive and in-depth subject knowledge on ICT and practical skills such as computer programming. Besides, the Government will enhance students' information literacy and its applications to other learning areas which will help them adapt to the fast-changing society and economic development, as well as provide intensive IT training to students who are interested and talented in IT, with a view to nurturing young IT professionals and even entrepreneurs to meet the long term development needs of Hong Kong.

- On the nurturing of professionals, given that the industry chain for ICT research and manufacture is yet to be developed in Hong Kong, the demand for and training of high-end professionals is hampered. The Government should explore how to further promote closer collaboration between the academia and the business sector to create a favourable environment for ICT talent to prosper, so as to meet the development needs of a smart city and knowledge-based economy.

- The Government should put more efforts in promoting the purpose and benefits of a smart city among the general public, especially for those who are relatively passive and have limited access to ICT (including some of the elderly, housewives and ethnic minorities), and guiding them in the use of various intelligent services, so as to achieve universal application of smart functions in the city.

Smart Living

- Hong Kong should promote integration and smartening of municipal facilities, for example, making use of CCTV and sensor networks

for real-time adjustment to streetlights and for better monitoring of public space to enhance safety.

- The Government may consider the adoption of standardised smart building codes for the convenience of living, business and emergency service, and to facilitate follow-up actions on buildings not in compliance with the Government's requirements for fire prevention and building structure and on those with unauthorized structures on the external walls.

- The possibility of consolidating information and promoting a smart reputable shop system for public online access may be considered.

- In view of Hong Kong's dense and ageing population, smart health may be developed to turn Hong Kong into a healthy city for all ages and on all fronts. Consideration in the longer run study may be given to enhancing the following measures:

  - Adoption of an integrated information sharing system for public and private medical institutions (examples include drug allergy profiles of individual patients and consolidated information for the Red Cross to review donors' blood safety).
  - Online expert tele-consultation.
  - Development of a smart booking system in the public health sector so that the public may make appointments, readily check the bookings and availability of service, and receive timely treatment notification via the Internet or mobile applications, thereby saving their queuing time.
  - Development of a telemedicine body check service to allow long-term and chronic patients to conduct simple body check (e.g. checking of blood pressure) by themselves or enable family members to do so for them, provided that the patients themselves or their family members have received proper basic training. Relevant readings and data of patients' drug intake can be transmitted to the system via an application for medical personnel's scrutiny and analysis, and giving medical

advice as appropriate.

- ❖ In the long run, services and information system of hospitals, clinics, various types of community medical facilities, elderly homes and so forth can be connected and fully integrated for shared use so that medical resources can be optimised and efficiency enhanced.
- ❖ Enhancement of community health management and home support for patients.
- ❖ Development of an integrated information system for government leisure and sports facilities, country parks and other public recreation outlets.
- ❖ Addressing factors such as greening, air ventilation, air quality, noise and heat island effect in city planning and architectural design by means of high-end technology.

Smart Government

- ➢ May consider developing a public participation system to provide a common platform for e-submission of opinions in public consultations, or an online petitions platform similar to We the People of the White House in the United States.

- ➢ The Government may make reference to the smart polling initiative introduced in some places of the United States to collect public opinion data on specific issues. In-depth analysis can be conducted on voter background and choices through data mining for identifying the trend of public opinions and implementing targeted policy initiatives, with a view to boosting interaction between the public and stakeholders in the course of policy formulation to realise smart engagement.

- The Government should explore ways to improve the technology and operation of the personal digital certificate with a view to establishing a digital ID for each citizen so that citizens can access, through an e-account, all public services to, for example, check electronic health records, and submit applications for a licence / permit / vacancy, etc.

- The Government may examine whether there is any room for further improvement in the smart infrastructure, for instance, comprehensive free Wi-Fi hotspots with quality, solar USB charging stations, free USB charging station, intelligent waste tube systems, and intelligent underground pipelines (including fresh water pipelines) monitoring system.

- The Government should scrutinise the compatibility and interoperability among different systems, and set a common standard in data interchange format to promote data linkage, integration and application in public and private sectors in a bid to go a step further in big data development.

- The Government should continue building on the foundation of Lands Department's Geospatial Information Hub and 3D Spatial Data model and Geoinfo One Stop 2 (GOS2) developed by the Planning Department as well as other existing Geographic Information Systems (GIS) developed in different B/Ds, and explore the promulgation of spatial data policies and standards to form a "Common Spatial Data Infrastructure" (CSDI). With a sustainable, reliable, interoperable and sharable CSDI, a variety of smart city initiatives requiring effective and efficient utilisation of spatial data can be developed and implemented by different bureaux and department s, thereby enabling Hong Kong's smart city development.

<u>Smart Environment</u>

- The Government should formulate an integrated strategic planning framework under the "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030" to facilitate the "Smart City"

development in respect of planning, infrastructure and building development.

- In view of the ever changing environment and global climate changes, cities around the world are looking for the use of ICT to increase the resilience of their systems to enable cities to adapt and rebound quickly. To better prepare Hong Kong in facing the challenges and changes, the Government should examine the opportunities and technological means to embrace the concept of resilience in smart city development.

- Depending on the experience gained from Kowloon East on the use of smart city facilities, the Government can explore the introduction of innovative methods and technologies in infrastructure provision, land development and urban management in the new development areas, and the use of ICT, such as Internet of Things, sensors and big data analytics in municipal planning and management so as to integrate the various intelligent and environmental measures put forward by the Government and the business sector, and adopt the concept of revitalising water bodies to build smart communities with comprehensive functions.

- The Government may take smart green neighbourhoods and buildings as a key consideration for the long-term development strategy. State-of-the-art experience of foreign countries includes smart and green transport mode, installation of vacuum system for waste collection/disposal, effluent reuse, hot-cold energy conversion systems, central organic food waste treatment systems, smart grid, smart metering solution, sustainable drainage system, solar and wind energy system within a neighbourhood and building, and electronic tariff collection system for power generation/transmission network. The Government may borrow such experience in the overall regional and district development or large-scale housing development for Hong Kong.

Advice sought

33. Members are invited to advise on the future development of Hong Kong as a smart city.

Secretariat to the Commission on Strategic Development
September 2015

Annex A

RESEARCH REPORT ON SMART CITY

CENTRAL POLICY UNIT

THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

September 2015

(Translation)

Table of Contents

Smart City

Purpose

The purpose of this research report is to introduce the definition and indicators of a smart city and to give a review of the development of smart cities in major regions of the world, on the Mainland and in Hong Kong, and to explore the further development of Hong Kong as a smart city.

Definition and Indicators of Smart City

2. Since the rapid rise and development of the Internet in late last century, information and communication technologies (ICT) have been widely used in governments, businesses, societies and daily lives. In recent years, it has been a worldwide practice to take ICT as a core consideration in city development and management. In 2008, IBM of the United States put forward the concept of "Smart City"[1] to study how the functions of a city can be optimised to promote the development of a talent-based economy and improve the quality of life. Today, the notion of smart city has become a global trend in the development of advanced cities in the 21st century.

3. Smart city, a brand new concept, carries a continually evolving definition and connotation, about which a consensus has yet to be reached among the academia and the relevant sectors. Generally speaking, a smart city can be interpreted as a city which is smarter than traditional ones and capitalises on new technologies and insights to transform and enhance its systems, operations and service delivery[2]. Smart cities share one thing in common: the use of innovative ideas and methods or the application of ICT in various aspects of the city to connect and integrate the systems and services of the city for better synergy as well as more efficient use of resources with a view to improving city management and service delivery as well as quality of life of citizens, and at the same time reducing environmental footprint, in support of the development of innovation and a low-carbon economy[3].

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[1] IBM Institute for Business Value, "Smarter cities for smarter growth" (2010).

[2] "Smarter cities of all sizes are capitalizing on new technologies and insights to transform their systems, operations and service delivery", see IBM Institute for Business Value, "Smarter cities for smarter growth" (2010).

[3] "Smart cities use information and communication technologies (ICT) to be more intelligent and efficient in the use of resources, resulting in cost and energy savings, improved service delivery and quality of life, and reduced environmental footprint – all supporting innovation and the low-carbon economy", see Boyd Cohen, "The Top 10 Smart Cities On the Planet" (2010).

4. The concept of smart city covers almost every aspect of society and people's livelihood, e.g. monitoring of public space, and management of underground pipelines and street illumination in respect of municipal facilities; construction, security, energy management and internal communication in respect of buildings; public transport service such as signal management, road traffic and parking monitoring; home automation and remote management; high-speed network and cloud storage; and electronic public and business services[4].

5. Boyd Cohen[5], an internationally renowned urban strategist and expert in smart city, initiated in 2012 the Smart City Wheel[6], as shown in the figure below, outlining the features, functions and goals of a smart city with reference to major indicators and rankings. The wheel consists of six major components, namely Smart Economy, Smart Environment, Smart People, Smart Mobility, Smart Living and Smart Government, and 18 sub-domains. On the basis of this, Cohen, together with other prominent researchers and advocates[7] of smart cities, developed a set of 62 assessment indicators[8] and announced the rankings[9] of smart cities around the world in 2013. Hong Kong ranked fourth in the Asia Pacific region, after Seoul, Singapore and Tokyo.

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[4] Jin-Hyeok Yang, "Smart City, Smart Strategy" (21 Jun 2012); Michelle Reis, "5 U.S. Cities Using Technology To Become Smart And Connected" (15 Aug 2014).

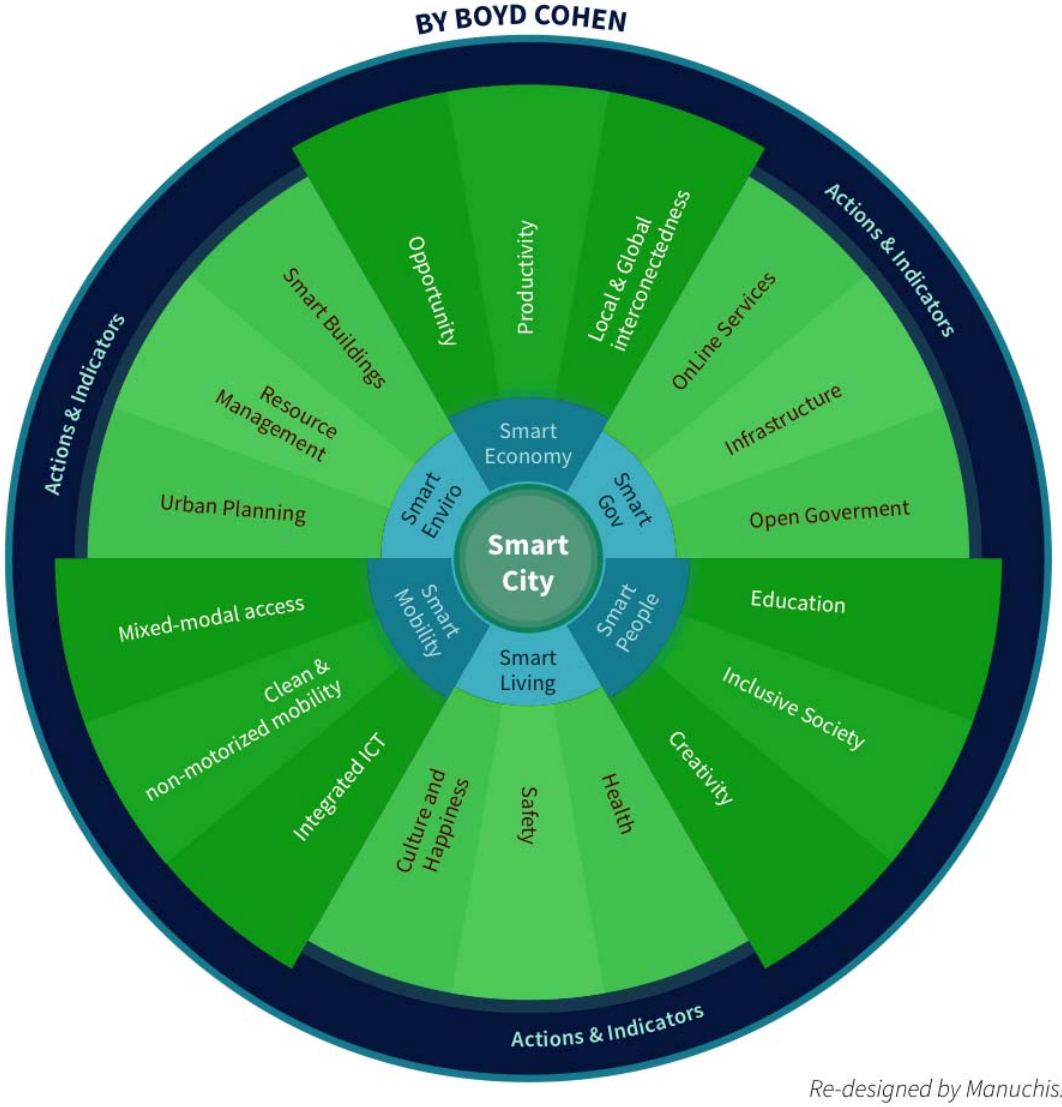
[5] Urban & Climate Strategist Boyd Cohen, "About Boyd Cohen".

[6] Boyd Cohen, "What Exactly Is A Smart City?" (19 Sep 2012) & "Basic Smart City Indicators" (2011).

[7] Including Rick Robinson, IBM Executive Architect in charge of smart city projects; Jesse Berst, founder of Smart Cities Council; and Esteve Almirall, Director of Center for Innovation in Cities, ESADE Business School in Barcelona.

[8] Smart Cities Council, "Smart City Index Master Indicators Survey" (2014).

[9] Boyd Cohen, "The 10 Smartest Asia/Pacific Cities" (21 Nov 2013).



6. The above framework developed by Cohen has been widely adopted by the academia and the relevant sectors. Based on this framework, a smart city consists of the following six components[10]:

- Smart Economy: It advocates innovation and entrepreneurship, focusing on developing new and high technologies (implementing production and services automation as well as accelerating work process) and encouraging innovation (developing new products, services, markets and intellectual property) to foster

[10] Boyd Cohen, "What Exactly Is A Smart City?" (19 Sep 2012) & "The Smartest Cities In The World 2015: Methodology" (20 Nov 2014); Somayya Madakam and R. Ramaswamy, "Smart Cities – Six Dimensions" (2014).

closer links between the domestic economy and the global economy, with a view to maintaining the vitality and competitiveness of a city.

- Smart Mobility: This involves the enhancement of the efficiency and service quality of urban transport through the use of video surveillance and remote detection technologies to monitor traffic facilities and conduct related data analysis for managing traffic flow, pedestrian flow and cargo flow in real time and handling emergencies. It also promotes mixed-modal access which integrates various modes of transportation, including public transport, clean-fuel vehicles, cycling and walking.

- Smart Environment: This involves the implementation of green urban planning through the use of web-based and remote monitoring technologies to fully understand and analyse the distribution of public spaces, grassland and green belts with a view to promoting a green environment. It is also about the effective management and optimisation of building, community and urban resources to achieve energy conservation and emission reduction, greening of channels and revitalisation of water bodies for greater environmental sustainability.

- Smart Citizen: Human resources conducive to the development of innovation and information technologies are valued and developed through the provision of a favourable environment for lifelong learning as well as promotion of social plurality, flexibility, open-mindedness and creativity. People are encouraged to participate in public affairs through online platforms and other appropriate channels.

- Smart Living: It means improvement to people's living environment and quality of life through the use of the "Internet of Things"[11] technology and online social platforms as an enabler for people to connect with each other and properly manage their home and thus have closer interaction with the surrounding environment. The purpose is to promote a healthy, happy and vibrant lifestyle.

- Smart Government: It means strengthening of connections within the Government and connections between the Government and the people as well as enterprises through integration of networks and provision of public information and services.

[11] The "Internet of Things" (IoT) is an internet technology which can connect objects to the web via Radio Frequency Identification (RFID) technology. Through the system, the exact location of an object can be identified, and the object can also be connected with other objects to facilitate centralised management. Currently, this technology is applied in areas including transport and logistics, healthcare and medical services, the home and workplace environment, etc. Please refer to Internet of Things Europe, "Internet of Things – Introduction" (2009).

The purpose is to enhance the Government's accountability, responsiveness and transparency so that community needs and aspirations can be addressed in a more effective and timely manner.

7. Owing to discrepancies in definitions, the international community has yet to reach a consensus on common standards and indicators for the determination and assessment of smart cities. Apart from the above classification methodology and ranking system adopted by Cohen, other relatively well-known assessment and ranking systems for smart cities in the world include:

Organisation	**Hong Kong's Ranking (Year)**
Innovation Cities Index by 2thinknow, Australia[12]	20 (2014) (third place in Asia)
Rankings of Smart cities published by Boyd Cohen, an American urban strategist	4 (Asia-Pacific region, 2013)
Digital Cities Rankings by Digital Communities, United States[13]	Not applicable (covering American cities only)
Networked Society City Index by Ericsson, Sweden[14]	9 (2014) (second place in Asia)
Smart Cities Index by International Data Corporation (IDC), United States[15]	Not applicable (covering certain countries and regions only)
Quality of Living Rankings by Mercer, United States[16]	70 (2015)
Green City Index by Siemens, the Netherlands[17]	"Above Average" (2015)
Digital Governance in Municipalities Worldwide by Rutgers University, United States[18]	3 (2013-14) (second place in Asia)

[12] 2thinknow, "Innovation Cities Index".

[13] Digital Communities, "Digital Cities Rankings".

[14] Ericsson, "Networked Society City Index 2014".

[15] International Data Corporation (IDC), "Smart Cities Index".

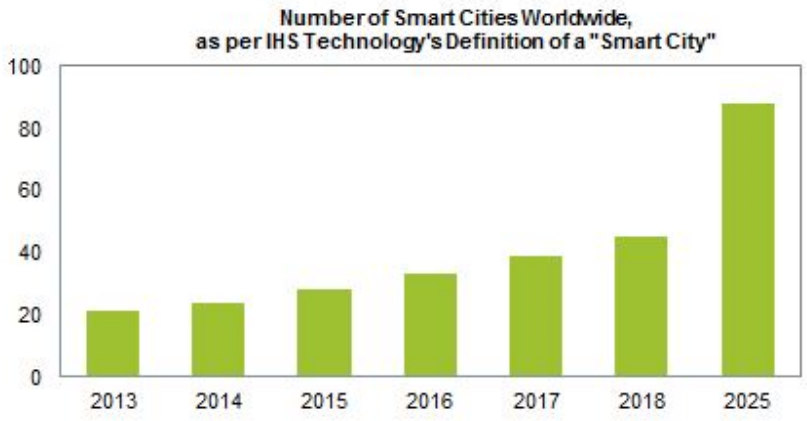
[16] Mercer, "Quality of Living Rankings".

[17] Siemens, "Green City Index". Rated cities are classified into five bands under the index. These bands, in descending order, are "Well Above Average", "Above Average", "Average", "Below Average" and "Well Below Average". Among Asian cities, only Singapore was in the "Well Above Average" band.

[18] Rutgers University, "Digital Governance in Municipalities Worldwide".

8. Among the above indices and ranking systems, the Networked Society City Index published by Ericsson in 2014 has attracted more attention. The index ranks 40 cities worldwide based on their performance, challenges and opportunities in terms of ICT sustainability and development, in order to get a glimpse into ICT maturity and its connection with social, economic and environmental development in cities around the world. Hong Kong ranks ninth in the world and is, among Asian cities, second only to Singapore (fourth place) and ahead of Tokyo (tenth place), Seoul (twelfth place) and Taipei (thirteenth place).

9. Given the lack of a common definition, there are differing views on the number of smart cities within the academia and the relevant sectors. According to a research done by an American consultancy firm IHS[19], the total number of smart cities worldwide was around 20 in 2013. Increasing year by year, the number is expected to rise to about 90 by 2025 (see table below).



Overview of the Development of Smart Cities in Major Regions of the World

10. The United States is the pioneer in development of smart cities around the world. In 2009, IBM put forward a Smart Planet initiative[20] to the Obama Administration, proposing nation-wide investments in the construction of a new generation of intelligent information infrastructure throughout the nation. Subsequently, IBM cooperated with Dubuque, Iowa in building the first smart city "Smarter Sustainable Dubuque" in the United States[21]. New

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[19] IHS, "Number of Smart Cities Worldwide" (2014).

[20] IBM, "What's new on a Smarter Planet?" (2009).

[21] The City of Dubuque, "Smarter Sustainable Dubuque: An Overview".

ideas include digitising public resources and services in the whole city and linking them up through the web, and also installing digital water and electricity meters for residents and businesses to collect and collate data for analysis, so that a picture of resource utilisation of the whole city can be obtained for the purpose of energy conservation and emission reduction, thereby enhancing the awareness and sense of responsibility of citizens and enterprises towards sustainable development. IBM then launched the Smart Cities Challenge programme[22] in 2010, sending experts to 100 cities around the globe to help them address challenges arising from city development and management. Since then, "smart city" has gradually emerged as a concept of cities' comprehensive development, and has also become a new trend in global city development in the 21st century.

11. Well before IBM announced the Smart Planet initiative, many developed countries and regions, and even emerging economies, had already adopted ICT extensively in various areas across their cities. Entering the 2010s, many places around the world are eager to forge ahead with the research and development of smart cities. As there are so many new initiatives, it is not possible for us to list them all. The latest development of regions proactively pursuing to develop their smart city projects are depicted in paragraphs 12 to 26 below, with highlights on some worthy examples of state-of-the-art experiences for the reference of Hong Kong.

United States

12. As shown in a research report entitled "Smart Cities: Business Models, Technologies and Existing Projects"[23] published by IHS in July 2014, smart city projects in the United States are mainly mapped out and implemented by respective local governments having regard to the environmental characteristics of their own cities, with particularly outstanding success achieved for those taken forward in collaboration with civic bodies and the business sector. Meanwhile, the focus of development varies from city to city, and can be broadly divided into five catergories: improving the transportation system to enhance the internal and external mobility of a city; enhancing energy efficiency to foster the sustainability of long-term development of a city; revamping all kinds of information and communication infrastructure to provide the public, the business sector and the public sector with a more friendly living, business and working environment; strengthening the monitoring and security of the public space of a city to make the city a safer place; reforming public governance, and planning and adjusting city functions and services to address a host of challenges in urban management, including traffic congestion and energy consumption.

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[22] IBM, "Smart Cities Challenge" (2010).

[23] IHS, "Smart Cities to Rise Fourfold in Number from 2013 to 2025" (29 Jul 2014).

New York

13. New York is a pioneer in smart city development in the United States. The government of New York City and Cisco IBSG have collaborated on implementing the Smart Screen City24/7 initiative[24] for the dissemination of consolidated information of the public and private sectors through mobile networks. Under this initiative, outdated payphone booths are converted to smart screens incorporating touch, voice and audio functions to enable public access to information anytime. As Wi-Fi hotspots, these smart screens will develop into the largest city Wi-Fi network of the nation. In addition, New York City has launched the Hudson Yards Project to develop a commercial and residential area on Manhattan's west side, over which a large number of electronic sensors will be installed to digitally track such factors as local traffic, energy consumption and air quality in real time. Other initiatives to enhance efficiency include the development of a trash-disposal system for removing waste via underground pneumatic tubes[25].

14. Besides New York, several other cities in the United States also have their own salient features regarding smart city development. Examples are as follows:

San Francisco, Boston, Seattle and San José

- San Francisco: The city excels in green and sustainability initiatives in that it implements comprehensive waste recovery and recycling programmes, mandating that garbage be separated into three categories, namely recycling, compost, and landfill waste; provides citizens with mobile access to near real-time data on energy consumption and to energy-saving advice; and provides more than 100 charging stations throughout the city to promote the use of hybrid and electric cars[26]. Located in the city, Silicon Valley is home to numerous innovation and technology enterprises, and there is free Wi-Fi coverage extending three whole miles along its main road.

- Boston: Mobile applications have been developed with a full range of functions for citizens, such as instant reporting of neighbourhood problems to the city government; search for on-street parking; real-time traffic information and route suggestions; help for children walking to school; and its city bike rental system[27].

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[24] Jeff Frazier and Tom Touchet, "Transforming the City of New York: New Platform for Public-Private Cooperation Ushers in Smart Cities of the Future" (2012).

[25] Michelle Reis, "5 U.S. Cities Using Technology To Become Smart And Connected" (15 Aug 2014).

[26] Michelle Reis, "5 U.S. Cities Using Technology To Become Smart And Connected" (15 Aug 2014).

[27] Michelle Reis, "5 U.S. Cities Using Technology To Become Smart And Connected" (15 Aug 2014).

Soofa has planned to install solar-powered hubs at benches in parks and along sidewalks for citizens to charge their mobile devices. These hubs can also be used for monitoring air quality and sound levels[288].

- Seattle: The city partnered with Microsoft to launch its High-Performance Building programme[29] to promote smart building technologies. The programme allows for real-time tracking of energy efficiency in buildings and helps reduce costs and carbon emissions by means of, say, making adjustments to peak energy consumption.

- San José (California): The city has collaborated with Intel on the project of Smart Cities USA[30], which is the first pilot scheme for smart city implementation. The project is aimed at furthering San José's Green Vision strategy and creating a sustainability lens for the city. As a network of air quality, sound and microclimate sensors, the sustainability lens is designed to measure characteristics such as particulates in the air, noise pollution and traffic flow for analysis, with a view to improving the transportation and environment, health and energy efficiency. Meanwhile, the project is expected to create 25 000 clean-tech jobs and achieve the three major goals of helping the city grow economically, improving the environment and enhancing life.

European Union

15. To tie in with the overall development of the entire European Union (EU), EU's smart city development places a greater emphasis on top-down planning. It focuses on two environmental areas, namely energy conservation and emission reduction, and regional development and innovation strategy, with emphasis on the development of five areas, viz. connectivity, open data, entrepreneurs and start-ups, development of high-speed 5G network, and innovation. It complements the three priorities of smart growth, sustainable growth and inclusive growth as set out in the Digital Agenda for Europe under the Europe 2020 Strategy[31].

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[28] SOOFA, "soofa: my urban hub" (2015).

[29] Puget Sound Regional Council, "Smart Buildings" (2014).

[30] Intel Smart America, "Smart Cities USA" (2014).

[31] EU-China Policy Dialogues Support Facility II (PDSF) and China Academy of Telecommunications Research (CART), "EU-China Smart and Green City Cooperation: Comparative Study of Smart Cities in Europe and China White Paper" (Mar 2014); "Digital Agenda for Europe – A Europe 2020 Initiative".

United Kingdom (UK)

16. Take the UK as an example. As pointed out in the "Information Economy Strategy", a report published by the UK Government in 2013, many pressing societal challenges being faced by the UK are all related to urban development, and it is a prevailing trend for cities around the world to use integrated intelligent systems for the delivery of vital public services. Cities make use of real-time Internet of Things technology to link up various systems including transport, energy, environmental, and healthcare systems for cost saving, provision of new services and efficiency enhancement[32]. The report has laid down a roadmap for the development of smart cities in the UK. On the operational front, the Technology Strategy Board of the UK has allotted funding for the smart city pilot schemes of cities including Glasgow, Bristol, London and Peterborough[33]. For Glasgow, as a core pilot project, the UK Government has implemented the Future Cities Demonstrator programme[34], under which public space and road monitoring management, municipal service data collection and analysis, energy conservation and emission reduction, real-time information and mobile application will be fully integrated in the city. Examples of specific plans in the UK include an investment of £1.2 billion by the government to enhance the broadband infrastructure, for instance, providing ultra-high-speed broadband networks for areas designated for high-tech industries; opening up more government data to facilitate the operation of non-governmental organisations and enterprises; facilitating online transactions by small and medium enterprises (SMEs) through such means as using the government electronic invoicing system and consolidating government tender information for its online publication on the cloud; conducting 5G network research; upgrading the e-service systems of 22 government departments/organisations; introducing electronic tax accounts; drawing up a consumer rights bill to protect customers engaging in online transactions; and integrating closed-circuit television (CCTV) systems with traffic management systems.

Spain

17. The Spanish city of Barcelona is an outstanding performer in smart city development in the EU, especially in terms of low-carbon technology application. To tie in with the three priorities of the EU's Europe 2020 Strategy mentioned in paragraph 15 above, the smart city project of Barcelona aims to improve the community and people's living by integrating urban planning, ecology and information technology so that Barcelona will become a productive and people-oriented metropolis which is highly connected and highly

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[32] UK Government, "Information Economy Strategy" (Jun 2013).

[33] UK Government, "Information Economy Strategy" (Jun 2013); The British Standards Institutions, "UK takes the lead as first country to develop Smart Cities standards" (Feb 2014).

[34] UK Government, "Information Economy Strategy" (Jun 2013).

efficient with zero emission in the long run. The overall strategy of Smart Barcelona, drawn up by the City Council, is spearheaded by one of the vice-mayors of the city. A Project Management Committee is responsible for monitoring the implementation of relevant programmes while a Project Management Office takes up the detailed planning, co-ordination and implementation duties. Importance is attached to integrated planning and top-down design, with the Government motivating the development of the Internet of Things in a focused approach, tapping technology and resources of the community and enterprises through various forms of public-private partnership to take forward specific programmes, gradually launching a series of smart city functions and services based on the Internet of Things. These include remote-control LED street lighting, building energy management, greenbelt irrigation, district heating and cooling system, public transport, zero emission on roads and open government. To date, Barcelona has made progress[35] in a number of areas, for instance, achieving remote control for 50% of the lighting and having telemanagement of irrigation for 12% of the parks. Other programmes have also been rolled out progressively: remote sensing monitoring devices are used extensively for purposes such as monitoring the use of parking spaces, detecting the trash level and smelliness of rubbish bins, and alerting blind people of the location of junctions; smart and environmental-friendly bicycle rental service is strongly advocated to enable citizens to hire and return a bicycle with a smart card and to locate a bicycle parking space via a smart system; a solar-powered bus stop information system, which is a pilot scheme covering 100 bus stops with the ultimate goal of converting the existing 2 000 bus stops in the city to smart bus stops, is launched to provide passengers with traffic information and enable them to know real-time bus trips and arrivals; an ordinance was enacted in 1999 and came into effect in 2000 to require the adoption of solar energy as a source of energy for not less than 60% of the hot water supply in all new buildings. For details about the smart city development strategy of Barcelona, please refer to Appendix A.

Asia

Japan

18. In 2009, the Japanese Government announced the *i*-Japan Strategy 2015[36], which aimed at full inclusion of digital technologies into society and economy, adding new vitality to both society and economy to help members of the public enrich their lives, strengthen connections and unleash their creativity. The Strategy covers five main areas as follows:

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[35] City Climate Leadership Awards, "Barcelona: Barcelona Smart City" (2014); Smart Tianjin, "Typical Examples of Foreign Smart Cities" (13 Nov 2014) (in Chinese).

[36] Japan IT Strategic Headquarters, "*i*-Japan Strategy 2015: Striving to Create a Citizen-Driven, Reassuring & Vibrant Digital Society – Towards Digital *i*nclusion & *i*nnovation" (6 Jul 2009).

- Electronic Government and Local Government: Creating structures to implement electronic government, following up on prior plans and establishing PDCA (Plan-Do-Check-Action) quality control structures; expanding the National e-PO Box scheme and integrating it with the Social Security Cards of nationals to provide one-stop administrative services for citizens and enhance the transparency of the Government.

- Healthcare: Developing telemedicine technologies to enhance regional healthcare co-ordination and manpower training for addressing the shortage of doctors in rural areas; implementing Japanese EHR systems and using electronic prescriptions to reduce medical errors and facilitate the provision of continuous treatment, and using health-related information for epidemiological study purposes.

- Education and Human Resources: Encouraging the use of digital technologies such as electronic blackboards and multimedia-based information in classroom teaching, enhancing teacher training, raising children's learning interest and abilities, and improving their skills in using information; building up a stable and sustainable pool of talent highly skilled in digital technologies, and expanding the bases for practical education and the functions of national human resources centre through collaboration among the government, business sector and the academia.

- Using Digital Technologies and Information to Transform Industrial Structure and Revitalise Local Communities: Developing business platforms for SMEs; promoting green information technology (IT) industries; establishing new business types in local industry; increasing the number of teleworkers; creating new business start-up markets to enhance the international competitiveness of Japanese industries.

- Development of Digital Infrastructure: Establishing high-speed broadband networks, putting in place information security measures, developing digital fundamental technologies, and developing infrastructure for dissemination and utilisation of digital information, etc.

To tie in with the implementation of the above Strategy, the Japanese Government has also conducted a comprehensive review of the existing laws and regulations, systems and practices with a view to achieving the Digital Global Vision in the long term and reinforcing the international competitiveness of Japan in digital technologies and related industries[37].

[37] Japan IT Strategic Headquarters, "*i*-Japan Strategy 2015: Striving to Create a Citizen-Driven, Reassuring & Vibrant Digital Society – Towards Digital *i*nclusion & *i*nnovation" (6 Jul 2009).

South Korea

19. In contrast to Japan's targeted development in specified areas, South Korea's smart city strategy focuses on integrated city management as well as ICT penetration and application. This is reflected in the Smart Seoul 2015 programme[38] announced by the Korean Government in 2011. Building on the previously launched u-Seoul project[399], the focus has been shifted from the application of ICT in individual municipal facilities to the development of a new generation of ICT infrastructure and an integrated city management framework, as well as educating citizens of all ages from different social strata to become smart users of various smart services. A Vice-Mayor, who is tasked to co-ordinate the formulation and implementation of the Smart Seoul strategy, also serves concurrently as the Chief Information Officer of the Seoul Metropolitan Government (SMG), supported by a 200-strong team of an Information Centre. In parallel, the SMG collaborates with leading ICT enterprises such as Samsung, LG and Hyundai, with the former taking charge of the overall planning and the latter responsible for the research and development as well as implementation of various smart functions and services. Examples of specific measures under the Smart Seoul programme include the u-service network, which is aimed at expanding the access of Seoul citizens to city services via smartphones and tablets; a free Wi-Fi network provided by the government in public places across the city; u-Health Care, which provides remote health monitoring and support to the elderly, the chronically ill and the underprivileged; u-Seoul Safety Service, which can, through location-based smart devices carried by those requiring special care such as the elderly, the mentally disabled and children, send instant electronic alerts to their parents and guardians when they are leaving a designated safe zone; a one-stop, integrated reservation system for public facilities and services; the establishment of ten Smart Work Centres to allow civil servants to work from distance at dedicated locations near their homes instead of working in their routine offices when circumstances so require; satellite positioning mobile applications for citizens to report community problems; city-wide CCTV networks and remote sensing monitoring systems; the bus service information system; the establishment of Seoul Data Mart to provide one-stop access to and retrieval of data; and the building of a smart community on the artificial island of Songdo to the west of Seoul, which is connected and operated by information systems with real-time information feedback and management capabilities, such as automatic recycling systems and readily accessible electronic medical records[40]. These measures are in place to

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[38] Seoul Metropolitan Government, "Smart Seoul 2015: Basic Strategic Plan for Informatisation of Seoul Metropolitan City" (2011).

[39] "U" is the short form of "ubiquitous", which means very common.

[40] Seoul Metropolitan Government, "Smart Seoul 2015: Basic Strategic Plan for Informatization of Seoul Metropolitan City" (2011); Smart Tianjin, "Typical Examples of Foreign Smart Cities" (13 Nov 2014) (in Chinese).

transform Seoul into a smart city with comprehensive functionality. For details about the smart city development strategy of Seoul, please refer to Appendix B.

Singapore

20. Besides Japan and Korea, Singapore is also a pioneer in smart city development. Like EU, Japan and Korea, Singapore adopts the top-down planning model for overall co-ordination in respect of strategic positioning, masterplanning and practical implementation. Long before the idea of smart city emerged, the Lion City had been keen on developing information and communication (infocomm) technologies in connection with urban development since the 1990s. Given its small size, dense population and tightly-packed facilities, Singapore adopts a smart city strategy that aims to build a well-connected society through developing and employing the infocomm industries in various aspects of the city, thereby shaping Singapore into a quality city-state. To this end, Singapore drew up a long-term blueprint for smart city development, namely the iN2015 Masterplan, in 2005 to propel the city into the pursuit of comprehensive development in the major directions of Innovation, Integration and Internationalisation. A dedicated Infocomm Development Authority (iDA) was also established to co-ordinate the planning. In addition to a Steering Committee comprising representatives from relevant government departments and the public and private sectors, 11 special committees are also formed under iDA for selected fields, with each being responsible for specific implementation action in respective fields to strengthen the economic competitiveness of the city, enhance the quality of life of its citizens and promote the development of infocomm industries. For details about the smart city development strategy of Singapore, please refer to Appendix C.

Overview of Smart City Development on the Mainland

21. The concept of smart city has also long been popular on the Mainland. The 2010 Shanghai Expo was held under the theme of "Better City, Better Life" to present the vision of smart city development at pavilions of different themes[41].

Building of National Pilot Smart Cities

22. In November 2012, as approved by the State Council, the Ministry of Housing and Urban-Rural Development (MOHURD) promulgated the "Notice on Carrying out National Pilot Smart Cities"[42], instructing all units responsible for construction projects in China to

[41] Yanlin Zhou, "The Path Towards Smart Cities in China: From the Case of Shanghai Expo 2010" (May 2014).

[42] "Office of the Ministry of Housing and Urban-Rural Development: Notice on Carry Out Pilot National Smart Cities" (22 Nov 2012) (in Chinese).

provide reports on national smart cities and adhere to the national policies of promoting innovation-driven development and modern urbanisation as well as building a moderately prosperous society on a full scale. They are also instructed to formulate outline and implementation plans for smart city development according to the "Interim Measures for the Administration of National Pilot Smart Cities"[43] and "Pilot Index System for National Smart Cities (Districts and Towns) (for Trial Implementation)" (Index System)[44] with due regard to the actual situation of individual cities, and put in place corresponding policies, organisations, and supporting funds. Under the Index System, there are four Class 1 indices, namely, security system and infrastructure, smart construction and livability, smart administration and service, and smart industry and economy, which are sub-divided into 11 Class 2 indices and 57 Class 3 indices, covering different areas including policies and regulations, system administration, IT development, town planning and infrastructure, enhancement of public services and social and economic functions, and industry planning and upgrading. Based on the reports and evaluation outcomes, MOHURD approved and published the first batch of National Pilot Smart Cities (90 in total and including cities at the municipal level, municipal districts, counties and towns) in January 2013. The second batch comprising 103 national pilot smart cities was announced in August 2014, and the third batch of 84 in April 2015, bringing the total number of pilot smart cities to 277[45].

23. While pilot projects for smart cities were implemented extensively in Mainland provinces and municipalities, the State Council issued the National New-type Urbanisation Plan (2014-2020)[46] on 16 March 2014, outlining six major directions for the development of smart cities, namely broadband information and communication network, digitisation of planning and management, smart infrastructure, convenient public services, development of modern industry, and meticulous social governance (collectively known as "the six directions"). Guided by these six directions, city management proponents should fully implement the "five new developments"[47] as follows:

- New Industry: Making use of information exchange and sharing to analyse and identify areas for improvement, to build smart industrial parks, and to promote

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[43] "Interim Measures for the Administration of National Pilot Smart Cities" (in Chinese).

[44] "Pilot Index System for National Smart City (Districts and Towns) (for Trial Implementation)" (in Chinese).

[45] "List of National Pilot Smart Cities – MOHURD"; "Office of the Ministry of Housing and Urban-Rural Development: Notice on Carrying out National Pilot Smart Cities" (22 Nov 2012) (in Chinese); "MOHURD announced the List of National Pilot Smart Cities 2013: The total number of pilot cities has reached 193" (in Chinese); "Office of the Ministry of Housing and Urban-Rural Development and Office of the Ministry of Science and Technology: Notice on the Announcement of the List of National Pilot Smart Cities 2014" (7 Apr 2015) (in Chinese).

[46] Webpage of the Central People's Government, "National New-type Urbanisation Plan (2014-2020)" (16 Mar 2014) (in Chinese).

[47] IBM/IDC, "Leading the way for a More Competitive Smart City 3.0 Era" (2014) (in Chinese).

optimisation and upgrading of industrial structure, so as to achieve sustainable development.

- New Environment: Implementation of energy management and environmental monitoring to achieve energy conservation, emission reduction, and optimisation of the distribution network through intelligent adjustments by means of data transmission, computation and analysis.

- New Mode: Diversification of the mode of development to replace the previous government-led operation with such approaches as franchise, public-private partnership, enterprise-led development and operation, and telecommunications operator-led development.

- New Life: Building an integrated smart community platform which encompasses all medical, welfare, education and employment services to improve people's quality of life and promote the development of relevant industries.

- New Service: Building a city operation command centre to make out the entire city landscape by means of Internet of Things and intelligent technologies, with a view to enhancing municipal management and facilitating the transformation of a service-oriented government.

24. Broadly speaking, the development of smart cities on Mainland China is marked with five characteristics[48]:

(a) Green and low-carbon living and user-friendliness as the guiding principle for the development of smart cities

To establish a "people-oriented" city management system in a number of areas, including public safety, transport, environmental protection, education, social services, social harmony and care, medical and healthcare services, and research and innovation. For example:

- About 80% of public services in Chengdu have gone electronic; services such as electronic health records, online booking and payment, and remote consultation have become part of the medical and health services.

[48] The Office of International Economic Cooperation of the Academy of Macroeconomic Research, National Development and Reform Commission, "A General Introduction of Smart Cities on Mainland China with Brief Introduction on Pilot Cities" (Nov 2013) (in Chinese).

- ❖ Measures to facilitate quick public transport interchange will be put in place for the new district of Qianhai in Shenzhen, where smart mobility facilities such as driving guidance and regional slow-moving systems will be introduced. Buildings in the district will be provided with a standardised air-conditioning system alongside smart power consumption facilities; integrated pipelines for city energy resources will be provided throughout the district for easy management, monitoring and maintenance; and a project known as the Smart Water City will be launched to identify drinking water locations instantly.

(b) Attaching high strategic importance to the development of smart cities with emphasis on overall co-ordination and top-down design

Cities in those regions with a leading position in socio-economic development (such as Beijing, Guangzhou and Ningbo) stress the importance of overall co-ordination. They establish their own characteristics, objectives, strategies and approaches in their development as a smart city; and strengthen their efforts in co-ordinating major projects among various departments and industries. For example:

- ❖ The Haidian district in Beijing drew up the framework, including policy, legislation and technical standards, for a start by promulgating the "Objectives and Strategies for the Twelfth Five-year Plan for the Development of a Smart City in Haidian District" and the "Smart Haidian Top-down Design", and took measures to ensure the implementation of the project as planned.

- ❖ Ningbo adopted a "seven-pronged" approach, aligning the work in areas including organisation and leadership, policy support, project management, consultation and decision-making, standards and regulations, training and publicity, and evaluation and assessment. The city also sought professional assistance by setting up expert advisory committees and the Ningbo Smart City Standard Development Planning Academy in order to improve the conditions for the implementation of smart city projects in Ningbo.

(c) New Cities and Districts Capitalising on Planning and Development Advantages to Bring in Advanced Development

Compared with the developed cities and districts, it is less difficult to co-ordinate the development of various smart city functions in new cities and districts. Smart

city initiatives can be incorporated in the planning of new cities and districts, and be launched and implemented in parallel. Examples include:

- ❖ A company specialising in communications network has been set up in Hengqin New Area of Zhuhai for central management of conduit networks in the area. An integrated conduit and channel system has been built so that inspection and repair of various channels and lines can be arranged centrally.

- ❖ Binhai New Area of Tianjin has implemented the "three ones" initiative to co-ordinate the development of the area, including building a dedicated e-government website to provide a one-stop public service platform; setting up a government cloud centre to enhance business process efficiency; putting in place a public sharing platform to allow the public and enterprises to obtain open government data for various research and application purposes.

(d) <u>Some Provinces/Regions Put Forward the Idea of Developing Smart City Clusters to Promote Collaborative Inter-city Development</u>

Provinces like Jiangsu and Zhejiang have put forward the idea of developing smart city clusters to achieve inter-city collaboration for smart city development, which is to be co-ordinated and planned in a holistic approach at the provincial level in such areas as transport, medical and health, and pollution control. Examples include:

- ❖ Jiangsu has established an integrated access platform for smart city clusters at the provincial level, which is the first of its kind on the Mainland covering all cities at prefecture level of the province, and the target is to preliminarily build up the "South Jiangsu Smart City Cluster" covering cities such as Yangzhou, Nantong and Huai'an in 2015, so that the cities may complement each other while giving play to their own strengths.

- ❖ Zhejiang has implemented a pilot advisory service model known as "3+X" ("3" refers to the ministerial, provincial and municipal levels, and "X" refers to a certain number of special smart applications) in 13 chosen cities at prefecture level of the province to develop exemplary smart applications according to their respective characteristics. Guidance is provided by government departments at different levels to achieve complementarity of advantages among the cities concerned, thereby promoting the development of "Smart Zhejiang".

(e) Accelerating the Building of Smart Cities in the Central-western Territory and Underdeveloped Regions of the Mainland so as to Foster Development by Leaps and Bounds

Leveraging the deepening and ubiquitous use of ICT to accelerate urbanisation of the central-western territory and underdeveloped regions. Examples include:

- Chengdu has set up more robust urban smart application systems and policy systems covering areas including transportation, healthcare, food safety, environmental protection, security supervision, logistics and urban administration through the wider use and integration of information technologies such as the Internet of Things, cloud computing and communication hub.

- Zhangzhou has implemented measures for the digitalisation of underground pipelines across the city and sharing of video surveillance information. As for livelihood services, easily accessible mobile services such as a user-friendly fee collection system, electronic supervision of food and drug, etc. have been launched.

25. In view of problems such as a lack of comprehensive planning, outdated systems, network security concerns, unclear ideas and unguided construction that arose in the course of developing pilot smart cities, the National Development and Reform Commission (NDRC), as endorsed by the State Council, issued the "Guiding Advice on Promoting the Healthy Development of Smart Cities" in August 2014 in conjunction with six departments, including MOHURD, to provide clearer guidelines on guiding concepts, basic principles and main objectives, top-down designs of building plans, information resources, organisational management, establishment of systems, etc. regarding the development of smart cities. All ministries and commissions, provinces, municipalities and autonomous regions are required to adhere strictly to the said guidelines in the implementation of related work[49] so as to facilitate the systematic and steady development of pilot smart cities on the Mainland.

Promoting International Cooperation

26. In addition to the building of smart cities at the domestic level, China and the EU launched "EU-China Smart and Green City Cooperation" in 2013, with each side selecting 15 pilot cities for their joint expert team to develop a Smart City Assessment Framework and

[49] National Development and Reform Commission, "Notice on the Publication of Guiding Advice on Promoting the Healthy Development of Smart Cities" (27 Aug 2014) (in Chinese).

conduct a comparative study, in the hope of offering a recommended roadmap for how Chinese smart cities will evolve[50]. In June 2014, China and the EU jointly published a white paper on the "Comparative Study of Smart Cities in Europe and China"[51]. On the basis of a comparative analysis of the Chinese and European pilot cities, the paper has identified the trends and challenges in smart city development and put forth recommendations for ways forward in key areas of the smart city concept, including smart city strategy, governance system, funding and resource deployment, assessment criteria, business models, ICT infrastructure and various smart city services. Among the EU member states concerned, the UK signed a cooperation agreement with China in July 2014 to establish partnership between the UK cities of Manchester and Bristol and the Chinese cities of Wuhan and Xuzhou[52], thus injecting new impetus for furthering international cooperation on smart city development.

Smart City Development in Hong Kong

27. As Asia's world city, Hong Kong goes in tune with global trends in its network infrastructure and ICT application, holding a leading position in this respect. In 2011, Google and the Boston Consulting Group (BCG) of the United States jointly published a report entitled "The Connected Harbour: How the Internet Is Transforming Hong Kong's Economy"[53]. According to the report, Hong Kong's internet economy is experiencing rapid growth, with a contribution of 5.9% to our gross domestic product (GDP). Benefiting from the Mainland's exports, Hong Kong has seen rapid development in e-commerce, online consumption and mobile communications, and has become one of the world's leading digital cities. In 2013, *Forbes* named Hong Kong among the world's top tech capitals to watch after Silicon Valley and New York[54]. Moreover, as mentioned in paragraph 5 above, Hong Kong stood in fourth place in the ranking of the ten smartest Asia-Pacific cities published by Boyd Cohen in 2013[55]. Cohen remarked that Hong Kong scored the highest in his ranking for smart mobility because of the prevalence of public transport and the ubiquitous use of electronic payments. All this points to the fact that Hong Kong has received worldwide recognition for its achievements in ICT development and application.

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[50] EU-China Policy Dialogues Support Facility II (PDSF) and China Academy of Telecommunications Research (CART), "EU-China Smart and Green City Cooperation: Comparative Study of Smart Cities in Europe and China White Paper" (Mar 2014).

[51] EU-China Policy Dialogues Support Facility II (PDSF) and China Academy of Telecommunications Research (CART), "EU-China Smart and Green City Cooperation: Comparative Study of Smart Cities in Europe and China White Paper" (Mar 2014).

[52] UK-China Smartcities, "UK-China Smartcities launches" (2014).

[53] The Boston Consulting Group, "The Connected Harbour: How the Internet Is Transforming Hong Kong's Economy" (May 2011).

[54] Karsten Staruss, "The World's Top 4 Tech Capitals To Watch (after Silicon Valley and New York)" (20 Mar 2013).

[55] Boyd Cohen, "The 10 Smartest Asia/Pacific Cities" (21 Nov 2013).

28. The ensuing paragraphs give a brief account of smart city development in Hong Kong according to the six major spheres of a smart city (for related examples of the various spheres, please refer to Appendix D):

Smart Economy

29. In the economic sphere, the main features of smart city development are the availability of a high-speed network infrastructure of wide coverage, extensive adoption of e-commerce, promotion of innovation and entrepreneurship, etc. As far as network infrastructure is concerned, Hong Kong has world-class communication facilities with wide telecommunications and data network coverage. According to a survey conducted by Census and Statistics Department in 2014, 77% of Hong Kong people use smart devices[56]. At present, household broadband penetration rate is 83%[57]. Each person possesses an average of 2.3 mobile devices[58]. While Hong Kong enjoys the highest average speed of internet connection worldwide, its telecommunications charges are among the lowest in the world[59]. In recent years, the Hong Kong Special Administrative Region (HKSAR) Government has been forging the development of Hong Kong as a regional data centre with initiatives to establish an Internet exchange centre and assume a leading position in cloud computing service in the region. From 2011 onwards, the city has been named for three consecutive years as the safest place for setting up a data centre in Asia[60]. Committed to creating its own cloud computing platform, the HKSAR Government has set up the Expert Group on Cloud Computing Services and Standards as well as the Hong Kong/Guangdong Expert Committee on Cloud Computing Services and Standards to promote the development of cloud computing and formulate relevant standards and specifications, thus laying the foundation for Hong Kong to develop into a regional Internet hub.

30. By virtue of its fast and stable network infrastructure, Hong Kong has also made certain achievements in e-commerce, the most well-known example of which is the Octopus electronic transaction system[61]. In 2006, the Octopus system was awarded the Chairman's

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[56] "Thematic Household Survey. Report No. 54: Informantion Technology Usage and Penetration (2014)" by Census and Statistics Department.

[57] With high-speed 4G services gaining popularity in recent years, some households in Hong Kong use mobile to access the Internet in lieu of fixed broadband. As a result of this "fixed-mobile substitution" effect, there is a slight downward trend on broadband penetration since its peak rate at 86.8% in March 2012.

[58] Office of the Communications Authority "Key Communications Statistics" (May 2015)

[59] Office of the Government Chief Information Officer "Hong Kong – A Premier Location as an ICT Hub" (July 2015)

[60] Cushman & Wakefield, "Data Centre Risk Index" (2011-2013)

[61] Octopus, "Where Can I Use It?".

Award[62] by the World Information Technology and Services Alliance (WITSA). It is now widely used in areas such as public transport, retailing, online payments, parking facilities, self-services, access control systems, recreational facilities, hospitals and schools, and public services. Key statistics for Octopus are as follows: over 28 million Octopus cards are in circulation; over 99% of people aged between 15 and 64 are using Octopus; more than 15 000 retail outlets from over 6 000 service providers accept payment by Octopus; more than 70 000 Octopus card readers have been installed; over 13 million Octopus transactions are processed a day (transactions are valued at over HK$150 million)[63]. To promote its versatility, Octopus also cooperates with, among others, local banks, telecommunications operators, Alipay and Taobao for the issue of credit cards, ATM cards, telephone cards with Octopus function as well as for payment to be made by Octopus for online shopping. Octopus also collaborates with Lingnan Pass and Shenzhen Tong to issue 2-in-1 Co-Branded Cards to enable transactions in Guangdong Province and Shenzhen municipality respectively. Moreover, Octopus provides assistance to some provinces and municipalities on the Mainland, the Netherlands, New Zealand and the United Arab Emirates in the development of their own electronic transaction systems, making Octopus an excellent example for the development of e-currency in other places around the world.

31. Apart from Octopus, two other well-developed one-stop e-payment platforms, namely EPS[64] and PPS[65], are available in Hong Kong, combining credit cards with payment service for various public services. The local banking sector also expands their business to e-banking vigorously. Some retail and service sectors also develop websites and mobile applications to provide a variety of functions including those for searching, booking, ordering and feedback. Examples include the integrated application of "Openrice" for restaurants[66], the vehicle booking applications of "GoGoVan"[67] and "FlyTaxi"[68], and the online bookstore of CP1897[69]. To further promote e-commerce, the Government has launched the Sector-specific Programme[70] and IT Training Programme for SMEs[71] to promote wider adoption of ICT among SMEs in their daily operation and service delivery.

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[62] Boyd Cohen, "The 10 Smartest Asia/Pacific Cities" (21 Nov 2013).

[63] Octopus, "Benefits for Your Business".

[64] EPS, " About EPS Company".

[65] PPS, "About Us".

[66] Openrice, "About Us".

[67] GoGoVan, "About Us".

[68] Startbasehk, "Flytaxi-#1 Taxi app in Hong Kong".

[69] CP 1897, "About CP1987".

[70] Office of the Government Chief Information Officer, "Sector-specific Programme".

[71] Office of the Government Chief Information Officer, "IT Training Programme for SMEs".

32. In addition, the Government encourages entrepreneurship and innovation in the community through a series of measures, such as providing infrastructural support like Cyberport, the Hong Kong Science and Technology Parks, and the Hong Kong Applied Science and Technology Research Institute; launching the Innovation and Technology Fund (ITF)[72] and SME Funding Schemes[73] to provide financial support to enterprises for developing ICT business; setting up Create Hong Kong (CreateHK) to promote and give impetus to the development of creative economy through the CreateSmart Initiative[74]; and cooperating with other economies to set up a bilateral framework of cooperation to foster ICT development of each other, so as to enhance the competitiveness and international status of Hong Kong in the global knowledge-based economy.

Smart Mobility

33. Smart mobility covers three major areas, namely real-time traffic information monitoring system over the entire city; comprehensive and efficient tracking and management of freight logistics; and diversified and highly effective modes of public transport. Regarding traffic management, the Transport Department has developed various intelligent transport systems such as the Area Traffic Control Systems[75] to manage all traffic lights of the city and conduct real-time monitoring via CCTV networks, making adjustments to traffic lights according to the actual traffic condition to divert traffic flow and enhance efficiency. Moreover, the Transport Department has developed the Transport Information System[76], which is a central database to collect, process and disseminate comprehensive transport information, to provide road users and the general public with four major services, including Road Traffic Information Service which disseminates online real-time traffic information, traffic speed charts and journey times of different routes, etc.; Hong Kong eRouting and Hong Kong eTransport which provide traffic route guidance for drivers and passengers respectively; provision of information on traffic directions, turning and stopping restrictions, etc. for the public and the business sector; and development of the Intelligent Road Network, which is an intelligent transportation application system. These systems help enhance transportation efficiency and provide the public with useful and easily accessible traffic information.

34. As for cargo transportation, both the Government and the cargo industry develop different systems for customs clearance, logistics, baggage handling and e-payment.

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[72] Innovation and Technology Commission, "Innovation and Technology Fund".

[73] Trade and Industry Department, "SME Funding Schemes".

[74] CreateHK, "CreateSmart Initiative".

[75] Transport Department, "Area Traffic Control Systems"

[76] Transport Department, "Transport Information System".

Examples include the Road Cargo System (ROCARS)[77] launched by the Customs and Excise Department to streamline customs formalities and enhance border control efficiency by allowing shippers to register cargo information in advance via the online system before transporting the cargoes through boundary control points; and the ezTRACK developed by GS1 Hong Kong[78] by integrating a number of technologies, including Radio Frequency Identification (RFID), Electronic Product Code (EPC), Global Positioning System (GPS) and sensors, to enable enterprises to have instant access to business-critical product information related to the work-in-progress status, product inventory data, delivery schedules and other product details. In addition, using the RFID technology to handle and track baggage locations, the baggage handling system[79] adopted by the Hong Kong International Airport as one of the pioneers worldwide helps enhance system efficiency and reduce the risk of lost baggage in the process. Another example is the Autotoll system[80], which is widely adopted at major trunk roads and tunnels to provide automatic electronic toll collection service to facilitate traffic flow.

35. Regarding mixed modal access, the Government has been co-ordinating various public transport services, with railway as the backbone and complemented by services such as buses minibuses, trams and taxis, to provide highly effective and multi-modal choices to the public. Furthermore, the current-term Government has introduced the "Universal Accessibility" Programme[81] and put in barrier-free facilities such as lifts and ramps in public space to provide a "universally accessible" environment for better public access to public walkways. The Government has also launched the pilot project of "Walkable Kowloon East"[82] and drawn up proposals for improving the local pedestrian and traffic environment, and considered providing seamless connection between major spots in the district by means of the Environmentally Friendly Linkage System (EFLS)[83]. The Government has also examined the feasibility of introducing a smart bicycle rental system and providing the public with information on bus-bus interchange, parking spaces, loading/unloading points, etc.

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[77] Customs and Excise Department, "Road Cargo System (ROCARS)".

[78] GS1 Hong Kong, "ezTRACK".

[79] Airport Authority Hong Kong, "HKIA Boosts Baggage Handling Efficiency with RFID Technology".

[80] Autotoll Limited, "Electronic Toll Collection System".

[81] LegCo Panel on Transport, "Universal Accessibility Programme" (discussion paper for meeting on 25 November 2014).

[82] Kowloon East Office of the Development Bureau, "Conceptual Master Plan - Connectivity, Branding, Design, Diversity in Kowloon East".

[83] Civil Engineering and Development Department, "Environmentally Friendly Linkage System".

Smart Environment

36. Smart environment covers the major areas of sustainable urban planning, resource management for sustainable use of resources, and construction and management of smart buildings. Regarding sustainable urban planning, Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030 promulgated in 2007 has set sustainable development as its overall objective. It has put forward planning concepts such as "resource management" and "doing more with less" and established Hong Kong's mode of development as an intensive and railway-oriented city. Given the high density of population and buildings in Hong Kong, the Government has promulgated the Greening Master Plan (GMP)[84] to provide guidelines on the planning, design and implementation of greening works for all districts. For example, to achieve synergy, the GMP for Kowloon East includes pedestrian-friendly facilities, a district cooling system (DCS), beautification works for channels and revitalisation of water bodies, waste processing, and promotion of green building and green environment. In addition, the Government has carried out a number of city-wide greening measures[85], which include active planting, proper maintenance and preservation of trees together with other vegetation; expanding urban green belts and enhancing existing greened areas; enhancing opportunities for quality greening during the planning and development of public works projects. Besides, the Government adopts the concept of revitalising water bodies in large-scale drainage improvement works and planning drainage networks for New Development Areas so as to build a better environment for the public. All these measures aim at striking a balance between development and conservation to improve the living environment[86]. Apart from revitalising and greening measures, the Government has established the Council for Sustainable Development[87] for public consultation on the overall strategy and measures in the key areas concerning sustainable development, with a view to creating a sustainable environment.

37. On resource management, the Environment Bureau issued the Hong Kong Blueprint for Sustainable Use of Resources[88] in 2013, setting out clear goals and a 10-year timeline for the resource management strategy of the city. The purpose is to promote a "Use Less, Waste Less" mode of living by implementing measures such as plastic bag charging, recyclable collection of food waste and yard waste, thereby achieving the goals of waste reduction and recycling. The Development Bureau has studied and promoted the use of renewable energy such as solar power, wind power, landfill gas, etc., and cooperated with the Electrical and

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[84] Civil Engineering and Development Department, "Greening Master Plan".

[85] Development Bureau, "Greening".

[86] 2015 Policy Address, paragraph 181

[87] HKSAR Government, "Council for Sustainable Development".

[88] Environment Bureau, "Hong Kong Blueprint for Sustainable Use of Resources 2013-2022".

Mechanical Services Department (EMSD) to promote the Energy Saving for All Campaign[89] by formulating the Energy Saving Charters on Indoor Temperature and on "No ILB", in order to engage the public in energy conservation and emission reduction.

38. Smart building is one of the marks of a smart city. Both the Government and the construction industry promote sustainable green buildings to make efficient use of energy and other resources and mitigate the overall environmental impact by adopting ecological and resource-saving methods to design, build, fit out, operate or reuse buildings. The Buildings Department has issued to the construction industry practice notes on quality and sustainable built environment[90]. These notes provide sustainable building design guidelines, covering, inter alia, building separation and permeability, building set back and site coverage of greenery of buildings. The Hong Kong Green Building Council has been updating BEAM Plus, which is a comprehensive environmental assessment scheme with a rating system developed for buildings[91]. The Housing Authority/Housing Department has introduced the Building Information Modelling (BIM)[92] on a pilot basis for generating three-dimensional, digital representation of building data throughout the life cycle of a building, with a view to enhancing building quality by optimising building designs, improving co-ordination and reducing construction waste. The Construction Industry Council has established the Zero Carbon Building (ZCB)[93] in Kowloon Bay to showcase the state-of-the-art eco-building designs and technologies, thereby raising community awareness of low-carbon living. On the management of building facilities, the EMSD has launched a thematic website[94] to promote the use of energy conservation and emission reduction technologies in building services such as air-conditioning systems, lighting systems, lifts and escalators. Moreover, such energy conservation measures have been implemented in some government/public and private commercial buildings and residential estates.

Smart People

39. Initiatives concerning smart citizens have the focus placed on areas including network usage, general ICT education and nurturing of an ICT-savvy workforce. As mentioned in paragraph 29, the coverage and speed of Hong Kong's network infrastructure are among the top in the world, with the penetration rates of family broadband and

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[89] Environment Bureau, "Energy Saving for All Campaign".

[90] Buildings Department, "Practice Notes on Quality and Sustainable Built Environment".

[91] Hong Kong Green Building Council, "BEAM Plus".

[92] Housing Authority, "Building Information Modelling".

[93] Construction Industry Council, "Zero Carbon Building".

[94] Electrical and Mechanical Services Department, "HK Sustainable Technology Net".

smartphone reaching over 80% and 70% respectively, and our highest average speed of internet connection is also among the fastest worldwide.

40. Regarding general ICT education, the Government will, building on the existing initiatives such as the Student IT Corner[95] and the Enriched IT Programme in Secondary Schools[96], provide our primary and secondary students with more comprehensive and intensive training to foster their IT knowledge and practical skills such as programming through the Fourth Strategy on IT in Education. Meanwhile, the Government will enhance students' information literacy and its applications to other learning areas, thus enabling them to adapt to the fast-changing society and economic development; and provide intensive training to students who are interested and talented in IT, thereby nurturing young IT professionals and even entrepreneurs to support the long-term development of Hong Kong.

41. As for human resources, local tertiary institutions offer ICT-related curricula to nurture talent. At present, there are about 83 000 ICT professionals working in different sectors, among which about 38% engage in software design and development[97], showing that Hong Kong has laid a foundation in ICT labour force.

Smart Living

42. With regard to daily life, smart cities are aimed at providing an environment with accessible information and communications to enhance the quality of life for their citizens. The Government has put in place a range of measures to offer support to the needy and the underprivileged[98] regarding ICT adoption, e.g. the Internet Learning Support Programme or "i Learn at Home", eElderly, ICT Outreach Programmes for Elderly, and the Sponsorship Scheme on Development of Digital Inclusion Mobile Applications; creation of accessible websites for the disabled, the elderly, people beset by cognitive and physical problems and those from ethnic minority groups to access online information and services, thus facilitating their integration into the community; and sponsoring community organisations to develop ICT-based assistive tools and application systems for people with disabilities, such as the On-line Navigation System for the disabled, the Text4U application for the visually impaired to access text information, and Intelligent Home for People with Physical Disabilities.

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[95] Office of the Government Chief Information Officer, "Student IT Corner".

[96] Office of the Government Chief Information Officer, "Enriched IT Programme in Secondary Schools".

[97] Vocational Training Council "Manpower Surveys and Information" (2014)

[98] Office of the Government Chief Information Officer, "Community Initiatives and IT Services"; Home Affairs Department, "Race Relations Unit".

43. With respect to promoting public participation in cultural activities, the Leisure and Cultural Services Department operates the Leisure Link[99] and URBTIX[100] systems to facilitate, among other things, the booking of government leisure facilities, the enrolment to recreational activities and the purchase of tickets for cultural programmes. As for the private sector, one-stop electronic services have also been developed for films and other performing activities. Examples include the CityLine[101], which is a comprehensive ticketing platform integrating ticket inventory management, point-of-sales systems, extensive sales and distribution channels, online payment options, and smart ticket fulfilment and admission control methods; and the Movie Express developed by MTel[102], which is a mobile application providing film information and links to ticketing systems of all cinema chains in Hong Kong.

44. As for improving the health of the public, the Government has been working on a city-wide initiative to collate medical records and data. Co-ordinated by the Food and Health Bureau, an eHealth[103] system is developed to maintain electronic health records of all patients in Hong Kong, which are open to access by participating public and private healthcare providers through a sharing system for the purpose of enhancing the efficiency and quality of healthcare services, reducing errors in health records, and capturing data for analysis purposes to facilitate public health surveillance and formulation of targeted policies and measures.

Smart Government

45. Smart government broadly refers to integrated and connected electronic public services, development of ICT infrastructure within the Government and in public space, digitisation and accessibility of government information and data, and e-engagement. Regarding electronic public services, GovHK[104] (formerly the ESDlife website) is a government information portal and public service platform through which citizens may obtain information on various kinds of public services and activities, make appointments for document and licence applications, look for job vacancies, pay government bills, etc. It also features mobile applications including EventHK, GovHK Notifications, and GovHK Apps[105] to facilitate public access to information on government services and activities anytime. The

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[99] Leisure and Cultural Services Department, "Leisure Link".

[100] URBTIX, "About Us".

[101] CityLine, "Our Services".

[102] MTel, "Movie Express".

[103] eHealth Record Office of the Food and Health Bureau, "eHealth".

[104] Office of the Government Chief Information Officer, "GovHK".

[105] Office of the Government Chief Information Officer, "GovHK Mobile Applications".

Government has also launched the Electronic Submission of Forms project[106] which, with the use of Smart Identity Card (Smart ID)[107] and personal digital certificate[108], enables the public to make submission of applications or other information to the Government, and use a wide range of electronic public services such as application for licences and permits, registration of persons, application for certification or permission, notification of updated information, etc.

46. The Government has made further efforts to promote the integration of electronic public services in recent years. On the basis of the 24-hour hotline 1823, the Efficiency Unit has launched Tell me@1823[109]. This system, which is similar to SeeClickFix[110] adopted by local governments in the United States, provides comprehensive cross-platform public services, enabling the public to make enquiries, complaints or suggestions to government departments by means of mobile applications, e-forms, emails, telephone calls or messages. It can also provide information in various forms such as text, voice recording, photo, video and satellite positioning to facilitate follow-up action by the departments concerned. Past reports may also be viewed. In addition, its CityReach[111] provides the public with useful information on frequently asked matters such as trees, slopes, motoring and cycling, rates and government rent. The new functions mentioned above allows the Government to have more interactive exchanges with the public in the course of service delivery while enhancing its transparency. The hotline 1823, currently covering the services provided by 22 government departments, may be extended to include services provided by other departments in the future as appropriate.

47. Apart from general enquiries, complaints and suggestions, it is now a generally accepted practice for the public to submit their opinions for consultations on various policies and statutory matters via email. For some consultations, such as those concerning plan preparation and planning application to the Town Planning Board, e-forms in a specified format are available for the public to submit their opinions, which facilitates the processing and consolidation of relevant information by the department concerned.

48. Regarding the development of ICT infrastructure within the Government and in public space, the Office of the Government Chief Information Officer is pursuing the development and upgrading of various e-government infrastructure including the Interoperability Framework (IF), Government Backbone Network (GNET), Central Computer

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[106] HKSAR Government, "Electronic Submission of Forms".

[107] Immigration Department, "The Smart Identity Card".

[108] GovHK, "Electronic Authentication & Digital Certificates".

[109] Efficiency Unit, "Tell me@1823 Mobile App".

[110] SeeClickFix.

[111] Efficiency Unit, "CityReach".

Centre (CCC), and Electronic Information Management (EIM). It also promotes further digitisation in government operation, and studies the adoption of paperless solution in record management and daily operation. Moreover, the number of free Government Wi-Fi (GovWiFi)[112] hotspots in the public space has been increased gradually to provide a more comprehensive and easily accessible network link for public use.

49. As regards digitisation and accessibility of government information and data, the Geospatial Information Hub[113] developed by the Lands Department consolidates relevant geographical data from different government departments to let various departments have fuller information about the city for analysis and assessment, thus facilitating their decision making and daily operation. In addition, the GeoInfo Map[114] provides geospatial information services and accessible data for the general public to search and find out information on specific subjects such as geographic locations, buildings, natural environment and public facilities. Apart from geographic information, the Government has also launched the "data.gov.hk"[115], which is a one-stop portal to provide various digitised open raw data for research and analysis and also for value-added reuse by the public and enterprises.

Latest Measures Implemented by the HKSAR Government for Smart City Development

50. HKSAR Government has been committed to promoting the development and application of ICT in Hong Kong. After its return to China, the HKSAR Government issued the Digital 21 Strategy in 1998, 2001, 2004 and 2008 respectively, setting out the blueprint for Hong Kong's ICT development. The aim of the Strategy is to outline how the Government, community, business, industry and academia can work together to put Hong Kong in the forefront of global ICT development. The Strategy will evolve alongside rapid advances in technology and the changing needs of the community.

51. The current-term Government is committed to promoting the development of related technology and infrastructure for a smart city. With the prevalence of wireless and cross-platform technologies, cloud computing, Internet of Things and big data,the Financial Secretary announced in his 2014-15 Budget that to build upon the robust IT infrastructure in Hong Kong, the Government had proposed in the fourth update of the Digital 21 Strategy,

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[112] Office of the Government Chief Information Officer, "GovWiFi".

[113] Science in the Public Service, "Geospatial Information Hub of the Lands Department" (in Chinese).

[114] Lands Department, "GeoInfo Map".

[115] HKSAR Government, "data.gov.hk".

under the theme of "Smarter Hong Kong, Smarter Living", the following five specific initiatives[116]:

- increasing the number of Wi-Fi hotspots to 20 000 to promote city-wide Wi-Fi for all;

- making all government information released for public consumption machine-readable in digital format to provide more opportunities for the business sector. Currently, Public Sector Information available for free access covers real-time data such as road traffic information, weather data, geo-referenced public facility data, property market statistics, population census statistics, etc.;

- further digitising government operations and actively implementing paperless solutions to enhance efficiency, facilitate information sharing and protect the environment;

- looking into the wider use of the Internet of Things, sensors and big data analytics to enhance our municipal management;

- considering the provision of digital identity to all Hong Kong citizens in order to develop a common, shared and safe platform for the delivery of services such as electronic health records and e-cheques.

52. In January 2015, the Chief Executive further stated in his 2015 Policy Address that the Government intended to use Kowloon East as a pilot area to explore the feasibility of developing a Smart City[117]. The pilot Smart City project for Kowloon East aims at using technology to enhance pedestrian and vehicular accessibility, manage district facilities, and disseminate information to the public in digital format with a view to making the area a better place for work and play[118]. Specific measures include:

- Walkable Kowloon East: Drawing up proposals to improve local pedestrian and traffic environment; examining the feasibility of introducing a smart bicycle rental system; providing information on bus-bus interchange, parking spaces,

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[116] Financial Services and the Treasury Bureau, "The 2014-15 Budget" (Feb 2014).

[117] Chief Executive's Office, "2015 Policy Address" (Jan 2015).

[118] Kowloon East Office of the Development Bureau, "Conceptual Master Plan - Connectivity, Branding, Design, Diversity in Kowloon East" (Jan 2015); Coconut Hongkong, "Wall-E Meets Hong Kong: Government Plans to Develop Kowloon East into a 'Smart City'" (16 Jan 2015).

loading/unloading points, etc.; and providing seamless connection between major spots in the district by means of the Environmentally Friendly Linkage System.

- Green Community: Implementing the Greening Master Plan for Kowloon East; providing more pedestrian-friendly facilities in the district; integrating art and creative spaces with the adjacent landscaped pedestrian networks to reduce the need for conventional transportation, thus reducing the associated carbon footprint in return; carrying out beautification works for channels and revitalising water bodies so as to enhance the environment, increase usable space and ease heat island effect; managing facilities by means of technologies such as DCS and waste processing to promote green building and green environment, so as to achieve synergy and turn Kowloon East into a vibrant and green central business district.

- Smart Data and Technology: Extending free Wi-Fi services to public space; making use of the Internet of Things technology to establish an interactive information platform and provide real-time traffic and community information for communication and data sharing to improve city management as well as enhance efficiency and quality.

Directions of Deliberation on the Development of Hong Kong as a Smart City[119]

53. The development of smart cities is getting into full swing around the world in the 21st century. Whether developed or developing, all regions are keen on smart city development to enhance their competitiveness and create an environment for sustainable development. With a high-density network infrastructure and well-developed ICT applications, Hong Kong has attained considerable achievements in the spheres of Smart Government, Smart Economy and Smart Mobility: extensive coverage of electronic public services, prevalence of various types of electronic transactions, proficient operation of cargo clearance and logistics systems, as well as popular use of mobile applications for taking public transport. In parallel, Hong Kong has also launched a number of measures in the spheres of Smart Environment, Smart Living and Smart People. As mentioned in paragraphs 5, 7 and 8, Hong Kong, being rated among the best in smart city-related indices or rankings and named as the world's Tech Capital alongside Silicon Valley and New York (paragraph 27), has in fact possessed the features and foundation of a smart city. The current-term government attaches great importance to smart city development and has introduced an array of measures.

[119] This part has incorporated the views expressed by some local academic and business experts on smart city development at the internal thematic exchange sessions arranged by the Secretariat to the Commission on Strategic Development.

Overall speaking, compared with other regions in the world and Mainland provinces and municipalities, we have made achievements in varying degrees in all the six major spheres of a smart city. However, when all major cities in the world are making rapid development and progress towards building themselves into a smart city, we cannot afford to remain complacent. Instead, we must comprehensively review all key areas in a scientific and systematic manner to leverage on our advantages and uplift our standards, establish our standing in the world and capitalise on this unprecedented opportunity.

54. Smart city development should be people-oriented to make citizens' life more comfortable and convenient through innovative methods or technologies. To this end, the Government should see things through the eyes of the public and start working in areas that are relatively concrete, apparent and easily noticeable in the daily life, for instance, education, healthcare, electronic public services, intelligent transport system (ITS) and barrier-free facilities. To garner extensive support, efforts should be stepped up to consolidate and promote existing and upcoming measures to allow people to experience personally the benefits of a smart city.

55. Moreover, in the era of digital economy, a slight variance in thought may lead to a huge difference in development. Hence, the Government should adopt a novel way of thinking to explore and leverage on the advantages of Hong Kong in its ICT infrastructure and industry so that a social environment conducive to innovation, creativity, entrepreneurship and startup can be fostered to promote structural diversification of the economy and industrial upgrading. This will contribute to sustained enhancement of society's overall level of development and quality of life.

56. Some major directions of deliberation are set out in the ensuing paragraphs for further study and discussion:

Perfecting high-level framework

57. As seen from the experience of advanced smart cities around the world, such development, mainly government-led together with community involvement, is achieved under rigorous high-level leadership with systematic strategies and programme plans, involving wide-ranging areas such as town planning, infrastructure, information technology, e-government, and various significant economic and social matters. Take Singapore as an example. The country has a solid high-level framework. From iN2015 Strategy to smart country platform, Singapore has formulated clear long-term goals and strategies for smart city development. Also, a dedicated organ, iDA, and various steering committees and specialised committees have been established to steer, co-ordinate and oversee the measures launched by

relevant departments as well as public and private organisations, so that duties and power have come to one, resulting in the systematic implementation of strategies.

58. In Hong Kong, matters concerning smart city development are under the purview of different bureaux and departments. For instance, the Commerce and Economic Development Bureau formulates the Digital 21 Strategy and is responsible for internet governance in respect of, say, the Electronic Transactions Ordinance and the Domain Name Administration Regime; the Development Bureau co-ordinates city-wide urban planning and infrastructure, and the pilot project of smart city in Kowloon East; the Environment Bureau is responsible for the strategy for sustainable use of resources and initiatives for energy conservation and emission reduction; and the Office of the Government Chief Information Officer co-ordinates ICT infrastructure within the government and integrates electronic public services. Departments such as the Efficiency Unit and the Innovation and Technology Commission also play a co-ordinating and initiating role in different aspects, such as promoting electronic public services and innovation and technology development. All policy bureaux and departments have made considerable contribution to the development of smart city-related functions. However, the development of smart city requires macro and systematic thinking. At present, the lack of a dedicated organisation in the government to steer the formulation, co-ordination and implementation of smart city strategies is not desirable for the long-term development of Hong Kong as a smart city. Drawing reference to overseas experience, the Government should, giving prominence to smart city development, establish a high-level steering committee to oversee and direct the development. A bureau should also be tasked to take the lead in formulating overall strategies and plans, co-ordinate inter-bureaux/department responsibilities, and strengthen the Government's facilitating role in support of the development of smart city technologies and services driven by the community and the business sector. It is believed that the Innovation and Technology Bureau proposed by the Government will be able to cover the above functions.

Formulating development strategies

59. In advanced smart cities around the world, overall strategies are developed by the government at the macro level for drawing up a roadmap to take forward the relevant work, which include setting priorities for the six major spheres mentioned above in the light of their own circumstances for optimising the allocation of resources. For example, in Stockholm, Sweden where traffic congestion and air pollution are of paramount concern, considerable resources have been devoted to developing an intelligent transport network, including a progressive electronic road pricing system designed on the basis of peak hours and off-peak hours. In Seoul, substantial resources have been allocated for upgrading the high-speed broadband infrastructure and extending the coverage of free Wi-Fi service provided by the government so as to lay a foundation for promoting more public- and business-friendly

measures (e.g. new and high-tech development zones and e-government initiatives). In Barcelona, where environmental protection is a major concern, enormous amounts of resources have been poured into smart green environment. In Singapore, a place that shares similarities with Hong Kong in terms of physical size, population density and socio-economic conditions, overall strategies and complementary projects/measures are in place for smart city development (see paragraph 20 and Appendix C for details), which can be summarised in three attributes as follows:

- Making plans according to local characteristics: identifying sectors with comparative advantages or potential having regard to Singapore's social and economic characteristics, and in each of the eight sectors identified, namely, financial services, manufacturing and logistics, tourism and retail, digital media and entertainment, healthcare and biomedical sciences, education and learning, government services, as well as social development, putting in place specific development goals and targeted measures to promote sectoral transformation and innovation.

- Integrating smart city with industry development: promoting the grand vision in three respects (i.e. innovation, integration and internationalisation) and building Singapore Brands by specifying the development of infocomm industry as one of the key objectives and providing the industry with incentives for the research and development of smart city products and services, so that its development as a smart city and the development of the infocomm industry can be integrated and be fully complementary to each other.

- Attaching great importance to the nurturing of information and communication talent: encouraging students to join the ICT sector and nurturing professional and competitive talent through facilitative arrangements in curriculum design, extra-curricular activities, skill accreditation, internship, exchange programmes and so forth, as well as promoting the general application of smart education and ICT so as to follow the dominant trend towards the development of a smart city and knowledge-based economy.

Stepping up research efforts

60. Hong Kong is comparatively lagging behind in the study on smart cities. Currently, relevant departments such as the Innovation and Technology Commission, the Office of the Government Chief Information Officer and the Development Bureau conduct studies on specific areas under their purview (e.g. e-government initiatives and the pilot scheme to develop Kowloon East as a smart city). The Government should consider

carrying out internal studies or engaging appropriate non-governmental research institutions (e.g. universities or think-tanks) to pursue comprehensive and in-depth research on the subject. As stated in paragraph 26 above, China and the EU started their comparative study of smart cities back in 2013, with some preliminary results obtained. Hong Kong should endeavour to closely liaise and collaborate with advanced countries, regions and research institutions, and by drawing on their advanced experience and in the light of Hong Kong's actual circumstances, further promote strategies and action plans that are most suitable for Hong Kong.

61. All in all, although Hong Kong has certain characteristics and the foundation of a smart city, there are not yet overall strategies or implementation plans for smart city development, nor has there been large-scale publicity on Hong Kong's achievements in such development. In formulating strategies to develop a smart city, the Government should first consider Hong Kong's various edges, such as its status as a well-developed economy in the world, its role as a super-connector with the world, its highest population density, its status as an international city with the greatest life-beat, its small but efficient government, before setting priorities for the six major spheres of a smart city, namely, Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living and Smart Government, with a view to formulating specific implementation proposals.

Formulation of Specific Action Plans

62. All advanced smart cities in the world draw up specific action plans for their development (like Singapore's specific projects and measures set out in Appendix C). If the action plans involve substantial financial expenditure, or in case their effectiveness remains to be proven, many such cities will implement them on a pilot basis and step forward after the action plans are proved to be feasible and effective. Regarding the specific action plans for each major area, we attempt to put forth some preliminary ideas in the ensuring paragraphs 63 to 82.

Smart Economy

63. Hong Kong, to a certain extent, enjoys an edge in the realm of smart economy. In particular, it takes a leading position in network infrastructure, with financial and technical support from the Government for innovation and entrepreneurship. Nevertheless, various factors including a service-led economy, the lack of an industrial base and high operating costs have hampered the creation of an environment conducive to innovation and entrepreneurship. An in-depth study is worth undertaking to examine whether our strategic partnership with Shenzhen can be enhanced for greater synergies by integrating both sides' respective edges in industry, academia and research through platforms such as the smart

network linkage system or through the development of the Lok Ma Chau Loop. Take Hong Kong's role as a super-connector in maintaining close contacts with countries and regions along the Belt and Road as another example. In developing a smart economy, Hong Kong should also consider possible ways to foster cooperation for the Belt and Road Initiative, including the establishment of an interconnected network for information exchange with governments of the countries and regions concerned.

64. Smart economy emphasizes the development of new modes of operation, which is particularly important for services economies like Hong Kong. While Hong Kong has, overall speaking, attained considerable achievements in e-commerce, there is still ample room for improvement in individual aspects, such as promotion of the Online-to-Offline (O2O) sales and marketing model to combine online and in-person shopping, integration of different systems to build a city-wide common platform for electronic transactions, etc. The Government may take the lead to promote the development of e-commerce, such as integrating the work of different departments, and providing a one-stop real-time government procurement and electronic billing system. The Government may also review the existing framework for governance and supervision of e-commerce, and discuss with the industry as to how to consolidate and then create a unified platform for electronic transactions.

65. The Government should initiate the development of financial technology, and promote infrastructure such as payment systems, clearing and settlement systems, and information and risk management systems. This will help enhance the operational efficiency of financial services and encourage financial innovation and the development of financial technologies, such as innovative transaction authentication methods, credit assessment algorithm models for speedy loan approval, the new generation of integrated electronic transactions solutions, unified transactions platform for electronic insurance, and digital information exchange in business finance.

66. The construction of big data and their application will become a prevailing trend in the future development of smart cities. The Government spares no effort in encouraging and facilitating the establishment of data centres by the industry in Hong Kong through such measures as providing new land supply, encouraging revitalisation of industrial buildings to develop data centres, and establishing the Data Centre Facilitation Unit. Given that SMEs can hardly afford the substantial investments involved for setting up a data centre, the Government may, in addition to furthering and strengthening the above measures, consider making use of resources where appropriate to facilitate and support the setting up of data centres. On another front, the Government should take the lead to adopt and promote cloud computing, through such measures as further digitalisation of government data and files for processing by cloud services, with a view to facilitating market development for such services. The Government may also strengthen its cooperation with the Mainland to set common

standards of cloud computing in terms of security, interoperability and management. This, together with mutual recognition of e-Certificates issued by both sides, will help achieve full connectivity and interoperability in customs, logistics and trade. In addition, the Government may consider providing technical and training support to local SMEs to help them employ advanced technologies such as Internet and cloud computing for the development of smart business solutions to enhance productivity and efficiency and to lower cost.

67. The Financial Secretary announced in the 2015-16 Budget that from 2015 onwards, all free online government information will be released in digital formats. The Government will continue to release more open data in digital format for public consumption and develop the Application Programming Interface (API) to link up different government systems so that it would be easier for the community and the business sector to make use of relevant data for research and development of new products or services, with a view to improving quality of life and bringing about more business opportunities.

68. At present, free Wi-Fi services are provided by the Government, network service providers, shopping malls and chain enterprises. The Government may take the lead to explore with such stakeholders the possibility of connecting their free Wi-Fi networks to form a free network with wider coverage, through which both Government and business information can be provided. Such a free Wi-Fi network, once created, will not only bring convenience to Hong Kong citizens but will greatly enhance Hong Kong's attractiveness and bring substantial new market potential and development momentum for a range of industries including tourism, retailing, transport and electronic transaction. In this connection, the Government may consider selecting certain industries (such as tourism and logistics) for trial run and promotion, with a view to setting an example of success before extending the network to other industries.

69. The global market of smart city industries is flourishing (Appendix E). While Hong Kong is exploring ways of developing itself into a smart city, the Government should provide appropriate support by putting in place policy measures that are conducive to technological advancement, innovation and knowledge-driven growth, and create a research- and development-friendly environment in order to encourage enterprises and talent to pursue their business and career in Hong Kong, as a move to facilitate smart city development.

Smart Mobility

70. Hong Kong has laid a foundation for ICT application in traffic management and freight logistics. Modes of public transport are diversified with extensive networks. Nevertheless, the development of intelligent transport systems to provide consolidated real-

time traffic information and route guidance to road users and the general public is still at a preliminary stage. On the other hand, with regard to public transport, the Mass Transit Railway (MTR) Corporation and the franchised bus operators provide passengers with service information through websites and/or mobile applications. MTR has even launched the MTR Next Train mobile application to provide updates of its train schedules. In addition, franchised bus companies provide information on their bus routes and schedules through various channels. The franchised bus companies are rolling out real time bus information system in phases. Information will be provided through websites, mobile applications and display panels at bus stops. Although intelligent transport systems are being developed by individual enterprises like Autotoll for comprehensive traffic control and fleet management, they are yet to be put into application. Smart mobility should be further developed in Hong Kong. Other measures such as bus stations with photovoltaic smart screen, intelligent parking space identification systems, as well as integrated electronic vehicle charging and hiring systems in advanced overseas cities are worthy of reference to Hong Kong.

71. With the Government's encouragement for development of smart city-related functions by the business sector, a number of enterprises are currently conducting research and development of applications such as parking guidance and public transport services application systems. However, the industry reflects that they have encountered some restrictions in launching these applications. For instance, the launch of new intelligent products and services may contradict existing regulations or policy requirements. The Government should put more efforts in policy coordination to enable enterprises to pursue business in intelligent technologies in a reasonable and lawful manner.

72. For the use of electronic technology and information to facilitate clearance of passenger and cargo flows at the control points of both the Mainland and Hong Kong, there is much room for improvement. Our long-term goal is to provide one-stop clearance. Without compromising their respective power of clearance examination (including the maintenance of their own database) and within the limits of the law, both sides may explore the feasibility of conducting co-location clearance through the use of cutting edge technologies, such as electronic data cards and an e-biometric identification system. That is to say, formal clearance can be conducted by one side, while pre-arrival clearance is carried out by the other side together with the establishment of a green express channel so that passengers and cargo can go through swiftly after passing pre-arrival clearance; formal clearance will only be conducted as and when necessary.

73. The Government may explore how to make use of ICT to build a barrier-free community for elders as well as people with reduced mobility, chronic diseases or cognitive dysfunction. With a three-dimensional concept, the barrier-free access facilities in Hong Kong are among the advanced in the world. However, a comprehensive review is needed as

there is still much room for improvement in terms of hardware and software. For instance, there are still quite a number of MTR stations without lift access to the ground level for wheelchair-bound users. Another example is the elevated walkway system in Central, where there are unconnected sections owing to issues involving land lease and property ownership. As for supporting facilities, the existing transport services, such as public transport and rehab buses, are unable to entirely meet the demand of those with reduced mobility. The Government may take the lead to explore the development of a smart network system to the best interests of these people. For instance, an integrated public service supporting system may be set up such that those in need of the service are issued with a special smart card which, by means of a reading device set up at key locations, will enable service providers to understand their needs instantly, and provide appropriate services or extend the pedestrian green time of traffic lights to cater for their needs. The Government may also explore other feasible barrier-free measures, such as a network for hire of electric wheelchairs, or a network for free ride offers by car owners.

Smart People

74. Nurturing of professionals, wider promotion and education are essential to smart city development. On general education, on the basis of existing measures such as Student IT Corner and Enriched IT Programme in Secondary Schools, the Government should provide primary and secondary school students with information technology courses with more comprehensive and in-depth content on practical skills such as computer programming and coding. Such course content can equip the new generation with basic information technology knowledge which will help them adapt to the fast-changing society and economic development. On the nurturing of professionals, there are favourable conditions in Hong Kong for nurturing research and development talent in that local tertiary institutions offer smart city-related curricula such as geography, computer science and electrical engineering, which are ranked among the best in the world. However, as the economic structure of Hong Kong is dominated by the financial and service sectors, the industry chain for ICT research and manufacture is yet to be developed, thus hampering the demand for and training of high-end professionals. To this end, the Government should explore how to further promote closer collaboration between the academia and the business sector to create a favourable environment for ICT talent to prosper, so as to meet the development needs of a smart city and knowledge-based economy.

75. Hong Kong has laid a foundation in network penetration, general ICT education and nurturing of an ICT-savvy workforce for its smart citizens. In addition, it has always been the concern of the Government to extend the benefits of information technology to the underprivileged, including subsidising students and disabled persons in need to purchase information technology equipment, organising free ICT courses, etc. The Government

should, on this basis, put more efforts in promoting the purpose and benefits of a smart city among the general public, especially for those who are relatively passive and have limited access to ICT (including some of the elderly, housewives and ethnic minorities), and guiding them in the use of various intelligent services, so as to achieve universal application of smart functions in the city.

Smart Living

76. The Government has made considerable achievements in the application of ICT to provide a barrier-free environment, develop electronic health and foster a cultural life for the public. Building on this foundation, the Government should continue to develop smart living, including providing a more convenient and safer living environment for citizens, such as:

- Promotion of integration and smartening of municipal facilities, for example, making use of CCTV and sensor networks for real-time adjustment to streetlights and traffic lights and for better monitoring of public space to enhance safety;

- Adoption of standardised smart building codes for the convenience of living, business and emergency service. This measure is conducive to day-to-day socio-economic activities, and can facilitate follow-up actions on buildings not in compliance with the Government's requirements for fire prevention and building structure and on those with unauthorized structures on the external walls;

- The possibility of consolidating information and promoting a smart reputable shop system for public online access may be considered.

- In view of an increasing demand for public and private medical services among Hong Kong's dense and ageing population, it becomes essential to develop smart health, which can help to boost efficiency, lower costs and enhance the health quality of the public, thereby turning Hong Kong into a healthy city on all fronts. Consideration may be given to enhancing the following measures:

    - Adoption of an integrated information sharing system for public and private medical institutions (simple examples include: drug allergy profiles of individual patients; and consolidated information for the Red Cross to review donors' blood safety);

    - Online expert tele-consultation;

- ❖ On the service front, a smart booking system should be developed in the public health sector so that the public may make appointments, readily check the bookings and availability of service, and receive timely treatment notification via the Internet or mobile applications, thereby saving their queuing time;

- ❖ As to long-term and chronic patients, who account for approximately half of the patients in public out-patient services, a telemedicine body check service may be put on trial to allow these patients to conduct simple body check (e.g. checking of blood pressure) by themselves or enable family members to do so for them, provided that the patients themselves or their family members have received proper basic training. Relevant readings and data of patients' drug intake can be transmitted to the system via an application for medical personnel's scrutiny and analysis, and giving of medical advice as appropriate. In the long run, we may follow the example of Singapore in adopting a mode of operation under which services and information system of hospitals, clinics, various types of community medical facilities, elderly homes and so forth can be connected and fully integrated for shared use so that medical resources can be optimised and efficiency enhanced;

- ❖ Enhancement of community health management and home support for patients; and

- ❖ Addressing factors such as air circulation, suspended pollutant accumulation, noise and heat island effect in city planning and architectural design by means of high-end technology.

Smart Government

77. There is progress in the three major areas of establishing a smart government in Hong Kong, namely electronic public services, development of ICT infrastructure within the Government and in public space, and digitisation and accessibility of government information and data. Public participation is an area that requires further development, such as the development of a public participation system to provide a common platform for e-submission of opinions in public consultations, or an online petitions platform similar to We the People[120] of the White House in the United States. The Government may also make reference to the smart polling initiative introduced in some places of the United States to collect public opinion data on specific issues. In-depth analysis can be conducted on voter background and

[120] White House, "We the People".

choices through data mining for identifying the trend of public opinions and implementing targeted policy initiatives, with a view to boosting interaction between the public and stakeholders in the course of policy formulation to realise smart engagement.

78. Against the background that the personal digital certificate is yet to be popularised in respect of electronic public services, there are views that such a certificate is not user-friendly enough. The Government should explore ways to improve the technology and operation of the certificate with a view to establishing a digital ID for each citizen so that citizens can access, through an e-account, all public services to, for example, check electronic health records, and submit applications for a licence / permit / vacancy, etc.

79. For many smart systems, the primary responsibility for infrastructure development rests with the Government. While borrowing overseas experience in providing policy and resource support for key facilities such as high-speed broadband networks and central data centres, the Government should thoroughly examine whether there is any room for further improvement in other aspects concerning, for instance, more free Wi-Fi hotspots, solar USB charging stations, free USB charging station, intelligent waste tube systems, and intelligent underground pipelines (including fresh water pipelines) monitoring system. Furthermore, the Government should scrutinise the compatibility and interoperability among different systems, and set a common standard in data interchange format to promote data linkage, integration and application in public and private sectors in a bid to go a step further in big data development.

80. Quite a number of overseas smart cities are striving to develop a geographic information system (GIS) as a common platform to connect and integrate the systems of various government departments and those of public and private sectors so as to provide consolidated geographic information. With the benefit of the technologies of ultra-high-speed network, big data, cloud storage and remote sensing, such a platform can perform in-depth analysis to provide the governments and citizens with more comprehensive and up-to-date information about the cities concerned, and enable the governments to take the right measures in enhancing city functions and providing public services that are friendly to both the public and the business sector. In this connection, the Lands Department has deployed a lot of manpower and resources to the development of a Geospatial Information Hub for Hong Kong over the years. It is also taking forward the development of 3D Spatial Data Model ; and building on this foundation, Hong Kong is expected to achieve comprehensive upgrading of its GIS to provide a reliable database for smart city development. Practical examples include providing visitors to Hong Kong with an easy access to information of their interest, such as hotel, transport and weather information, advice to visitors and information about individual tourist spots.

Smart Environment

81. Hong Kong has made progress in varying degrees in three major areas of smart environment, namely sustainable urban planning, resource management for sustainable use of resources, and construction and management of smart buildings. Apart from policy support, the Government has promulgated the Building Energy Efficiency Ordinance, the Energy Efficiency (Labelling of Products) Ordinance, the Practice Notes on Quality and Sustainable Built Environment, etc. to set out the legal framework and administrative guidelines on environmental and energy efficiency standards for buildings and electrical products. In addition, both the Government and the business sector have put forward various intelligent and environmental guidelines and measures. Yet, there has not been comprehensive integration in this respect. In particular, the work on how to make use of Internet of Things, sensors and big data analytics in municipal planning and management is in need of strengthening. Depending on the experience gained from Kowloon East on the use of smart city facilities, the Government can explore introducing innovative methods and technologies in New Development Areas (NDAs) , with a view to building smart communities with comprehensive functions in the future.

82. The density of buildings in Hong Kong is among the highest in the world. However, there are few smart green buildings. Given their enormous potential of development, such buildings may be taken as a key consideration for the long-term development strategy. State-of-the-art experience of foreign countries includes installation of vacuum tubes for waste disposal, hot-cold energy conversion systems, central food waste treatment systems, solar and wind energy system within a building, sustainable drainage system such as green roofs, rainwater reuse and porous and pervious road surfaces, and electronic tariff collection system for power generation/transmission network. The Government may borrow such experience mentioned above in studying the overall regional development or large-scale housing development for Hong Kong in the future.

Concluding Remarks

83. The aim of smart city development is to create a better and more sustainable living and business environment, which inevitably involves transformation, upgrading and enhancement of various economic operations and life styles for the purpose of meeting the actual needs of citizens and enterprises[121]. In addition to IT development and application as well as the Government's promotion efforts, its success also depends on the participation of community stakeholders including citizens and enterprises. The ICT sector of Hong Kong

[121] Joseph Leung, "What is Smart City?" (Jan 2015) (in Chinese); IBM, "Analyzing the future of cities" (2015).

has a solid technological and manpower foundation, employing tens of thousands of experienced professionals. Related players such as GS1 Hong Kong, Autotoll and Octopus have considerable technological advantages and practical experience. Some Mainland enterprises with research and development centres in Hong Kong possess rich expertise in smart city development[122]. And various sectors have started vigorous discussions on smart city development[123]. Furthermore, thanks to the popular use of Internet in Hong Kong, most citizens know how to go on-line and make mobile communication. With these characteristics, Hong Kong should give full play to its comparative advantages as a knowledge-based society, and encourage openness and innovation among its citizens and enterprises so that a sustainable smart city ecosystem can be established.

84. The Government should seek to cooperate with civic organisations and the business sector to integrate various smart city functions and services of the public and private sectors in order to achieve optimal outcomes. In this connection, the Government should determine the respective roles of the private sector and itself in smart city development. To complement the efforts of each other, the Government should focus on promoting the overall smart city development and laying down relevant definitions and standards for all key areas, whereas specific measures and services can be taken up by private businesses and civic organisations.

85. From the concepts of "sustainable city" in the 1980s and "low carbon city" in the 1990s and the 2000s to the notion of "smart city" in this decade, the focus of modern urban development has been continually evolving. With good governance and an internationalised environment, Hong Kong has been taking the lead in municipal planning and development and possesses advantages in terms of technologies and talent. All this has contributed to the remarkable achievements in the development of Hong Kong as a smart city in all six major spheres. To pursue the smart city development in an organised manner, the Government should draw reference to the measures and experience of both the Mainland and foreign cities to formulate Hong Kong's own long-term strategy for smart city development, focus on its comparative advantages and items identified for focal development, set priorities among various initiatives, take forward those measures across the city or in pilot areas having regard to their nature and scale, and then appoint a dedicated authority to organise manpower and other resources for implementation of the initiatives, so that the socio-economic environment and municipal development can be optimised and the branding and status of Hong Kong as Asia's world city be further promoted and strengthened.

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[122] Smart China, "Smart City System Services" (2015) (in Chinese).

[123] The Hong Kong Institute of Surveyors Annual Conference 2014, "Hong Kong: Our Smart City in the Next 30 Years" (13 Sep 2014); French Chamber HK, "Wisecity Hong Kong" (Nov 2014).

86. With globalisation, the global trend of developing smart cities brings both huge new opportunities and severe challenges to Hong Kong and other world cities. Hong Kong must adopt a visionary and international perspective to embrace this latest development opportunity. To take forward smart city development, we have to put in place a high-level steering and coordination framework, strategies for future development and specific measures. In the process, we should absorb overseas experiences as far as practicable and deliberate on ways to apply them flexibly in the context of Hong Kong. Smart city development is a gigantic project requiring substantial resources. Apart from the Government's leading role, community involvement is also essential.

Central Policy Unit
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Appendix A

Smart City Development Strategy of Barcelona[124]

The Spanish city of Barcelona is an outstanding performer in smart city development in the European Union (EU), especially in terms of low-carbon technology application. Back in 2000, Barcelona already implemented key measures to develop a low-carbon green environment, promoting wider use of solar energy and electric vehicles. In recent years, efforts have been extended to other aspects of developing a smart city. To tie in with EU's Europe 2020 Strategy, which aims at "smart, sustainable, inclusive growth", and to leverage Barcelona's advantage as a unique Mediterranean coastal city with picturesque scenery and historical architecture, the Smart Barcelona project goes for integrated town planning and extensive use of information and green technology, with a view to improving the community and people's living, ultimately creating a productive, people-oriented, highly connected, fast moving and zero-emission metropolitan. Goals include the following:

- Interconnectedness：To extend the network of optic fibre and free public Wi-Fi hotspots to cover the entire city, providing citizens with instant Internet access via computers and mobile devices for the use of various smart services. In addition, a ultra-high-speed network will enhance data transmission, laying grounds for the big data and cloud computing required for the Internet of Things.

- Sensing：To have regard to the significance of the impact of the Internet of Things on smart city development and make use of wide covering wireless sensing installations and routers to transmit data to various systems for consolidation and analysis, allowing timely monitoring and adjustment of city functions and services.

- Openness：To promote information sharing among departments and systems within the Government and to open up government information for use by the public and

[124] This part is consolidated with reference to a number of publications and literature, including: City Climate Leadership Awards, "Barcelona: Barcelona Smart City" (2014); Smart Tianjin, "Typical Examples of Foreign Smart City" (13 Nov 2014) (in Chinese); Microsoft, "Barcelona Shaping a City of the Future" (11 Aug 2013) (in Chinese); Wang Guangbin and Cui Qinghong, "Cases Study of European Smarter Cities" (23 Mar 2013) (in Chinese); Barcelona Hong Kong, "Hong Kong Barcelona Urban Exchange: A Dual Approach to Waterfront Regeneration" (2013); UK-China Smart Cities, "Barcelona 2014"; D1Net, "Case Study of the Smart City of Barcelona" (9 Apr 2015) (in Chinese); Smart Eco City, "Barcelona 22@ Green District, Spain" (21 Oct 2014); Barcelona City Council, "BCN Smart City" (2015); Justine Ancheta, "Ten Reasons Why Barcelona is a Smart City" (26 Feb 2014); City Protocol, "Orthogonal Bus Network in Barcelona" (2015); Ajuntament de Barcelona, "Barcelona Smart City" (15 Oct 2012); Ajuntament de Barcelona, "Barcelona Urban Habitat" (2012).

enterprises, facilitating research and development efforts for delivery of various smart services, thus enhancing overall efficiency of city operation.

- Green：To promote a low-carbon green environment by reducing carbon dioxide emission and implementing a new plan of green city operation which embraces the use of renewable energy, transport management and green building.

- Service：To enhance the citizens' quality of life by rolling out smart services in such forms as smart lighting, smart grid, zero emissions mobility, smart parking, smart transport etc., which will improve people's livelihood and in the long run help save public resources.

- Innovation：To focus on the application of new technology in city operation and people's daily life, launching measures to encourage research efforts and actual practices, promoting technology innovation, energy saving and environmental friendliness, and transformation of old urban areas.

2. The overall strategy of Smart Barcelona, drawn up by the City Council, is spearheaded by one of the vice-mayors of the city. A Project Management Committee is tasked with monitoring the implementation of relevant programmes while a Project Management Office takes up the detailed planning, co-ordination and implementation duties. Importance is attached to integrated planning and top-down design, with the Government motivating the development of the Internet of Things in a focused approach, tapping technology and resources of the community and enterprises through various forms of public-private partnership to take forward specific programmes, gradually launching a series of smart city functions and services based on the Internet of Things. These include Smart Lighting which refers to a system of remote-control LED street lighting; Smart Energy which encompasses smart grids and smart buildings; Smart Water which adopts the technology of remote-sensing irrigation for urban green belts; District Heating and Cooling for hot water supply and air-conditioning for buildings; Smart Transport which makes use of orthogonal bus network to enhance trip schedule efficiency; Zero Emissions Mobility which is achieved through the combined use of electric vehicles, charging stations network, smart fleet management and vehicle hiring; and Open Government which advocates information sharing and transparency and public engagement. The above measures, implemented in a planned and coherent manner, are closely inter-related and meant to comprehensively enhance the functions and services of the city.

3. Specific measures under the development strategy of Smart Barcelona are as follows:

I. Public and Social Services

Employment of new technology to enhance public and social services with a view to creating a more inclusive and skilled society and improving people's quality of life.

A. Public Services

- To facilitate the public's interaction with the Government by improving and simplifying administrative procedures so that electronic public services are accessible to people in a quicker and more flexible way.

- eAdministration: This includes promoting digital and paperless internal operation of the Government, implementing digitised file storage, upgrading system software and hardware, and stepping up system integration for higher efficiency.

- Citizen Help and Information Virtual Office: This consists of a virtual service booth in the Citizen Help and Information Office. With the provision of a video-conference screen, a printer and a scanner, people can complete government procedures (such as applying for documents and lodging complaints) in comfort and privacy, and seek staff assistance through the video-conference facility.

- Services and Procedures Portal: It allows the public to complete government procedures online in a more convenient, flexible and personalised manner. The launch of electronic public services has also provided an opportunity for reviewing, redesigning, simplifying and automating some of the administrative procedures.

B. Health and Social Services

Employment of smart technology and services to enable the Government to stay alert to the needs of the underprivileged and provide them with more effective support.

- Telecare: This provides 24-hour free emergency support services all year round to the elderly, the disabled and others in need. A communication device is installed in the users' home, which allows them to ask the call centre for help at the simple press of a button. The centre has a team of professionals who, after assessing the situation, will give instructions to the

users and take appropriate actions, including locating the users' guardians and sending emergency services teams to the users' home to provide assistance.

- Radars Project: It is a neighbourhood support measure targeting singleton as well as cohabiting elderly people not residing in elderly homes. Volunteers from local non-government organisations disseminate information about the programme through door-to-door visits, inviting the elderly to join. Supported by a Telephone Monitoring Platform, the volunteers contact the participants regularly, asking after them and keeping them informed of local activities and services. The Government also engages the local community, including local residents, retailers and social organisations, in making reports to the local Social Services Centre for follow-up when anomalies are noticed in the daily routine and behaviour of the elderly.

- Vincles Digital Platform: It is a social support network developed for the elderly with the joint efforts of their family members and friends as well as health care personnel and social workers. For example, if the elderly people need to stay alone at home when family members are away on a trip, they can receive messages and images of their family members at any time through a mobile device. Upon receiving prompting messages, relatives and friends living in the vicinity will visit them, giving them a feeling of affection. Health care personnel and social workers will also provide services to the elderly according to established procedures or specific instructions of their family members so that they can keep in touch with the community and stay worry free.

- Social Inclusion Apps: This allows people to check the whereabouts of their young children in all-round conditions through the use of such technology as mobile applications, mobile devices and global positioning systems.

C. Education and Culture

Use of new technology in the process of education to facilitate learning and offer opportunities for everyone to acquire knowledge and share information, with a view to creating a socially inclusive and collaborative community.

- mSchools: This programme allows secondary students to make use of mobile technology in classroom learning, with relevant theory and application knowledge integrated into the curricula. Specific measures include introducing mobile application design as a school subject; offering the Mobile

Learning Awards to encourage innovative ideas from students and teachers on the use of mobile technology; launching the Mobile History Map project for students to plan on points of interest (historical, cultural etc.) and field trip routes in the vicinity of their schools; arranging students to visit research and development institutes and enterprises specialising in mobile technology so as to enhance their understanding of this field and arouse their interest in learning the relevant knowledge.

- Smart Allotment: This programme is introduced for students with special educational needs. With the aid of a computer programme and sensors installed at the allotment, the students can measure the light intensity, temperature and humidity at the allotment and then trigger the appropriate irrigation. Through an e-scarecrow fitted with a video camera, the students can continue to monitor the growth of the crops via mobile devices outside school hours.

- Infantium API: Neuroscience is applied in education through various means such as publications, videos and interactive programmes, having regard to infants' cognitive ability, their learning preferences and incentives, so as to meet individual learning needs and maximise learning effectiveness.

- The City I want to Live In: A thematic social networking platform is created for young people to share their views on city development and put forward their suggestions.

- Biblioteques de Barcelona: This makes use of the city's library network and various professional library services and multimedia resources to provide the public with interactive and shared spaces as well as more personalised services, catering to their searching, reading and learning needs.

- Culture Notebook: This is a cultural and recreational activities programme for first-year secondary students to join or view events organised by participating bodies, with a view to enhancing their understanding of and interest in the local culture.

D. mobileID

Encouraging people to access various city services through mobile devices, thus making Barcelona a benchmark in the use of mobile technology.

- Digital Identity: Citizens are each allotted a digital identity, with which they can enjoy various public services, submit applications and complete government procedures through specific mobile applications.

II. Environment

Application of innovative technology and solutions in environmental management to enhance the efficiency and sustainability in waste disposal, recycling, water conservation, energy conservation, emission reduction, energy recovery, etc.

A. Smart Rubbish Collection

Implementation of smart waste disposal and management measures to save resources and reduce the adverse impact on the environment while creating job opportunities.

- Organic Waste Recycling: Citizens are encouraged to participate in careful separation and recycling of organic waste, and made aware that doing so will benefit the city and themselves. Studies show that recycling organic waste can reduce greenhouse emissions by 65%. One kilogram (kg) of recycled organic waste can generate 0.75 kWh of electricity, which is enough to power an electric vehicle for a 5-kilometre journey, and 100 kg of organic waste can be used to produce 20 to 30 kg of high-quality compost.

- Green Points: These are household waste and recycling centres at various locations in the city for the collection of different types of refuse. Electric vehicles serving as mobile household waste collection points also visit communities, schools and designated venues regularly or upon request to collect waste for recycling.

B. Smart Water

Employment of a series of smart measures to manage the hydrological resources of the city, one of them being rational consumption of groundwater by public services.

- Telemanaging Irrigation: A telemanaged system is used to irrigate the green spaces of the city. Sensors are in place to monitor soil moisture and control spray volume and time. Irrigation is suspended under inclement weather so as to save water.

- Telecontrol of Ornamental Fountains: Information on fountains managed by different bodies are consolidated for remotely controlling the operation times and the amount of water used by each fountain so as to enhance water and energy efficiency.

C. Energy Conservation and Self-sufficiency

Implementation of energy saving measures and development of an energy self-sufficiency plan for the generation of a portion of the energy needed by the city.

- Renewable Energy: Use of renewable energy such as solar and wind power for electricity generation, thus reducing reliance on fossil fuel.

- Smart Grid: Use of digital and telemetric technology for linking up the power stations, power grids and electricity users, and for all-round surveillance and control of power supply to ensure effective use of the existing electricity infrastructure. Specific measures include: use of sensors to locate and isolate the faulty site in power outage incidents to facilitate immediate restoration of power supply to other locations; provision of smart meters for users to check their consumption volume and time pattern so as to achieve more efficient use of electricity; a smart grid integrating various renewable energy power plants, energy storage and electric vehicle charging facilities, etc. for significant reduction of carbon dioxide emission.

- Hot and Cold Network: Central air-conditioning systems are established at specific areas to cool or warm the buildings in the locality. Units in these buildings are fitted with sensors that adjust the indoor temperature as appropriate.

- Smart Lighting: Use of the Internet of Things and sensor technology for better management and higher energy efficiency of the lighting for streets, pedestrian facilities, government buildings, parks and other public spaces.

D. Urban Transformation

To re-model the main streets, plazas and urban areas according to the principles of viability, sustainability, efficiency and effectiveness.

- Urban Spaces with Territorial and Social Involvement (BUITS) Plan: Citizens are invited to submit conceptual proposals regarding the use of

vacant sites in the city. An assessment committee will pick the winning proposal. The site will be handed over to non-governmental organisations for their provisional management and use for a period of 3 years.

- Superblocks: Five blocks in the city are chosen for integrated planning for a more liveable environment. Specific measures include: consolidation of bus route networks, cycling tracks and footways to reduce carbon emission and noise levels; addition and revitalisation of sitting-out areas; more vegetation for a greener environment; provision of suitable spaces and facilities to encourage activities that favour community participation and social inclusion; promotion of resources conservation, renewable energy generation and better use of water resources; and beefing up the element of public engagement in the process of drawing up various community projects.

- 22@Barcelona: A block measuring some 2 square kilometres is dedicated to smart city-related research and practice, providing a testing ground for urban refurbishment. A number of smart technology facilities are put in place in the area, including demonstration and promotion of free charging facilities for electric vehicles; refuse collection points fitted with smart sensors; car parks fitted with smart sensors and parking management system; and smart water management and conservation schemes.

- Waterfront Regeneration: Leveraging Barcelona's advantage as a Mediterranean coastal city with picturesque scenery, the old urban area at the waterfront is renewed. By optimal restoration of buildings with historical values and redesigning and reconstruction of local facilities, including barrier-free accesses, cultural and recreational establishments etc., the area is turned into a green and low-carbon land-water interface emerging as a landmark of Barcelona.

III. Mobility

Realisation of a safe, sustainable, fair and efficient mobility mode to minimise the impact on the environment, improve the quality of life and ensure the smooth operation of the public transport systems.

A. Multi-Mode Transport

Development of an electric mobility system and multi-mode transport to achieve zero greenhouse gas emission.

- Logistics for Electric Vehicle Implementation (LIVE): Promotion of use of electric vehicles and electric motorbikes as the standard mode of public and private transport. Specific measures include: setting up free charging stations in different locations across the city; increasing the number of parking spaces with charging facilities; introducing electric buses and taxis; and enhancing the electric vehicle hiring system to encourage car sharing.

- Bicing: Establishing 420 Bicing stations in the city, providing 6 000 bicycles for rent by members of the public who have registered online. Using a mobile application, they can access information such as the location of the Bicing stations and bicycle availability as well as rental record and payment status.

- Orthogonal Bus Network: Re-organising the bus routes into a scheme of vertical, horizontal and diagonal lines according to the configuration of streets in the city. The purpose is to straighten the bus routes in order to shorten the trip time and avoid the concentration of bus routes along certain streets. In addition, interchange points are set up in the intersections of routes for passengers to change lines for their destinations. Supported by the smart fleet management system and smart real-time bus stop announcement system, the operation of the entire bus network becomes more efficient, alleviating road traffic congestion.

- Micro-Platforms for Goods Delivery: Use of electric tricycles with 180-kg loading capacity for goods delivery in the Old Town. Goods are first delivered from various areas of the city to designated unloading points by conventional lorries before they are forwarded to clients in the Old Town by electric tricycles, thus minimising the impact of conventional lorries on the streets in the Old Town.

- School Pathways: This is a programme involving school children, parents, schools, community organisations and government departments such as the police. Its purpose is to encourage school children to walk to school along footpaths and pedestrian crossing facilities, thus raising their awareness of road safety. It is also meant to deepen their knowledge of their own community and to promote a healthy life style.

B. Smart Traffic Management

Development of an electric mobility system and multi-mode transport to achieve zero greenhouse gas emission.

- Smart Traffic Lights: When a pedestrian light turns green, a specific sound signal is activated to prompt the blind people to cross the road. When an emergency service vehicle passes by, the traffic light system automatically detects it and synchronises the traffic lights along its route so that they remain green until the vehicle has got through.

- Smart Parking: A single platform is set up to consolidate information of parking spaces within the same district so that drivers can check the number and locations of available parking spaces in the vicinity through roadside message screens or their own mobile devices.

- ZonaBus: Designated carparks and pick-up/drop-off areas for coaches are set up near major tourist attractions in the city. The purpose is to alleviate the pressure on roads and parking facilities. A system is also in place to handle parking permits and pre-paid parking cards.

C. Smart Traffic Apps

Implementation of the Barcelona in Your Pocket programme for people to improve their commuting efficiency with the aid of mobile applications.

- App&Town: This is a free mobile application about public transport, providing people with a variety of information on major public transport systems (bus, metro, train, tram, etc.) in the city, such as real-time trip schedule, locations of stops nearby and trip schedule alert, suggested route choices, etc.

- ApparkB: This is a mobile application for public parking payment. Drivers can tap their mobile device on the readers fitted alongside the public parking spaces for payment after pulling in. The system automatically calculates the parking fee according to the type of parking and deducts the appropriate amount from the designated account of the driver.

IV. Research and Innovation

Fostering a creative environment, promoting research and innovation, facilitating employment and investment, attracting professionals to Barcelona and providing assistance to enterprises and business starters.

A. Smart Innovation

Promotion of innovation by keeping in contact with enterprises, business starters, research institutes and civic bodies and encouraging transversal projects covering various smart areas.

- Barcelona Growth: Holding the Barcelona Growth Round Table as a meeting point and place for dialogues between the local authority and the enterprises and civic bodies for proposing action agenda to boost the economy of the city and create new jobs; establishing the Business Support Office (BSO) to offer general support and mediation services; the Barcelona Activa programme aiming to provide support for international enterprises that wish to establish their presence in Barcelona, helping them to recruit staff, seek financing means and deal with municipal procedures.

- Smart City Campus and Spark Lab: These involve the conversion of an old factory into a zero-emission smart building and the establishment of a laboratory focusing on the technology of innovative city. The programmes aim to promote synergies by bringing together players in the industry, academia and research sectors for cooperation in developing smart city technology and solutions.

- Barcelona Institute of Technology for the Habitat (BITH): Setting up a fund to support the operation of BITH, and promote collaboration among BITH, local and multi-national enterprises and research institutes in developing innovative city functions and services.

- Industry Ring: The Trusted Internet Connection (TIC) is established to allow recognised bodies from the Government, industry, academia and research sectors to communicate with each other, link up their systems and share resources in a relatively safe network. With the aid of such shared facilities as supercomputer and ultra-high-speed network, the achievements made by these bodies in research, development and innovation (I+D+I) can be fully integrated and utilised.

B. Information Support

Collecting information from various systems and sources for consolidation and dissemination to the public and enterprises for exploring and developing new products and services.

- BCN Cloud: This is an integrated platform to facilitate smart city development. It consolidates, analyses and stores data gathered by a sensor network covering the whole city, and disseminates them for the use by various systems and organisations.

- City OS: This is a platform to acquire and process information on the running of the city. With smart systems helping it to analyse and relate events, it can produce simulations and anticipate any problem that might affect the city. Assistance is then provided for the Government in conceiving counter-measures.

- Open Data: Various public information is provided to citizens and enterprises through a single platform in standardised and digitised formats to help them carry out studies and analyses, and develop new products and services. In parallel, Barcelona is pursuing with municipalities of the Catalonia Autonomous Community the standardisation of digital format of open data so that they can be shared and consolidated for the provision of value-added services.

- Shared Innovation Centres: Establishing multi-disciplinary and multi-functional cooperation frameworks to encourage collaboration among research units with different specialties so as to promote transformation of innovative ideas of information and communication technology into real projects.

- Sentilo: This is a shareware with open-source code, providing the code of BCN Cloud to other cities interested in developing a similar platform, facilitating their value-added re-use of the code so as to jointly promote the building of a smart city.

- Multi-council Open Data: Municipalities at different levels in the Catalonia Autonomous Community to open up their data in a standardised digital format for sharing and consolidation for the delivery of value-added services.

V. Communication

Establishment of an efficient, stable, wide covering and multi-mode communication network to facilitate all-round information exchange.

- New Telecommunication Network: Integration of the existing communication grids to promote the application of mobile devices and smart city functions and services.

- Barcelona WiFi: Provision of free Wi-Fi hotspots in 461 municipal facilities and street sites across the city, thereby creating the largest free-access public Wi-Fi network in Spain and one of the most important in Europe. In the long term, Barcelona aims to establish another 1 520 hotspots and expand the coverage to include parks, metro stations and buses to enable public access to various smart services anytime, anywhere.

- BCN Contactless: It consists of hundreds of access points distributed throughout the city. Using mobile devices with Near Field Communication (NFC) or Quick Response (QR) code functions, members of the public can access a specific mobile website which provides information of the facilities and services presently available at the user's current locations. This service operates 24 hours a day all year round to offer instant support to the public.

- Apps4BCN Portal: It provides mobile applications relating to various information and services of the city for Barcelona residents and tourists alike. Regular testing is conducted by experts to ensure that the applications are working smoothly and up-to-date.

- Services on Your Mobile: This is a dedicated website offering mobile applications about the public services in Barcelona and SMS alert service reporting the latest news of the city.

- Smartquesina: This is an interactive bus stop that provides various smart facilities, including free Wi-Fi connection; a municipal mobile applications downloading point via BCN Contactless; a touch screen displaying bus information, real-time bus schedule and information on other related city services (such as availability of public bicycles and tourist attractions); and USB ports for charging mobile devices.

VI. Governance and collaboration with citizens

Taking forward the Barcelona Open Government initiative, which aims at promoting a new relationship based on transparency, participation and collaboration between the City Council and citizens.

- Governobert: A website providing citizens with an electronic channel for suggesting ideas and proposals about public affairs. It also publishes various open data in standardised format for citizens' use.

- Coinnovació: A joint innovation platform for citizens to put forward proposals on city governance for public discussion. Any proposal securing a certain number of supporting votes will be further studied by the City Council and, if found feasible, be implemented.

- Barcelona Open Government App and Partcipació website: Allowing citizens to express their views anywhere, anytime in respect of policy consultations or other public affairs by following standard procedures through an interface with a clear-cut design and a full range of functions.

- Smart Citizen: Making use of the Internet, software and hardware systems and geolocation technology to allow citizens to take part in measuring greenhouse gas emissions, temperature, light intensity, noise and humidity levels, and other environmental indicators in their respective community, using low-cost sensing devices. The measurements are transmitted via the network to a central system for consolidation and analysis to help improve environment quality.

- Fabrication Laboratories: Adopting new learning and organising modes such as network-based co-creation, collaboration, crowdsourcing, crowdfunding, etc., innovation programmes are conducted at the school, home and community levels to stimulate citizens' interest in science and technology, inspiring them to learn and take part in digital fabrication and other technology that can be applied to their daily life.

- More Sustainable Barcelona Map: This is an interactive virtual map introducing the points of interest of the city, explaining their environmental and social values. For citizens to participate in the initiative, a special application is available for them to share their ideas and experiences, which

will be consolidated and sorted out for use as consultation materials on conservation measures.

- Barcelona's Agenda 21: Through extensive consultation with different stakeholders, including the commercial sector, civic and professional bodies, trade unions, universities, primary and secondary schools, community organisations, etc., the programme engages the public in drawing up the pledges and roadmap regarding Barcelona's sustainable development.

- Citizens' Postbox: An alternative channel for citizens to report incidents occurring in the city via mobile applications for the relevant departments to follow up and act in response.

- Public Works Information Service: It provides a central platform to gather, store and publish information relating to various public work programmes in the city, assisting stakeholders in monitoring the work progress, and facilitating their follow-up and co-ordination efforts.

- Geographic Integration System: Various geographic information of the city is fully integrated to form a reliable database for developing smart city functions and services. Mobile applications are also available for citizens and tourists to access the information.

Appendix B

Smart City Development Strategy of Seoul[125]

Thanks to Korea's vibrant information and communication technology (ICT) industry, Seoul has established itself as a global leader in the application of ICT in city functions and services. In 2011, the Korean Government announced the launch of the Smart Seoul 2015 programme. The programme is built on the previous u-Seoul[126] project, with the focus shifted from application of ICT in individual municipal facilities to development of a new generation of ICT infrastructure and comprehensive framework of municipal management. The aims are to enhance the sustainable development and competitiveness of Seoul and to promote a more blessed life among its citizens. Comparing with u-Seoul, which aimed for better municipal services, the people-oriented Smart Seoul strives to optimise the use of smart technologies in city functions and day-to-day services, and to foster a collaborative relationship between the city and citizens. The Smart Seoul strategy puts forward targeted measures on municipal planning as well as hard and soft infrastructure, such as communication network, facilities in streets and buildings, traffic and energy surveillance systems, etc. A Vice-Mayor, who is tasked to co-ordinate the formulation and implementation of the Smart Seoul strategy, also serves concurrently as the Chief Information Officer of the Seoul Metropolitan Government (SMG), supported by a 200-strong team of an Information Centre. In parallel, the SMG collaborates with leading ICT enterprises such as Samsung, LG and Hyundai, with the former taking charge of the overall planning and the latter responsible for the research and development as well as implementation of various smart functions and services. In general, the Smart Seoul strategy is launched in three phases:

- The First Phase, or the individual service level, applies ICT to individual areas of traffic, safety/security, environment and culture, etc., for example, putting in place a

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[125] This part is consolidated with reference to a number of publications and literature, including: Seoul Metropolitan Government, "Smart Seoul 2015: Basic Strategic Plan for Informatization of Seoul Metropolitan City" (2011); "Smart Cities – Seoul: a case study" (ITU-T Technology Watch Report, February 2013); Jin-Hyeok Yang, "Smart City Smart Strategy" (KC Smart Service, KT Corporation, 21 Jun 2012); Xu Hao-long, He Zhao-xi, Zhang Yu-li, "A Preliminary Study on the Development Strategies and Design Modes for the New Generation of Asian Intelligent Cities" (Journal of Interior and Architectural Design, Jun 2011) (in Chinese); "Typical Examples of Foreign Smart Cities" (smartcity.enorth.com.cn, 13 Nov 2014) (in Chinese); UCLG ASPAC TAIPEI 2014, "An Adaptive City: Embedding Design in City Governance" (Sep 2014) (in Chinese); "Use of Data in Decision-making and Dispute Resolution: Interview with Dr. Gunso Kim, Chief Information Officer and Assistant Mayor of Seoul Metropolitan Government" (Business Next, 17 Jul 2014) (in Chinese); "Big Data + Mobile Platform: Unveiling Key of Success of "Mobile Seoul" by Assistant Mayor of Seoul, Dr. Gunso Kim" (Business Next, 27 Jun 2014) (in Chinese).

[126] "U" is the short form of "ubiquitous", which means very common.

CCTV network covering public spaces across the city for maintaining public safety, and using a real-time bus schedule information system.

- The Second Phase, or the vertical service level, utilises smart technologies to integrate relevant functions and services within the major sectors of the city to enable the provision of more advanced services. Taking the transportation sector as an example, service frequencies of major transport systems, real-time road traffic conditions, information on traffic lights, driving directions, emergencies, etc. are consolidated and made available on a common platform for ready access by the public. The platform may also make suggestions on travelling routes and allows people to report on-the-spot traffic conditions or give relevant advice.

- The Third Phase, or the horizontal service level, establishes a comprehensive smart city ecosystem through seamless integration of the functions and services in different areas of the city, such as the aforesaid traffic information platform, electronic transaction system, energy saving and emission reduction for vehicles, etc., in a bid to enable the city to operate more efficiently and make life convenient for the citizens.

2. The Smart Seoul strategy roughly covers the following three areas:

- Smart Infrastructure: To develop a new generation of ICT infrastructure and, through the publication of city administrative information and the creation of open-source app-development models, encourage the community to research, develop and roll out various smart services.

- Smart Governance: To put in place an integrated city-management framework and identify the city functions to be included therein. The existing sub-systems and meta-systems concerned are integrated under the framework with their respective technological and data formats standardised for compatible operation.

- Smart Functions and Services: To develop various people-oriented smart functions and services by the government, the community or even public-private partnership to enhance the efficiency of municipal operation and convenience of people's daily life.

3. Specific initiatives of the Smart Seoul strategy are as follows:

I. Smart Infrastructure

A. u-Seoul Net

- The 192-kilometre u-Seoul Net, an optical communication network dedicated to smart services, is established to enable government departments to handle huge amounts of data generated from a variety of smart devices and provide the citizens with free Wi-Fi services and full access to public services websites. With u-Seoul Net, the citizens can have access to various smart services anytime, anywhere.

- u-Seoul Net is divided into three sub-networks: (1) a public Wi-Fi network covering all public areas of the city to offer free Wi-Fi services; (2) a CCTV network connecting 30 000 CCTV installations at public spaces across the city to facilitate real-time monitoring and consolidation of video data received; and (3) a u-service network to make more public information and services accessible by the citizens via smartphones and tablets by allowing direct public access to the websites of all departments of the SMG without utilising private Internet services.

- Apart from the provision of services, the government also plans to extend, in the long run, the application of u-Seoul Net in specific areas like children's safety and vehicle-emissions control systems to enhance their functions.

B. Seoul Data Mart

- The SMG intends to release all administrative information that can be made public for access by the citizens. Having made reference to the "Government 2.0" strategies adopted by European countries and the United States, Seoul's "open governance 2.0" strategy aims at enhancing the transparency of municipal administration and promoting communication between the government and the citizens. On the SMG's website, there is an Information Open Square that makes available for public inspection various administrative documents, including information on the work in progress, to facilitate citizens and enterprises to explore new job and business opportunities.

- As a key building block to the Information Open Square, Seoul Data Mart (also known as "Seoul Open Data Square") divides the information that can be made public into 10 main categories: general administrative work; welfare, culture and tourism; city management; environment; safety/security; education; health; industry; economy; and transportation. Seoul Data Mart comprises 33 public information systems and 880 databases, presenting different combinations of data on, for

example, child care services, public transportation routes, utilisation of parking spaces, regional weather and eateries, accompanied by such information as maps, internet links, charts and statistics. More public information and databases will be added to the Data Mart in the long run. Application Programming Interface (API) is used by the Data Mart for easier data access and exploitation by citizens and enterprises.

C. 3-Dimensional Spatial Information

- The 3-dimensional spatial information system is an essential component of Smart Seoul, which facilitates the provision of comprehensive information on spaces in the city (e.g. streets, buildings and underground ducts) and renders support to various smart services, such as streetscape guide, guided touring of tourist attractions and town planning simulation. The system also helps environmental monitoring and disaster prevention and control. For instance, the SMG makes use of this system to simulate flooding scenarios so as to anticipate the levels of impacts on different areas for the formulation of preventive and contingency mechanisms.

D. Smart Devices for All and Smart Users

- A key pillar of Smart Seoul is to increase public access to smart devices and educate new users on their operation. As the ICT market moves rapidly with the continual roll out of new products, the SMG encourages citizens, by tax relief, to give away smart devices such as smartphones and tablets no longer in use to the low-income families and other needy people (e.g. beneficiaries of Korea's National Basic Living Security).

- Besides providing devices to those in need, the SMG also promotes the use of various smart devices among citizens of different social strata and age groups, who are trained to use various smart services and become "smart users".

- 120 Dasan Call Centre consolidates the call centres of 25 district offices of Seoul and offers a mobile app for public use. People with hearing impairments are then able to contact the Call Centres through a video-call system for enquiries or for services needed. In parallel, government-funded smart ICT classes are operated through private education institutions for immigrants, low-income individuals and the elderly to learn the basics for the use of smart city services.

II. Smart Governance

A. Smart Work Centre

- The SMG has established 10 smart work centres throughout the city to allow civil servants to work from distance at dedicated locations near their homes instead of working in their routine offices when circumstances so require. Each centre is equipped with personal workstations, various kinds of shareware apps and teleconference systems to ensure that no hindrance will be caused to the staff even though they are working away from their routine offices. Facilities of the centres are open for use, by reservation, by all staff of the SMG when necessary. The number of workstations amounts to about 30% of the total staff strength. According to an internal survey of the SMG, over 90% of its staff have indicated interest in working at such work centres near their homes.

B. Community Mapping

- Community Mapping serves to further Seoul's open governance. With the use of geographic information systems and global positioning system (GPS) mobile apps, citizens can raise their concerns on municipal issues. For example, physically disabled people can mark streets or shopping malls without wheelchair access on a map shared on the SMG's FixMyStreet online platform for follow-up actions by and responses from the departments concerned. The SMG plans to extend the coverage of Community Mapping in the long run to seek public comment on a wider range of municipal issues in order to establish closer collaboration between the government and the community.

C. Public Applications

- The Public Application Contest was orgainsed by the SMG with a view to promoting the development of public apps. Citizens and enterprises were invited to develop apps on electronic public services, and the winning entries were made available at the Seoul's App Market for free download by the public.

- The SMG has also developed 37 different public apps either by itself or in collaboration with enterprises.

- The Public Application Management System monitors the utilisation of various public apps; figures out if there is any overlapping of functions among the apps; and ensures timely updating of their contents and functions. Among the apps, the

Seoul Bus'app, which gives instant bus information, and iTour, a travel guide app, are successful examples.

D. Mobile Seoul (m.Seoul)

- Mobile Seoul (m.Seoul) makes use of mobile web and mobile app technologies to offer 62 mobile services to Seoul's citizens. The m.Seoul supports location-based services (LBS) pinpointing nearby government offices, restrooms, hospitals, supermarkets, bus stations, etc. on smartphones and tablets. Other services include live real-estate listings, job-search updates and notifications of free cultural events. It also enables citizens to make suggestions on improving the city environment; participate in online votes on specific public issues; and exchange without charge city information over social networking platforms. Moreover, the service of "Staying Safe in Seoul" alerts citizens of emergencies brought about by heavy rain, snow, typhoons or fires.

E. Content Management System (CMS)-based Homepage

- With the state-of-the-art CMS technology, the SMG revamped its website, consolidating over 70 specialised webpages previously maintained by different government departments, to offer the public a single platform to access various electronic public services. Members of the public can set up personalised interfaces and search modes such that the website can provide information specific to their needs.

F. Online Reservation System for Public Services

- The Online Reservation System for Public Services serves as an integrated one-stop platform for the public to reserve educational, sports and recreational facilities; enrol in cultural and tourism activities; register for medical services; and order government publications, etc. The project will cover over 30 000 public services delivered by the SMG and its affiliates.

III. Smart Functions and Services

A. Smart Metering Project

- The Smart Metering Project provides households, offices and factories with instant reports of their electricity, water and natural gas consumption. The reports also give information on the energy-consumption patterns and suggestions on energy

reduction. The long-term target of the project is to reduce the city's total energy consumption by 10%. Installation of smart meters in 1 000 households was piloted in the first stage of the project and will be extended to other types of users in phases.

B. u-Health Care

- With u-Health Care, the elderly, the chronically-ill and the underprivileged are provided with distant health monitoring and support services so that their health conditions can be constantly monitored without the need for frequent visits to hospitals or clinics, and they can obtain health instructions from health care professionals in non-emergency situations.

C. u-Seoul Safety Service

- The u-Seoul Safety Service is launched for children, the elderly, the disabled and those suffering from Alzheimer's disease. Under the Service, a smart device with GPS functions has been developed by employing the state-of-the-art Location Based Services (LBS) and CCTV technologies. When a person carrying the device leaves a designated area or pushes the emergency button, an emergency alert will be sent to his/her guardians, police, fire services department and CCTV Control Centres. Users of the u-Seoul Safety Service are required to register with the designated mobile services providers. Government assistance is given to the low-income families and other underprivileged groups for use of the Service.

- The u-Children Safety System, developed by making use of the Multi-input Multi-output (MIMO) wireless network technology, is also launched by the SMG. The System provides children safety zones and enables government departments to locate missing children as quickly as possible through real-time CCTV networks and smart devices which the children are carrying.

D. Near Field Communicated (NFC)-based Mobile Payment System

- With the NFC-based Mobile Payment System, which is a product of public-private collaboration, citizens can pay for their purchases at over 22 000 stores simply by touching their mobile devices on the specialised readers for electronic payment. The amounts they paid would be directly debited from their credit cards or bank accounts. Other smart functions of the System include enabling the users to do the following through their mobile devices: using electronic coupons; receiving texts, pictures and videos of products and services by scanning the street or mall posters;

enjoying discounts and tailor-made services (e.g. movie time reminder); and making point-to-point money transfers from one mobile device user to another by entering a PIN number, which marks a breakthrough from the traditional mode of electronic money transaction.

E. Virtual Store

- Virtual Store is a Business-to-Business (B2B) and Business-to Consumer (B2C) mode of electronic transactions using smart devices and online transaction platforms. The service combines traditional and virtual ways of shopping. Members of the public can access product or service information from advertising panels on the street or at transport stations. They can use mobile devices with scanning function to read the bar codes or Quick Response (QR) codes on the advertisements to access detailed information of the products or services, place orders and arrange for shipment. Transactions between enterprises can also be done by using this service which offers a new business mode other than traditional in-person shopping and online shopping.

F. School Newsletter Application

- This mobile app provides a School Board platform, on which primary schools can announce updates on lesson arrangements and other information as well as reminding parents of changes in academic schedules and the items students are required to bring to school.

G. u-Shelter Bus Stop

- u-Shelter bus stops, which incorporate devices such as meteorological sensors, CCTV cameras and remote terminal units, offer citizens a package of smart services including interactive Bus Route Guide, Digital Map, Destination Search, Traffic Broadcasting Station, Weather Forecast and Check Traffic Card Balance.

H. Eunpyeong u-City

- Located in the northwest of Seoul, Eunpyeong provides its 45 000 residents with a range of smart city services under the u-City Project. For example, residents may obtain real-time information of the district through smart devices; intelligent CCTV cameras installed on every street enables automatic surveillance of vehicles and passers-by; persons in need (such as children and the elderly) are provided with intelligent devices so that their guardians may locate them through GPS in a timely

manner; the Complex Street Lamps adopting high-end energy saving technology may also be used for broadcasting and providing wireless network; Media Boards installed in public spaces provide both residents and visitors with useful information such as community digital news and bus schedules; and with the u-Green Service, air and water quality is monitored through the district-wide sensor network with the relevant data transmitted to the aforesaid Media Boards and smart devices at home to inform residents of the latest environmental situation.

- The SMG has set up the u-City Consolidated Operation Centre to oversee the various smart functions and services in the Eunpyeong u-City and collect data for in-depth analysis.

I. Songdo u-City Project

- Being the first in South Korea and the world to adapt the digital city concept in its renovation, Songdo u-City aims at developing a mode of "smart technology, smart living" for city planning and operation. It has an estimated capacity of 65 000 households, totalling a population of 200 000. Under the Project, instant feedback and smart community management can be achieved by connecting and integrating the operation of information systems on such aspects as residences, health care, enterprises and government agencies. All residences, streets and buildings will be equipped with built-in ICT devices which are linked with a variety of intelligent systems, such as intelligent transport systems, intelligent buildings, intelligent family networks and smart card trading systems, offering a range of smart functions and services to the residents.

- The specific initiatives include: smart streets with intelligent lighting adjustments and traffic signs management; e-Park; underground ducts monitoring systems; automatic resource recycling systems; readily retrievable electronic medical record and distant health checking systems; smart meters for monitoring of energy consumption; real-time traffic information systems; and diversified smart traffic modes. Smart card holders can ride the subways, pay parking fees, watch movies, borrow free public bicycles, open house doors using sensor system; as well as chatting visually with neighbours and surfing on the Internet at any time in an intelligent apartment. By optimising the comprehensive city management framework as well as installing and developing its software and hardware, Songdo will become a model of smart city life for the next generation.

Appendix C

Smart City Development Strategy of Singapore[127]

Singapore is among the first to launch smart city development. Like other regions, it has a top-down planning framework for overall co-ordination in terms of strategic positioning, masterplanning and implementation. Even before the smart city concept was proposed, Singapore had been promoting information and communication technologies, or infocomm, for municipal development since the 1990s. Its smart city strategy aims at making Singapore a quality city-state with a well-connected society powered by the growth and use of infocomm in various areas. In 2005, the iN2015[128] masterplan was formulated as a long-term blueprint for smart city development in Singapore. The plan aims to enrich people's lives, enhance Singapore's economic competitiveness and boost the growth of its infocomm industry. Comprehensive development will be promoted in respect of the following three themes:

- Innovation: To develop infocomm talent and an advanced infocomm infrastructure, and support and foster continued innovation in all economic and social spheres in terms of operation, management, products and services. This will allow Singapore's future development to be distinctive from others.

- Integration: To apply infocomm to bridge individuals, communities, sectors, organisations and regions speedily and efficiently. This will enable Singapore to harness resources and capabilities across regions to achieve continuous breakthroughs.

- Internationalisation: To better integrate Singapore's local economy into the global economy by capitalising on its features and positioning as a small city-state, and apply its cutting-edge infocomm technologies to access global resources and open doors for the export of its best ideas, products, services, enterprises and talent.

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[127] This part is consolidated with reference to a number of publications and literature, including: "2014: Building a Smart Nation"; "iN2015 Master Plan; Digital Marketplace For Global Media And Entertainment"; "Drive The Future. Be A Player. Go Infocomm"; "Empowering Learners And Engaging Minds, Through Infocomm"; "Enhancing Service, Enriching Experience, Differentiating Singapore"; "Factsheet: Smart National Platform"; "From Integrating Services To Integrating Government"; "Growing To Go Global"; "Innovation. Integration. Internationalisation."; "Integrating Healthcare, Empowering Patients"; "Leveraging Infocomm To Ensure Singapore's Prospects In the Financial Markets"; "Orchestrating Global Supply Chains, Enabling High Value Manufacturing"; "Realising the iN2015 Vision"; "Smart cities: The Singapore case"; "Smart Nation Vision For Singapore"; and "Totally Connected, Wired And Wireless".

[128] "i" means "intelligent".

2. To achieve the above, the Singapore Government has set out four specific strategic thrusts (see paragraph 5 for details):

(a) to spearhead the transformation of and innovation in the government, society and key economic sectors;

(b) to establish an ultra-high speed, pervasive and trusted infocomm infrastructure;

(c) to develop a globally competitive infocomm industry; and

(d) to develop an infocomm-savvy population and workforce.

3. The Infocomm Development Authority (iDA) established by the Singapore Government takes charge of the overall planning and implementation of the four strategic thrusts and the specific goals and measures. A steering committee known as iN2015 Steering Committee has been set up under the iDA to co-ordinate the implementation and supervision of the iN2015 masterplan. The iN2015 Steering Committee, led by the Chairman of iDA, comprises representatives from government departments (including the Ministry of Information, Communications & The Arts, the Ministry of Finance and the Ministry of Education), tertiary institutions (such as the National University of Singapore), research institutes (such as the Singapore Institute of Management) as well as relevant public and private enterprises (such as Raffles International Ltd and Hewlett-Packard Asia Pacific Pte Ltd). Specialised sub-committees have also been formed under the steering committee in accordance with the 11 designated areas of iN2015, namely financial services, manufacturing and logistics, tourism and retail, digital media and entertainment, healthcare and biomedical sciences, education and learning, government services, social development, infocomm infrastructure, infocomm enterprise development, and infocomm manpower development. Each sub-committee is responsible for the implementation of projects and measures in their respective areas.

4. The iN2015 masterplan is yielding results after ten years of implementation. To date, ultra-high-speed broadband coverage in Singapore has reached 95%. Ninety percent of households are using broadband and almost all households with school-going children own computers. This is complemented by a fast-growing infocomm sector which now employs 150 000 people, including over 13 000 accredited professionals. The foundation for a smart city has been laid in terms of infrastructure, industrial development and manpower. In tandem with the measures being rolled out, Singapore is endeavouring to build the world's first Smart Nation Platform. Enabled by the ultra-high-speed and pervasive infocomm infrastructure already in place, a nationwide sensor network will connect the government, society and economic sectors together, and technologies such as Internet of Things, big data

and cloud computing will be deployed to deliver systematic collection, analysis and sharing of data. These data, which reflect the city operation and the living environment in real time, will provide the government, enterprises and individuals with the necessary information to improve administration, business and life, realising the vision of a smart city.

5. The objectives, specific items and measures of the four strategic thrusts are listed below:

I. To Spearhead the Transformation of and Innovation in the Government, Society and Key Economic Sectors

Infocomm technologies will be employed to spearhead transformation of and innovation in the following eight sectors which have been chosen in the light of the social and economic characteristics of Singapore. This will also contribute to making Singapore a place of choice for residence, work and business.

A. Financial Services

Electronic transactions, asset management, insurance services, corporate financial information exchange, etc. will be promoted to transform Singapore into an innovative hub for financial services. Measures include:

- Developing next-generation electronic transaction models: This measure aims to build a nationwide electronic and mobile transaction infrastructure, review and revise legislation and policies relating to electronic transactions, and collaborate with electronic transaction value-chain players (including network providers, system developers, electronic transaction service providers and retailers) to implement Near Field Communication (NFC). NFC is an innovative electronic transaction solution which uses mobile apps as an integrated interface to process e-payments, shop bonuses and shopping privileges. It provides a unified e-payment platform applicable to over 30 000 retail outlets across the country to facilitate transactions and enhance efficiency.

- i-Wealth Management: This measure aims to implement paperless fund management by developing a common standard for financial messaging and streamlining fund management processing. It also seeks to provide clients with a 360-degree holistic view and analysis of their assets through innovative consolidation and management of their financial information.

- Developing a unified electronic insurance trading platform: This measure aims to promote paperless insurance by supporting the e-commerce models of B2B (business-to-business) and B2C (business-to-consumer) for integration between value-chain players (including consumers, financial advisors, insurers and brokers) through the adoption of a common platform and common standards.

- Implementing Corporate Financial Information Exchange: This measure aims to use the worldwide popular eXtensible Business Reporting Language (XBRL) to set standards for reporting financial information, and co-ordinate the regulation of corporate financial reports; to streamline financial reporting processes to facilitate financial analyses; to co-ordinate efforts in development of standards for classifying electronic reporting of financial information; and to co-ordinate academic institutions to fine-tune finance course curricula for incorporating the necessary expertise and skills for the implementation of the above measures.

B. Manufacturing and Logistics

Building on its existing trade and industrial capabilities, Singapore will leverage infocomm to make itself a high-value manufacturing hub and supply chain nerve centre. Measures include:

- Digital Manufacturing: Product Lifecycle Management applications will be implemented in collaboration with manufacturers. Powerful modelling and simulation software for product development will be made accessible to spur companies' product design capability. Companies will also be encouraged to look into new smart business models.

- Integrating major supply chains and developing standards: TradeXchange will be deployed to integrate the existing trade information systems into a common platform and provide value-added services so that enterprises can have access to different products or service providers and carry out international trade more easily.

- Supporting SMEs in adopting infocomm: Infocomm solutions including iSPRINT (Increase SME Productivity with Infocomm Adoption & Transformation) and SaaS (Software-as-a-Service) will be introduced to help enterprises enhance productivity and efficiency.

- Shipping and logistics systems: The Infocomm@Airport/Seaport programme will use Radio Frequency Identification (RFID) to conduct remote monitoring and provide air and sea navigation services. It also seeks to improve the system

security of trade and transport linkages to other ports, and offers a platform to pilot new shipping technologies. In addition, the e-Freight@Singapore programme will be developed to enhance the efficiency and competitiveness of the freight and logistics industry.

C. Tourism and Retail

Adoption of infocomm to foster growth and competitiveness will be promoted in the tourism and retail sectors. In parallel, infocomm-themed tourist attractions and products will be developed to bring a superior experience to visitors. Measures include:

- Supply Chain Integration: Building on the existing Electronic Supply Chain Management (eSCM) efforts, more initiatives will be introduced to encourage the adoption of Collaborative Planning Forecasting and Replenishment (CPFR) for more accurate management of inventory levels, RFID for tracking physical goods flow, and uniform B2B data standards for interfacing among operators. These technologies will be adopted by the large retailers first, and then be promoted to other enterprises gradually.

- Digital Concierge: This is a mobile e-platform run by both tourism and retail businesses that provide personalised concierge services for visitors. With data integration capabilities, it can analyse and anticipate visitors' needs and preferences in sightseeing, shopping, dining, etc., and provide suitable information and services anytime, anywhere to help visitors make good use of their time and resources.

- EnAbling Speedy rEgistration (EASE) for Visitors: Designed for Business Travellers and Meetings, Incentives, Conventions and Exhibition (BTMICE) events, this programme provides one-stop service for BTMICE visitors to attract them and their organisations to continue choosing Singapore for conferences, exhibitions and group travels.

D. Digital Media and Entertainment

To maintain Singapore's world-leading position in the media and entertainment industry, cutting-edge technologies will be adopted to develop high value-added media and entertainment activities and provide new experience for service users. Measures include:

- Research and development of Digital Media and Entertainment (DME) technologies: Singapore strives to develop into a global centre of excellence for DME technology research and development, focusing initially on electronic games and branching out subsequently to other digital media types such as animation and special effects.

- Promoting Digital Assets Marketplace: To develop Singapore as a global trading hub for digital assets, the necessary technical, business, financial and service infrastructure will be put in place to support the management, trading, brokering and distribution of digital assets.

E. Healthcare and Biomedical Sciences

In the light of the demographic structure and medical needs of Singapore, healthcare services will be consolidated and further personalised. Efforts will also be made to enhance the public's health awareness and promote the development of biomedical sciences. Measures include:

- Health Information Exchange: Standards for exchange of public healthcare data and information among healthcare providers will be established with due consideration of confidentiality and privacy. An information exchange platform where different databanks are linked and integrated will be created to offer healthcare providers a holistic view of the patients' conditions. To raise public awareness of healthcare and alertness to diseases, patients will also be given suitable access to medical records for reference.

- Integrated Healthcare Continuum: This initiative will link up different components of the healthcare system by integrating and re-engineering a wide range of medical services and procedures from primary care, hospital treatment to community care. Infocomm facilities of family doctors and community care centres will be upgraded. The goal is to provide patients with seamless and appropriate treatment at appropriate locations (including at home).

- Telehealth: This programme will allow patients with chronic non-communicable diseases to stay at home and receive medical supervision from healthcare providers with the assistance of remote monitoring technologies, and ensure timely provision of assessment, advice and treatment for these patients.

- Translating biomedical discoveries into medical treatments: Biomedical research and clinical applications will be better aligned so that researchers can obtain clinical

data to conduct research, put their findings to clinical tests and apply them to meet actual medical needs.

F. Education and Learning

A customised and life-wide learning environment that extends beyond the classrooms will be provided to meet the diverse needs of learners. Measures include:

- EdVantage programme: Each student will be provided with a personalised infocomm device which serves as a doorway to textbooks, homework, extra-curricular activities and lessons for learning anytime, anywhere. This can also catalyse the development of learning applications and content.

- Trials on innovative teaching models: A total of 15%-20% of schools will be designated as Experimental Schools to try out innovative teaching and learning methods. Another 5% will be Schools of the Future to provide a pluralistic learning environment for experimenting with and integrating technologies that will be widely used in future education. The ultimate goal is to turn the vision of "classrooms without walls" into reality.

G. Government Services

The development of a smart government involves the provision of more personalised public services through various channels and setting a common standard for electronic public services to enhance efficiency and communication with the citizens. Measures include:

- Comprehensive review of electronic public services: Mobile communication technologies will be employed to roll out innovative services. The eCitizen will serve as a one-stop portal for electronic public services and information released by various departments, and the mGov@SG mobile application will provide more than 100 types of governmental and non-governmental public services. The objective is to make government services more accessible and available to a larger population. Assistance will also be provided to help those in need understand and use electronic services.

- Stronger connection with citizens: Government websites will be made more attractive and accessible so that they can become citizens' preferred source of government information. More will also be done to raise public awareness of the

government's consultation efforts and make it more convenient for citizens to give feedback on public policies and municipal administration through e-channels.

- Better infocomm infrastructure in the government: Government systems will be reviewed and updated to enhance efficient sharing of data, processes and systems.

- i-Powered Public Employee: This aims to develop a high performance workforce with next-generation infocomm technologies and enhance public officers' capacities and productivity through the implementation of knowledge management initiatives. An environment for innovative exploitation of infocomm will also be fostered in the government and the public sector through setting up incentives for innovation and sharing technology exploitation experience.

- iGov: The development of iGov seeks to collaborate with the infocomm industry in the co-creation, development and export of iGov solutions. The long-term goal is to develop Singapore into a centre of excellence and test-bed for iGov solutions by showcasing and promoting Singapore's iGov brand name, expertise and solutions globally.

H. Social Development

Apart from boosting economic competitiveness, infocomm will also be widely used in Singapore's social development to help people embrace the information era and improve their quality of life. Measures include:

- Infocomm access for all: Infocomm equipment will be made available to the most needy in society. For example, new computers and free internet access will be provided for needy families with school-going children, with a target penetration rate of 100%. CitizenConnect Centres are set up to provide internet access and on-site support for those in need and help people understand and adopt infocomm in intelligent living.

- Higher infocomm awareness in the community: Customised training programmes will be provided for elderly people and people with disabilities in the use of technologies like e-services, instant messaging and Voice over Internet Protocol (VoIP), which can help them connect with families and others.

- Live environment and living lab: A nationwide sensor network covering all the streets and public facilities will be built to enable systematic collection, analysis and sharing of live data. The data will be useful reference for policy makers to gain a

fuller understanding of people's needs and expectations. Individuals, communities and enterprises can also use the data to make informed decisions. In the trial point of Jurong Lake District, more than 20 public agencies and enterprises have participated in this programme. Over 1 000 data sensors have been installed to test projects like smart queue monitoring and smart navigation for autonomous buggies, with a view to improving the district's operational efficiency and offering a more comfortable experience to visitors.

II. To Establish an Ultra-High-Speed, Pervasive and Trusted Infocomm Infrastructure

To tie in with the transformation and innovation of the eight major sectors listed above, Singapore will update and enhance its entire infocomm infrastructure so that organisations and citizens can enjoy ultra-high-speed connectivity for systems and functions in and outside the city and use the services anytime, anywhere.

A. Developing Leading Infocomm Infrastructure

- National Fibre Network (NFN): This is an ultra-high-speed network connecting all homes, schools, hospitals, enterprises, etc. It is also a competition-enabling platform as different service providers are allowed to use the network to deliver their services to customers.

- Wireless Broadband Network: Wireless technologies will be employed to provide connectivity in places not wired for the NFN, such as metro stations, bus interchanges, lobbies of buildings and tourist spots. The more pervasive coverage so created will be conducive to the roll-out of various systems and services.

- National Platforms, Policies and Standards: Policies and statutes will be formulated to address the issues of internet identity, security, privacy, location, payment and interoperability. New initiatives will be introduced, including a National Trust Framework (NTF), a National Authentication Framework and a National CyberThreat Monitoring Centre. The objective is to foster a trusted infocomm environment as the foundation for full smart city development.

B. Creating an Environment for the Innovation and Commercialisation of New Applications and Services

- Stage Alpha Programme: This programme provides a platform to showcase and test next-generation infocomm infrastructure and technologies. It is also a platform for

working with major users of the infrastructure and technologies to fast-track the launch of new applications and services.

III. To Develop a Globally Competitive Infocomm Industry

With a view to making the infocomm industry Singapore's key economic engine, measures will be introduced to sustain its growth, upgrade its management and technology capabilities, establish the "Made-by-Singapore" brand and attract businesses and professionals from abroad.

A. Strengthening Technology Capability of the Local Infocomm Industry

- Assistance will be given to help local enterprises develop business strategies, build human capital and management capability, improve processes and acquire technologies to compete in the global market.

- A team of advisors and experts will help identify projects that will benefit and nurture local enterprises. An international network of experts will also be set up to mentor local enterprises.

- Industry Experience Sharing Platform: The platform will allow like-minded enterprises to collaborate with and learn from one another, and jointly explore opportunities to go international.

B. International Branding and Marketing of "Made-by-Singapore" Infocomm Products and Services

- "Made-by-Singapore" branding: The campaign will include organising local and international sector-wide events. A feasibility study will be conducted on creating an endorsement mark for the local infocomm industry. Media, publishing and internet platforms will also be deployed to promote the industry and individual enterprises.

C. Nurturing the Expansion and Growth of Local Infocomm Enterprises

- Assistance for local enterprises to expand overseas: This includes the provision of information about establishing overseas markets and networks, as well as access to capital by promising enterprises to help their future development.

- Leveraging Singapore's well-recognised brand in e-Government to help enterprises export their e-Government solutions and secure projects overseas: An e-Government Leadership Centre will be set up to provide training for foreign government officials on Singapore's e-Government experience. Conditional use of government-held intellectual property in e-Government solutions will be available to enterprises for commercialisation and export to foreign governments.

- Assistance will be given to infocomm enterprises to expedite the creation of intellectual property and strengthen their branding in the international market. Partnerships between local firms and multinationals will be established so that they can work together on sectoral solutions for overseas markets.

- iDA's networks with local firms and multinationals can be made use of to attract overseas infocomm technopreneurs and start-ups to set up development and engineering centres and operation hubs in Singapore. The cross-pollination of knowledge and ideas between local and overseas technopreneurs will also spur technological diversification and innovation.

IV. To Develop an Infocomm-savvy Workforce

A pool of talent will be built up through a series of incentives, such as systematic training, competency certification and scholarships, to attract more students to take up infocomm as a career. The goal is to develop globally competitive infocomm professionals in the long term.

A. Developing Infocomm Competencies in Key Economic Sectors

- CXO Programme: It provides a platform for heads of enterprises and organisations and overseas experts to exchange views on how infocomm can be used as a strategic tool to sharpen the competitive edge of the organisations. It also provides assistance for inexperienced enterprises by finding feasible infocomm solutions that can enhance their competitiveness.

- Infocomm Competency Development Initiative: It provides training and certification for non-infocomm workers and helps them build up infocomm skills applicable to their job to enhance efficiency.

B. Promoting Infocomm as a Future Career among Students

- National Infocomm Scholarship: Scholarships for local and overseas studies are provided to encourage outstanding local and foreign students to pursue infocomm as a field of study and take up an infocomm career in Singapore upon graduation.

- Flagship Infocomm Courses: Fast-track bachelor and master programmes will be jointly offered by renowned local and overseas universities to attract more students to pursue an infocomm education. Local universities are also encouraged to develop their infocomm schools and take Singapore to the front of the region.

- National Campaign: This campaign aims to raise the interest in infocomm among the young and attract them to take up infocomm as a career through a number of initiatives, including organising infocomm competitions, giving recognition to infocomm capabilities in students' education credits and inviting renowned infocomm leaders to share their success stories with students.

- Infocomm Co-curricular Activities: Students can acquire infocomm knowledge and skills by taking part in interesting projects and competitions. Such competencies will be useful to their work and daily life regardless of what career they embark on.

C. Developing Globally Competitive Infocomm Professionals

- National Infocomm Competency Framework: Skill requirements and the corresponding training requirements will be set for various infocomm occupations to help assess infocomm practitioners' level of competency and map out their training needs and career paths. Course fee subsidies will be provided to encourage enterprises and infocomm practitioners to take up training courses within this framework.

- Work-study Opportunities: Infocomm students will be provided with work-study opportunities to acquire advanced skills training before they enter the workforce so that they can move faster to higher value-added jobs.

- Talent Exchanges and Partnerships: Support will be given to the sharing of talents and ideas between local and overseas infocomm enterprises, research institutes and tertiary institutions. Foreign professionals are encouraged to study, work and live in Singapore to help foster a culture of innovation and entrepreneurship.

Appendix D

Examples of Smart City Development in Hong Kong

Sphere	Situation / Measures
Smart Economy	➢ Hong Kong enjoys the highest average speed of Internet connection worldwide. ➢ Octopus: An electronic transaction system widely used in areas such as public transport, retailing, online payments, parking facilities, self-services, access control systems, recreational facilities, hospitals and schools, and public services. ➢ e-banking: Provision of various banking services via websites and mobile applications, such as personal and business banking, investment in stocks and other financial products, trading in foreign currencies, insurance, and fund management. ➢ Wi-Fi.HK: Promoting a common Wi-Fi brand to make it easier for the public to find and use free Wi-Fi services provided by the public and private sectors. ➢ Moving forward the development of Hong Kong as a regional data centre: Establishing an Internet exchange centre and assuming a leading position in cloud computing service in the region. ➢ Cloud computing: Creating the Government's own cloud computing platform; setting up the Expert Group on Cloud Computing Services and Standards as well as the Hong Kong/Guangdong Expert Committee on Cloud Computing Services and Standards to promote the development of cloud computing and formulate relevant standards and specifications. ➢ Innovation and Technology Fund and SME Funding Schemes: Providing financial support to enterprises for developing ICT business. ➢ Provision of infrastructural support: Including Cyberport, the Hong Kong Science and Technology Parks and the Hong Kong Applied Science and Technology Research Institute. ➢ Sector-specific Programme and IT Training Programme for SMEs: Promoting the wider adoption of ICT among SMEs.

Sphere	Situation / Measures
	➢ CreateHK: Promoting and giving impetus to the development of creative economy through the CreateSmart Initiative, etc. ➢ Cooperation with other economies to set up bilateral framework of cooperation: Fostering ICT development of each other to enhance the competitiveness and international status of Hong Kong in the global knowledge-based economy. ➢ Clearing and settlement systems: Introduced the Clearing and Settlement Systems (Amendment) Bill 2015 into LegCo for the purpose of fostering innovation in retail payment products and services. ➢ e-cheque service: Will be launched in December 2015 to provide an alternative payment method that carries enhanced security features, enables high level of system automation and is more environmentally friendly.
Smart Mobility	➢ Road Cargo System (ROCARS): Launched by the Customs and Excise Department to streamline customs formalities by allowing shippers to register cargo information in advance via the online system before transporting the cargoes through boundary control points. ➢ Autotoll: Providing automatic electronic toll collection service at major trunk roads and tunnels and developing intelligent transport systems such as comprehensive traffic control, vehicle access control, on-board staff attendance system and fleet management. ➢ Airport baggage handling system: The Hong Kong International Airport is one of the pioneers worldwide to adopt Radio Frequency Identification (RFID) to enhance system efficiency and reduce the risk of lost baggage in the process. ➢ ezTRACK: Developed by GS1 Hong Kong through integrating a number of technologies, including RFID, Electronic Product Code (EPC), Global Positioning System (GPS) and sensors, to enable enterprises to have instant access to business-critical product information related to the work-in-progress status, product inventory data, delivery schedules and other product details.

Sphere	Situation / Measures
	➢ Computerised Area Traffic Control Systems: Managing all traffic lights of the city and conducting real-time monitoring of traffic condition via CCTV networks. ➢ Transport Information System: A central database to collect, process and disseminate comprehensive transport information. It provides four major services, including Road Traffic Information Service (which disseminates online real-time traffic information, traffic speed charts and journey times of different routes, etc.); Hong Kong eRouting; Hong Kong eTransport; and Intelligent Road Network (which provides information on traffic directions, turning and stopping restrictions, etc., and which can be used by the business sector to develop an intelligent transportation application system). ➢ MTR: Operating the railway networks of the whole city and complemented by services such as buses, minibuses and taxis, thus giving full play to the effectiveness of a mass transit system. ➢ "Universal Accessibility" Programme: Putting in barrier-free facilities (lifts and ramps) to provide a "universally accessible" environment for better public access to public walkways. ➢ "Walkable Kowloon East": Drawing up proposals for improving the local pedestrian and traffic environment; examining the feasibility of introducing a smart bicycle rental system and providing information on bus-bus interchange, parking spaces, loading/unloading points, etc.; and considering providing seamless connection between major spots in the district by means of the Environmentally Friendly Linkage System. ➢ Autotoll Limited has developed pool car management and automatic equipment identification systems to enhance effectiveness in fleet management.
Smart Environment	➢ The Building Energy Efficiency Ordinance and the Energy Efficiency (Labelling of Products) Ordinance: Setting out the legal framework for regulating key building services installation in buildings and energy efficiency standards for electronic products.

Sphere	Situation / Measures
	➢ Green buildings: Promoting sustainable green buildings to make efficient use of energy and other resources and mitigate the overall environmental impact by adopting ecological and resource-saving methods to design, build, fit out, operate or reuse buildings. ➢ Practice notes on quality and sustainable built environment: Providing sustainable building design guidelines, covering, among other things, building separation and permeability, building set back and site coverage of greenery of buildings. ➢ BEAM Plus: A comprehensive environmental assessment scheme with a rating system developed for buildings. ➢ Building Information Modelling: Introduced on a pilot basis for generating three-dimensional, digital representation of building data throughout the life cycle of a building, with a view to enhancing building quality by optimising building designs, improving co-ordination and reducing construction waste. ➢ Energy conservation and emission reduction: Promoting the use of energy conservation and emission reduction technologies in building services such as air-conditioning systems, lighting systems, lifts and escalators. ➢ Zero Carbon Building (ZCB): Showcasing the state-of-the-art eco-building designs and technologies, thereby raising community awareness of sustainable living. ➢ Energy Saving for All Campaign: Engaging the public in energy conservation and emission reduction through the Energy Saving Charters on Indoor Temperature and on "No Incandescent Light Bulbs". ➢ Hong Kong Blueprint for Sustainable Use of Resources: Setting out clear goals and a timeline to promote a "Use Less, Waste Less" mode of living by implementing measures such as plastic bag charging, recyclable collection of food waste and yard waste. ➢ Renewable energy: Studying and promoting the use of renewable energy such as solar power, wind power, landfill gas, etc.

Sphere	Situation / Measures
	➢ The Council for Sustainable Development: Conducting on-going public consultation on the overall strategy and key areas concerning sustainable development. ➢ Greening Master Plans (GMPs) for various districts: Defining an overall greening framework for districts and providing guidelines on the planning, design and implementation of relevant works. ➢ Green policy: Active planting, proper maintenance and preservation of trees together with other vegetation; expanding urban green belts and enhancing existing greened areas; enhancing opportunities for quality greening during the planning and development of public works projects, with a view to improving the living environment. ➢ Revitalisation of water bodies: Revitalising and beautifying drainage facilities while adopting the concept of revitalising water bodies, so as to promote a water-friendly culture and activities and build a better environment for the public. ➢ Landslip Warning System: The system is supported by an extensive network of raingauge system and weather radars which collects real-time rainfall data throughout Hong Kong. By combining with the rainfall forecast from Hong Kong Observatory and instant prediction of landslide occurrence by means of a computer algorithm, the level of landslide danger can be identified and the Landslip Warning can be issued via the Internet and mobile application. ➢ Landslide Detection and Alert System: The system aims at automatic detection of the occurrence of landside and debris impact via a network of sensors installed on debris-resisting barriers, for alerting relevant departments and the affected population to take appropriate emergency action. ➢ Hydrometric information system: Monitoring flooding situations by water level sensors and CCTV installed in some of the flood prone areas and major drainage facilities, so as to enable timely deployment of resources in case the flood water at a particular location reaches the trigger level. Computational hydraulic modeling is also applied to predict the

Sphere	Situation / Measures
	water level/extent under storm events in order to optimise flood management. ➢ Implementation of the GMP for Kowloon East: Providing pedestrian-friendly facilities and a district cooling system, beautifying works for channels and revitalisation of water bodies, nullah waste processing, and promoting green building and green environment to achieve synergy. ➢ Extending free Wi-Fi services to the public space in Kowloon East, establishing an interactive information platform, and providing real-time traffic and community information for communication and data sharing to improve city management as well as enhance efficiency and quality. ➢ Smart metering: Conducting a pilot scheme to read water consumption data automatically and real-time, so as to explore the use of consumption data at night time recorded by the smart meters to detect inside service leakage. Besides, the measure of making consumption data available to consumers through the Internet or mobile application to raise their awareness on water consumption will also be explored. ➢ Air quality monitoring: Gathering air quality monitoring data from the air quality monitoring network, and disseminating Air Quality Health Index (AQHI) information and forecasts measured by monitoring stations of the various districts through the Internet and mobile application. This app notifies users when the forecast or the actual AQHI is at or above a health risk level preset by the user. ➢ Monitoring of beach water quality: The Environmental Protection Department monitors 40-odd beaches open for swimming in Hong Kong, and disseminates information on the weekly grading of these beaches via the Internet. ➢ Looking into the wider use of the Internet of Things, sensors and big data analytics to enhance our municipal management. ➢ Implementation of energy conservation measures in some commercial buildings and residential estates.

Sphere	Situation / Measures
Smart People	➢ Penetration rate of family broadband has reached 83%. ➢ Penetration rate of smartphone has reached 77%. ➢ Each person possesses an average of 2.3 mobile devices. ➢ There are about 83 000 ICT professionals working in different sectors, among which about 38% engage in software design and development; tertiary institutions offer ICT-related curricula. ➢ Development of human resources in ICT: Promoting closer collaboration between the academia and the business sector to create a favourable environment for ICT professionals to prosper, so as to meet the needs of a digital economy. ➢ Student IT Corner and Enriched IT Programme in Secondary Schools: Providing useful information on ICT learning, news on employment and industry, as well as intensive IT enrichment training to Secondary 2 to 6 students. ➢ e-learning: The Education Bureau provides principals and teachers with related training in professional development to pave the way for a more extensive and optimal use of e-learning in schools to improve learning effectiveness.
Smart Living	➢ Electronic Health Record (eHR) Sharing System: Developed to maintain electronic health records of all patients in Hong Kong, which are open to access by participating public and private healthcare providers, subject to the individual's consent, through a sharing system to be implemented by stages for the purpose of enhancing the efficiency and quality of healthcare services, reducing errors in health records, and capturing data to facilitate public health surveillance and formulation of policies. ➢ Web accessibility: Enabling the disabled, the elderly and people beset by cognitive and physical problems to access online information and services, thus facilitating their integration into the community. ➢ Sponsoring community efforts to develop ICT-based assistive tools and application systems for people with disabilities, such as the On-line Navigation System for the disabled; the Text4U application for the visually impaired to access text information; Intelligent Home for People with Physical Disabilities;

Sphere	Situation / Measures
	KineLabs, a rehabilitation games and evaluation platform; a mobile, multi-modal human interface device; a Chinese text input system that uses a brain-computer interface; Easy-Dots 2.0 for the visually impaired; Touchscreen Text Input Application for the Visually Impaired; and QuicKey "Barrier-free input device". ➢ Wearable Electronics for Better Quality Community Care for the Elderly: involves an outerwear made of a special fabric embedded with the RFID system for the purpose of improving the monitoring of the elderly, particularly those who might be more susceptible for losing their way due to Alzheimer's disease. ➢ Providing support to the underprivileged regarding ICT adoption: the Internet Learning Support Programme; "i Learn at Home"; sponsoring community organisations to encourage ICT adoption among the elderly; eElderly; ICT Outreach Programmes for Elderly; the Sponsorship Scheme on Development of Digital Inclusion Mobile Applications, etc. ➢ Websites of support services for ethnic minorities: Providing different versions in ethnic minority languages to enhance accessibility. ➢ Leisure Link and URBTIX: Facilitating, among other things, the booking of government leisure facilities, the enrolment to recreational activities and the purchase of tickets for cultural programmes. ➢ Cityline: A comprehensive ticketing platform integrating ticket inventory management, point-of-sales systems, extensive sales and distribution channels, online payment options, and smart ticket fulfilment and admission control methods. ➢ MovieExpress: A mobile application providing film information and links to ticketing systems of all cinema chains in Hong Kong.
Smart Government	➢ Digital 21 Strategy: Setting out the blueprint for ICT development. ➢ Internet governance: Providing a legal framework for e-

Sphere	Situation / Measures
	business through the Electronic Transactions Ordinance; reviewing and updating the Domain Name Administration Regime. ➢ Smart Identity Cards: Issued to all Hong Kong citizens by the Immigration Department, they provide cryptographic protection for personal data stored therein and facilitate immigration clearance, the borrowing of books, the use of electronic certificates, etc. ➢ "data.gov.hk": A one-stop portal providing the community with various public raw data in digital formats for value-added reuse, thereby opening up business opportunities and also bringing convenience to the public. ➢ Tell me@1823: Enabling the public to make enquiries, complaints or suggestions to the Government by means of mobile applications, and providing information in various forms such as text, voice recording, photo, video and satellite positioning to facilitate follow-up action by the departments concerned. In addition to mobile applications, the public can also submit relevant information by means of e-forms, emails, telephone calls and messages. ➢ GovHK: A public service platform and information portal featuring mobile applications including EventHK, GovHK Notifications, and GovHK Apps. ➢ GovWiFi: With the target of increasing the number of Wi-Fi hotspots to 20 000. ➢ Geospatial Information Hub: Consolidating relevant geographical data from different government departments to facilitate their operation; and providing, through the GeoInfo Map, geospatial information services for the general public to search and find out information on specific subjects such as geographic locations, buildings, natural environment and public facilities. ➢ Statutory Planning Portal: Providing planning information on land use and facilitating submission of public opinions on applications for amendment of plan and planning permission. ➢ Electronic Submission of Forms project: Enabling the public to

Sphere	Situation / Measures
	submit information to the Government by electronic means, and introducing more electronic public services for the general public. ➢ e-Government infrastructure: the Interoperability Framework (IF), the Government Backbone Network (GNET), the Central Computer Centre (CCC), Electronic Information Management (EIM) and e-Government Infrastructure Services (EGIS). ➢ Further digitisation in government operation; actively adopting paperless solution. ➢ Considering the provision of digital identity to all Hong Kong citizens in order to develop a common, shared and safe platform for the delivery of services such as electronic health records and e-cheques. ➢ Control centre for mega events: To oversee crowd control in Kai Tak Development during mega events by real-time monitoring of vehicular and pedestrian traffic, for the purpose of better city resilience.

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Appendix E

Global Development of Smart City Industries

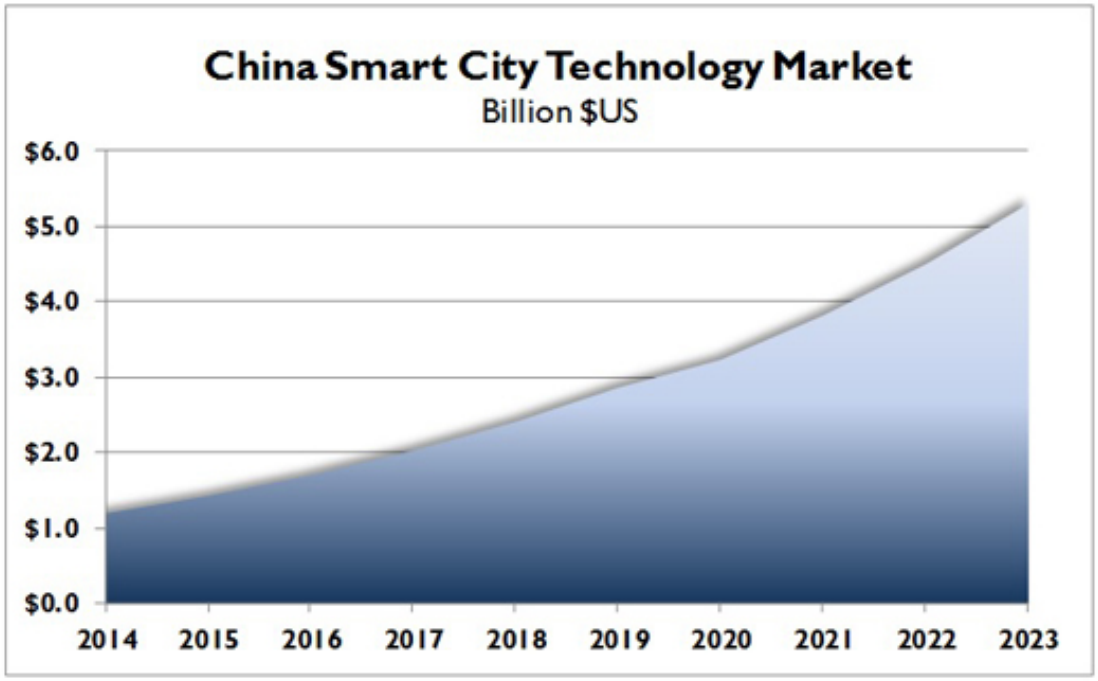
With rapid expansion and robust development momentum of the smart city-related industries[129] over the world in recent years, the market size of these industries, according to the reports issued by various research groups, will increase to tens of billions of US dollars[130] in the foreseeable future:

Research institutions	Market size/Number of smart city
ABI Research	The total value of smart city technology market amounted to US$8.1 billion in 2013, which will increase to US$39.5 billion in 2018.
Frost & Sullivan	The global market value of smart city is projected to reach US$3.3 trillion in 2025.
GSMA Connected Living Tracker	There were a total of 257 pilot schemes or business projects relating to mobile smart city underway worldwide in 2012.
International Data Corporation	The total value of the Mainland smart city market was estimated to be worth US$10.8 billion in 2013, with a projected double digit growth in the next five years.
Lee & Hancock	There were a total of 143 smart city projects, either completed or underway, worldwide in 2012.
Pike Research	The total value of smart city technology market amounted to US$6.1 billion in 2012, which will reach US$20.2 billion in 2020.
Consultancy research by the UK Government	The annual output of the global market of smart city system will reach US$400 billion in 2020.

[129] Given that there is no consensus on the definitions of smart city-related industries among the academia and the industries, the estimated number and market size of smart cities worldwide will therefore vary. According to the "About Us" of the China Wisdom Cities Industry Alliance (CCIT), its members consist of the enterprises and business undertakings engaged in such realms as smart cities, new urbanisation planning and construction, smart industries and modern service industries, tertiary institutions, scientific research organisations, industry associations, standardisation organisations and municipal governments. It covers a range of industrial sectors such as town planning, infrastructure of cities and townships, system and software development, information and telecommunications technology equipment, smart building and home services, energy, environmental protection, transportation and logistics, e-commerce, tourism and retail services, technology testing assessment, professional and consultancy services. Please refer to "About Us" on CCIT's website (2013) (in Chinese).

[130] EU-China Policy Dialogues Support Facility II (PDSF) and China Academy of Telecommunications Research (CART), "EU-China Smart and Green City Cooperation: Comparative Study of Smart Cities in Europe and China White Paper" (Mar 2014); UK government, "Information Economy Strategy" (Jun 2013)

2. Speaking of the Mainland market alone, the market size of smart cities is anticipated to increase from around US$1 billion in 2014 to over US$5 billion in 2023 (see the chart below)[131]:



Source: Donald Johnson/Navigant Research

3. In the light of the massive potential of smart city industries and to provide more incentives to enterprises for their participation in developing Hong Kong into a smart city, consideration may be given to seizing the opportunities of smart city development around the world and on the Mainland, so as to promote the expansion of local smart city-related industries. In the long run, a smart city industry chain can be formed on the basis of the local IT industry to give full play to Hong Kong's strengths in technology research and development, professional services and so forth. As a consequence, exploration of business opportunities can proceed in tandem with city development.

[131] China Business Review (2014).

Annex B

Government initiatives on smart city development

This paper reports on the policies and measures related to smart city development implemented/planned by the various bureaux and departments of the HKSAR Government.

Overview of HKSAR Government's strategy for developing Hong Kong as a smart city

2. The latest edition of the Digital 21 Strategy entitled "Smarter Hong Kong, Smarter Living" champions wider use of sensors, big data analytics and IoT technology to establish a smarter city infrastructure for more efficient, timely, responsive and informed municipal management.

3. In the 2014-15 Budget Speech, the Financial Secretary announced that in the fourth update of the Digital 21 Strategy, a series of initiatives under the theme of "Smarter Hong Kong, Smarter Living" had been proposed. These measures included the following:

(a) doubling the number of Wi-Fi hotspots with complete or time-limited free public access to 20,000 by the end of 2014 through public-private partnership to promote city-wide Wi-Fi for all;

(b) making all government information released for public consumption machine-readable in digital formats from 2015 onwards to provide more opportunities for the business sector;

(c) further digitalising government operations and actively implementing paperless solutions to enhance efficiency, facilitate information sharing and protect the environment;

(d) looking into the wider use of IoT, sensors and big data analytics to enhance our municipal management; and

(e) considering the provision of digital identity to all Hong Kong citizens in order to develop a common, shared and safe platform for the delivery of services such as electronic health records and e-cheques.

4. In the 2015 Policy Address, the Chief Executive stated that the latest Digital 21 Strategy envisioned that the Government would make wider use of sensors, IoT and big data analytics for better public services and sustainable social and economic growth. Moreover, he announced that the Government intended to use Kowloon East as a pilot area to explore the feasibility of developing a smart city (Appendix 5).

Government initiatives related to smart city development

5. Government bureaux and departments have already implemented/planned a wide range of initiatives related to smart city development. Some examples of the key initiatives are highlighted as follows:

(a) Smart Economy

(i) ICT infrastructure

6. Hong Kong is one of the most Internet-ubiquitous cities in the world and our mobile penetration of 228% tops the world. Our Internet connection speed is among the fastest worldwide. With over 30 000 Wi-Fi hotspots throughout the territory, Hong Kong is very well-connected. Hong Kong's robust ICT infrastructure, with its Internet-ubiquity, and mobile penetration rate and Internet connection speed which are among the top worldwide, underpins the development of smart city.

(ii) e-commerce

7. Noting the increasing popularity of e-commerce and its significant impact on the business mode and environment around the world, the Working Group on Manufacturing Industries, Innovative Technology, and Cultural and Creative Industries under the Economic

Development Council (EDC) established the Expert Group on E-commerce (EGE) to study the development potential of e-commerce in Hong Kong in a focused and comprehensive manner. The EGE will submit to the EDC specific recommendations on support policies or measures to facilitate the development of e-commerce in Hong Kong for the Government's consideration and implementation as appropriate.

(iii) Financial Technologies ("Fintech")

8. Hong Kong will explore development in Fintech, which has been expanding rapidly globally and particularly in the Mainland, to facilitate the conduct of financial transactions in an efficient yet secure manner through leveraging our position as an international financial centre and our sound financial regulatory system. The Government has established a Steering Group on Financial Technologies to study how to promote Hong Kong's Fintech sector together with the industries, R&D institutions as well as regulatory authorities. The Steering Group aims to provide its recommendations on measures needed to foster a conducive ecosystem for Fintech-related activities and promote Hong Kong as a Fintech hub to the Financial Secretary within this financial year.

(iv) Promotion of innovation and entrepreneurship

9. The enabling technologies for smart city include IoT, cloud computing, big data analysis, mobile technology and sensor technology. Many researchers in local universities and R&D centres are working in these areas with funding support from the Innovation and Technology Fund (ITF) administered by the Innovation and Technology Commission (ITC). The Government provides funding support, through the ITF, to universities and R&D centres to conduct applied R&D with a view to transferring the results to companies in the relevant industry.

(b) Smart Mobility

10. The Transport Department (TD) conducted the first Intelligent Transport Systems (ITS) Strategy Review in 2000, to formulate the strategy to maximize the utilization of our limited road space through the application of innovative traffic management within the resources

available. The TD has been implementing ITS strategy under two major areas, namely "Smart Way to Travel" and "Smart Way for Safety and Efficiency". "Smart Way to Travel" focuses on providing the public with real-time transport and traffic information, such as information on routing and public transport services. "Smart Way for Safety and Efficiency" focuses on providing comprehensive traffic control and surveillance coverage over the territory, as well as developing territory-wide coordination among control centres for traffic and incident management.

11. The franchised bus companies will be rolling out real time bus information system in phases. Passengers will be able to access the departure time at bus termini and the estimated arrival time at bus stops for bus routes through mobile platforms (including computers and mobile applications) and display panels at major bus stops.

(c) Smart Environment

(i) Town planning

12. To enhance the quality of living, to improve the performance of urban infrastructure and services, and to reduce costs and resource consumption, we must plan our city smartly and innovatively with the application of advanced practices and technologies. Under Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030 (Hong Kong 2030+), we aspire to make Hong Kong a smart, green and resilient city. New strategic growth areas would offer very good potential for adopting smart city initiatives, spanning from the city form, infrastructure, provision of services to accommodating individual lifestyles. Many of these are already proposed under various studies, and will be further developed in a more coherent framework under Hong Kong 2030+.

(ii) Environmental protection

13. The Government has been keen to promote demand-side management of energy consumption through various initiatives. Some overseas utilities have adopted Advanced Metering Infrastructure (AMI) to help consumers use information provided by the system to change their normal consumption patterns to take advantage of lower prices offered for

different time periods. Incentive pricing may be used to curb growth of peak consumption. The two power companies in Hong Kong have started to study the application and technologies of AMI for general customers.

14. To improve roadside air quality, the Environmental Protection Department (EPD), in September 2014, started deploying roadside remote sensing devices to screen out excessively emitting petrol and LPG vehicles without stopping them. The owners of these vehicles are required to fix the excessive emission problem and pass an emission test at a designated vehicle emission testing centre within 12 working days. Failing to comply with the requirement will lead to cancellation of the vehicles' licences. EPD will continue to monitor closely the development of the remote sensing technology with a view to extending its application to excessively emitting diesel vehicles.

15. EPD is also using smart technologies in other areas such as monitoring of the collection of chemical and clinical wastes and the marine dumping of mud, monitoring of fly-tipping blackspots, and dissemination of the latest Air Quality Health Index (AQHI) information and forecasts.

(iii) Promotion of green buildings

16. The use of automatic controlled building services/ electrical and mechanical (BS/E&M) systems in the design and construction of government buildings is part of the Architectural Services Department's (ArchSD) sustained initiative in the promotion of green building design and construction practices, and this helps contributes to the development of smart and intelligent buildings. The "3S strategy", i.e. standardisation, simplification and single integrated element construction method for building construction, is applied. Prefabrication, reuse/recycling and labour saving measures are adopted as appropriate.

17. With the availability of proven smart sensors and actuators on the market, practical application of "on-line energy management and monitoring system" may be explored. Potential application of Radio-frequency Identification (RFID) technology for BS/E&M systems for trial in new building projects may also be explored. At the same time,

ArchSD will continue to strive to explore possible applications of new technologies to develop intelligent systems in facilities upkeep.

18. Housing Department (HD) adopts a wide application of innovation technologies for the promotion of sustainable development in the planning and construction of public housing developments as well as the management of estates. For example, to reduce communal energy consumption of the lighting system in domestic blocks of public rental housing (PRH) and subsidised sale flats (SSF) developments, a two-level lighting control system was developed whereby light levels are operated by environmental lighting controls using motion sensors and on-demand switches with timer-controls. On water conservation, to supplement fresh water supply for irrigation purposes, HD adopted the Rainwater Harvesting System in some new PRH developments. Building on the rainwater harvesting technique, an innovative low-carbon design solution was further adopted whereby rainwater collected at high elevations, such as, building rooftops, green roofs and covered walkway would be treated via bioretention and held in storage tanks for reuse. To support the Government's initiative of promoting the use of electric vehicles to improve air quality, HD provides electric vehicle charging facilities in carpark buildings of all new PRH and SSF developments.

(d) Smart People

(i) ICT penetration

19. Hong Kong's mobile penetration of 228%[1] tops the world. Hong Kong's household broadband penetration rate of 83[2]% and smartphone penetration rate of 77%[3] are also amongst the highest in the world.

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[1] Office of the Communications Authority: Key Communications Statistics (May 2015)

[2] With high-speed 4G services gaining popularity in recent years, some households in Hong Kong use mobile to access the Internet in lieu of fixed broadband. As a result of this "fixed-mobile substitution" effect, there is a slight downward trend on broadband penetration since its peak rate at 86.8% in March 2012.

[3] "Thematic Household Survey Report No.54: Information Technology Usage and Penetration (2014)" by Census and Statistics Department.

(ii) IT in education

20. The Fourth Strategy on IT in Education (ITE4) will be formally launched in 2015/16 school year. Major initiatives include the phased provision of wireless network services and other supporting facilities for all public sector schools. As a pioneer measure, 100 schools have already set up WiFi infrastructure in their campuses in the 2014/15 school year. Under ITE4, about 900 remaining schools will complete the set-up progressively in three-year time starting from 2015/16 school year according to their school-based needs.

21. Principals and teachers are being provided with related training in professional development to pave the way for a more extensive and optimal use of e-learning in schools including how pedagogy may be adapted to better harness the potential of e-learning to improve learning effectiveness.

22. Recurrent funding will be disbursed to schools to sustain the adoption of WiFi infrastructure for e-learning. To facilitate schools' adoption of e-learning, the quality of e-learning resources will further be enhanced in collaboration with Hong Kong Education City. The curriculum will also be renewed to transform pedagogical and assessment practices. Teachers will be supported to further build up their professional leadership and capacity through professional development programmes and community of practice. Parents, stakeholders and the whole community, including the IT industry, will be involved to evaluate and sustain the development of IT in Education. The development and outcomes of IT in Education will be sustained through research and development with a view to consolidating knowledge and experiences as well as to enhancing support measures whenever appropriate.

(e) Smart Living

(i) Promoting digital inclusion

23. The Office of the Government Chief Information Officer (OGCIO) has been providing support to underprivileged and needy groups, such as students from low-income families, persons with disabilities and

the elderly, to promote a digitally inclusive society. Examples of these initiatives include: the Internet Learning Support Programme has been launched to help eligible families acquire affordable computer equipment and Internet access service through flexible payment arrangement; the Government has been actively promoting web accessibility to facilitate persons with disabilities to access online information and services and enhance their user experience, and funding has been provided to universities and non-profit organisations to support the development of ICT-based assistive tools and applications for persons with disabilities; OGCIO has provided funding to non-profit organisations to organise outreach programmes for elderly to arouse their awareness of and interest in using ICT to broaden their social circles and improve their quality of life; and OGCIO has launched support scheme to encourage the development of mobile apps that provide practical content and services for various needy groups, so as to help them enhance their quality of life and integrate into the community through the use of these apps.

(ii) Enhancing quality of healthcare

24. The Food and Health Bureau (FHB) has been developing a territory-wide Electronic Health Record (eHR) Sharing System as a key infrastructure for Hong Kong's healthcare system to enhance the quality and efficiency of healthcare provided to the population.

25. The Public-Private-Interface Electronic Patient Record Sharing Pilot Project (PPI-ePR), launched in 2006, allows participating private healthcare providers and other registered institutions to view the Hospital Authority's (HA) records subject to patient's consent. This pilot project has received positive responses from the public and private healthcare providers.

26. FHB's plan is to implement a two-stage programme to develop an efficient platform for both public and private healthcare providers (e.g. hospitals and clinics) to upload and access individuals' eHR for healthcare purposes, subject to the individual's consent. FHB will complete the final preparatory work for commencing operation of Stage 1 system by early 2016. Afterwards and subject to funding approval of the Finance Committee of the Legislative Council, FHB will proceed with

development of Stage 2 of the system to provide functional enhancements facilitating better continuity of care and better healthcare services.

(iii) Facilitating services for the elderly

27. The "Senior Citizen Card Scheme" (the Scheme) launched by the Social Welfare Department (SWD) in April 1994 aims at promoting a spirit of care and respect for the elderly through aligning concessions, discounts and priority services offered by government departments, public organisations and private companies. Senior Citizen Cards are issued to eligible Hong Kong residents aged 65 or above for them to enjoy the said privileges. The Scheme has been well received by elderly persons, companies, organisations and the community since its implementation, with around 1 020 000 elders in the territory being card holders, which covers over 90% of total eligible elderly persons. At present, over 2 600 companies and organisations are participating in the Scheme.

28. Following the rapid development of the information technology, SWD has uploaded to its Homepage the concession information offered by participating companies and organisations, and launched in September 2011 the Senior Citizen Card Smartphone Applications with a view to facilitating the elderly as well as their family members and relatives to select their preferred products and services from the participating companies and organisations.

(f) Smart Government

(i) GovHK

29. GovHK (www.gov.hk) is the one-stop portal of the HKSAR Government featuring the most sought-after public services and information to make them easier to be accessed and used by members of the public. In addition, OGCIO has launched mobile apps to enhance the services provided by GovHK, such as EventHK, GovHK Notifications and GovHK Apps. EventHK provides a one-stop platform for citizens to find public events which are organised by government departments or held at government venues. GovHK Notifications provides a one-stop platform for citizens to receive Government notifications according to their choice.

GovHK Apps acts as a centralised platform for citizens to download all Government mobile apps.

(ii) "1823" service

30. On the basis of the "1823" service which provides a round the clock, one-stop contact point to answer general enquiries for a wide range of departments and receiving complaints and suggestions about Government services, the Efficiency Unit has developed the "Tell me@1823" service to let citizens convey their enquiries, complaints or suggestions via multiple channels such as mobile application, e-form, email and telephone. Supplementary information in the form of text, voice recording, photos and short videos can also be submitted to facilitate follow-up by the departments concerned.

(iii) Release of Public Sector Information in digital formats

31. Public Sector Information (PSI) refers to the great quantity and variety of information collected, produced and disseminated by governments and public bodies (e.g. demographic, socio-economic, geographical, meteorological and municipal management data) in their day-to-day operations. Such data, if made available to the public in digital formats, can be creatively re-used to develop innovative products. PSI helps open up new business opportunities, bring convenience to the public, enhance the quality of life and even generate social benefits4. Many popular mobile apps in Hong Kong make use of PSI to deliver cherished information and services on user-friendly platforms. The most common data used include traffic snapshots, weather, air quality, etc. Through these apps, users can plan their routes based on real-time traffic situation or their activities based on weather and air quality information. So far, over 70 mobile applications or solutions using PSI have been developed and most of them are free for download.

32. To step up the release of PSI, the Financial Secretary announced in the 2015-16 Budget that from 2015 onwards, all free online government

[4] Experience from other developed economies also shows that the widening access to PSI datasets can lead to positive social outcomes. For instance, in New York, application of PSI on hygiene inspections has led to a significant drop in food poisoning incidents by around 20%.

information will be released in digital formats. In order to provide a larger and more flexible platform for departments to release data, OGCIO launched the revamped PSI portal "data.gov.hk" earlier this year to encourage more creative re-use of data. The portal now provides more than 4 500 datasets in 18 broad categories such as weather, health, population and transport.

33. The Government will continue to work closely with public and private sectors to identify new public data to release and encourage them to see data as a valuable resource not only to themselves, but also to the public and further development of smart city.

Energizing Kowloon East

34. A key initiative in smart city development in Hong Kong announced in the 2015 Policy Address is to use Kowloon East as a pilot area to explore the feasibility of developing a smart city.

35. For the smart city framework of Kowloon East, the Energizing Kowloon East Office (EKEO) of the Development Bureau intends to work towards an integrated area-based approach in building a smart city district by focusing on six aspects, namely Smart People, Smart Mobility, Smart Environment, Smart Living, Smart Governance and Smart Economy. The aim is to transform Kowloon East into Hong Kong's alternative core business area where people would like to stay, work, play and do business.

36. EKEO plans to commission a consultancy study around end 2015 to formulate a framework, and set direction and priority for the smart city proposals in Kowloon East, including on-site pilot tests. The study area, comprising both new development area (i.e. Kai Tak Development) and developed area (i.e. Kowloon Bay Business Area, Kwun Tong Business Area), will provide an ideal test bed for showcasing a diverse range of smart city proposals in different urban settings.

37. It is worth noting that developing a smart city is not something to be done by the Government alone. To this end, EKEO has been engaging various research institutions, academics, IT industry experts, public transport operators, public utility companies and the private sector

since the announcement of the smart city initiative in Kowloon East for collaboration to work towards this vision.

List of smart city initiatives

38. The policy areas in which initiatives related to smart city development are being implemented or planned, and the responsible policy bureaux and departments, are listed in the table below. Details of the policies and measures concerned are set out in the respective appendices.

Responsible bureaux/ departments	**Policy areas**	**Appendices**
Commerce and Economic Development Bureau (CEDB)		
Commerce, Industry and Tourism Branch, CEDB	• Commerce and Industry	Appendix 1
Innovation and Technology Commission	• Information Technology and Broadcasting	Appendix 2
Office of the Government Chief Information Officer	• Information Technology and Broadcasting	Appendix 3
Hong Kong Observatory	• Public Safety	Appendix 4
Development Bureau (DEVB)		
Energizing Kowloon East Office, DEVB	• Energizing Kowloon East	Appendix 5
Architectural Services Department	• Public Buildings	Appendix 6
Civil Engineering and Development Department	• Slope Safety	Appendix 7

Responsible bureaux/ departments	Policy areas	Appendices
Drainage Services Department	• Flood Control	Appendix 8
Lands Department	• Survey and Mapping	Appendix 9
Planning Department	• Town Planning	Appendix 10
Water Supplies Department	• Water Supply	Appendix 11
Education Bureau (EDB)	• IT in Education	Appendix 12
Environment Bureau (ENB)/ Environmental Protection Department (EPD)	• Environment Protection	Appendix 13
Financial Services and the Treasury Bureau (FSTB)	• Financial Technologies	Appendix 14
Food and Health Bureau (FHB)	• Health	Appendix 15
Labour and Welfare Bureau (LWB)		
Social Welfare Department	• Social Welfare	Appendix 16
Transport and Housing Bureau (THB)		
Housing Department	• Planning and construction of public housing developments and estate management	Appendix 17
Transport Department	• District traffic and transport services	Appendix 18

Secretariat to the Commission on Strategic Development
September 2015

Appendix 1

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Commerce and Economic Development Bureau/Commerce, Industry and Tourism Branch

Policy Area : Commerce and Industry

Overall/General Remarks :

The Government attaches great importance to economic development. The Economic Development Commission (EDC) as established by the Chief Executive in 2013 has been focusing on the overall strategy and policy to broaden our economic base and enhance our long-term development, and identifying industries which would present opportunities for Hong Kong's further economic growth, so as to recommend possible policy and other support for these industries.

Individual Policy :

Supporting the work of the EDC to explore and identify growth sectors or clusters of sectors which present opportunities for Hong Kong's further economic growth.

Existing Measure(s) :

Noting the increasing popularity of e-commerce and its significant impact on the business mode and environment around the world, the Working Group on Manufacturing Industries, Innovative Technology, and Cultural and Creative Industries under the EDC established the Expert Group on E-commerce (EGE) to study the development potential of e-commerce in Hong Kong in a focused and comprehensive manner, with a view to making specific recommendations on any support policies or measures.

Future Measure(s)/Action(s) :

The EGE will submit to the EDC specific recommendations on support policies or measures to facilitate the development of e-commerce in Hong Kong, for the Government's consideration and implementation as appropriate.

Appendix 2

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Commerce and Economic Development Bureau/Innovation and Technology Commission

Policy Area : Information Technology and Broadcasting

Overall/General Remarks :

1. The enabling technologies for Smart City include internet of things (IoT), cloud computing, big data analytics, mobile technology and sensor technology. Many researchers in local universities and R&D centres are working in these areas with funding supports from the Innovation and Technology Fund (ITF) administered by ITC.

2. In 2011, we introduced the Public Sector Trial Scheme (PSTS) whereby additional funding is provided for the production of tools/prototypes/samples and the conducting of trials in the public sector. This Scheme helps realization of R&D outcomes through actual implementation and also promotes the adoption of new technologies to government sectors. The PSTS has been an effective means to transfer technologies from research community to government sectors to realize the smart city initiatives. In 2014, we have increased the funding ceiling of PSTS to 50% of the actual cost of the original R&D project (up to 100% for projects supported by any of the five R&D centres set up by the Government).

3. Furthermore, in order to encourage more projects in the public sector, starting from 2015, Innovation and Technology Commission (ITC) may consider waiving the industry sponsorship requirement for ITF platform projects if such applications have clear support from Government bureau/departments and/or statutory bodies (other

projects are required to obtain industry sponsorship of at least 10%). This new measure helps Government bureau/departments to introduce new technologies to their areas of work.

4. So far, the ITF has supported a number of projects related to SmartCity. Some selected examples include –

(i) the Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies (LSCM) has collaborated with the Customs and Excise Department to apply the "E-Lock-Based Enabling Technology" at border control points. This technology has helped reduce the number of repeated customs inspection for cargos at control points, enhance couriers' efficiency and reliability, and facilitate logistics flow between Hong Kong and the Mainland;

(ii) the Hong Kong Research Institute of Textiles and Apparel (HKRITA), LSCM and the Hong Kong Applied Science and Technology Research Institute (ASTRI) have jointly developed a system on "Wearable Electronics for Better Quality Community Care for the Elderly" which involves an outerwear made of a Nu-Torque fabric embedded with the RFID system. Trial of this system has been conducted in two elderly centres under the Tung Wah Group of Hospitals (TWGHs) to improve monitoring of the elderly, particularly those who might be more susceptible to losing their way due to Alzheimer's disease; and

(iii) LSCM has collaborated with the University of Hong Kong to develop radio frequency identification (RFID) enablement middleware for enterprise applications. This technology is currently being applied at the Hong Kong International Airport in order to increase the efficiency of baggage handling at one of the largest RFID baggage handling systems in the world. At present, the implementation of the system has been demonstrably successful in increasing the baggage handling capacity of the Hong Kong International Airport from 8 000 articles an hour to over 16 000 articles.

Individual Policy :

Funding schemes under the Innovation and Technology Fund (ITF) including the Innovation and Technology Support Programme and the University-Industry Collaboration Programme.

Existing Measure(s) :

To provide funding support to universities and R&D centres to conduct applied R&D with a view to transferring the results to companies in the relevant industry.

Future Measure(s)/Action(s) :

- We will continue to implement the enhancement measures of the ITF to encourage more R&D projects in the public sectors. For example, we will consider waiving the sponsorship requirement if such applications have clear support from Government bureau/departments and/or statutory bodies, demonstrate clear community interests, and have difficulties in seeking industry sponsorship in the prevailing circumstances. We will also encourage universities and R&D Centres to make use of the PSTS to promote realisation of their R&D outcomes in the public sector.

- ITC will serve as a bridge to foster collaborations between Government departments/bureaus and research institutes such as universities and R&D centres. For example, recently we see a lot of exchanges between the Energizing Kowloon East Office (EKEO) under the Development Bureau and local universities as well as R&D centres. Some of these discussions have culminated into research projects that are seeking ITF funding support for implementation.

Appendix 3

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Commerce and Economic Development Bureau/Office of the Government Chief Information Officer

Policy Area : Information Technology and Broadcasting

Individual Policy : Release of Public Sector Information in Digital Formats

Overall/General Remarks :

Hong Kong is a populous modern city and has a need to manage its resources and the multitude of metropolitan functions effectively to maintain a high standard of living. The latest edition of the Digital 21 Strategy entitled "Smarter Hong Kong, Smarter Living" champions wider use of sensors, big data analytics and Internet of Things (IoT) technology to establish a smarter city infrastructure for more efficient, timely, responsive and informed municipal management.

Existing Measure(s) :

Public Sector Information (PSI) refers to the great quantity and variety of information collected, produced and disseminated by governments and public bodies (e.g. demographic, socio-economic, geographical, meteorological and municipal management data) in their day-to-day operations. PSI is a treasure trove in the digital era. Such data, if made available to the public in digital formats, can be creatively re-used to develop innovative products. PSI helps open up new business opportunities, bring convenience to the public, enhance the quality of living and even generate social benefits*. Many popular mobile apps in Hong Kong make use of PSI to deliver cherished information and services on user-friendly platforms. The most common data used

include traffic snapshots, weather, air quality, etc. Through these apps, users can plan their routes based on real-time traffic situation or their activities based on weather and air quality information. So far, over 70 mobile applications or solutions using PSI have been developed and most of them are free for download.

To step up the release of PSI, the Financial Secretary announced in the 2015-16 Budget that from 2015 onwards, all free online government information will be released in digital formats. In order to provide a larger and more flexible platform for departments to release data, Office of the Government Chief Information Officer (OGCIO) launched the revamped PSI portal "data.gov.hk" earlier this year to encourage more creative re-use of data. The portal now provides more than 4 500 datasets in 18 broad categories such as weather, health, population and transport.

<u>Future Measure(s)/Action(s)</u> :

Smart cities are about collaboration, sharing and transparency. While Government would continue to release public data for free use, other data owners, including NGOs and private companies, are also encouraged to do the same in the interest of a smarter Hong Kong. We should continue to release more datasets to unleash the potentials of PSI, such as availability of car parking spaces, crime rate, traffic incident spots, inspection records of restaurants, passenger flow of MTR stations, etc.

The Government will continue to work closely with public and private sectors to identify new public data to release and encourage them to see data as a valuable resource not only to themselves, but also to the public and further development of smart city. We will also encourage public participation, with the overarching aim of facilitating decision making and transparency through widening the release of PSI in digital formats.

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* Experience from other developed economies also shows that the widening access to PSI datasets can lead to positive social outcomes. For instance, in New York, application of PSI on hygiene inspections has led to a significant drop in food poisoning incidents by around 20%.

Appendix 4

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Commerce and Economic Development Bureau/Hong Kong Observatory

Policy Area : Public Safety

Overall/General Remarks :

Hong Kong Observatory (HKO) provides weather information and related services for the public including specialised users, making use of new technologies where feasible.

Individual Policy :

To identify opportunities constantly of using new technologies in delivering the relevant services, taking into account actual demand and the availability of resources.

Existing Measure(s) :

HKO makes an extensive use of mobile technologies in providing weather information. The mobile weather application, 'MyObservatory', is available on three smartphone platforms. HKO is also maintaining a mobile application for the World Meteorological Organization (called "MyWorldWeather) which can be used by members of the public.

Future Measure(s)/Action(s) :

To continue to keep in view technological advancements, in particular those relating to sensors and data mining, and improve existing "smart" services and better support city planning where possible.

Appendix 5

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau

Policy Area : Energizing Kowloon East

Overall/General Remarks :

A "Smart City" is often perceived as a city that uses digital/information and communication technologies (ICT) to enhance performance of the city and the wellbeing of the citizens. Yet for the smart city framework of Kowloon East, the Energizing Kowloon East Office (EKEO) of the Development Bureau intends to work towards a more integrated and area-based approach in building a smart city by focusing on 6 aspects, (1) **Smart People**, (2**) Smart Mobility**, (3) **Smart Environment**, (4) **Smart Living**, (5) **Smart Governance**, (6**) Smart Economy**, aim at transforming Kowloon East into Hong Kong's alternative core business area where people would like to stay, work, play and do business.

EKEO plans to commission a consultancy study around end 2015 to formulate a framework, set direction and priority for the smart city proposals in Kowloon East, including on-site pilot tests. The study area, comprising both new development area (i.e. Kai Tak Development) and developed area (i.e. Kowloon Bay Business Area, Kwun Tong Business Area), will provide an ideal test bed for showcasing a diverse range of smart city proposals in different urban settings.

Cross-bureau/department policy support and collaboration are essential in developing a smart city and there is a need for a common e-platform for sharing and dissemination of both public and private sector information if we are to leverage on the capability of ICT and big data.

It is also worth noting that developing a smart city is not something to be done by the Government alone. To this end, EKEO has engaged various research institutions, academics, IT industry experts, public transport operators, public utility companies and the private sector in collaborating with us in working towards this vision.

Individual Policy :

In 2015 Policy Address, it was announced that the Government will carry out a pilot study in Kowloon East (comprising the Kowloon Bay Business Area, Kwun Tong Business Area and Kai Tak Development) to explore the feasibility of developing a Smart City. The pilot area is approximately 488 hectares in size.

Future Measure(s)/Action(s) :

A number of ICT related measures are being considered for pilot testing in Kowloon East and they include:

Smart People

a. A mobile phone application* is being developed for release in 2016, which aims at providing a common platform for sharing and disseminating of real-time information to the public, such as parking availability; traffic, environmental and weather information; and multi-modal travel information, etc. The mobile phone application will be able to demonstrate how open data can be used to enhance the everyday life of the citizens.

Smart Mobility

b. Smart traffic light – making use of real-time vehicular traffic and pedestrian flows to fine-tune traffic light signals for traffic management at certain junctions (support from Transport Department is required).

c. Real-time parking availability* – real-time information on parking

availability for private, public, on-street and off-street parking spaces in Kowloon East to be disseminated via the mobile phone application.

d. Real-time loading and unloading bay information* – real-time information on availability of loading and unloading bays in the Kwun Tong Business Area to be disseminated via the mobile phone application.

e. Cycle Track with automatic bike rental system* – A consultancy study to review the feasibility of providing a comprehensive cycling network in Kai Tak Development will soon commence. The Study will explore the use of smart city elements such as automatic bike rental system, provision of real-time information on bike availability and on-line reservation, etc.

f. Electric vehicle (EV) charging infrastructure – Provision of such facilities in new private development and public housing sites as well as new government buildings in Kowloon East to encourage EV ownership and usage to address roadside air pollution problem.

Smart Environment

g. Automatic refuse collection system* in Kowloon Bay Action Area – preliminary technical feasibility is being studied.

h. Building information Modelling (BIM) – use of BIM in new government building to enhance buildability and constructability.

i. Integrated Building Management System (iBMS) – use of iBMS in managing new government buildings and optimising building energy performance.

j. Revitalising water bodies – incorporating the concept of revitalising

water bodies to the district including the existing nullahs to enhance the environment, promote co-use of land, and mitigate urban heat island effect.

k. BEAM Plus Gold or above rating and higher greening ratios – developments on new private development and public housing sites as well as for new government buildings in Kowloon East to attain Provisional Gold or above rating and adopt higher greening ratios.

Smart Living

l. Smart lamp post* – serves as wi-fi hotspots and for other purposes, e.g. information dissemination and public notifications.

m. Smart water and electricity meters for new commercial and residential developments and government buildings – to promote demand-side management of water and energy consumption.

n. Indoor way-finding system* – install indoor beacons to enable indoor navigation, e.g. in major public buildings.

Smart Governance

o. Common geographic information system (GIS) platform* – for sharing of geo-spatial and related information among government departments.

p. Remote monitoring of public facilities for faster maintenance response.

q. Control centre to oversee crowd control in Kai Tak Development during mega events* – real-time monitoring of vehicular and pedestrian traffic for better city resilience.

Smart Economy

r. The above measures will be conducive to the transformation of Kowloon East into an attractive core business district.

* The actual implementation of the initiatives in the longer term will hinge on whether management and maintenance parties can be identified.

Appendix 6

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau/
Architectural Services Department

Policy Area : Buildings, Land, Planning, Heritage Conservation, Greening and Landscape

Overall/General Remarks :

Architectural Services Department (ArchSD) has been applying information technologies/systems for effective and efficient delivery of its works under the programme areas of monitoring and advisory services, facilities upkeep, and facilities development. For design and construction of government buildings, the use of automatic controlled BS/E&M systems is part of ArchSD's sustained initiative in promotion of green building design and construction practices, and this may help contribute to the development of smart and intelligent buildings. Upon clients' request, IT infrastructure will be provided in buildings to facilitate the eventual IT system installations by clients.

Buildability and constructability of the buildings will be addressed starting from the design stage, which will be facilitated by advanced design tools like BIM and implementation of the 3S strategy.

Individual Policy (1) :

To tie in with DEVB's policy for Energizing Kowloon East and select suitable new government buildings in that area as pilot scheme to implement smart building initiatives. In the selection of suitable project(s), a balance between value-for-money and innovation for smart building initiatives would be considered.

Existing Measure(s) :

- ArchSD keeps abreast of development of BS/E&M technologies which are suitable for applications in Hong Kong and has issued General Specifications for Building Services Installations, which are reviewed and updated from time to time, to facilitate wider adoption of intelligent and automatic BS/E&M systems in ArchSD's building projects with due consideration of cost effectiveness, energy efficiency and operational needs.

- For large government buildings (e.g. large office buildings, hospitals), central control and monitoring systems (CCMS) are provided to control and monitor the operation and performance of air-conditioning plants/equipment units and other BS systems in the buildings.

- Apply 3S strategy: standardization, simplification and single integrated element construction method for building construction. Prefabrication, reuse/recycling, and labour saving measures will be adopted as appropriate.

Future Measure(s)/Action(s) :

- With the availability of proven smart sensors and actuators on the market, practical application of "on-line energy management and monitoring system" may be explored. This system, which is an advanced form of CCMS, will log large amount of on-line energy data for major BS/E&M systems (i.e. A/C, lighting, lift, water pumps etc) for real-time energy management. The energy database collected may facilitate future analysis and energy audit for individual BS/E&M systems and the overall energy consumption of the building. Such system will be adopted for trial in an ArchSD building project to assess the effectiveness of the system when the building is commissioned.

- Potential application of Radio-frequency Identification (RFID) technology for BS/E&M systems for trial in new building projects

may be explored. It is envisaged that RFID technology could facilitate easy identification of hundreds of components/equipment and their technical data in the BS/E&M systems, which in turn delivers potential O&M benefits and contributes to asset management for the BS/E&M systems. RFID would also be applied on quality control and logistic planning for the prefabrication works.

Individual Policy (2) :

To tie in with 2015 Policy Address for Energizing Kowloon East and select suitable existing government facilities in that area as pilot schemes to implement smart building initiatives. In the selection of suitable project(s), a balance between value-for-money and innovation for smart building initiatives would be considered.

Existing Measure(s) :

Besides the new government buildings, ArchSD has been implementing established measures that are promulgated under established policy relating to refurbishment and minor building works projects for existing government buildings as far as practicable. The consideration of applying RFID technology for BS/E&M systems for trial in new buildings may be extended to building materials to at least facilitate identification and management of building maintenance.

In addition, ArchSD operates a Repair Call Centre (RCC) with operators to take telephone calls from client departments. RCC handles the reported defects and issues minor works order for maintenance term contractors to follow-up necessary repair work. Alongside with the RCC, a Cyber RCC is operated round the clock for all departmental portal users to report the defects via electronic computer network in a paperless and synchronised approach.

For some repair requests with higher complexity and further investigation, referral would be arranged by RCC to ArchSD staff for further in-depth

investigation. Works repair instruction is then issued to maintenance term contractors via Automated Communication, Technical Information and Operation Network (ACTION System). Upon completion of the investigation, repair works will be proceeded should the building condition warrants.

To conclude, the ACTION and RCC system has been contributing in digitalising government operations and actively implementing paperless solutions to enhance efficiency, facilities information sharing and protect the environment.

Future Measure(s)/Action(s) :

In line with Government's strategy for developing Hong Kong as a Smart City, ArchSD will continually strive for exploring possible applications of new technologies to develop intelligent systems in facilities upkeep perspective together with extending the digitalised and paperless features of the ACTION and RCC system to other web systems in ArchSD as a holistic approach.

Appendix 7

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau/Civil Engineering and Development Department

Policy Area : Slope Safety

Overall/General Remarks :

The Geotechnical Engineering Office (GEO) of Civil Engineering and Development Department (CEDD) adopts a multi-pronged approach to manage landslide risk in a holistic manner, via: (i) improving slope safety standards, technology and administrative and regulatory frameworks, (ii) ensuring safety standards of new slopes, (iii) rectifying sub-standard Government slopes and maintaining them, (iv) ensuring that private owners take responsibility for slope safety, and (v) promoting public awareness in and response to slope safety. The system has proved to be effective in managing the landslide risk in Hong Kong, as is evident from the significant reduction in landslide fatalities in the past 30 years. However, climate change will increase both the frequency and intensity of extreme rainfall events, and thereby bring about an increasing chance of serious landslides including in particular failures and debris flows originated from natural terrain. We need to further enhance our landslide emergency preparedness for extreme rainfall events. Some initiatives that adopt smart technology are highlighted below.

Individual Policy :

We alert the public to reduce their exposure to danger from landslides through the issue of Landslip Warning during periods of heavy rainfall when it is predicted that numerous landslides will occur in Hong Kong. The Landslip Warning is issued by the Hong Kong Observatory (HKO)

based on decision made by the GEO/CEDD.

Existing Measure(s) :

The Landslip Warning System is supported by an extensive network of raingauge system and weather radars, which collects real-time rainfall data throughout Hong Kong. By combining with the rainfall forecast from HKO and instant prediction of landslide occurrence by means of a computer algorism, the Government can identify instances when the landslide danger is high and when it would be appropriate to issue a territory-wide Landslip Warning to the public. With the advancement in information technology (IT) and mobile service, the System can now be accessed via internet and mobile application to enable continuous surveillance by GEO/CEDD for timely issue of warning to the public.

Future Measure(s)/Action(s) :

To enhance our landslip warning service, GEO/CEDD is taking forward an initiative to develop a site-specific landslide detection and alert system. The system aims at automatic detection of the occurrence of landslide and debris impact via a network of sensors installed on debris-resisting barriers, for alerting the affected population to take appropriate emergency action.

Appendix 8

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau/
Drainage Services Department

Policy Area : Flood Control

Overall/General Remarks :

Drainage Services Department (DSD) has in the past 25 years built a reliable drainage infrastructure protecting Hong Kong from the risk of flooding. As a result, the number of flooding blackspots has dropped from 90 in year 1995 to 10 in year 2015.

To further enhance the drainage infrastructure and prepare for climate change, DSD has started to explore a smarter and sustainable approach for evolving the drainage system into "smart" and "blue-green" infrastructure.

Individual Policy (1) :

Drainage Master Planning / Flood Prevention / Revitalising Water Bodies.

Existing Measure(s) :

In the past two decades, DSD has completed a series of Drainage Master Plan studies covering all the flood-prone areas in Hong Kong. The studies utilized the then state of the art computational hydraulic modelling techniques to simulate the flooding situations under different storm scenarios and formulate drainage improvement works for implementation. The completed drainage improvement works have made substantial improvements to the drainage system.

Since 2008, a new round of Drainage Master Plan Review studies has been started to revisit the drainage performance in different drainage catchments. The review studies use more advance computational hydraulic modelling techniques, and consider new development planning, land use and climate change effect. The studies and construction of some of the recommended drainage improvement works are on-going.

As an adaptation strategy for climate change, as well as DSD's aspiration towards sustainable development, the concept of revitalising water bodies is included in large-scale drainage improvement works and planning drainage networks for new development areas so as to build a better environment for the public. This approach is now included in the Chief Executive's 2015 Policy Address.

Regarding technology, the use of operational hydrology and real-time sensors for facilitating drainage operations is increasing in recent large scale drainage improvement works. For examples, real-time water level sensors are installed at the Happy Valley Underground Stormwater Storage Scheme. The computer controlled weirs would be raised or lowered based on the water level data received and the operation mode required.

Real-time water level monitoring systems are installed at strategic locations of rivers and storage tanks to monitor the potential flood risk. A recent trial was conducted to extend the use of such sensors at strategic drain locations to facilitate the operation and maintenance works. These sensors would log the water level inside the drain and send data back to the server periodically. They will also send alert messages to the relevant personnel when the preset alert water level is reached.

<u>Future Measure(s)/Action(s)</u> :

DSD will continue to use state of the art computer technologies for hydraulic modelling and planning of drainage infrastructure development. DSD will adopt the concept of revitalising water bodies in full scale for large-scale drainage improvement works and planning drainage networks

with the project proponents for new development areas. DSD will also explore the increasing use of sensors to facilitate the operation and maintenance works and the development of operational hydrology.

Individual Policy (2) :

Enhancement of Operational Hydrology for Flood Management.

Existing Measure(s) :

Some of the flood prone areas and major drainage facilities in the Territory have been installed with water level sensors and closed circuit television (CCTV) for flood monitoring under the Hydrometric Information System. These measures provide an online monitoring at designated locations so as to facilitate resources deployment in case the flood water at particular location reached the trigger level. It enables the early deployment of emergency team for flood alleviation at these flood prone locations. The flood management could also be optimized if the water level / extent could be predicted accurately under a particular storm event through the application of the advance computational hydraulic modeling.

Future Measure(s)/Action(s) :

DSD has commenced investigation to look into the good practice of operational hydrology with a view to further enhancing the existing Hydrometric Information System in the Territory. A pilot scheme with the application of sophisticated hydrological monitoring device to capture the long term flow behavior in Yuen Long drainage system is undergoing. Subject to successful implementation and monitoring from this pilot scheme, installation of the flow monitoring device would be extended further to other drainage catchments so that a comprehensive flow regime across the Territory could be developed. With sufficient long term flow monitoring data to calibrate, validate and optimize the hydraulic models, a smart flood control prediction system would be developed to enhance the flood management in Hong Kong.

Appendix 9

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau/Lands Department

Policy Area : Survey and Mapping

Overall/General Remarks :

It is estimated that over 80% of daily life information has a spatial dimension. Spatial information is being considered an essential element for the Government in policy and decision making. Its importance and potential of spatial information is being increasingly recognized.

Lands Department (LandsD) is the central authority for all types of mapping in Hong Kong. Her survey and mapping service mainly includes the maintenance of geodetic reference frame of Hong Kong such that all positioning within the territory can make reference to; and the collection, updating and distribution of core spatial information to both public and private sectors such as basic mapping and land boundary information in both paper based maps and digital data formats. To serve the community better, she developed and launched a one-stop online map portal, namely "GeoInfo Map" (www.map.gov.hk) in 2010 integrating location information of over 120 types of public facilities for dissemination to the general public. A pilot mobile map app namely "MyMapHK" (http://www.landsd.gov.hk/mapping/en/MyMapHK) has also been launched since June 2014 to provide members of the public a convenient and on-the-go access to the digital maps and geospatial information about the Government facility information.

To realize the concept of a joined-up e-government and enable better geospatial information sharing across bureau/departments (B/Ds) within the Government, a purposely built common geospatial information

platform - the Geospatial Information Hub (GIH) (http://gih.landsd.ccgo.hksarg/gih-hksar/view/HGH.jsp) was developed and launched in 2004. At present, this web Geographic Information System (GIS) is serving 66 B/Ds with the database of 41 datasets comprising over 500 data layers contributed by 25 B/Ds.

The LandsD has also developed the Hong Kong Satellite Positioning Reference Station (SatRef) network to support high accuracy positioning in Hong Kong since 2001. The SatRef serves as an active position-fixing reference framework for all surveying and location-based services (LBS), including Geographical Information System (GIS) applications.

Future Measure(s)/Action(s) :

LandsD will continue to use state of the art surveying technologies for 3D spatial data collection for making the quantitative (e.g. digital maps, 3D spatial data) and qualitative (e.g. digital aerial photos) spatial information available supporting both B/Ds and the public in their current day-to-day businesses and future innovative applications.

Based on the successful models of GeoInfo Map and MyMapHK, LandsD will continue providing necessary support in the Smart City pilot study led by the Energizing Kowloon East Office (EKEO), in particular in the field of GIS/ICT. An EKE Smart City app is being developed.

A smart society conserves resources and the environment and improves its quality of living through innovation in all fields. It should also be an inclusive place, using technology and innovative solutions to improve social inclusion and combat poverty and deprivation. The LandsD has started a pilot project in 2014 to develop a digital inclusion mobile map app, namely “VoiceMapHK”, for use by the visually impaired, with the vision to bridge the digital gap and enable everyone enjoy the benefits of the technology advancements.

LandsD is also going to enhance the existing system architecture and improve the overall performance of GIH by 2017 with a view to ensuring the continuity of the commitment of the GIH to the B/Ds and enabling the

further development of the common geospatial information platform inside the Government.

Under the project namely “Development of a Hong Kong Positioning Infrastructure based on GPS, Beidou, and Ground based Augmentation System” funded by ITF, the SatRef has been employed as an essential positioning infrastructure to support robust LBS and the GNSS technology for improving positioning accuracy with smartphones and tablets by March 2016.

Given the GIS/ICT expertise/experience of LandsD, and the resilient framework in basic spatial information and positioning infrastructure, LandsD will support DEVB in paving way forward for the formulation of Spatial Data Policy for the establishment of a Common Spatial Data Infrastructure (CSDI); and develop a pilot common web GIS platform at NENT NDAs and other areas wherever considered appropriate, with a view to providing the information infrastructure foundation to support the progressive transformation of Hong Kong towards a smart and sustainable metropolis. The CSDI will encompass policies, standards, setups and technical platform that guide and support the collation, use and sharing of spatial data for the planning, development, operation and management of the city enabling innovative applications.

Appendix 10

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau/Planning Department

Policy Area : Town Planning

Overall/General Remarks :

The Planning Department embraces the concept of utilising ICT to facilitate different aspects of urban planning, including data collection and analysis, information sharing, as well as providing a platform for engaging the community interactively and effectively in various stages of the planning process. Many measures are already in place, and new initiatives will be taken to further improve the systems.

To enhance the quality of living, to improve the performance of urban infrastructure and services, and to reduce costs and resource consumption, we must plan our city smartly and innovatively with the application of advanced practices and technologies. We must also plan for resilience against the likelihood of more frequent occurrences of extreme weather as a result of global climate change. Under Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030 (Hong Kong 2030+), we aspire to make Hong Kong a smart, green and resilient city. New strategic growth areas would offer very good potential for adopting smart city initiatives, spanning from the city form, infrastructure, provision of services to accommodating individual lifestyles. Many of these are already proposed under various, and will be further explored in a more coherent framework under Hong Kong 2030+.

Individual Policy (1) :

Utilising ICT to facilitate different aspects of town planning, including data collection and analysis, information sharing, as well as providing a platform for engaging the community interactively and effectively in various stages of the planning process.

Existing Measure(s) :

Territory-wide survey for broad land use classification and update of Land Utilization Map in Hong Kong (LUM) using satellite images and GIS, provides an annual update about broad land use pattern, including greening, in Hong Kong.

The GIS-based Pearl River Delta Region planning and infrastructure database (Hong Kong-Macau-Guangdong Planning and Infrastructure Database) provides consolidated statistics, planning information and major infrastructural networks covering Hong Kong, Macao and Guangdong. The information is accessible to relevant users within the Government.

Territorial Population and Employment Data Matrix (TPEDM) is a comprehensive set of information to support planning analysis in optimizing transport, population and employment distribution.

Computer-aided Sustainability Evaluation Tool (CASET) enables project proponents to systematically analyse environmental, economical and social sustainability of development proposal.

Utilising web-GIS, including Geoinfo One Stop 2 (GOS2) to disseminate information and planning proposals and to users within the Government. Statutory Planning Portal 2 (SPP2) to disseminate statutory planning matters to the public and Public Participation GIS (PPGIS) to facilitate public engagement by providing interactive platform for the public to provide comments on planning and development proposals.

Future Measure(s)/Action(s) :

As a pilot, a Common Geo-spatial Information System Platform (CGISP) is being examined under the Detailed Design Study for the Fanling North and Kwu Tung North NDAs to facilitate planning, construction, monitoring and maintenance work. Subject to the experiences of this pilot scheme, similar applications may be explored for other NDAs and strategic growth areas.

Individual Policy (2) :

Planning for a Smart, Green and Resilient City through innovative town planning and urban design, as well as application of advanced practices and technologies.

Existing Measure(s) :

The Hong Kong 2030 has established a planning framework stressing the need to balance development with conservation. New planning initiatives such as 'planning green and blue spaces', 'integrated green infrastructure' and 'planning of a smart green and resilient city' under the Hong Kong 2030+ would further enhance environmental planning.

PlanD has also taken the lead to establish air ventilation assessment for better living environment in Hong Kong. To support a smart environment, site wind data (MM5) are constantly updated and uploaded to PlanD's website for free download for carrying out qualitative and quantitative wind analyses and air ventilation assessment. With the 'Urban Design Guidelines' promulgated under the Hong Kong Planning Standards and Guidelines, PlanD has been actively promoting sustainable building and layout design throughout the planning process.

Proposed measures in pursuit of a quality and green living environment are being investigated which include a compact city form, environmentally friendly transport, energy efficient buildings, district cooling system, use of renewable energy, sustainable drainage system, effluent reuse system, waste reduction and efficient use of water resources.

When planning for a new area, we ill generally adopt a rail-based development concept with a compact development form and green mobility. An integrated blue-green infrastructure system comprising total water management, efficient waste collection, revitalising water bodies, sustainable drainage, energy saving building/neighbourhoods and an ICT platform to coordinate different city functions has been proposed.

Future Measure(s)/Action(s) :

Under Hong Kong 2030+, we will further explore smart city concepts and the applicable planning framework to respond to new circumstances and challenges, including the new global and regional economic order, climate changes, ageing population, as well as aspirations for better quality of life and new lifestyles.

Appendix 11

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Development Bureau/
Water Supplies Department

Policy Area : Water Supply

Overall/General Remarks :

In line with government's latest initiative to develop Hong Kong into a green and resource-efficient city, Water Supplies Department (WSD) has formulated measures with a view to achieving the following objectives:

Effective planning and application of Information and Communication Technologies (ICT) aims at making use of smart ICT to effectively and efficiently manage, operate and maintain the water infrastructures and drive water conservation.

Individual Policy :

Total water management with emphasis on containing growth of water demand through water loss management and water conservation.

Existing Measure(s) :

WSD plans to progressively establish the Water Intelligent Network (WIN) over the territory by installation of sensors to set up District Metering Areas (DMAs) in the water supply networks. An intelligent network management system will be put in place to enable intelligent (and where necessary real-time) network performance analysis of the data collected from the sensors for continuous monitoring of the conditions of the water supply networks so that water mains in poor condition can be

identified early for action.

WSD is conducting pilot study to explore the use of consumption data at mid night recorded by the smart meters to detect inside service leakage.

Future Measure(s)/Action(s) :

WSD will make use of WIN (when it is in place) to implement smart network management to detect system anomalies and defects.

WSD also aims at installing smart water meters in the new development sites. Water consumption data will be read automatically and nearly real-time and historical consumption data as well as alerts of abnormal water consumption (e.g. inside service leakage) can be made available to consumers through the Internet and smart phone app to raise their awareness on water conservation.

Appendix 12

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Education Bureau

Policy Area : IT in Education

Overall/General Remarks :

The Fourth Strategy on IT in Education (ITE4) has been launched in August 2015. Major initiatives include the phased provision of wireless network services and other supporting facilities for all public sector schools.

Individual Policy :

The Fourth Strategy on IT in Education

Existing Measure(s) :

As a pioneer measure, 100 schools have already set up WiFi infrastructure in their campuses in the 2014/15 school year. Under ITE4, about 900 remaining schools will complete the set-up progressively in three-year time starting from 2015/16 s111chool year according to their school-based needs. There will be about 400, 300 and 200 schools setting up their WiFi infrastructure across these three school years. Principals and teachers are being provided with related training in professional development to pave the way for a more extensive and optimal use of e-learning in schools including how pedagogy may be adapted to better harness the potential of e-learning to improve learning effectiveness.

Future Measure(s)/Action(s) :

Recurrent funding will be disbursed to schools to sustain the adoption of WiFi infrastructure for e-learning. To facilitate schools' adoption of e-learning, the quality of e-learning resources will further be enhanced in collaboration with Hong Kong Education City. The curriculum will also be renewed to transform pedagogical and assessment practices. Teachers will be supported to further build up their professional leadership and capacity through professional development programmes and community of practice. Parents, stakeholders and the whole community, including the IT industry, will be involved to evaluate and sustain the development of IT in Education. The development and outcomes of IT in Education will be sustained through research and development with a view to consolidating knowledge and experiences as well as to enhancing support measures whenever appropriate.

Appendix 13

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Environment Bureau/
Environment Protection Department

Policy Area : Environment Protection

Individual Policy (1) :

Energy - Advanced Metering Infrastructure (AMI).

Future Measure(s)/Action(s) :

Advanced Metering Infrastructure (AMI)

The Government has been keen to promote demand-side management of energy consumption through various initiatives. AMIs are systems that measure, collect, and analyze energy usage, and communicate with metering devices such as electricity meters either on request or on a schedule. They form part of the "Smart Grid" system and provide two way meter communications, allowing commands to be sent toward the consumer for multiple purposes, including "time-of-use" pricing information, demand-side response, etc. Some overseas utilities have adopted AMIs to help consumers use information provided by the system to change their normal consumption patterns to take advantage of lower prices offered for different time periods. Incentive pricing may be used to curb growth of peak consumption. The two power companies in Hong Kong have started to study the application and technologies of AMI for general customers. Whether AMI technologies should be introduced into Hong Kong will be subject to any AMI development proposal from the two power companies and the Government's assessment of the feasibility and tariff implication of the proposal.

Individual Policy (2) :

Environmental Law Enforcement - Control of Asbestos under the Air Pollution Control Ordinance (APCO).

Existing Measure(s) :

Asbestos is commonly used in old structures and its removal must be carried out in accordance with the requirements of the APCO. To ensure compliance with the legal requirements, EPD needs to identify the locations of the structures containing asbestos. Apart from inspections made by EPD officers, EPD has also engaged consultants since 2012 to assist in conducting ground level inspections to assess the usage, distribution and conditions of asbestos structures in rural or village areas. In view of the large coverage of survey areas, the consultants have recently used a Remote Controlled Drone for aerial inspections in rural areas on a trial basis to supplement ground level inspections. Application of aerial photography is expected to enhance the efficiency and accuracy of the assessment, in particular to those inaccessible areas and other areas not visible from ground level.

Future Measure(s)/Action(s) :

EPD will review the results of the application of Remote Controlled Drone for aerial inspections by end of 2015 and consider its wider use in future work.

Individual Policy (3) :

Environmental Law Enforcement - Control of Emissions from Ocean-going Vessels under the APCO.

Future Measure(s)/Action(s) :

EPD will study the feasibility of using remote sensing equipment to track down ocean-going vessels using high sulphur fuel while berthing in Hong

Kong waters.

<u>Individual Policy (4)</u> :

Environmental Law Enforcement - Control of Movements of Materials under the Waste Disposal Ordinance (WDO) and Dumping at Sea Ordinance (DASO).

<u>Existing Measure(s)</u> :

The collection of chemical waste and clinical waste and the marine dumping of mud are subject to the control of the WDO and DASO respectively and real-time tracking of these consignments is currently conducted as follows:

- Chemical waste and clinical waste collection: Collectors of chemical waste and clinical waste are required under licence to procure a network service and install on-board GPS facilities on their vehicles/vessels, which enable real-time tracking of their locations by EPD and the collectors' management. EPD can easily locate them while in the field or at the office for conducting compliance checks within a short period of time. Records of these data also enable retrospective analysis for law enforcement investigations. The Chemical Waste and Clinical Waste Tracking System, an electronic data submission portal system for chemical and clinical waste collection and disposal, facilitates collectors and disposal site operators to submit waste consignment data to EPD for monitoring.

- Marine dumping: Vessels conducting marine dumping of mud/sediment are required under permit to install an automatic recording equipment, namely the Front End Mobile Unit (FEMU). FEMU is a key component of EPD's Real Time Tracking and Monitoring of Vessels (RTTMV) System. The System uses GPS telemetry technology, a mobile telephone network and computerized data capturing and transmission devices. The FEMU transmits self-monitoring data (position, draught and other

operational information) directly from the vessels at sea to EPD's control centre through mobile communication network. Contractors and dumping operators can access the same data on-line via a dedicated and secure RTTMV website. Permit holders can also gain access to the website to monitor and manage their dumping fleets online through the internet. Retrospective analysis of the dumping activities can also be done based on the records.

Future Measure(s)/Action(s) :

Regularly review the real-time tracking system specifications to enhance/ introduce the remote tracking functions, data integrity/communication protocol, synchronizing functions, advanced automatic alarm functions such as geofencing and other supporting services to users.

Individual Policy (5) :

Environmental Law Enforcement - Control of Waste Disposal Activities, Namely Fly-tipping of Waste and Livestock Waste Discharges, under the WDO.

Existing Measure(s) :

Unscrupulous waste-related operators and livestock farm operators may dispose of their waste by means of fly-tipping and illegal discharge of waste to watercourses respectively in order to avoid the costs of waste treatment/disposal. EPD's enforcement mainly relies on regular inspections and ambushes. As these illegal activities are usually carried out at inconspicuous locations or at odd hours, it is difficult to catch the offenders red-handed for prosecution purpose. Moreover, enforcement at livestock farms is increasingly difficult as the operators have strengthened their farm enclosure with higher panels and take surveillance before every illegal discharge.

To enhance the effectiveness of monitoring the fly-tipping blackspots, EPD has already installed different types of surveillance cameras,

including Closed Circuit Televisions (CCTVs), internet protocol (IP) cameras and other digital cameras, at a few fly-tipping blackspots. Whilst CCTVs and IP cameras allow direct transmission of images to EPD's office for real-time monitoring and off-line review, access to power supply, site constraints, installation costs and time may limit their feasibility.

Future Measure(s)/Action(s) :

EPD will explore the following options to enhance its surveillance capability of the above illegal activities:

- More extensive use of different types of surveillance cameras (incl. CCTVs, IP cameras, motion detection cameras) at fly-tipping blackspots and problematic farms.

Individual Policy (6) :

Provision of Water Quality Monitoring Data to the Public.

Existing Measure(s) :

(a) Beach Water Quality:

The EPD monitors 41 gazetted beaches and three non-gazetted beaches in the territory, and issues weekly gradings of all gazetted beaches open for swimming. The information is disseminated to the public through weekly press release, EPD's thematic website, the beach enquiry hotline, GeoInfo Map of the GovHK website, noticeboards at the beaches as well as the public sector information portal of the Hong Kong SARG (https://data.gov.hk/en/). The public can obtain the annual reports on beach water quality and more details of the beach monitoring programme from EPD's beach water quality thematic website (http://www.beachwq.gov.hk).

(b) Marine Water Quality:

Marine water quality is monitored monthly at 76 open water stations of Hong Kong. Water quality in typhoon shelters is monitored bimonthly at 18 stations, and sediment samples are collected twice per year at 60 stations. The public can obtain the marine water quality data and the annual reports on marine water quality from EPD's website. The public can also obtain the most recent data on dissolved oxygen and E. coli levels for a selected station from each of the 10 Water Control Zones at the website:

http://wqrc.epd.gov.hk/en/water-quality/marine.aspx.

More details of the marine water quality monitoring programme can be obtained from EPD's Hong Kong Water Quality Resource Centre (HKWQRC) thematic website (http://wqrc.epd.gov.hk)

(c) River Water Quality:

River water quality is monitored monthly at 82 stations, covering 30 rivers and streams. The monitoring involves conducting field measurements and collecting water samples for laboratory analyses of over 40 physico-chemical and biological parameters. The public can obtain the river water quality data and the annual reports on river water quality from EPD's website. The public can also obtain the most recent data on dissolved oxygen and E. coli levels at 12 selected rivers at the website:

http://wqrc.epd.gov.hk/en/water-quality/river-2.aspx.

More details of the river water quality monitoring programme can be obtained from EPD's Hong Kong Water Quality Resource Centre (HKWQRC) thematic website (http://wqrc.epd.gov.hk)

Future Measure(s)/Action(s) :

We will/are exploring the development of mobile apps to facilitate the public's easy search and reference of EPD's water quality monitoring information at gazetted beaches, marine coastal waters and rivers/streams.

Individual Policy (7) :

Use of various technologies to publicize AQHI.

Existing Measure(s) :

Air Quality Health Index

In order to provide timely and useful information on the potential short-term health risk caused by air pollution, EPD developed the Air Quality Health Index (AQHI) based on air quality monitoring data gathered from the existing air quality monitoring network. AQHI information is reported with a scale of 1 to 10 and 10+, and is grouped into five health risk categories, i.e. low, moderate, high, very high and serious. Specific health advice for people with different degrees of susceptibility to air pollution are also developed for different health risk categories.

While the AQHI information are updated every hour, AQHI forecast is also provided twice every day to help the public plan their outdoor activities and consider taking precautionary measures to protect their health.

The latest AQHI information and forecasts are disseminated through a number of channels including the AQHI website (www.aqhi.gov.hk), AQHI Mobile App and a hotline on 2827-8541. The AQHI Mobile App provides users a convenient way to receive air quality information measured by the monitoring network and by district as well as forecast of AQHI. This App will notify users when the forecast or the actual AQHI is at or above a health risk level preset by the user. AQHI is also regularly reported by different media like radios, TV and newspaper every day.

In 2015, EPD collaborated with the Standard Chartered Marathon Organizing Committee and local universities to provide a 'AQHI-Green Marathon', the first time to provide runners with real-time air quality information at strategic locations of the route.

Individual Policy (8) :

Electronic transaction, Mobile Apps and GIS for the public and our daily operation.

Existing Measure(s) :

Environmental Protection Interactive Centre (EPIC)

EPIC provides a through-train service under a secured electronic transaction platform for the public to apply for licences and permits and settle licence fees any time through the Internet, and it also enables the public to request for specific environmental data in an interactive way.

Mobile Apps

ENB launched several mobile apps in recent years, including Hong Kong Air Quality Health Index (HK AQHI), Waste Less, Plastic Shopping Bag Charging (PSB Charging), and Don't Fly-tip. They aroused public awareness of the hot issues related to environmental protection of Hong Kong and providing on-line services and support to both internal and external users. For Waste Less, it applies Global Positioning System (GPS) technology to assist the user in locating nearby recyclable collection points on a map. Notification is regularly pushed to the user about waste reduction and recycling news and knowledge.

Future Measure(s)/Action(s) :

Cloud Computing

OGCIO is developing cloud services for Government-wide needs, e.g.

Human Resources Management and Electronic Records Keeping, etc. ENB/EPD will keep in view of the progress to adopt cloud services to increase the cost-effectiveness where appropriate.

Geographical Information System (GIS)

Application systems will apply GIS in the daily operation of EPD, e.g. the Contract Management Information System.

Individual Policy (9) :

Strengthened Emissions Control of Petrol and Liquefied Petroleum Gas (LPG) Vehicles.

Existing Measure(s) :

Poorly maintained petrol and liquefied petroleum gas (LPG) vehicles are a major roadside air pollution source. However, their emissions are invisible to the naked eyes. To improve roadside air quality, EPD started in September 2014 deploying roadside remote sensing devicess to screen out excessively emitting petrol and LPG vehicles without stopping them. The owners of these vehicles will be required to fix the excessive emission problem and pass an emission test done with the aid of a chassis dynamometer at a designated vehicle emission testing centre within 12 working days. Failing to comply with the requirement will lead to cancellation of the vehicles' licences.

Future Measure(s)/Action(s) :

Apart from deploying roadside remote sensing devices to catch excessively emitting petrol and LPG vehicles, EPD will continue to monitor closely the development of the remote sensing technology with a view to extending its application to excessively emitting diesel vehicles.

Appendix 14

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Financial Services and the Treasury Bureau

Policy Area : Financial Technologies

Overall/General Remarks :

Financial Technologies (Fintech) can enhance operational efficiency of financial institutions and help foster new modes of development for the financial services industry. As an international financial centre with a highly developed information and communication technology sector, Hong Kong is an ideal hub for developing Fintech. Financial Services and the Treasury Bureau (FSTB) will work closely with all stakeholders to examine ways to foster a conducive ecosystem for developing Fintech in Hong Kong.

Individual Policy :

Hong Kong will explore development in Fintech, which has been expanding rapidly globally and particularly in the Mainland, to facilitate the conduct of financial transactions in an efficient yet secure manner through leveraging our position as an international financial centre and sound financial regulatory system.

- The development in Fintech will offer services beyond the traditional financial services model of bricks-and-mortar branches with fixed opening hours, and cater for clients' growing desire for initiating (sometimes spontaneous) interactions anytime, anywhere. Moreover, innovative services channels can cater for customers' changing

demand arising from the culture of instance feedback and social networking.

- As examples, technologies that enable small amount peer-to-peer fund transfers, innovative authentication for banking transactions, point-and-purchase e-commerce transactions and rapid approval for loans using algorithm for credit assessment are some examples for Hong Kong's progress towards a smart city.

- At the same time, financial institutions and Fintech firms can take advantage of the latest technologies to enhance their operational efficiency and offer better customer experience. These could include usage of big data technology to perform tasks from mitigating adverse human bias in investment strategy and ensuring compliance to regulations, to better anticipating clients' product demand and providing more favourable credit pricing to borrowers.

- In addition, the development of more robust security technology could help strengthen fraud detection for the benefit of both consumers and financial services providers as well as fortify trust in the financial system.

Existing Measure(s) :

Development of Fintech involves Government policy, regulatory infrastructure, talents, and also requires behavioural and cultural change of traditional financial services providers, startups and consumers. The Government has established a Steering Group on Financial Technologies to study how to promote Hong Kong's Fintech sector together with the industries, research and development institutions as well as regulatory authorities.

Regarding payment system, the Clearing and Settlement Systems (Amendment) Bill 2015, which will introduce a regulatory regime for and help foster innovation in payment products and services, will resume its second reading debate at LegCo before end-2015. For e-Cheque service to be launched in December 2015, it will provide an alternative payment

method that carries enhanced security features, enables high level of system automation and is more environmentally friendly.

Future Measure(s)/Action(s) :

The Steering Group aims to provide its recommendations on measures needed to foster a conducive ecosystem for Fintech-related activities and promote Hong Kong as a Fintech hub to the Financial Secretary within this financial year. FSTB will also work closely with all stakeholders to look into the potential of the Fintech sector and possible measures to promote developments in this regard.

Appendix 15

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Food and Health Bureau

Policy Area : Health

Overall/General Remarks :

Currently in Hong Kong, health-related and medical data are usually created and kept by different healthcare providers (or sometimes by individual patients) at different locations in different formats, e.g. at doctors' clinics and separately at hospitals. With the major exception of the Hospital Authority (HA), such data are usually kept in paper form by most healthcare providers. While some healthcare providers may deploy electronic medical/patient record systems to store and retrieve medical/patient data, such systems are generally not capable of data sharing at any large scale if at all.

Individual Policy :

To develop and implement a territory-wide Electronic Health Record (eHR) Sharing System as a key infrastructure for Hong Kong's healthcare system to enhance the quality and efficiency of healthcare provided to the population.

Existing Measure(s) :

- To test the concept and feasibility of eHR sharing, we launched the Public-Private-Interface Electronic Patient Record Sharing Pilot Project (PPI-ePR) in 2006, which allows participating private

healthcare providers and other registered institutions to view the HA's records, subject to patients' consent. The pilot project receives positive responses from the public and private healthcare providers, and has laid a solid foundation for implementing the two-way sharing of the eHR Sharing System.

(For information: By end June of 2015, more than 441,000 patients,3,433 private healthcare professionals (2,580 private medical practitioners and 853 nurses), 11 private hospitals and 77 other private organisations or NGOs providing healthcare-related services (including their 439 residential care homes or centres) had participated in the project.)

- We are implementing a two-stage programme to develop the full eHR Sharing System to provide an efficient platform for both public and private healthcare providers (HCPs)(e.g. hospitals and clinics) to upload and access individuals' eHR for healthcare purposes, subject to the individual's consent. Given the sensitive nature of health records and the unique arrangement of data sharing, we introduced a new legislation to provide for the establishment of the System, sharing and using of data and information contained in the System, as well as the protection of the System, in order to instill public confidence in the System.

  (For information: Stage 1 of the System, which includes the development of the core infrastructure of the eHR Sharing System and its complementary components (including the Clinical Management System (CMS) Adaptation (for private hospitals) and CMS On-ramp (for private clinics)) has been completed and the system is technically ready for commencement. Participation of the system is voluntary. The eHR Sharing System Bill was passed by the Legislative Council at its meeting on 13 July 2015. We are now proceeding with the preparatory work with a view to commencing

operation of the System by early 2016.)

<u>Future Measure(s)/Action(s)</u> :

- After the commencement of operation of the Stage 1 eHR Sharing System and securing funding approval from LegCo, commence the development of Stage 2 system to provide better continuity of care and better healthcare services. Tentative scope of stage 2 development includes radiological images sharing, expansion of sharable scope of eHR, new features to enhance patients' control/selection over data sharing, patient portal etc.

Appendix 16

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Labour and Welfare Bureau/ Social Welfare Department

Policy Area : Social Welfare

Individual Policy : Elderly Services

Existing Measure(s) :

"Senior Citizen Card Scheme"

The "Senior Citizen Card Scheme" (the Scheme) launched by Social Welfare Department (SWD) in April 1994 aims at promoting a spirit of care and respect for the elderly through aligning concessions, discounts and priority services offered by government departments, public organisations and private companies. Senior Citizen Cards are issued to eligible Hong Kong residents aged 65 or above for them to enjoy the said privileges.

The Scheme has been well received by elderly persons, companies, organisations and the community since its implementation, with around 1 020 000 elders in the territory being card holders, which covers over 90% of total eligible elderly persons. At present, over 2 600 companies and organisations have participated in the Scheme.

Following the rapid development of the information technology, SWD has uploaded to its Homepage the concession information offered by participating companies and organisations, and launched in September 2011 the Senior Citizen Card Smartphone Applications with a view to

facilitating the elderly as well as their family members and relatives to select their preferred products and services from the participating companies and organisations.

Appendix 17

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Transport and Housing Bureau/ Housing Department

Policy Area :

Hong Kong Housing **A**uthority (HA) develops and implements a public housing programme. The Housing Department (HD) is the executive arm of HA. Policy areas related to Smart City are –

(i) Planning and construction of public housing developments; and

(ii) Estate management.

Overall/General Remarks :

In the planning and construction of public housing developments, management of estates and the operation of various offices, HD has developed a strategic framework and adopts a wide application of innovative technologies for the promotion of sustainable development. Besides, to tie in with the advancement of information technology and to facilitate residents, HD endeavours to equip new public housing developments with digital infrastructures for the provision of internet services to residents.

Individual Policy (1) :

Energy Conservation and Enhancing Energy Efficiency

Existing Measure(s) :

(i) To reduce communal energy consumption of the lighting system in domestic blocks of public rental housing (PRH) and subsidised sale flats (SSF)developments, a two-level lighting control system was developed whereby illumination levels are operated by environmental lighting controls using motion sensors and on-demand switches with timer-controls;

(ii) To enhance community awareness of environmental protection, one to two solar-powered lights were installed in some of the new PRH and SSF developments for educational purposes;

(iii) A smart meter cum energy information display system was developed which shows the average electricity, gas and water consumptions per flat in an estate. This system will be placed at the main entrance lobby of domestic blocks of PRH and SSF developments where residents can obtain energy/resource figures of different blocks within the same estate for the purposes of encouraging resource conservation;

(iv) Replacement of the electromagnetic ballast of existing light fittings with electronic ballast for better energy conservation was completed in about 820 existing PRH domestic blocks;

(v) Carbon emission estimation, energy estimation, and the use of green design of building equipment, such as photovoltaic (PV) panel system and solar powered lights are adopted in new PRH developments; and

(vi) Energy certificates for all domestic blocks in newly completed PRH and SSF developments have been obtained.

Future Measure(s)/Action(s) :

(i) To explore and study the use of more energy efficient equipment, including with the utilisation of regenerative power for large

capacity lifts and light-emitting diode (LED) bulkheads;

(ii) To replace the electromagnetic ballast of existing light fittings with electronic ballast for better energy conservation in about 140 existing PRH domestic blocks by the third quarter of 2015; and

(iii) To conduct carbon audit in 14 typical PRH domestic block types for monitoring and benchmarking purposes.

Individual Policy (2) :

Water Conservation

Existing Measure(s) :

(i) To supplement fresh water supply for irrigation purposes, HD adopted the Rainwater Harvesting System (RWHS) in some new PRH developments. Building on the rainwater harvesting technique, an innovative low-carbon design solution was further adopted whereby rainwater collected at high elevations, such as, building rooftops, green roofs and covered walkway would be treated via bioretention and held in storage tanks for reuse;

(ii) For new PRH and SSF developments, HD promulgates specification on dual flush system to reduce flushing water consumption;

(iii) For new PRH and SSF developments, HD promulgates specification on the use of Water Efficiency Labeling Scheme registered shower heads and mixers; and

(iv) HD has implemented an innovative twin-tank water supply system in all new PRH and SSF developments to ensure no interruption of water supply to tenants during regular tank cleansing and for water saving.

Future Measure(s)/Action(s) :

To monitor the performance of the new rain water harvesting system installed in commercial centres and PRH developments.

Individual Policy (3) :

Air Quality Improvement

Existing Measure(s) :

To support the Government's initiative of promoting the use of electric vehicles to improve air quality, HD provides electric vehicle charging facilities in carpark buildings of all new PRH and SSF developments.

Individual Policy (4) :

Digital Services

Existing Measure(s) :

(i) All domestic blocks in new PRH and SSF developments are provided with dual sets of in-building telecommunications wiring systems (block-wirings) to broaden tenants' choices of advanced network services; and

(ii) Conduits are built in all PRH estates for telecommunication service providers to provide residents with free Wi-Fi services at the ground floor lift lobbies and outdoor recreational areas.

Appendix 18

Policies as well as Existing and Future Measures in Developing Hong Kong as a Smart City by Policy Bureaux and Departments of the HKSAR Government

Policy Bureau/Department : Transport and Housing Bureau/ Transport Department

Policy Area : District Traffic and Transport Services

Overall/General Remarks :

Various intelligent transport systems measures mentioned in the Third Comprehensive Transport Study completed in 1999 have been implemented by phases.

Individual Policy :

The Transport Department (TD) conducted the first Intelligent Transport Systems (ITS) Strategy Review in 2000, to formulate the strategy to maximize the utilization of our limited road space through the application of innovative traffic management within the resources available. The TD has been implementing ITS strategy under two major areas :-

(a) **"Smart Way to Travel"** – focuses on providing the public with real-time transport and traffic information, such as information on routing and public transport services; and

(b) **"Smart Way for Safety and Efficiency"** – focuses on providing comprehensive traffic control and surveillance coverage over the territory, as well as developing territory-wide coordination among control centres for traffic and incident management.

Existing Measure(s) :

1. Infrastructures of Intelligent Transport Systems

   (a) TD has been installing Closed Circuit Television (CCTV) cameras at strategic locations since the 1980s to monitor traffic condition. As at end 2014, 669 CCTV cameras were installed in urban, new towns and strategic routes for traffic control and surveillance. In addition, 180 sites were installed with fixed CCTV cameras for disseminating real-time traffic images to the public via the Internet and mobile devices.

   (b) TD completed the installation of Transport Information System (TIS) in 2008. TIS is a centralized data warehouse for collecting, processing and disseminating transport information.

   (c) In 2010, TD offered the Intelligent Road Network Package for sale to private companies and value-added service providers (including telecommunication companies, fleet and freight operators, as well as logistic and IT organizations), such that they can use such traffic information (e.g. travel directions, turning restrictions, etc.) to develop ITS application such as car navigation, fleet management system and personalized information service.

   (d) In 2011, TD started providing the public traffic data for free via the DATA.GOV.HK website. By now, there are six types of information including public transport and real-time traffic data in the website for public to develop applications. In addition, the public (such as private companies and software developers) can now obtain the "Hong Kong eTransport Kiosk" software package from TD free-of-charge to develop public transport information-related applications.

2. Traffic Information

(a) TD launched 'Road Transport Information Services' (RTIS) in 2009, providing four types of real-time traffic information on website including real-time traffic snapshots and webcast, journey time of the three cross harbour tunnels, traffic speed maps along some major routes and special traffic news to the public so as to allow them to choose the suitable transport modes and routes. TD launched a mobile version in 2010 to further facilitate the public to use RTIS anytime and anywhere.

(b) TD launched the 'Hong Kong eTransport' website in 2009 for the public to search the most suitable public transport modes and routes to their destinations. TD launched the mobile application and mobile website in 2011 for the public to use the service anytime and anywhere. Considering some overseas visitors may not have access to the internet in Hong Kong, TD installed eight 'Hong Kong eTransport' kiosks at six strategic locations in November 2014 as a trial for them to get the traffic related information.

(c) TD launched the 'Hong Kong eRouting' website in 2010. Motorists can search for the suitable driving routes based on their preference such as the route with shortest distance, shortest journey time or lowest toll. TD also launched the mobile website and mobile applications in 2011 and 2013 respectively for the public to use the service anytime and anywhere.

(d) TD launched the 'Journey Time Indication System' (JTIS) on Hong Kong Island in 2003 and expanded JTIS to Kowloon and Hong Kong East in 2010. JTIS displays the estimated journey time required for using the three road harbour crossings and allows motorists to choose the appropriate driving route before the diversion points, depending on the actual traffic situation at the RHCs.

(e) TD commissioned five sets of 'Speed Map Panels' (SMPs) on the major roads (Kowloon-bound) in the New Territories in 2013. Such panels assist motorists in making informed route choices by providing them with real-time traffic conditions on the roads ahead through gantry signs as well as smartphone apps in a schematic map format. Different colours are used to represent different levels of congestion on the road sections concerned.

3. Traffic Control

(a) By now, more than 97% of the traffic signals in Hong Kong are connected to the 'Area Traffic Control' (ATC) system which can coordinate the operations of traffic signals to minimise the stopping time of vehicles to ensure smooth traffic flow and efficient passage of emergency vehicles through the signalised junctions.

(b) The 'Traffic Control and Surveillance' (TCS) facilities on strategic roads include CCTV cameras, incident detectors, Variable Message Signs (VMS) and lane control signals. TD and tunnel operators can use the TCS to monitor traffic conditions, detect traffic incidents and provide motorists with real-time traffic information and guidance. At present, traffic control and surveillance facilities have been installed at all road tunnels in the territories, Tsing Ma Control Area, Shenzhen Bay Bridge, Kong Sham Western Highway and Tsing Sha Control Area.

4. Supporting Enforcement

(a) To deter red light jumping, TD started installing red light camera system since 1995. By now, there are a total of 155 sites with camera system in operation.

(b) To combat speeding, TD installed a speed enforcement camera

system on a road section of Tolo Highway as a pilot in 1999, and completed the Phase 1 and 2 projects in 2004 and 2013 respectively. At present, there are 120 sites in the territory with speed enforcement camera system in operation.

Future Measure(s)/Action(s) :

(a) The franchised bus companies will be rolling out real time bus information system in phases. Passengers will be able to access the departure time at bus termini and the estimated arrival time at bus stops for bus routes through mobile platforms (including computers and mobile applications) and display panels at major bus stops.

(b) The Government will conduct a public engagement exercise on the Electronic Road Pricing (ERP) scheme to explain to the community the concept of ERP, its practical operation and implications, as well as to listen to public views on the implementation of a pilot scheme in Hong Kong.

(c) TD is implementing the Traffic and Incident Management System (TIMS) scheduled for completion in 2016. TIMS is a multi-function computer system which performs incident management and automatic incident detection, suggests traffic and transport contingency plans, streamlines the dissemination of traffic and transport information to the public, and coordinates existing and future Traffic Control and Surveillance Systems (TCSS). It also includes a common data platform for interested parties to acquire TD's traffic speed and incident information for developing value-added services.

(d) TD will examine whether real-time parking space information systems should be provided in Government car parks managed by TD, taking into account factors including cost effectiveness, resources required and the exemplary effect. TD will also continue to communicate with and encourage private car park

operators to disseminate vacancy information via better used of web-based technology.

(e) TD will work with the Energizing Kowloon East Office in exploring various smart city initiatives in East Kowloon, including the provision of more parking information, ratoinalisation of loading/unloading activities and the facilitation of the use of "HK eTransport" services by the public, etc.

(f) TD is exploring the feasibility of expanding the SMPs to other major routes in the territory. TD will also install ten more 'Hong Kong eTransport' kiosks in 2016.

(g) TD plans to complete the Phase 4 Red Light Camera Expansion Project in 2015 comprising 40 new digital red light cameras which are being installed at 40 new locations throughout the territory.

(h) In the longer run and subject to further consideration and the availability of resources, TD may explore:

i. the feasibility of providing smart facilities at signalized pedestrian crossings to extend the pedestrian green time (especially the flashing green time) when there are demands for crossing from the elderly or persons with physical disabilities;

ii. the feasibility of providing smart devices to communicate with visually impaired persons at signalized pedestrian crossings directly on whether the signals are red or green for them to cross roads safely. The sound level of the audible traffic signal can then be lowered, thus the noise nuisance to nearby residents can be reduced; and

iii. the feasibility of upgrading the functions of Transport Information System.