For discussion
on 10 July 2017

Legislative Council
Panel on Information Technology and Broadcasting

Smart City Development

Purpose

This paper briefs Members on the latest progress of formulating a smart city blueprint for Hong Kong.

Background

2.   In recent years, a number of cities around the world have been striving to develop smart cities by using information and communications technology ("ICT") to improve city management and development, in order to address citizens' concerns in a modern city. However, the definition of smart city around the world is not always the same. Different cities would set their smart city development goals according to their own circumstances and policy priorities.

3.   In the 2017 Policy Address, the Chief Executive re-affirmed the Government's commitment to develop Hong Kong into a smart city. The objectives are -

    (a)   to make use of innovation and technology to address urban challenges, to enhance the effectiveness of city management and to improve people's quality of living as well as Hong Kong's sustainability, efficiency and safety;

    (b)   to enhance Hong Kong's attractiveness to global businesses and talents; and

    (c)   to inspire continuous city innovation and sustainable economic development.

4.   In order to incorporate the experience and wisdom of different cities in smart city development, we commissioned a consultant to assist in the formulation of the overall development framework of the Hong Kong Smart City Blueprint. The scope of the consultancy study includes policy objectives

and strategies, development plans, governance arrangements, digital infrastructure, open data sharing and public-private collaboration, etc.

5.　　　PricewaterhouseCoopers Advisory Services Limited was appointed as the consultant for this research in September 2016.　During the 9-month study, the consultant met with stakeholders from various sectors and fields, including government bureaux and departments ("B/Ds"), public bodies (including regulatory authorities), the academia, research and development centres, industry representatives and professional bodies, as well as private enterprises.　We also set up a dedicated website (www.smartcity.gov.hk) to solicit preliminary public views on the development of smart city.

Findings and proposals from the consultant

6.　　　The consultant submitted the study report to the Government by the consultant in late June 2017.　It has been uploaded to the Office of the Government Chief Information Officer's website (www.ogcio.gov.hk) for public view.　The summary is at **Annex**.　The major findings and proposals from the study are highlighted in the ensuing paragraphs.

Vision, Objectives and Strategies

7.　　　The consultants suggested that Hong Kong's smart city development should meet the following vision, missions and policy objectives –

> *Moving forward to developing Hong Kong into a people-centric smart city, we set our vision for Hong Kong to be "Smart Hong Kong - Embracing innovation and technology to build a strong economy, enhance quality of living and make Hong Kong a well-known Smart City" with the following missions –*
>
> *(a) people will be happier, healthier, smarter and more prosperous. The city will be more livable, green, clean, sustainable, resilient and competitive;*
>
> *(b) businesses will continue to capitalise on Hong Kong's renowned business-friendly environment, foster innovation, transform the city into a living lab and test bed for development and accelerate into local and global markets;*

(c) the elderly and youth will be better cared for, and there will be a stronger sense of community. Businesses, people and the Government will be more technologically savvy as the city continues to be more digitally enabled; and

(d) as a member of the global community, Hong Kong will be more environmentally friendly and consume fewer resources whilst maintaining its efficiency, livability and vibrancy.

<u>Development Plans</u>

8.　　Based on the Boyd Cohen model, the consultant developed recommendations on Smart City Development Program for Hong Kong covering six areas, namely "Smart Mobility", "Smart Living", "Smart Environment", "Smart People", "Smart Government" and "Smart Economy". The consultant has taken reference from overseas experience in making recommendations for the development goals and plans under each area. The consultant has proposed a strategic framework that includes short-term (2017-20), mid-term (2021-25) and long-term (2030) measures and set policy objectives to allow the Government and other stakeholders to consider the proposed action based on feasibility, priority and resource allocation. The consultant's recommendations include:

(a) **Smart Mobility**: developing a strategic road map for intelligent transport systems; providing multi-functionalities by sensors at public transport interchanges; developing an all-in-one transport mobile application; using Internet-of-Things ("IoT") to improve car park searching; upgrading the Hong Kong International Airport into a smart airport through automation, mobility, personalisation and self-service; enhancing the safety of vehicles by integrating technologies; gearing up for the testing of autonomous vehicles; providing environmentally friendly passenger ferries; encouraging the use of bicycles in new towns and new development areas, etc.;

(b) **Smart Living**: promoting digital profile; offering more options of digital payment; promoting gerontechnology; using wearable technology to track health; developing smart hospitals, etc.;

(c) **Smart Environment**: promoting green and intelligent buildings; managing electrical grid with smart technology; increasing the efficiency of waste management; enhancing pollution

management by using remote sensors; improving energy efficiency in commercial settings, etc.;

(d) **Smart People**: enhancing Hong Kong's capability in data science; providing convenient access to public services through a city "One-Stop Shop"; using different Internet based tools and the social media to gauge the views of the public; fostering entrepreneurial and innovative spirit through education, etc.;

(e) **Smart Government**: preparing for the deployment of 5G mobile communication technology; installing multifunctional smart poles in the community; setting up a virtual 3D simulated platform; offering more citizen-centric e-services; enhancing the government's data analytics capability; using common utility tunnels, combining electricity, water supply pipes, and sewer pipes in appropriate locations, etc.; and

(f) **Smart Economy**: developing financial technology; revitalising Hong Kong's manufacturing with "re-industrialisation"; enhancing the eco-systems for start-ups to attract investments by foreign companies; establishing a research and development platform at the Hong Kong – Shenzhen Innovation and Technology Park in Lok Ma Chau Loop; promoting smart tourism, etc.

Governance Arrangement

9.   The consultant recommended establishing a high-level cross-B/D committee to oversee smart city development in Hong Kong.   The consultant also proposed the establishment of a Smart City Programme Office to coordinate B/Ds to implement the relevant measures.   As for individual smart city projects, they would be implemented by project teams formed by the relevant departments.

Digital Framework

10.   The consultant has set out an array of measures and initiatives to build an appropriate digital framework, in order to support long-term smart city development in both the public and private sectors.

Enhancing Government Digital Infrastructure

11.   Having regard to the increasing public expectations on public services and the rapidly changing business environment, the consultant proposed to develop an application architecture framework and to implement a central platform to enable departments to share or reuse resources, which would allow the Government to deliver e-Government services in a more agile and efficient manner.   In addition, the consultant proposed developing a new integrated cloud infrastructure to support e-government services delivery in the years ahead.   The new cloud infrastructure will be able to cater for shared services and data, allowing the government to provide continuous and flexible e-Government services, and have sufficient capacity and scalability to support the operation of B/Ds and the provision of various public services.

Big Data Analytics

12.   The Government takes active steps to promote adoption of big data analytics.   To enhance the Government's expertise and capability in this area, the consultant proposed to develop guidelines on big data security and privacy by making reference to global best practices; to increase in-house big data technical resources and capabilities; to implement a big data development platform featuring artificial intelligence tools for data collection and analytics; and to improve the training of government personnel.

Cybersecurity

13.   The Government upholds information security policies, standards and guidelines to protect government information systems and data.   With the proliferation of IoT applications and devices for developing various smart city initiatives, IoT security becomes increasingly important.   The consultant proposed an IoT security framework which comprises technical measures compatible with security standards and IoT standards.

Open Data

14.   Through the Public Sector Information portal, the Government has already released thousands of data sets and around 1 000 Application Programming Interfaces, covering 18 areas, for free re-use by the public. Geographical information will also be provided within 2017.   To further promote open data, the consultant has identified in the report a list of public and private datasets that should be opened up with priority.   We will discuss with relevant departments and organisations to open up data sets conducive to urban innovation, whilst protecting personal privacy.

Privacy issues

15.   The consultant noted that many international organisations proposed to address the privacy issues that may arise from IoT, big data and open data by the "Privacy by Design" principle.   Having regard to global best practices, the consultant recommended the Government to study jointly with the Office of the Privacy Commissioner for Persona Data on how to implement "Privacy by Design" as appropriate in Hong Kong, and setting policies or guidelines on consent, transparency and de-identification.

Public-Private Partnership ("PPP")

16.   The consultant considered collaboration between the public and private sectors a key factor of smart city.   Drawing on the experiences of cities like Amsterdam, Copenhagen, New York, Valencia, etc., the consultant summarised the benefits of developing a smart city in a PPP model, including encouraging private sector development and promoting industry innovation, optimising skills and expertise in public and private institutions, encouraging the private sector to invest in infrastructure projects and services in the public sector; and allocating risks more effectively, etc.

17.   In response to Hong Kong's aging population, the consultant proposed developing an elderly care homes collaborative platform to provide matching and quality assurance services, such as helping elderly home operators find local small and medium-sized enterprises as partners to explore how to use technology to enhance the service standards of elderly care homes, and how to ease manpower shortage.

Pilot projects

18.   When formulating the holistic blueprint, the consultant suggested a number of pilot projects.   Some projects (e.g. smart parking) can be implemented through existing measures, while other projects (e.g. smart integrated poles and the relevant sensor applications) may need to be further planned and studied.   The consultant also supported implementing the following projects –

    (a)   Implementing Smart City solutions in New Development Areas ("NDA")

           The consultant recommended the Government to consider holistically implementing in NDAs various technologies and smart

city solutions, such as urban drainage system, rainwater harvesting, grey water reuse, smart water network management, walkability, electric vehicles charging infrastructure, free public Wi-Fi, smart integrated poles, and underground integrated facilities. Locations recommended by the consultant included the Anderson Road quarry consultation project and the Lok Ma Chau Loop.

    (b)   Smart Region Living Lab

The Hong Kong Science and Technology Parks Corporation, in collaboration with the Chinese University of Hong Kong, plans to set up a living lab to support the pilot application of innovative solutions. Recommended testing items include a social culture platform, autonomous vehicles, smart building and facility management, a cashless society, etc. Depending on the progress of the development of the 5G communications technology, it may also be considered for incorporation in the pilot.

    (c)   Cultural and Heritage Tourism in Central District

The Hong Kong Tourism Board recently launched the "Old Town Central" campaign which focuses on promoting various revitalised tourist attractions and providing visitors with different routes for self-guided walk under different themes, such as historical architecture, arts and culture, modern living, dining and entertainment, etc. The consultant recommended using ICT to further enhance tourists' experiences, such as providing interactive videos or photos, electronic coupons or discount offers at selected tourist spots, digital walking routes guide and on-line information on accessibility, etc.

Way Forward

19.   The findings of the consultant serves as a good reference basis for the development of a smart city blueprint. The recommendations in the report involve the policy initiatives of different aspects of Government, and have an impact on the operation and the provision of public services by Government departments, public and private organisations; operation of individual industries, as well as the protection of personal privacy. A consensus among all sectors of society needs to be reached. We will study the recommendations of the report taking into account Hong Kong's unique circumstances and relevant policies, and discuss with relevant B/Ds to consider

feasible initiatives to promote smart city in different areas. We will also consult stakeholders and various sectors of the community on how to take forward individual projects and initiatives, in order to formulate a smart city blueprint that is in line with the situation in Hong Kong. We aim to publish the blueprint in the third quarter of 2018.

Advice Sought

20.   Members are invited to note the latest progress of formulating a smart city blueprint for Hong Kong and give their views on the findings and proposals from the consultant.

Innovation and Technology Bureau
Office of the Government Chief Information Officer
July 2017

Report of Consultancy Study on Smart City Blueprint for Hong Kong

Executive Summary

June 2017

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1. Smart City Vision, Policy and Strategy

Having regard to the urbanisation challenges facing Hong Kong and global trends, the guiding principles in developing Hong Kong into a smart city include being people-centric, having a high level of coordination across the public and private sectors, encouraging participation from all stakeholders, and embracing innovation and technology.

It is recommended that Hong Kong should position its smart city development under the following vision and mission statements:

<u>Vision</u>
"Smart Hong Kong - Embracing innovation and technology to build a strong economy, bring quality living and make Hong Kong a well-known Smart City."

<u>Mission</u>
(a) *People will be happier, healthier, smarter and more prosperous. The city will be more livable, green, clean, sustainable, resilient and competitive;*
(b) *Businesses will continue to capitalise on Hong Kong's renowned business-friendly environment, foster innovation, transform the city into a living lab and test bed for development and accelerate into local and global markets;*
(c) *The elderly and youth will be better cared for, and there will be a stronger sense of community. Businesses, people and the Government will be more technologically savvy as the city continues to be more digitally enabled; and*
(d) *As a member of the global community, Hong Kong will be more environmentally friendly and consume fewer resources whilst maintaining its efficiency, livability and vibrancy.*

Nine smart city strategic actions may be adopted for guiding the journey for Hong Kong towards a smart city based on Hong Kong's current capabilities, city challenges, and aspirations for the future. These include:

1. Invigorating the ecosystem for innovation to support the development, commercialisation, scaling up and export of smart solutions;
2. Engaging the public and business and co-creating smart solutions with stakeholders to better meet the needs and fulfil the aspirations of the people;
3. Cultivating a culture of embracing changes and collaboration for smart city development;
4. Integrating with city planning;
5. Establishing a sound digital framework to support further improvement to the operations of urban infrastructures and provision of services;
6. Providing support to reduce the digital divide and ensure inclusiveness of Smart City development;

7. Equipping students and workforce with the knowledge and skills to seize opportunities in a Smart City;
8. Developing an innovative strategy for procuring smart solutions; and
9. Improving preparedness, prevention, and mitigation of adverse events.

2. *Smart City Development Plans*

2.1. *Smart Mobility*

The policy objectives for Smart Mobility are to facilitate commuters' choice of efficient and integrated multimodal transport; promote non-mechanised transport modes for short trips and maximise use of public transport; reduce carbon emissions and air pollution through the use of efficient modes of transportation; and alleviate traffic congestion problems through effective planning and enforcement. The anticipated outcome and benefits include better informed journey planning for both drivers and commuters; better user experience in travelling within Hong Kong; and reduced carbon emissions for a cleaner Hong Kong.

The Smart Mobility initiatives enhance people's mobility through efficient and targeted capital deployment models and infrastructure investments. Potential short-term, medium-term and long-term projects include:

- Developing strategic road map for Intelligent Transport Systems ("ITS") to map out the short-term and long-term goals of smart mobility, with the development of various ITS initiatives interacting with each other using real-time city wide traffic data.
- Enhancing user experience at smart public transport interchange or major bus stops to provide functions and features such as integration of sensors to demonstrate multi-functionalities (e.g. traffic detection and air quality), provision of free Wi-Fi and multi-purpose touch screen.
- Facilitating informed journey planning through all-in-one transport mobile application ("HKeMobility") by Transport Department.
- Improving car park searching experience in off-street parking and traffic management at signalised junctions and pedestrian lights by making use of IoT sensors.
- Enhancing the user experience at Hong Kong International Airport via digital transformation, focusing on automation, mobility, personalisation and self-service. In addition, the airport should provide integrated multi-modes of transport to plan journeys from/to airport for passengers and visitors.
- Enhancing safety features of vehicles running in Hong Kong, by integrating technologies into vehicles to equip them with internet access and wireless

connectivity to allow for vehicle-to-everything ("V2X") communications for applications like alerting drivers to vehicle forward collision warning, do-not-pass warning, vehicle queue warning, curve speed warning, blind intersection notification, and emergency vehicle alert.

- Reducing road congestion through Electronic Road Pricing.
- Enhancing our bus services by integrating buses with sensors and sharing data with other transportation systems to provide real time information on bus capacity, routes and location, and to detect congestions or other traffic events.
- Gearing up for adoption of autonomous vehicles, which may first be piloted in areas such as the airport, Science Park and the Lok Ma Chau Loop.
- Maximising the use of car assets through promoting car pooling and car sharing.
- Encouraging using bicycles in new towns and new development areas ("NDAs").
- Easing payment and traffic data collection through installing in-vehicle unit.
- Providing environmentally friendly passenger ferries.
- Adopting smart technologies for traffic enforcement.

2.2. Smart Living

The policy objectives for Smart Living are to instil and enhance citizens' confidence and ability in transacting electronically with the public and private sectors, to empower the elderly to age in their own communities, and support general citizens' wellbeing. The anticipated outcome and benefits include better living experience across age groups and demographics; improved public healthcare services; better wellbeing for our citizens; and happier elderly as they can age in the surroundings they prefer.

The Smart Living initiatives seek to enhance the overall living experience of the people of Hong Kong. Potential short-term, medium-term and long-term projects include:

- Providing more options of digital payment.
- Providing a secured means for individual identification and access to digital profile/persona.
- Enhancing the living and health environment for the community, through the use of gerontechnology, teleconsultation and remote health monitoring, to help the elderly live in the community and institutions comfortably, healthily and independently while remaining closely connected to the community and their families.
- Using wearable technology to track health and fitness, and for other applications.
- Making our hospitals services smart through new hospitals and retrofitting old ones with smart features and services which are enabled by technology-driven solutions and products.

- Facilitating smartness at workplace by adopting office technologies, cloud-based management, VR for team design and collaborations, AI in business operations and network connectivity, and facilitating flexible working environment.

2.3. Smart Environment

Having regard to the Climate Action Plan 2030+ announced in January 2017, which outlined the Government's long term action to combating climate change and setting out the carbon emission reduction target for 2030, the policy objectives for Smart Environment are to promote a more sustainable environment for Hong Kong and optimise the use of city resources through a focus on "reduce, reuse and recycle". The anticipated outcome and benefits include inducing systemic and cultural changes in relation to the concept of sustainable and green living, as well as city-wide pollution and waste management, which in turn leads to a better and more sustainable environment for all.

The Smart Environment initiatives seek to change how Hong Kong's built and natural environment are managed in order to improve Hong Kong people's everyday life and quality of living. Potential short-term, medium-term and long-term projects include:

- Promoting green and intelligent buildings in construction and maintenance.
- Advancing the electrical grid with smart technology for better energy management by interconnecting various sensors, meters and appliances to allow remote monitoring of energy usage, and for users to manage their own energy demand and shift peak hours of energy usage.
- Exploiting the value of waste through improving Hong Kong's waste management practices to maximise landfill diversion and increase recycling, and increasing efficiency in the overall waste management processes.
- Enhancing pollution management by using remote sensing technology to monitor and reduce pollution.
- Improving energy efficiency in commercial settings, e.g. in neon signs and illuminated signboards.

2.4. Smart People

The policy objectives for Smart People are to enable people to interact with service providers and participate in civil society with ease and confidence; facilitate lifelong learning for individuals in the public and private sector, youth to elderly, about science, technology, engineering and mathematics ("STEM"), leading to fluency in the development of innovation and information technologies; and nurture a highly adaptive population that readily embraces changes. The anticipated outcome and benefits include creating an environment of social inclusiveness, creativity, open-mindedness, greater connectedness, resilience and collaboration across citizens and government where stakeholders can effectively and

confidently interact with public and private service providers; and further developing human capital in the areas of innovation and information technologies.

The Smart People initiatives aim to fundamentally transform the way that people access public and private sector services in their capacity as individuals, businesses, parents, investors, employees and employers, and facilitate retooling of talents and lifelong learning. Potential short-term, medium-term and long-term projects under this theme are:

- Enhancing Hong Kong's capability in data science through the school curricula and other education and training programmes.
- Providing convenient access to services through a city One-Stop Shop to allow simple and easy access to multiple public services.
- Maximising the impact of on-line channel and social media for stakeholders engagement, by leveraging internet-based tools (e.g. engagement portal) and social media to gauge the view of the public to develop people-centred smart city initiatives and solutions to major issues.
- Fostering entrepreneurial and innovative appetite and exporting best practices to promote and support technical skills and creative thinking through education.
- Increasing confidence of the community in embracing new smart city practices, by running relevant trainings and learning seminars, and publishing new training material to educate those in the public sector and the general public on the latest challenges, opportunities and trends brought about by innovation and how to plan for changes.

2.5. Smart Government

The policy objectives for Smart Government are to promote a data-driven approach to further develop e-government and related public services; deploy appropriate infrastructure to support Smart Government; and facilitate easy access to government services for transacting with the Government. The anticipated outcome and benefits include a more informed, fact-based and data-driven decision making process of the Government; improved user experience and ease of access and interaction with the Government; and an enhanced infrastructure supporting the exploitation of city data for the benefit of the community, which in turn leads to a more vibrant, more dynamic and safer community.

The Smart Government initiatives seek to change how the Government manages the city and serves its stakeholders through the deployment of supporting infrastructures for managing city data. Potential short-term, medium-term and long-term initiatives include:

- Preparing for the deployment of 5G which supports a broad array of innovative services and applications characterised by high speed mobile transmission, high

speed mobility, extreme low-latency, real time communications and massive IoT connections.

- Enabling a more efficient building life cycle through the use of Building Information Modelling ("BIM") which can be leveraged as a technology tool in the construction industry, allowing those involved in various processes in a buildings' life cycle to design, build and operate buildings with the aid of a virtual environment, which helps minimise changes and reduce project risks. Examples of applications include clash detection, cost estimation, fabrication and shop drawings, asset and facilities management, and construction sequencing planning.

- Offering the community with multidisciplinary functionalities through smart poles which involves integrating sensors and other hardware into the poles infrastructure across the city to provide multidisciplinary functionalities.

- Allowing various aspects of Hong Kong to be simulated and analysed in a virtual and managed manner through a virtual 3D simulated platform that allows departments to perform interactive visualisations and performance analysis with spatial data of various nature of the built environment, environmental data and building data generated by BIM and IoT data.

- Making efficient and orderly use of Hong Kong's underground space for utility lines by building an underground passage that carries utility lines such as electricity, water supply pipes, and sewer pipes in appropriate NDAs and the Lok Ma Chau Loop.

- Advancing e-Government services for offering citizen-centric e-services meeting the rising expectations of Hong Kong's citizens and the business community. A new application architecture framework is required to support the agile development of a new generation of e-Government services.

- Equipping the government with data analytics capability to support smart city implementation. Big data analytics has become an effective means to assist in city management. It is therefore quintessential for the Government to take early steps to build up its own capability on big data analytics with respect to technical infrastructure and expertise in developing big data analytics.

2.6. Smart Economy

The main objectives for Smart Economy are to improve and promote the overall business climate with the advancement of FinTech and re-industrialisation for high technology industry; increase city attractiveness for start-ups and investors; and attract leading talents and investments globally to improve the city's economic vibrancy through an established smart city brand. The anticipated outcome and benefits include a sustainable economy, growth through improved productivity and competitiveness of Hong Kong, increased attractiveness of Hong Kong as a tourist location, and a well-known destination of innovation and technology for overseas investment and talents.

The Smart Economy initiatives aim to transform and strengthen Hong Kong's economy. Potential short-term, medium-term and long-term projects in this area include:

- Complementing the existing strengths of Hong Kong's financial sector with FinTech development.
- Revitalising Hong Kong's manufacturing with re-industrialisation. Specifically, emerging technologies such as robotics, IoT, drones, 3D printing, AI and analytics, can be used to attract investment in high value-added manufacturing.
- Enhancing the attractiveness of Hong Kong for foreign investments.
- Nurturing an organic and sustainable start-up ecosystem.
- Expanding Hong Kong's R&D platform and capability: establishment of a platform dedicated to research and development at the Hong Kong – Shenzhen Innovation and Technology Park to be developed in the Lok Ma Chau Loop.
- Attracting more visitors to Hong Kong through smart tourism features: to leverage smart and innovative technologies with an aim to ease visitors' interactions with the city, navigate and find services, plan their trip, and enhance the overall tourists' experience.

3. *Governance Arrangements*

The proposed governance structure for implementing the Smart City Blueprint in Hong Kong reflects the need for senior leadership to sponsor smart city initiatives and provides a centralised coordination and implementation body within the Government. It involves three layers: policy-making, oversight / management and implementation:

- Policy-making: to set up the Smart City Steering Committee ("SCSC") for setting the strategic directions for the smart city implementation, determining the priority policy areas and smart city programmes, and defining and monitoring key performance indicators ("KPIs"). Given that the SCSC is expected to provide high-level steer and coordinate of relevant policy bureaux, and that smart city initiatives are mostly cross-B/Ds in nature, it is advisable that the SCSC be chaired by the Chief Secretary for Administration ("CS") or the Financial Secretary ("FS").

- Oversight / Management: to set up the Smart City Programme Office ("SCPO") for coordinating the relevant efforts of B/Ds for implementation of smart city programmes, as well as managing risks. In addition, the SCPO coordinates the development of individual smart city projects underpinning each programme and monitoring the implementation and outcome of these projects.

- Implementation: A project delivery team ("PT"), under the direction of the SCPO, will draw resources from all relevant departments, and may be formed for cross-departmental smart city project.

4. *Digital Framework*

4.1. Digital Infrastructure Development Framework

With the world-class ICT infrastructure, the Government can initiate digital transformation to create the foundational capability for smart services. The key technical components required for the development of the digital infrastructure are set out below:

- Big Data - To enhance the Government's expertise and capability in this emerging area, it is proposed to develop guidelines on big data security and privacy leveraging global best practices; increase in-house big data technical resources and capabilities; and implement a digital highway and a big data development platform featuring artificial intelligence tools for big data collection and analytics.

- Spatial data - To develop a Common Spatial Data Infrastructure ("CSDI") to provide government departments as well as public and private organisations with an information infrastructure to share spatial data which is essential to support smart city applications.

- Government Data Centres (Cloud & Application Architecture) - To develop an application architecture framework and implement a central platform to enable the Government to deliver e-Government services in a more agile manner. It is also proposed to develop a new integrated cloud infrastructure with new functionalities to support digital government services delivery in the years ahead.

- Cybersecurity - To review and update current policies, processes, standards, guidelines and governance models with respect to security, privacy, cyber protection; conduct reviews and adopt best practices and appropriate systems and technology infrastructure; devise programmes to raise awareness and educate users on security risks and best practices specific to smart services; and closely monitor the development of IoT security and develop appropriate IoT security guidelines and practices in due course.

- Digital Persona - Riding on the existing Government digital certificate infrastructure, to develop a Digital Persona infrastructure and enable acceptance of Digital Persona to authenticate digital identity of individuals and authorise them to use on-line services.

- Standards - Hong Kong will require a unique mix of technology solutions to enable current and future smart services delivery. Given that Hong Kong may consider itself a testbed and capital of innovative solutions and applications, relevant international and Mainland standards will need to be considered for adoption.

4.2. Open Data Policy

To continue the implementation and adoption of open data, based on existing guidelines and leading practices of other cities, Hong Kong should consider the following:

- Establishing governance structure and appointing a central coordination party.
- Conducting current inventory of existing datasets, prioritising their release, and monitoring data statistics and feedback to ensure relevance and usefulness.
- Establishing common practices and formats for data release and usage.
- Establishing KPIs that can effectively assess open data effectiveness and be marketed as milestones to the community.
- Improving on Hong Kong's existing *data.gov.hk* portal by automating release of datasets and implementing APIs.
- Putting together a potential priority list of public and private datasets for opening in the PSI Portal, based on overseas references, a survey conducted by the Hong Kong Science and Technology Parks with its tenants in January 2017, and suggestions from stakeholders and the public during the stakeholder engagement of the consultancy study.

4.3. Privacy Issues in Smart Cities

International organisations recommend the Privacy by Design ("PbD") framework to augment existing privacy principles to cater for issues arising from IoT Platform, Big Data, and Open Data initiatives under smart city. PbD provides specifics on how Personally Identifiable Information ("PII") is to be used and can serve as an answer to ongoing smart city privacy concerns. The tenets of PbD provide clarity to data controllers on how to handle PII specifically.

Having regard to global best practices, Hong Kong may consider improvements in the privacy protection regime for the provision of smart services. Hong Kong should:
- Work jointly with the Privacy Commissioner for Personal Data ("PCPD") to adapt privacy principles based on PbD for smart city capabilities.
- Implement additional privacy measures.
- Set policies and specify practices around consent, transparency and de-identification.

5. *Public-Private Partnership ("PPP")*

Smart city development calls for collaboration among the public sector, private sector, academia and citizens, over the whole cycle of smart city implementation: from identification of city challenges, formulation of strategy, research and development ("R&D"), conceptualisation of potential projects, feasibility assessment, proof of concept through pilot projects to city-wide implementation. PPP models can be adopted for the implementation of smart city initiatives across different themes. Used effectively, PPPs can provide various benefits, such as:

- Encouraging the private sector to develop and promote innovation in the industry.
- Optimising both public and private sectors' skills and expertise.
- Encouraging the private sector to invest in public sector infrastructure projects and services.
- Facilitating the public sector to focus on project outcomes and benefits from the onset.
- Emphasis on quality of projects.
- Effective risk allocation.
- Helping the public sector pay for services.
- Greater budgetary certainty for the public agency.

A possible proposal is to set up a collaborative platform with public-private partnership to address elderly care homes in improving the quality of services and alleviating the manpower shortfall situations.

6. *Proposed Pilot Projects*

Pilot testing in the context of smart city is the conducting of small-scale trials in order to assess the practicality of the proposed solutions under the local environment and operational constraints, as well as the feasibility of implementing the proposed solutions territory-wide. This approach allows the Government to test innovative solutions in a managed and controlled manner so as to minimise risks.

The following six major pilot areas are suggested:

1. Smart public transport interchanges/major bus stops.

2. Smart intelligent and integrated on-street poles.

3. Intelligent signalised junctions and pedestrian lights.

4. Smart parking (off-street parking spaces and pricing information).

5. Setting up a Smart Region Living Lab for Smart City at Hong Kong Science Park and The Chinese University of Hong Kong to support and pilot application of innovation solutions.

6. Promoting cultural and heritage tourism in Central District - To explore wider use of ICT to further enhance tourists' experiences by digital elements like interactive videos or photos, electronic coupons or discount offers at selected tourist spots, digital walking routes guide and on-line information on accessibility and other matters for the recently launched Old Town Central guidewalk campaign under the Hong Kong Tourism Board.

In addition, the NDAs (i.e. Tung Chung, Kwu Tung North / Fanling North, Hung Shui Kiu New Development Area, Yuen Long South Development, New Territories North), the Anderson Road Quarry Development and the Lok Ma Chau Loop are ideal sites for implementing various pilots or even scaling-up smart city solutions. The Government should start early planning and make provision for these areas in supporting smart city development.

Executive Summary for Report of Consultancy Study on Smart City Blueprint for Hong Kong