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Smart City Development in Hong Kong: Barriers and Challenges

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Contents

Executive Summary

1. With smart city development becoming a global trend to tackle urbanisation challenges, the Government of HKSAR launched the Digital 21 Strategy in 1998. The path taken to enhance Hong Kong's e-economy was different from those of other cities in the world which focused more on sustainability in city management and citizens' quality of life. Hong Kong's recent rankings in indexes on smart city and city competitiveness show that it is lagging behind many other counterparts. In October 2017, the Chief Executive reaffirmed the Government's commitment to developing Hong Kong as a smart city, and published a blueprint in December 2017 to map out its development plans for the next five years. The Government's decision has received strong support from different sectors of the community. In the Legislative Council, a motion was passed in July 2018 urging the Government to expedite actions to promote smart city development in Hong Kong.

2. Experiences in other smart cities have indicated that smart city development is a very complex issue. In March 2018, Tianda Institute commenced a study on the common barriers and challenges faced by smart cities in their early stage of development and how far such barriers, if also found in Hong Kong, would impact on the development of smart city in Hong Kong. The study was completed in September 2018. This report provides an analysis of the barriers and challenges facing Hong Kong and puts forward recommendations for the attention of policy makers and stakeholders.

What is smart city?

3. The smart city concept is about the integration of information and communication technology ("ICT") and physical infrastructure and devices connected to it to enhance city management and improve the quality of citizens' everyday life. Though there is no agreed definition of a smart city, it is clear that a smart city must possess a **vision** which aims to address the unique needs and characteristics of the city, a **strategy** which makes the best use of technology and innovation, and **benefits** which will bring about sustainable growth and higher quality of life for its citizens.

4. Smart city is about making a difference in people's lives, so central to the implementation of smart city is the way to address people's needs and priorities. Technology is the tool while citizen participation is the key. In implementing smart city concepts, it requires careful analysis of a city's internal capabilities and external challenges and opportunities, so as to develop a strategy based on the characteristics of the city, priorities determined by its citizens, and the business models and regulatory framework considered viable by stakeholders and other participants in the development.

Analysis of barriers to smart city development in Hong Kong

5. Hong Kong's strategy has all along been directed to the building of a strong digital infrastructure to enhance the e-commerce environment for economic growth. Citizens may not be able to see the benefits for themselves as individuals. The current mechanism for communicating with citizens is mostly stakeholders-driven. There is still a long way for the community to understand the need

to move to a smart city and what citizens are expected to contribute to it or benefit from it. Implementation requires a lot of mutual understanding and trust, and this has to start from the people. The barriers which may become obstacles to development are summarised as follows:

(a) There is little discussion in Hong Kong on the integration of technologies, implementation strategies, stakeholders' involvement and collection of data based on worldwide city development trends and indicators. The development plans under six themes with 70+ initiatives for implementation in the next five years cannot be regarded as a holistic smart city strategy and a well-constructed smart city roadmap.

(b) For smart city development to be successful, Hong Kong needs strong human capital. Despite the Government's good intention to strengthen students' knowledge base in science and technology disciplines, students' ability to apply innovation and entrepreneurial spirit to other subjects is still very limited. With teachers not fully equipped to apply innovation across the board, the possibility of grooming the new generation to become skilled individuals to participate in the digital economy within the next decade becomes rather remote.

(c) The successful implementation of smart city initiatives relies heavily on all levels of trades and industries working together to develop solutions with innovation and evidence-based research. Hong Kong is weak in research and development ("R&D"). Even with the potentials in the Greater Bay Area to provide for start-ups and integration of technologies, factors

like language, reluctance to venture into a new neighbourhood and work culture, lack of mentorship and guidance, etc. are limiting our young people's choices for development opportunities.

(d) Young start-ups in innovation and technology ("I & T") need guidance and advice during the development of new products. They also encounter difficulty in marketing their products as there is no policy to encourage the Government to use their products although the funding for developing the products might have come from the Government. The lack of test grounds and showrooms at affordable rentals and young start-ups' poor networking have also made it difficult for them to survive in Hong Kong.

(e) The lack of diversity in project funding and procurement methods has deterred private participation. For fear of allegations of benefitting any preferred entities in the private sector, the Government is more inclined to finance smart initiatives out of the public purse and procure services through conventional procedure which is not conducive to the procurement of innovative technologies.

(f) The funding process through the Legislature is unduly long especially if the funding required is huge and the expected outcome is not entirely specific. It is now an opportune time for the Government and the Legislature to explore more suitable funding and procurement options taking into account overseas experiences and to take a bold step to open new grounds for achieving better results.

(g) The current Steering Committee on Innovation and Technology may examine and steer smart city projects but has

no jurisdiction in overseeing the entire strategic planning and development. It also cannot directly deal with the poor coordination at the lower levels of different departments which report to different Directors of Bureaux. The role that can be played by the current Smart City Office and the development team under OGCIO is very limited as smart projects involve not only I & T support but also a global perspective in city management.

(h) Smart city development requires a high level of adaptation and integration and this cannot be successful if those who control the systems do not have the mindset to cooperate. Civil servants are generally resistant to changes. With smart city movement coming on the scene, it calls for a reform in the civil service so that a new philosophy and mode of thinking could be permeated into the day-to-day operation at all levels of civil servants.

(i) The Government does not have the expertise within the civil service to lead changes and has to rely largely on outside consultants. Without the expertise, it is difficult for the Government to exercise more vigilance in project management and selecting the right partners in the development.

(j) Outdated legislation and regulation impede I & T development. There is also no timetable to review the current law to cater for the new technology. The conservative and passive attitude in some of the Government departments has tremendous negative impact on the willingness of entrepreneurs to use their technical knowledge and professional skills to improve citizens' quality of life. The most controversial part of the

discussion on barriers to smart city implementation is the general concern about privacy protection in the light of the development and usage of big data, Internet of Things, etc.

(k) Protection of consumer rights is another area which has raised concern among general consumers. The current financial regime does not support the development of financial technology which in turn hampers the development of e-commerce.

(l) The proximity to and connectivity with the neighbouring cities in Mainland China will provide opportunities for Hong Kong to address some of its major challenges, such as ageing population, shortage of land for better quality of living and working, lack of testing grounds for new technologies, etc. It requires more collaboration among the authorities to tackle common urban challenges and address common needs. More vigilant communication is required.

(m) Hong Kong may not have collected the data which is consistent with the new set of smart city performance indicators developed by the International Organisation for Standardisation (ISO 37122) to allow Hong Kong's performance to be compared fairly against other cities.

Recommendations

6. Smart city development is a worldwide trend and many cities are moving fast in building their infrastructure for the next stage of growth - integration. Hong Kong, with its strong digital capacity, must develop its overall strategy to make the best use of its infrastructure and talents to maintain its competitiveness and sustainability, and to

demonstrate its qualities and potentials to lead in this worldwide development. Successful implementation requires an overall strategy, well-integrated roadmaps and well-coordinated action plans, with the support of citizens and stakeholders, strong leadership from the Government, an open, fair and dynamic marketplace for the private sector to participate in, a supportive environment for all age groups to learn and to innovate.

7. We develop our recommendations according to three strategic directions to address the barriers and challenges:

   (a) Forward-looking: to match the policy direction Hong Kong will take in fostering its economic position and facing the challenges ahead;

   (b) Foundation-building: to build up Hong Kong's internal capabilities, including consolidating community support, for moving forward; and

   (c) Out-reaching: to strengthen partnership with other city authorities and world-class smart project advisers to tackle common problems and achieve greater results.

8. **Strategic planning**: Smart city development is a form of city management to assist the city authorities in tackling urban challenges and therefore cannot be planned and implemented in isolation, without regard to other development strategies. If it has become necessary to explore opportunities for Hong Kong people, especially the younger generation, to live, work and bring up their new families in areas adjacent to Hong Kong, the Government's policy direction should allow a strong base at home which provides

the best possible support for its people no matter where they live and work, while retaining the economic benefits to finance the provision of this base. We recommend that:

(a) The Government should develop its smart city strategic plan for addressing the sustainable needs of its citizens paying regard to Hong Kong's own social and economic characteristics and its unique political environment.

(b) The smart city strategy should be part of the long-term strategic plan for Hong Kong, and should be holistic enough to integrate the development plans under individual themes in a coherent manner.

(c) There is scope for the Steering Committee to initiate discussions on the formulation of a holistic strategy for smart city development in Hong Kong by involving all Directors of Bureaux and other interested parties.

(d) The Government should develop its own expertise in interpreting international standards on ICT and smart city requirements so as to be able to administer the preparation of procurement and partnerships without relying solely on consultants. The Government should take the lead to provide training and give advice to both the public and private sectors on the meeting of international standards and on compliance matters.

(e) The Government should not lose sight of the new indicators added to indexes compiled by recognised bodies for evaluating different aspects of a city's performance and ensure that the methodology so developed is flexible and user-friendly enough for coping with changes in such

evaluation indicators.

9. **Developing internal capabilities**: In the case of smart city development, internal capabilities refer to the citizens' support and readiness to change, availability of resources (manpower and funding) and suppliers (technology and expertise), effectiveness of organisational structure and processes, readiness of stakeholders to catch up with the overall trends, etc. We recommend that:

   (a) The Steering Committee should review its role and consider whether it should be expanded to cover not only I & T development but also smart city strategic planning. If it is considered that the coordination work for smart city development should be taken up by another set-up, the leadership of this new set-up should be no less than one at the Chief Executive or the Chief Secretary for Administration level.

   (b) As smart city development is new to Hong Kong, the Government should take the lead to provide training and give advice to both the public and private sectors on the meeting of international standards and on compliance matters, and also on the development of contract preparation and procurement systems. A dedicated office under OGCIO should be established not only to assist government departments but also the private sectors in ensuring consistency of standards.

   (c) A task force should be set up within the Government under the supervision of the Steering Committee (or a new set-up to steer smart city) to initiate and monitor engagement of the

public in smart city development.

(d) A cross-departmental project team approach should be adopted to oversee the implementation of individual projects. Team members should be given the mandate to make decisions without having to revert to the heads of bureaux and departments all the time. The project teams should maintain close links with the technical team under OGCIO so that any ill practices or mismatch in technologies identified in the process can be referred to the central team to develop standardised best practices for all project teams to note and to follow.

(e) There should be better utilisation of the current technology display centres through more publicity among parents and schools.

(f) Small successes breed more successes. Achievements, no matter how small they are, should be publicised so that the public can have a better idea about smart city concepts. Concern over intrusion into the privacy of individuals and protection of sensitive information of corporations should be addressed and explained to the public.

(g) Workshops, seminars on smart city development should be organised by both the Government and interest groups to continue to promote awareness and encourage discussions among stakeholders.

(h) There should be more systematic training for school principals and teachers specifically on smart city concepts. Training and teaching materials should also be provided for general teachers who should have access to core STEM/STEAM

teachers for advice and guidance.

(i) Suitable training should be provided to teachers in secondary schools and universities on how to encourage students to participate in research work and competitions starting from a young age.

(j) In order to allow young people to explore opportunities in the Greater Bay Area and to market their innovative products in the Mainland and overseas markets, more opportunities should be provided for students to practise Putonghua and English in their daily curriculum.

(k) Attention should also be given to students who are not high achievers in schools as they will form the bulk of the future workforce. There should be special funding to allow institutions like Vocational Training Council, universities and others alike to organise dedicated courses related to smart city applications and general ICT techniques for all working adults.

(l) The Government and the Legislature should jointly examine more alternative financing models for smart city projects.

(m) For start-ups, there should be sufficient financial and land support for the development of new technologies for testing, showcasing and marketing. Technical mentorship and guidance should be provided through partnership with local universities or other institutions with the requisite knowledge and experience.

(n) The two-stage procurement method for acquiring innovative technologies currently used in other more established smart cities may be considered.

(o) More training on project management should be provided across the board for professionals who have a responsibility to look after contracts. Where consultants are hired to oversee projects, such consultants should also receive such training as part of pre-assignment briefing and the same standard should be adopted in monitoring and scrutinizing the performance of the contractors.

(p) Civil servants at all levels should undergo standardised training to acquire an understanding of smart city concepts and ICT knowledge so that they will have the right mindset and competency to lead changes within the Government and to work with stakeholders.

10. **Partnership with other city authorities and world-class smart project developers:** Hong Kong should be kept abreast of smart city development in other parts of the world and develop strategies to confront challenges common to our neighbouring cities. With more Mainland students studying in Hong Kong, it is an opportune time to enhance their exposure to smart city development and sustainability concepts so that they can become future partners of Hong Kong's development. We recommend that:

(a) The tertiary institutions in Hong Kong should develop programmes and courses on sustainability to strengthen students' knowledge about smart city development and other sustainability subjects. There should be more collaboration with the universities in the Mainland for the undertaking of field visits, R&D and other exchange activities to enhance students' learning.

(b) There should be joint working groups between the professionals of Hong Kong and the Mainland to monitor the development of technologies for greater integration between the systems on both sides, and to share information on the procurement processes to ensure compliance with international standards. Where feasible, world-class smart project advisers should be invited to participate in these discussions to update the professionals with world trends.

(c) There should also be joint efforts to examine the issues which may arise due to the integration of systems and sharing of data on both sides. The experiences in other places where different cities under different jurisdictions and legal systems can work together for better results should be useful for Hong Kong.

Chapter 1
Hong Kong Stepping into Smart Age

Background

1.1 On 15 December 2017, the Government of the Hong Kong Special Administrative Region ("HKSAR") published *the Hong Kong Smart City Blueprint* ("*the Blueprint*"). It was after years of public discussions and advocacy work from all sides regarding the urgent need to speed up Hong Kong's development into a world-class smart city that the Government finally, in 2016, commissioned a consultancy study for this purpose. Following the completion of the study in June 2017 and months of public consultation, the Chief Executive announced in her 2017 Policy Address the Government's commitment to expediting smart city development and push ahead three major infrastructure projects, including achieving universal broadband coverage across the territory and the development of intelligent and integrated transport system. The Chief Executive would personally chair a high-level, inter-departmental Steering Committee on Innovation and Technology ("Steering Committee") to examine and steer measures under the innovation and technology development areas as well as smart city projects.[1]

1.2 The objectives of the Government's commitment to developing Hong Kong as a smart city, according to *the Blueprint*, are to make use of information and communications technology ("ICT") to enhance city management and people's quality of life, to attract global businesses and

[1] The Chief Executive's 2017 Policy Address.
https://www.policyaddress.gov.hk/2017/eng/policy.html

talents and to inspire continuous city innovation and sustainable economic development. *The Blueprint* outlines over 70 initiatives to be completed in the next five years under six areas: Smart Mobility, Smart Living, Smart Environment, Smart People, Smart Government and Smart Economy. For implementing these initiatives, *the Blueprint* highlights the importance of a strong and effective governance structure, more vigorous public-private partnership and a special environment for the testing of innovative initiatives.[2]

1.3 In the 2018-2019 Budget, the Government has earmarked a further $50 billion, in addition to the $10 billion approved in 2017-2018, for financing Hong Kong's innovation and technology development, including smart city projects. This government commitment has met with full support by the Legislative Council. In July 2018, the Finance Committee approved, inter alia, the injection of $20 billion into the Innovation and Technology Fund to support more research and development ("R&D") work and to introduce new initiatives such as the 5-year Technology Talent Scheme. The funding approved also included an injection of $10 billion to the Hong Kong Science Park to support two research clusters: healthcare technology and artificial intelligence and robotic technology, to capitalise the strong research capabilities and international credibility already established by the universities. The Legislative Council was also briefed on the preparatory work in relation to the three major smart city infrastructure projects mentioned in the 2017

[2] Hong Kong Smart City Blueprint, Innovation and Technology Bureau (December 2017). https://www.smartcity.gov.hk/doc/HongKongSmartCityBlueprint(EN).pdf

Policy Address, aiming at considering the relevant proposals in the later part of 2018.[3]

1.4 The momentum in pushing forward the ICT-related projects which would facilitate smart city development in Hong Kong has been building up in an unprecedented pace in the past year. Yet is this pace fast enough to allow Hong Kong to catch up with the development of other places worldwide, in particular neighbouring cities in the region? During the past year, practitioners, academics, different professional sectors, advocacy groups, interest groups wasted no time in putting forward their views on *the Blueprint* in symposiums, workshops, seminars and other public forums. The general response is that while there is strong support from all fronts for the general direction embraced in *the Blueprint*, Hong Kong is still lagging far behind many cities in smart city development. There is strong urge for more speedy and proactive actions to upgrade the technological infrastructure and to apply new innovations and technologies to improve people's quality of life.[4]

1.5 On 5 July 2018, a motion was passed unanimously by the Legislative Council to urge the Government to expedite the promotion of smart city development. The Council urged the Government to focus on measures which would enhance WIFI access in public places, improve digital government services, step up data sharing, update the intellectual property rights and data privacy regimes, enhance STEM education in schools and provide on-the-job training for employees including civil servants. Members also stressed the need to remove barriers to enable

[3] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr17-18/english/panels/itb/papers/itb20180312cb4-701-3-e.pdf

[4] Legislative Council Panel on Information Technology and Broadcasting. http://www.legco.gov.hk/yr17-18/english/panels/itb/minutes/itb20180108.pdf

IT enterprises to contribute to the smart city development in Hong Kong and, in a larger scale, to apply new innovations and technologies to the development of Guangdong-Hong Kong-Macao Bay Area and the Belt and Road Initiative. Members also called for greater transparency in public-private partnership and a more comprehensive policy on data management to enhance civic participation and accountability of governance.[5]

The Study

1.6 Following the release of *the Blueprint*, the Hong Kong Policy Research Centre of Tianda Institute ("the Institute") has been monitoring the public's response to the objectives, scope and range of initiatives contained in *the Blueprint*. There is a strong consensus among all sectors of the community including different political affiliations in supporting smart city development in Hong Kong, but it is also noticed that there is an equally grave concern about Hong Kong's ability to manage the challenges and obstacles that would come along with the implementation of the new initiatives. Smart city development is complex in nature. The Institute considers that if challenges and obstacles are not identified and tackled early, they would seriously hamper the entire implementation and may lead to waste of public funds and loss of trust in the Government. Since smart city development will have great impact on Hong Kong's long-term growth and the community has already started to deliberate the subject, the Institute considers it timely to embark on a research study to understand and examine the common barriers to smart

[5] Legislative Council Meeting of 4 July 2018. https://www.legco.gov.hk/php/hansard/english/rundown.php?term=yr16-20&date=2018-07-05&lang=2

city development, and identify those that could be particularly relevant to Hong Kong.

1.7 The study commenced in March 2018 and has taken 6 months to complete. A research team headed by the Director of the Hong Kong Policy Research Centre of the Institute was formed. The team conducted literature review on the development of smart city concept in recent years and its application to the Hong Kong setting. It also conducted a detailed analysis of Hong Kong's internal and external environments to assess Hong Kong's overall competence and readiness for developing into a smart city and what needs to be done, as a matter of priority, to ensure more effective implementation. By referring to the more successful experiences in other developed smart cities, the team also studied Hong Kong's unique characteristics and developed a strategy which would optimise its strengths and bring about more immediate yet sustainable results to nurture further successes.

1.8 In the course of the study, the research team has placed much emphasis on the engagement of the key players in the implementation of smart city development in Hong Kong. These key players include the IT practitioners, smart city pioneers and advocacy groups, consultants and contractors, Legislative Council Members, academics, educationists and professionals of various disciplines. Focus-group discussions and person-to-person interviews were held to allow more in-depth discussions on what these key players perceived as the main barriers in the Hong Kong context and what they considered to be essential for successful implementation.

1.9 As the objective of the study is to identify the barriers to smart city implementation, the research team has selected the smart initiatives in

three areas, namely Smart Living, Smart People and Smart Government, to assess Hong Kong's current capabilities and the effectiveness of the governance structure in steering smart initiatives. For this purpose, four focus groups comprising notable practitioners and academics in the relevant fields were formed as follows:

(a) Physical and electronic connectivity; digital payment; e-commerce; support for the elderly and the disabled; big data collection and sharing;

(b) Education; STEM; vocational training; continuous development; innovation and technology development; research and development;

(c) E-Government; e-Health; civil service culture; inter-departmental cooperation; training and development for the public and private sectors;

(d) Start-ups; entrepreneurial environment; youth development; Hong Kong-Mainland business.

1.10 Government officers from the relevant Bureaux/departments were also invited to share with the focus groups the nature of support and collaboration they would hope to secure from the community. The discussions in the focus groups centred around Hong Kong's unique strengths and weaknesses and possible ways to build on its capabilities and current achievements. The research team also took into account the deliberations on this subject in the Legislative Council as well as in various workshops and symposiums it attended during the research period.

Smart City Development

Concept

1.11 The concept of smart city is about the integration of ICT and physical infrastructure and devices connected to it to enhance city management and improve the quality of citizens' everyday life. The objective is to optimise the use of the data collected from the process to enhance quality, reduce costs and unnecessary consumption, leading to long-term efficiency, growth and sustainability. Due to the strong emphasis of using ICT in the development of a smart city, smart city concept is often used interchangeably with "digital city". This could be due to the fact that the idea of smart city was developed originally from the digital city concept. Back in 1994, Amsterdam, which is generally considered to be the first smart city in the world, started to use an online communication tool under the name of Amsterdam Digital City to enhance the sharing of public opinions in face of an election. Singapore, also known as one of the earliest "intelligent cities", made strong digital investments even before 1993 to enhance its production and distribution processes.[6] In fact, the idea of using digital technology to improve people's quality of life could be traced back to the 1960s when Los Angeles made it its policy to use data collected by technologies to help direct resources to "ward off blight and tackle poverty".[7]

1.12 Up to now, there is still no agreed definition of a smart city. However, it is clear that a smart city must possess a **vision** which aims

[6] Dameri, R.P. (2017). *Smart City Implementation – Creating Economic and Public Value in Innovative Urban Systems*. Springer.

[7] Vallianatos, M. (2015). *The Early History of the 'Smart Cities' Movement – in 1974 Los Angeles*. Planetizen. https://www.planetizen.com/node/78847

to address the unique needs and characteristics of the city, a **strategy** which makes the best use of technology and innovation, and **benefits** which will bring about sustainable growth and quality of life for its citizens. The latest trend in smart city developments has pointed to the direction of developing also the social and human capital, as evident in the smart cities in Europe. "Smart people" becomes a fundamental dimension of a smart city, to be measured by education, lifelong learning, creativity, participation in public life and other indicators.[8] There is also the trend of smart cities, such as those in Europe, working in joint efforts to tackle global issues like climate change, economic restructuring, ageing population, etc. In Europe, smart city development has been moving very fast across over 80 cities in 19 countries. Under the auspices of the Smart Cities and Communities European Innovation Partnership ("EIP SCC") initiated by the European Commission ("EC") in 2012, the target was to have a critical mass of 300 smart cities by 2019 to foster integration in areas like business models, finance and procurement, infrastructure and processes, planning, policy and regulations, sustainable environment and urban mobility. This illustrates how smart development can assist the international community in confronting common challenges and bring about better living for people despite the diverse needs and characteristics of different nationalities and cultures.

Smart city development in Mainland China

1.13 The same momentum of smart city development has also taken place in Mainland China. IBM introduced the concept of "Smarter planet" to China around 2008 when China was facing the urgent need to deal with a whole range of urbanisation issues arising from the rapid

[8] Dameri, R.P. (2017).

expansion of urban population. The experiences of other countries in using innovative information technology to tackle the shortage of resources and environmental challenges were regarded as possible solutions to urbanisation and city management in a more scientific and smarter manner.

1.14 In 2012, the Ministry of Housing and Urban-Rural Development approved 90 pilot projects of smart cities and issued the "Notice of Carrying out the National Smart City Pilot" and "National Interim Measures for Smart City Pilot" to serve as guide for the implementation of these pilot projects. Between 2012 and 2015, instructional guidelines were issued by both the Central Authorities and local governments of Shanghai, Fujian, Henan, Tianjin, Guangdong, etc. As at April 2015, over 285 cities had been identified for piloting smart cities development, as a catalyst to apply modern technology to urban management and services and also other areas of development. Telecommunications operators, domestic and foreign IT companies have actively participated in smart city projects through different forms of public-private-partnership in building the infrastructure.[9]

1.15 In a report published by the EU SME Centre, practical problems at this early stage of smart city development in China have also been identified in regulations, standards and evaluation methodology. Small and medium enterprises ("SMEs") which are currently working in these smart projects are advised to pay attention also to the ability to manage and operate infrastructure, a system to connect developments in individual non top-level design projects, cyber security and changes in

[9] Li, Y., Lin, Y. and Geertman, S. (2015). *The development of smart cities in China.* http://web.mit.edu/cron/project/CUPUM2015/proceedings/Content/pss/291_li_h.pdf

the regulatory framework.[10] At present, the government plays a dominant role in financing smart city projects mainly through purchasing products and services from the private sector. This phenomenon is expected to change when the construction of smart cities becomes more market-oriented and the government begins to shift its role to that of an enabling body by focusing more on law-making, planning, etc.[11]

1.16 Successful implementation of smart initiatives is a common challenge for all smart cities. Smart city development is bottom-up by nature.[12] There can never be enough resources to implement all desired projects and it becomes necessary to have a strategy which is supported by the citizens who have a role to play in prioritising the projects. In the end it is the public value created by smart initiatives that will make smart city development sustainable.[13] In the management of a city, ICT can only be the tools. Smart projects are not necessarily ICT-related. In some cases, ICT could be the leading technology, but in other cases ICT may only play a supporting role. The key players are the government and the citizens. The success in the implementation of smart city concept relies heavily on how effectively the government communicates with the citizens so that everyone will work together for the benefit of the city. Engagement of citizens has therefore become another important dimension of smart city development. There should be clear goals and

[10] Report: Smart Cities in China. (2015) EU SME Centre. http://ccilc.pt/wp-content/uploads/2017/07/eu_sme_centre_report_-_smart_cities_in_china_i_edit_-_jan_2016_1_1.pdf

[11] Li, Y., Lin, Y. and Geertman, S. (2015).

[12] Dameri, R.P. (2017).

[13] Dameri, R.P. (2017).

processes determined well in advance to enable the citizens to quantify results and measure performance.

1.17 During the past two decades, some cities have emerged with exemplary achievements in the implementation of smart city technologies and programs. Each pursues its smart city development according to its own circumstances and priorities. It is therefore not difficult to see the different emphases of development among these countries. For example, Singapore is known for its connectivity by developing its information and communications industries. Copenhagen is a green city and is to become a technology solutions leader in relevant areas.[14] Amsterdam focuses on both infrastructure and people, especially citizens' quality of life.[15] Genoa is best known for its governance and its positive synergy in research, innovation and technological transfer from smart projects to business, public bodies and citizens.[16] All these cities have had decades of experience in finding their pathways. How far these experiences can serve as reference for Hong Kong is further discussed in Chapter 3.

Hong Kong Smart City Blueprint

1.18 Government's plan to explore the feasibility of developing a smart city was announced in the 2015 Policy Address by using Kowloon East as a pilot area. Its commitment to developing Hong Kong into a smart city was reaffirmed in the 2016 Policy Address. In June 2016, the

[14] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr15-16/english/panels/itb/papers/itb20160613cb4-1087-4-e.pdf

[15] Dameri, R.P. (2017).

[16] Dameri, R.P. (2017).

Government announced that it would first formulate a Smart City Development Blueprint for Hong Kong as a holistic framework and to this end, a consultancy study was commissioned. The scope of the study was to recommend smart city strategies and initiatives to address major urban challenges faced by Hong Kong up to 2030, to draw up indicators/parameters to assess progress and improvements over time, to suggest the governance structure, digital infrastructure, legal framework and mode of implementation including public-private collaboration.

1.19 In June 2017, the report on the consultancy study ("*the Consultancy Report*") was released. *The Consultancy Report* confirmed that for Hong Kong to become a livable, competitive and sustainable "Asia's World City", the overarching planning goal is "to champion sustainable development with a view to meeting our present and future social, environmental, and economic needs and aspirations". To achieve this vision, Hong Kong should follow the guiding principles of: adopting a people-centric approach, formulating a long-term strategy and integrated framework, enabling participation by all sectors, and promoting innovation and technology. The Report also recommended that the development plans underpinning the smart city strategy could be organised under the six themes in alignment with the Boyd Cohen model which the consultant found to be particularly useful in the case of Hong Kong. These six themes are mobility, living, environment, people, government and economy.[17]

1.20 *The Blueprint* published in December 2017 followed *the*

[17] Report of Consultancy Study on Smart City Blueprint for Hong Kong. (2017). https://www.smartcity.gov.hk/report/full/

Consultancy Report's recommendation of using Boyd Cohen's six themes in setting out its development plans. Its vision is to "embrace I&T to build a world-famed Smart Hong Kong characterised by a strong economy and high quality of living". *The Blueprint* outlines the current status and the strategy and initiatives for each of the six themes. According to the Office of the Government Chief Information Officer ("OGCIO"), the initiatives set out in *the Blueprint* are those which the Government has confidence to complete or to take on board within the next five years. There is no doubt that Hong Kong is to step into the Smart Age, but whether there exists a holistic strategic plan to unite all stakeholders to move in the same direction remains a question to be addressed. This holistic strategic plan, according to practitioners in the IT industry, does not seem to exist in *the Blueprint* or in any of the Government's policy statements on the subject of Smart City Hong Kong. This is further elaborated in Chapter 2, in the context of Hong Kong's current situation.

Chapter 2
Hong Kong's Current Situation in Smart City Development

Hong Kong's Digital Development

2.1 Back in 1997, it was the Chief Executive's vision to make Hong Kong a leader in the information world and to drive Hong Kong's economic expansion with the help of information technology. The rapid development in digital technology since 1970s had driven the whole world into a digital age and Hong Kong, as a city with one of the world's most advanced telecommunication infrastructure, was well positioned to take advantage of the opportunities coming along with the wider use of digital technology. In November 1998, the Government launched its first IT strategy for Hong Kong, entitled "Digital 21", aiming to enhance and promote the information infrastructure and services so as to make Hong Kong a leading digital city in the globally connected world of the 21st century.[18]

2.2 The 1998 version of the Digital 21 Strategy started with a commitment to joining the forces of the Government, business, industry and academics to take advantage of the opportunities in the digital world to build on Hong Kong's strengths. Its focuses were on a high capacity communications infrastructure, an open and secure interface for electronic transactions, and a stimulated culture for creativity and

[18] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr00-01/english/panels/itb/papers/a1332-1e.pdf

technical know-how. Since then, the Strategy was updated three times and the emphases of developments had been shifted mainly to cater for the changing needs of the business environment, as follows:

- In 2001 – enhancing e-business environment, driving e-government, developing IT workforce, improving access to IT, and exploiting technologies to strengthen digital communication.[19]
- In 2004 – enhancing Government's leadership role, deepening e-government programmes to facilitate e-commerce, strengthening infrastructure and business environment to promote digital entertainment and broadcasting, developing a vibrant IT industry, etc.[20].
- In 2008 – deepening technological cooperation with the Mainland, building an inclusive, knowledge-based society, promoting wider use of ICT among SMEs.[21]

2.3 The ultimate aim of the Digital 21 Strategy, which shaped Hong Kong's digital development in the past two decades, was to promote Hong Kong's economic development and to provide better services to citizens. All efforts were channeled to the development of a digital economy, hoping that this would enable the core industries to sustain and improve their competitive position. The path Hong Kong took during the two decades under Digital 21 was quite different from what other smart

[19] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr00-01/english/panels/itb/papers/a1332-1e.pdf

[20] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr03-04/english/panels/itb/papers/itb0325cb1-1326-1e.pdf

[21] 2008 Digital 21 Strategy. http://www.legco.gov.hk/yr07-08/english/panels/itb/papers/itb-leaflet071230-e.pdf

cities in the world were taking at that time. While other smart cities were looking at sustainability in city management and citizens' quality of life, Hong Kong was still focusing on digital economy and WI-FI connectivity which only form one part of smart city development. It was not until December 2015 that the Government announced its objective to develop smart city "to make people's life more convenient, healthy and environmentally friendly".[22]

Hong Kong's Position in Smart City Rankings

2.4 During the review of Hong Kong's international standing in digital development in 2004, the Government stated the following:

> "Our remarkable progress and achievements have received international recognition. Hong Kong was ranked first in the International Telecommunications Union (ITU) Mobile/Internet Index 2002. The Economist Intelligence Unit (EIU) ranked Hong Kong first in Asia in 2003 in terms of e-readiness. Accenture ranked Hong Kong seventh in the world in 2003 in terms of e-government leadership. The Electronic Service Delivery (ESD) Scheme also won the prestigious Stockholm Challenge Award in 2001. An important milestone in this regard will be the coverage of 90% of amenable public services with an e-option. Hong Kong

[22] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr15-16/chinese/panels/itb/papers/itb20160613cb4-1087-4-c.pdf

has come a long way in positioning itself as a leading digital city."[23]

In the more recent indexes published by the same institutions, Hong Kong was ranked 6th in ITU's ICT development Index (2017) and 10th in the EIU Index Technological Readiness Index (2017). It should be noted that the categorisation of the indexes has been changed; so are the indicators used to produce the indexes. It is a common practice for institutions to revise these indicators from time to time to take into account global technology and social developments. ITU and EIU have changed their more technology-oriented indicators, such as those related to mobile, Internet and other electronic services, to those that evaluate ICT development, innovation, networking and sustainability. Because of the changes in the benchmarking methodology, cities which are included in the survey would take the initiative to adjust their development strategies according to global trends so as to be assessed on the same footing with other cities.

2.5 Besides the changes in the scopes and research methodologies adopted by these long-standing institutions, there were also new indexes emerging since the 1990s to rank specifically smart cities. The Smart Cities Wheel started by the US scholar Boyd Cohen in 2012 had also gone through a period of adjustments to provide more depth to benchmark smart cities with enough value added to city planning. Cohen increased the number of indicators on Smart Cities Wheel in 2014 from 28 to 62 with 16 directly mapped to the new sustainable cities ISO standard (ISO 37120). Based on his six key components of a smart city,

[23] Legislative Council Panel on Information Technology and Broadcasting. https://www.legco.gov.hk/yr03-04/english/panels/itb/papers/itb0325cb1-1326-1e.pdf

he developed 18 subcomponents and each with related indicators. The cities included in the survey are required to respond with the data relevant to each indicator for analysis. In other words, if certain data is not available in most of the eligible cities, there would not be enough proxy to come up with a reliable evaluation. So Cohen at present is considering further revising the indicators so that more cities can participate in the survey.[24]

2.6 Does a smart city index serve any purpose? According to the 2017 report on the CITYKeys project, funded by the European Commission, various city indexes have been developed since the 1990s using varying sustainability indicators. Many rankings produced are based on relative positions among the cities under survey. They cannot be regarded as an absolute state of a city. Nevertheless, an index is an aggregate of many indicators, aiming "to provide a coherent and multidimensional, though simplified, view of a system". The indexes do provide a snapshot of the current situation and can be used as a tool to compare cities or track the performance of a city. They can become a driving force to make a city reflect on what it has done well or not so well in the past year or over a period of time, and they are increasingly used in policy making and for public communication. The CITYKeys report stresses that ideally, city indexes should help city stakeholders "to better understand their specific challenges, provide them with insights into effective policies and best practices and supporting their decision making (Siemens Green City Index)".

[24] Cohen, B. (2014). *The smartest cities in the world 2015: Methodology*. Fastcompany. https://www.fastcompany.com/3038818/the-smartest-cities-in-the-world-2015-methodology

2.7 For illustration purposes, we consider it useful to set out Hong Kong's rankings in some of the more popular indexes relating to smart city, digital and innovation performances in recent years. Below are our research findings:

- 4th in Boyd Cohen's Smart Cities Wheel 2013 (Asia-Pacific Region), after Seoul, Singapore and Tokyo;
- 68th out of top 100 in EasyPark Smart Cities Index 2017, after Singapore, Taipei, Tokyo, Osaka and Seoul;
- 35th out of top 100 in 2thinkow's Innovation Cities Index 2018, after Beijing, Shanghai, Shenzhen and Guangzhou;
- 27th out of top 100 in Global Innovation Index G11 2018, dropping from 7th in 2013, 10th in 2014, 11th in 2015, 14th in 2016 and 16th in 2017;
- 11th out of 63 in IMD World Digital Competitiveness Ranking 2018, dropping from 7th in 2017
- 14th out of 41 selected cities in Ericsson Networked Society City Index 2016, dropping from 9th in 2014
- 4th in Rutgers SPAA Global e-Governance Survey (2015-2016), dropping from 3rd in 2013-2014;
- 71th in Mercer Quality of Living Ranking in 2018, dropping from 70th in 2017
- Outside top 20 in Global Smart City Performance Index 2017 (Juniper Research)

2.8 Looking at the above, it is quite clear that Hong Kong is lagging behind in its smart city development and is not catching up with the

developments around the world. In this respect, the CITYKeys Report stresses that in assessing smart city performance, only the indicators which are applicable to "smartness" or specific smart areas are selected. CITYKeys, which provides index on performance of European cities, looks at environmental, economic and social aspects from the viewpoint of strong sustainability. It also assesses cities in different stages of development using common axes of evaluation. If Hong Kong is to be compared favourably with other smart cities in these indexes, it has to examine what indicators are used to evaluate the smart city performance and not just confining itself to digital infrastructure without applying the technology to the sustainable environmental and social development of the city.

2.9 Among Chinese cities, there have also been vigorous competition. Hong Kong, being one of the world's most competitive cities, is often used to benchmark the performance of cities in Mainland China. According to the Chinese Academy of Social Sciences ("CASS") Study in 2011, Hong Kong ranked 37th among Chinese cities in the Information Technology Infrastructure Index under Infrastructure Facilities Competitiveness. In 2016, Hong Kong rose to the first place but came down to second in 2017, surpassed by Shenzhen. It should be noted that the CASS Study looks at competitiveness and its evaluation is based on the development as an information city, convenience of air traffic, outward information exchange and people to people exchange, and degree of dependence on foreign trade. This is quite different from other smart city indexes which focus on overall ICT development, innovation and sustainability.

Shortfalls and Anticipated Challenges

2.10 Hong Kong Government's policy on digital development has all along been about e-economy. With its high Internet penetration, fast connection speed, secured data protection system, Hong Kong enjoys a high position in international ICT rankings. According to World Competitiveness Year Book by International Institute for Management Development, Hong Kong has been ranked first in technological infrastructure in the same study for five consecutive years since 2011. The question is how Hong Kong can capitalise on its strong technological infrastructure to benefit participants in the economy and to bring about a better quality of life for its citizens.

2.11 In September 2015, the Central Policy Unit ("CPU")[25] of the Government published a research report to introduce the concept of smart city and explore the further development of Hong Kong as a smart city. The CPU Report provided a comprehensive account of Hong Kong's achievements and inadequacies expressed in the context of Boyd Cohen's six themes of smart city development. It highlighted that in addition to IT development and application as well as Government's promotion efforts, participation by community stakeholders including citizens and enterprises was also important in creating a better and more sustainable living and business environment. To pursue smart city development in an organised manner, the report concluded that the Government should, inter alia, draw reference from the measures and experiences of both the Mainland and foreign cities to formulate Hong

[25] The Central Policy Unit was revamped in 2018 as a new office known as the Policy Innovation and Coordination Office responsible for policy research and innovation, co-ordination across bureaux and departments, etc.

Kong's own long-term strategy for smart city development, and focus on its comparative advantages and items identified for focal development.

2.12 In *the Consultancy Report* published in June 2017, recommendations were put forward to the Government to enable it to formulate a blueprint for long-term smart city planning and development in Hong Kong, and to develop a strategy to address various urban challenges and to achieve its smart city vision. *The Consultancy Report* also provided development plans based on the six themes in Boyd Cohen's model and suggestions on the potential projects and activities in the short, medium and long term. An analysis of the governance structure and digital framework as well as legal requirements for smart initiatives was also provided. In reviewing Hong Kong's current capabilities in digital framework, *the Consultancy Report* considered that notwithstanding the world-class ICT infrastructure possessed by Hong Kong, the Government should create the foundational technical capability to allow smart city services to be built through a common platform for the integration of public and private services. *The Consultancy Report* also highlighted the areas which required special attention in respect of the building of Big Data, spatial data management, integration platform, access to e-services, sharing of data and cyber threat intelligence.

2.13 Apart from pointing out the inadequacies in Hong Kong's digital framework to facilitate smart city development, *the Consultancy Report* also highlighted certain macro challenges and pressing needs:

(a) Hong Kong has the highest longevity in the world, with 36% of its population to be 65 and above by 2043, pointing to the need for more effective chronic disease managements;

(b) Hong Kong has a very low rate of building replacement, at

0.4%, aggravating the high greenhouse gas concentration effect generated from particularly commercial buildings;

(c) Hong Kong must be able to provide a high-quality living and working environment with sufficient provision of affordable housing, high quality healthcare and efficient means of transportation

(d) Hong Kong must make continued improvement in education ratings and increase entrepreneurship and ICT opportunities so as to retain young people in Hong Kong, and to address the continued need to deliver city services efficiently and effectively;

(e) With Hong Kong's total equipped capacity of external telecommunications facilities approaching 200 Tbps by the end of 2018, Hong Kong has great potential to make itself a hub for innovative technologies if there are corresponding policies, standards and digital infrastructure to support new technologies.

(f) Hong Kong must recognise international standards, such as ISO 37120 indicators, for data definition, collection and processing, and determine which indicators best represent what Hong Kong strives to achieve and which should be used for public reporting and internal monitoring; and

(g) The Government must encourage participation or cooperation of the private sector and initiate policies and legislation to provide an enabling environment and a strong culture to adopt innovations and applications in different walks of life.

2.14 Smart city development is a global movement to tackle urbanisation challenges. Common standards are developed worldwide to facilitate effective monitoring of measures to confront these challenges. Hong Kong cannot develop its own smart city strategy without regard to the experiences of other leading cities and the standards adopted by these places for achieving the best outcome.

Chapter 3
Experiences Elsewhere and Common Barriers

3.1 Although Hong Kong has developed a strong digital infrastructure, the concept of smart city is still new to most of its citizens and enterprises. Even within the Government, how the smart initiatives in *the Smart City Blueprint* are to be implemented is yet to be worked out by the relevant Bureaux or Departments. Nevertheless, Hong Kong has the benefit of learning from the experiences in other places especially those that have gone through their smart city development for over two decades. In this study, we have examined the development in European cities and referred to the various reports made by European Commission ("EC") in relation to smart city implementation, in particular the report presenting recommendations for local, national and European Union ("EU") level policy makers on policy implementation issues.

3.2 We have also studied the ways some of the cities in Asia, including Mainland China, planned and implemented the smart city concept, and highlight those areas which are particularly relevant to Hong Kong.

Smart City Planning and Implementation in Europe

3.3 Europe has a long history of smart cities. With a target of having a critical mass of 300 smart cities by 2019, the EC, through its Smart Cities Information System ("SCIS"), published a series of reports to enable established and developing smart cities to share experiences and to understand the common problems they are facing. The reports provide

the best practices of over 80 cities across 9 countries which have experienced different stages of growth and development in becoming a smart city, examples of replication to build up innovation and technological transfer, and policy recommendations to deal with barriers in the course of implementation. In this Chapter, we provide a gist of the areas which may be particularly useful as reference for Hong Kong.

3.4 It should be noted that the creation of smart cities in Europe "is a motivator for growth, new jobs and is a productive investment in Europe's future, leading to a sustainable, low carbon and environmentally friendly economy, as well as putting Europe at the forefront of renewable energy production".[26] The meeting of the decarbonisation objectives of EU for 2030 and 2050 is a primary objective for these smart cities. The SCIS reports therefore place special emphasis on how smart cities can play a role in changing the way they use energy, and then go beyond energy to socioeconomic and environmental challenges facing Europe today. Before attempting to replicate smart cities in Europe, Hong Kong may need to consider its own challenges and pressing needs, as set out in paragraph 2.13, in developing its own strategy and priorities.

City planning process

3.5 We find the 5-step approach to city planning set out in SCIS's report on replication mechanism regarding the governance tool to

[26] The making of a smart city: best practices across Europe. (2017). EU Smart Cities Information System.
https://www.smartcities-infosystem.eu/sites/default/files/document/the_making_of_a_smart_city_-_best_practices_across_europe.pdf

manage integrated smart cities and communities' solutions particularly useful for Hong Kong:

Step 1: Strategic vision of the city's development
Step 2: SWOT analysis of the city
(strengths, weaknesses, opportunities, threats)
Step 3: Defining strategic goals to develop the city
(including leveraging the benefits of existing "smart" technologies)
Step 4: Measurable indicators of city development
(according to leading international city ratings)
Step 5: A smart city roadmap containing a list of initiatives and their descriptions

3.6 In the case of Hong Kong, the SWOT analysis may be conducted first, together with an analysis of the external factors, so that a more realistic vision and strategy can be developed. Very often due to practical reasons, there could be changes in the course of implementation resulting in a need to change the conditions and develop new technologies. It is therefore necessary to have the technical standards put in place and avoid engaging a single provider and being locked in solutions that cannot evolve. In this respect, we noted that *the Consultancy Report* has given a detailed account of Hong Kong's strengths and weaknesses as well as its challenges and opportunities. We therefore do not wish to repeat what the Consultant has already done but we would elaborate in this report what we consider to be particularly important.

3.7 In taking forward smart initiatives in the Smart City Roadmap, the SCIS reports recommend that consideration should be given to the

priorities and schedule, technologies and IT solutions, regulatory support, project management, IT, utilities and transportation infrastructure, scope of initiatives, stakeholders, social-economic effect assessment, budget and ways to attract investors and partners. Stakeholder participation, in particular, is found to be essential throughout the entire process and in all cases. Stakeholder participation means the involvement of experts and those who take part in the implementation as well as community leaders in devising the overall strategy. The city authorities on the other hand need to determine the options which would integrate well into the city strategy and provide the standards for participants to follow. Impact assessment is required to develop the best business models, funding options and procurement approaches. A regulatory feasibility check should also be conducted before launching a project especially if it is replicated from another city. This is particularly important to the regulatory environment put in place by different jurisdictions for regulating emissions and energy consumption. In this respect, administrative burdens have become a major inhibiting factor due to the complicated processing procedure for obtaining the approvals and permits. Integration of different technologies also plays an important role in smart development. Different technologies should be allowed to be combined and work together to achieve the best outcome.

3.8 Stakeholder participation also helps in early identification of hidden and unforeseen costs. Any changes in consumers' behaviour may have an impact on the initial and subsequent operating costs of a project. Especially in energy-efficiency projects, the net energy saving depends on many factors which may give rise to a lot of uncertainties. Investment in new technologies for a relatively small market may increase financial risks and may not be too attractive to private enterprises. In the end, public policy support mechanisms would have to be put in place to

mitigate the barriers to new energy-efficiency technologies. The EC provides different sources of funding support and publishes guidelines on how to combine the various sources. This however is not easy to achieve due to the compartmentalisation of the funds and legal barriers which limit the use of certain funds.

3.9 For project financing which requires funding partially or wholly born by private capital, a financial plan to ensure self-financing for the project is necessary. For these projects, the users must be willing to pay, so public acceptance is important in private-funding projects. Even if public funding is required to pay, the payment should be based on performance and subject to levels of provision for protecting public interest. Various models of financing have been suggested in the SCIS reports. One particular model which the reports have highlighted is the monetisation of benefits from energy investments by the creation of Energy Services Companies, i.e. a fund manager with the expertise to charge for the benefits of energy investments, particularly in the areas of energy efficiency. Other funding modes examined in the SCIS reports are public-private-partnership schemes, crowdfunding, issue of Smart Bonds, Social Impact Bonds, spread shareholding, and fiscal funding. The key point is that when deciding on the model, it should be a financially viable model.

Barriers to implementation

3.10 The report on policy recommendations is particularly useful to Hong Kong as it examines key policy issues affecting the deployment of innovations and contains recommendations for policy makers based on the analysis of the barriers encountered by projects caused by policy

framework conditions in place. At the local level, the report examines the following key difficulties that can be addressed by policy actions:

- Inappropriate level of local competences;
- Inappropriate level of local administrative capacity;
- High administrative burdens;
- Inappropriate procurement rules;
- Inappropriate stakeholder involvement;
- Access to capital;
- Public-private-partnerships.

3.11 **Inappropriate level of local competences** refers to the adequacy of "the necessary competences to manage effectively a number of areas central for the development of smart cities". In the Hong Kong context, it refers more to the multilevel governance in the ability to introduce what the Government wishes to achieve. For example, in Smart Mobility, *the Blueprint* has set out a list of measures to achieve environmental friendliness in transport. How the various bureaux and departments can work together to take forward the initiatives would be subject to the effectiveness of the multilevel governance structure within which civil servants at various levels in different bodies could work as a team. At a higher level, the working mechanism between the Government and Legislative Council in getting the funds and legislative framework approved to facilitate new initiatives to be taken forward is also very important. Any delay in one aspect of a project could have tremendous impact on the implementation of the entire strategy. For larger projects which require coordination with neighbouring regions, the competence of the local administration in negotiating with the relevant authorities, in

addition to the central authorities, is crucial to the long-term partnership with these neighbouring authorities in building a smart region for the nation.

3.12 **Inappropriate level of local administrative capacity** refers to the ability to introduce changes. In the case of EU, the emphasis has been on the local response to climate change adaptation and mitigation. This is a global issue and Hong Kong is also required to understand the importance and interplay between key energy and environmental indicators and the technological options available. To provide strong coordination across governmental departments as well as high level of ICT integration, there is a need for innovation in the financing and procurement of projects to be coordinated by highly skilled personnel in the Government to develop the right contractual terms and procurement systems. In this respect, managerial training programmes and exchange of good practices with more advanced cities would be beneficial to the development of civil servants and all levels of practitioners who take part in smart projects. The creation of central networks would also help transfer of knowledge and showcase economies of scale.

3.13 **High administrative burdens** are found to consitute a significant inhibiting factor for smart city development. It is particularly stressful for project developers if there is a lack of coordination among the different responsible governmental departments and lack of clarity in respect of each other's responsibilities. The common problem faced by most new smart cities is the lack of certainty over the permissibility of new initiatives under current legislation. Even legal experts within the Government may not be able to give advice in view of the lack of experience in this new area of work, and the legal structure in other places may not be directly relevant. Fragmented actions are therefore not appropriate in smart city

development as it involves a more holistic and central approach to provide a legal framework to facilitate project implementation, especially when the projects involve preservation of the esthetical and historical value of local structures.

3.14 **Inappropriate procurement rules** are also found to be a central concern in EU smart cities as outdated procurement requirements constitute a significant barrier in obtaining the required approvals for initiating a project. Public procurement for innovation is a primary focus of the EC as it is considered that procurement processes for smart initiatives should not be based on price but solutions to the challenge, i.e. calling for innovation. This will result in a change to the evaluation methods, and in Hong Kong, this is particularly difficult as changes in procurement procedure often attract resistance from within the Government and from the political sector due to possible biases and favouritism. However, as the SCIS report has suggested, in order to facilitate investment, public authorities need to show flexibility in adapting to these rapidly evolving technologies and show consistency in the application of standard requirements across projects. City authorities may consider using a two-stage process, with firstly an expression of interest asking for ideas, allowing small scale feasibility studies to identify the most promising solutions. More than one project can be selected at this stage to encourage competition and collaboration. The second stage could involve selecting two or three participating companies that will work with the local authorities and with each other in order to optimise the outcomes from the process.

3.15 **Inappropriate stakeholder involvement** has been identified as a considerable problem when introducing new technologies. It has never been easy for general citizens to understand and appreciate innovations

and very often such expectations may eventually turn to disappointment. More involvement of the stakeholders including citizens and other relevant city departments can minimise misunderstanding and avoid conflicts within the administration. Stakeholder involvement should always be performed with clear objectives of reaching consensual solutions.

3.16 **Access to capital** is a challenge common to all smart cities. The difficulty, as the SCIS report has suggested, is not just confined to the local authorities but also extends to the private sector as investment in innovation often gives the impression of high uncertainties, given the economic conditions in Europe. Research and development in the private sector is particularly weak in Europe, hence affecting cities' medium and long-term competitiveness. Where conventional solutions continue to be more cost-effective particularly in terms of initial capital investment, investors tend to avoid developing new technologies, especially in the case of renewable energy projects. City authorities themselves are also tempted to procure known technologies though other more sustainable solutions have been tested in other places. This is mainly due to the higher upfront costs, the risks associated with the innovative nature of the technologies and the lack of a skilled workforce. The situation in Hong Kong is particularly serious as it has never been easy to impose more stringent environmental requirements partly due to lack of evidence-based research in developing innovation and technology and also resistance from trades, industries and workforce which are not yet prepared or equipped for major technological changes. Without the higher standards needed to bring about a more environmental-friendly way of life, total reliance on voluntary compliance or upgrading will have minimal effect in making the city smarter. Under the circumstances, fiscal incentives could be a motivational factor

especially if there is an understanding that it is going to be the future worldwide trends and the national policy to accord priority to sustainability.

3.17 **Public-private-partnerships** ("PPPs") are of growing importance in the development of smart cities. PPPs can provide significant benefits, but are very challenging for the public sector, especially if not accustomed to and skilled in such arrangements. The SCIS reports find PPPs difficult to implement as they need to be well designed to balance the private interests and the public objectives, with an appropriate risk distribution between the two. In Hong Kong, PPPs are not new but they have always been viewed with skepticism for fear of imbalance of public and private interests, and also due to the lack of transparency on the achievements and benefits brought to citizens in previous PPPs.

EU's advice for smart cities

3.18 In summary, to overcome barriers, the SCIS reports put forward the following recommendations for policy makers:

(a) A multilevel governance structure should be adopted in the local administration to ensure the right level of competences is transferred to the local level;

(b) Obsolete rules that are causing administrative burdens should be removed and coherent standard procedures should be adopted across departments to facilitate the introduction of innovations;

(c) Stakeholder engagement should be streamlined in urban development programmes and should be used in any larger smart innovation projects;

(d) Financing is one of the most serious challenges for cities today, and to mobilise private capital, methods to expand the use of the facilities available and collaborate with national promotional banks should be further promoted;

(e) As urban development needs become more complex and multifaceted, integrated PPPs are becoming a necessity;

(f) The stability of the regulatory environment is of paramount importance. Without a stable policy framework, investors may stay away from the markets;

(g) There is a need for further coherence between funding sources to be able to efficiently combine resources;

(h) Public procurement rules need to be reformed;

(i) Solid standards should be required in procurement, otherwise the evaluations of projects proposals will not be based on clear indicators; and

(j) All projects for Smart Cities need to have a robust monitoring protocol that should include clear specifications for the planning, installation and operation phases of the monitoring system. This includes providing a common and reliable set of KPIs.

Smart City Planning and Implementation in Asia

Singapore

3.19 With the exception of Singapore, there is little information which provides in-depth analysis of the barriers facing cities in Asia and in

particular those in Mainland China. We however find it useful to focus on the planning process and financing models adopted by selective smart cities in Asia as the challenges they face are quite similar to those in Hong Kong.

3.20 Singapore is regarded as one of the world's best smart cities. Yet it also faces the same hurdles as any other smart cities such as funding constraints, technology, communications, data security and energy usage. Despite that new technologies can transform the way the city delivers, operates and maintains public amenities, there is great challenge over the integration of technologies among city services. Singapore's strengths lie in its forward-thinking infrastructure including the design of its buildings, connectivity in transportation and use of underground space. Having the right mindset across the board helps the authorities to plan longer and multi departments to work in collaboration to make city-wide systems work as one ecosystem.[27]

Cities in Mainland China

3.21 It is worth noting that in Mainland China, smart city development is a national policy and as development is still at its early stages, guidance notices have been issued by both the central and local authorities to provide insight into the planning and implementation of smart city projects. However, as they only serve as guidelines and there is no standardisation of practices for many aspects of smart city development, it is envisaged that problems relating to evaluation, project management and operation plans may arise. According to an EU Report on Smart Cities in China

[27] Ross, K. (2018). *Singapore, London and Barcelona named as World's best smart cities*. https://www.powerengineeringint.com/articles/2018/02/singapore-london-and-barcelona-named-as-world-s-best-smart-cities.html

published in 2015, many issues have already come to light including a lack of planning, more focus on infrastructure construction rather than the ability to manage and operate in an effective manner, and most important of all, the lack of mature business models and working mechanisms. The Report finds that with only a few successful cases to demonstrate certainty in smart city investments, coupled with the risk of changing policies and regulations, it would be difficult to attract private companies to commit to a project.[28]

3.22 The building of a well-integrated ICT infrastructure is crucial to smart city development. City authorities in the Mainland also pay a lot of attention to smart infrastructure[29]. PPPs model has been promoted as an appropriate business model for smart city development where all stakeholders involved can submit ideas on how each party will contribute and how each project will be effectively operated and enable local citizens to benefit from construction[30]. However, as seen from real cases, the kind of funding model adopted in Mainland cities is mainly "Government Fully", i.e. Government to fund, operate and own. The effect is that the government is under long-term financial pressure with low operational efficiency and service level. Ningbo, for example,

[28] The making of a smart city: replication and scale-up of innovation in Europe. (2017). EU Smart Cities Information System https://www.smartcities-infosystem.eu/sites/default/files/document/the_making_of_a_smart_city_-_replication_and_scale_up_of_innovation_across_europe.pdf

[29] Li, Y., Lin, Y. and Geertman, S. (2015).

[30] The making of a smart city: replication and scale-up of innovation in Europe. (2017). EU Smart Cities Information System. https://www.smartcities-infosystem.eu/sites/default/files/document/the_making_of_a_smart_city_-_replication_and_scale_up_of_innovation_across_europe.pdf

financed all its ICT infrastructure at the start of development and was only able to attract private participation after one to two years of practice. Some cities, such as Shenzhen and Xi'an, have adopted "Government invest-private operate" model in which the government provides subsidies to private sectors which generate profits from advertising and value-added services. A survey conducted in 2013 showed that the mode was changing to "who build-who operate" in which the government provides other financial incentives such as tax-exempt status. [31]

3.23 On data management, due to the lack of top-level coordination and standardisation of practices in Mainland China, smart city projects basically proceed on their own, hence making integration of systems and technologies highly unachievable, resulting in technology exclusiveness and monopolies. There is also an under-utilisation of the data collected for evaluation and research and inconsistency in making complete data open to non-government key players for fear of potential data theft, privacy infringement and other security reasons.[32]

[31] Li, Y., Lin, Y. and Geertman, S. (2015).

[32] The making of a smart city: policy recommendations. (2017). EU Smart Cities Information System. https://www.smartcities-infosystem.eu/sites/www.smartcities-infosystem.eu/files/document/the_making_of_a_smart_city_-_policy_recommendations.pdf

Chapter 4
Analysis of the Barriers and Challenges Facing Hong Kong

4.1 The Tianda research team has conducted a series of focus-group discussions to share with representatives of stakeholders and key advocates for smart city development on what would be perceived as the main barriers to making Hong Kong a smart city, as explained in paragraphs 1.8 – 1.9 above. Out of the six themes in *the Blueprint*, we have selected Smart Living, Smart People and Smart Government as test cases for identifying the potential barriers under each theme and verifying the extent of impact of such barriers on the implementation of initiatives under other themes. Tianda Institute is of the view that it is important to identify the potential barriers and take early steps to mitigate the negative effect of these barriers on smart projects which would incur substantial financial costs and involve community's trust in the Government. We believe our analysis of the Hong Kong situation would serve as good reference for other cities in Mainland China which may face similar problems and would also need to find solutions to address these barriers.

4.2 In this Chapter, we summarise some of the key issues brought up at our discussions with focus groups and also with stakeholders who have expressed concern about the impact of these issues which may turn into barriers obstructing the successful implementation of the various initiatives.

A Holistic Strategy and a Well-structured Roadmap

4.3 It has been the policy of the Government to build a strong digital infrastructure for bringing bring Hong Kong's economy to new heights and surpass other economies in the region in terms of competitiveness and economic performance. As pointed out in paragraph 2.3, the Government's Digital 21 Strategy from 1997 to 2015 was to enhance the e-commerce environment to improve economic development and provide better services to those who live and work in Hong Kong. The route it took in almost two decades remained primarily the same while other leading cities in the world had taken steps to integrate technologies, infrastructure and devices to enhance sustainable city management and improve citizens' quality of life. Singapore, for example, had made use of its strong digital infrastructure to address a wide range of urban issues linked to high-density living. Dubai wasted no time in implementing distributed ledgers to process government transactions via blockchain technology. London succeeded in enabling a wider ecosystem of smart city application developers and start-ups through its advanced open data policies.[33] Hong Kong, which was once labelled as the world's top digital city, continued to lose its leading position when the indicators used to measure smart city performance began to shift to sustainability pointing at making a difference in citizens' lives. In December 2015, finally, the Hong Kong Government decided to join the main stream of smart city development.

4.4 Smart city is about making a difference in people's lives, so central to the implementation of smart city is the way to address people's needs

[33] "Singapore tops the smart city rankings" (2018) SmartCitiesWorld. https://www.smartcitiesworld.net/news/news/singapore-tops-the-smart-city-rankings-2875

and priorities. Technology is the tool while citizen participation is the key. In this respect, Hong Kong is not entirely behind other places. Public discussions on smart city development in Hong Kong took place long before the release of *the Blueprint* in December 2017. This has been attributed to the setting up of the new Innovation and Technology Bureau in 2016 and the initiative taken by smart city advocacy groups like Smart City Consortium as well as local universities which held discussions of different scales in search of a future direction for Hong Kong. The discussions, especially those among senior professionals, academics and business executives, were to some extent successful in arousing an awareness of the subject within the community and creating a dialogue on what the Government ought to focus, especially after hundreds of short, medium and long-term measures were put forward in *the Consultancy Report*. There was however little discussion on the integration of technologies, implementation strategy, stakeholders' involvement and collection of data based on worldwide city development trends and indicators. Therefore, when *the Blueprint* which set out the 70+ initiatives for implementation in the next five years was announced, it was generally felt that these initiatives were no more than a collection of what the Government had originally planned to do, rather than priority actions based on a well-constructed smart city roadmap. The lack of coherence among the 70+ initiatives has also made it difficult for citizens to visualise the technological environment which Hong Kong aims to create in five years' time. Without a holistic strategy and a solid roadmap, it is difficult for smart project developers to be engaged in the search for solutions to meet the technical standards required at critical points of the roadmap and at the same time allow evolvement of technologies for meeting future needs.

Technical Competence of Workforce

4.5 For smart city development to be successful, we need strong human capital. In parallel with the actions to move Hong Kong into a smart city since 2015, the Government has also started to introduce STEM education in primary and secondary schools. It has further been turned into Science, Technology, Engineering, Arts and Mathematics ('STEAM') education and in 2016, STEAM education became Government policy with resources earmarked to promote the teaching of programming and coding so as to better prepare the younger generation for the rapid economic, scientific and technological developments ahead. This policy has been written into *the Blueprint* as a strategy under Smart People with the aim to nurture young talents to embrace changes in technology and to support future development of I & T.

4.6 The effect of STEAM education in creating the human capital for smart city development has been discussed at the focus group meetings in the current study. The feedback is that despite the Government's good intention to strengthen students' knowledge base in science and technology disciplines, students' ability to apply innovation and entrepreneurial spirit to other subjects is still very limited. One of the barriers is that teachers are not professionally equipped to apply innovation to other regular curriculum. They also do not regard creating an innovative culture as part of their responsibilities. There is also a lack of commitment in schools to elevating the capabilities of teachers so as to enrich students' learning experiences. Therefore, despite unanimous community support for STEAM education, the possibility of grooming a new generation of skilled individuals to participate in the digital economy within the next decade becomes rather remote.

4.7 The successful implementation of smart city initiatives relies heavily on all sectors of the community and all levels of different trades and industries working together to develop solutions with innovation and evidence-based research. Hong Kong is weak in R&D, at only 0.73% of Gross Domestic Product, partly because of the disappearing of its once active manufacturing industry and partly because of the lack of affordable space and facilities to test and showcase innovative inventions. The proximity to other cities in the Greater Bay Area does provide potentials for start-ups and integration of technologies as a result of the interface with findings from R&D in these places. However, language remains an inhibiting factor; in addition, reluctance to venture into a new neighbourhood and work culture, lack of mentorship and guidance, etc. are all barriers limiting our young people's choices for development opportunities.

4.8 The overall lack of technical competence of the workforce is the biggest hurdle in encouraging the use of new technologies in the workplace. The survival of new technologies relies on testing and re-testing in real-life situations. To encourage the financing of new smart technologies, the projects must be viable. If users are not motivated to put new technologies to use, there is no chance for the technologies to be further developed. It is important that general users, in particular those in the workforce, are willing to adopt changes and provide feedback for improvements.

4.9 The capability of the workforce to confront technical challenges and to do things differently is very important in smart city development. In this respect, the "think and do" approach adopted by the Vocational Training Council in providing vocational and professional training to working adults is in a way effective in cultivating the passions for learning

while imparting the necessary skills and know-how for coping with new technologies. With the mission to work with employers in manpower development, the Vocational Training Council is in fact well-positioned to undertake a more active role in enhancing employees' professional and technical competence to cope with the rapid changes in the market.

4.10 Nevertheless, given the need to implement the 70+ initiatives within such a short span of time, there is urgency to attract and retain more I & T professionals in Hong Kong and to this effect a fast track talent admission scheme has been launched. We believe that the admission of talents from outside Hong Kong has the added value of bringing in knowledge and skills which are not readily available in the local market, but it can only be an interim measure. The long-term goal should be to build up the technical competence of our workforce through all-rounded education and skills-specific vocational training.

Support for Start-ups

4.11 Globally, promotion of youth entrepreneurship has also ranked high on the policy agenda of many places, partly to solve the youth unemployment problem. Hong Kong's success in the second half of the 20th century was attributable to the rising number of small and medium enterprises ("SMEs") which undertook all forms of trades and services with innovation and courage. Today, we have over 330,000 SMEs in Hong Kong and they constitute over 98% of our business establishments and 45% of our workforce in the private sector.[34] Despite the Government's commitment to providing financial support for start-ups,

[34] https://www.tid.gov.hk/english/smes_industry/smes/smes_content.html

there is still a lack of an entrepreneurship policy to create a supportive "entrepreneurial ecosystem" in the society. According to overseas studies, the governments need to (a) create a more facilitative regulatory environment; (b) enhance entrepreneurship education through mentoring and networking of young business owners; (c) ensure adequate supply of talents; and (d) create a level playing field to embrace sustainable start-ups in all economic sectors, rather than a specific segment of economic activity.[35]

4.12 The feedback given to us about the challenges encountered by young start-ups in the I & T field is that they have difficulty in getting mentorship from institutions with the relevant knowledge and experience. Although they may have been successful in getting funding support from the Government, they do rely on guidance and advice during the development stage. Today they have none. They also encounter difficulty in marketing their products as there is no policy for the Government to accord priority to using or testing their products although the funding for developing the products in fact comes from the Government. In the end, they have to find opportunities in other places and the new technologies eventually become franchised in these other places. Besides, the lack of test grounds and showrooms at affordable rentals and poor networking have also made it difficult for young start-ups to survive in Hong Kong.

[35] https://www.legco.gov.hk/research-publications/english/1516rb04-challenges-of-manpower-adjustment-in-hong-kong-20160607-e.pdf

An Enabling Political Environment

4.13 It is an accepted fact that for smart projects to be taken on board, private sector's involvement is crucial. Private participation can bring in capital, hence reducing burden on taxpayers. It can also generate greater integration of concepts and skills. Yet the lack of diversity in project funding and procurement methods in the past decade in Hong Kong has deterred private participation. This may have stemmed from the lack of confidence on the part of the Government in getting support from the public especially if opportunities are opened to the private sector through unconventional means. For fear of allegations of benefitting some preferred entities in the private sector, the Government is more inclined to bear the entire costs of smart initiatives, as seen in all recent cases. As a result, most of the smart projects are currently funded out of public purse, and yet the Government still procures with the outdated method of using prices as the basis for selection. These arrangements are not conducive to smart city development as smart projects call for a high level of innovation and continuous testing and re-testing. If the procurement method does not allow for trials and errors as well as flexibility for modifications, it would be difficult for new technologies to develop and become usable.

4.14 Another hurdle preventing the Government from being more forthcoming and dynamic in the procurement of technologies is the much polarised political environment which has made compromises difficult to achieve. The funding process through the Legislature is long especially if the funding required is huge and the expected outcome is not entirely clear. Nevertheless, the passage of the motion to speed up smart city development at the LegCo meeting in July 2018 is a clear signal that there is consensus among Members of the Legislature for smart city

policy to proceed. It has opened an opportunity for the Government and the Legislature to explore more suitable funding and procurement options taking into account overseas experiences and to take a bold step to open new grounds for achieving better results.

4.15 An enabling Government with the backing of the Legislature is the future route to take in building Hong Kong into a smart city. Public engagement and stakeholder participation can play an important part in bridging differences in the course of developing roadmaps and prioritising actions. Some cities lag behind in city development due to the difficulty in reconciling competing interests of new and old stakeholders and in apportioning costs between taxpayers and users. Hong Kong is also facing a similar situation as we also own an ageing infrastructure and a lot of interests may be at stake if we completely reverse the condition of the infrastructure. For example, the Government has taken some years to try to establish an intelligent transport system starting with a real-time parking vacancy information system available on Apps, but without much success. Feedback from our focus groups has suggested to us that stakeholders are not unaware of the benefits to drivers but they cannot see the benefits for their own companies. How to move the long-established social and economic structure to the new age requires a lot of mutual understanding and trust, and this has to start from the bottom – from the people.

Public and Stakeholder Participation

4.16 Smart city development is bottom-up in formulating priorities and top-down in implementation. This is what we see in most successful smart cities. Citizen engagement is most important especially during the

initiating stage. In the more successful cases especially those in Europe, the roadmaps and priorities are determined by the citizens as they are the one to bear the costs, the inconvenience during transformation, and the risks of failure. Early involvement of citizens is crucial especially as smart projects are about innovation and technology which are not easy to understand. It is therefore necessary to make the expected outcomes of smart projects as quantifiable as possible, e.g. the greenhouse gas emission reduced, the waiting time shortened, etc. Citizens must be able to see the impact of these projects on their living environment in 5 years, 10 years, 15 years and so on.

4.17 Hong Kong has a very good mechanism to solicit public views – through District Councils, advocacy and interest groups, trade and workers' unions, and the Government's well-established public consultation process. The Legislature itself has also established a committee system where public hearings are held to listen to the views of the general public and stakeholders during the scrutiny of a policy, a legislative or a financial proposal. It is also common for the Government, political parties and interest groups to conduct opinion polls and policy research studies to examine the public's responses to specific policies, bills and projects. In other words, if citizen engagement is to be made an essential part of the roadmap formulation process, there is the machinery to do so. Citizen engagement must be conducted with the highest degree of transparency so that citizens are aware of the issues under consultation and able to give their views at the right moments and not after everything has been decided.

4.18 Stakeholder participation is the most difficult part in the development process. Stakeholders, as mentioned in paragraph 3.7, refer to experts, participants and partners in projects and community

leaders. It is particularly difficult to introduce changes to an old infrastructure when all the “stakes” are well established. For example, the two power companies are non-governmental entities operating under profit control schemes agreed respectively with the Government. Within the schemes, the two power companies may make profits of a predetermined percentage of the value of their fixed assets. The two companies, which are listed on the stock exchange, also have a responsibility to their shareholders. Any changes in the profits that they are allowed to make under the respective schemes would definitely affect them. However, they also have an obligation to the public at large. It is also citizens’ wish that these power companies’ electricity production activities are subject to environmental legislation that prescribes, among other things, standards of pollutant emission. Such legislation is changed from time to time, and the two companies will have to meet the new standards accordingly. Of course, the increased operating costs incurred may be met by increasing electricity charges. However, if for any reason that they cannot raise the charges, and yet the Government for the sake of ensuring a stable and safe supply of electricity may have to absorb such increased operating costs by public funds through concessions or other financial measures. In the end, all parties have to work out a solution which will make everyone happy including exploring less costly means to achieve more sustainable outcomes. That’s where innovation and technology can come into play. It is important that stakeholders are also made aware of their social responsibilities and made a partner in the smart city movement. There should be sufficient flexibility and scope to allow interested parties to develop the strategy and technology for the best result. Due to the need for negotiations and compromises, such discussions among all parties at stake may not always be held in public. This is something citizens must be able to accept, but the Government, when initiating these talks that are held in private, must ensure the

upholding of the highest ethical standards so that the discussion outcome should be in the best interest of citizens and all parties concerned.

Multilevel Governance Structure

4.19 Without the support of the public and cooperation of stakeholders, it is not easy for the Government to implement any new initiatives even though they are meant to bring long-term improvement to our way of living. Quite a number of initiatives in *the Blueprint* have in fact been on the Government agenda for some time, such as connectivity of pedestrian walkways, real-time public transport information system, online applications, e-health, but achievements are still rather limited. It is common that when a project involves more than one policy bureau or department, it will take a long time to agree on the division of responsibilities, allocation of resources, implementation timeframe, etc. *The Consultancy Report* therefore recommends a governance structure with a senior champion to provide top-down leadership and a centralised coordination and implementation body within the government to work with both internal and external stakeholders on multi-disciplinary and cross departmental issues, as in most successful smart city cases.

4.20 In her first 2017 Policy Address, the incumbent Chief Executive announced that she would personally chair a high-level, inter-departmental Steering Committee to examine and steer measures under the innovation and technology development areas as well as Smart City projects. With almost all Directors of Bureaux sitting on this Committee to determine the way forward and to report on progress, any cross departmental issues can be ironed out almost immediately. The feedback from our focus groups is that it is the poor coordination at the

lower levels of different departments which report to different Directors of Bureaux that has caused confusions and delays. The role that can be played by the Smart City Office under ITB and the development team under OGCIO is very limited as smart projects involve not only I & T support but a global perspective in city management. By following the conventional pyramid management structure in the Government, the communication channels are long and clumsy as project officers have to go through a hierarchy in order to get clearance from their own Director of Bureau before anything can be done. For smart city programmes, the Steering Committee may consider adopting the modern project teams approach by setting up cross-departmental project teams which report to the Director of Bureau in charge of the project concerned. The teams should be formed based on the skills and knowledge required and not ranks; outside experts can be co-opted to be team members to provide the skills and knowledge not available within the Government.

Competence of Civil Servants in Smart City Development

4.21 Under the top-down approach for the implementation of smart city initiatives, civil servants play a dominant role in steering the completion of projects. One observation we find is that civil servants are generally resistant to changes although they may be convinced of the need to change. Smart city development requires a high level of adaptation and integration and this cannot be achieved if those who control the systems refuse to cooperate. Civil servants' reluctance to change is understandable as they are accountable to the public and their performance is audited and monitored according to established procedures and pledges. With smart city movement coming on the scene, it calls for a reform in the civil service so that a new philosophy and mode

of thinking could be permeated into the day-to-day operation at all levels of civil servants so that those in the frontline are prepared to suggest changes to improve our citizens' quality of life.

4.22 A reform in the civil service culture is not new to Hong Kong. Back in late 70s and early 80s, the Government vigorously launched a civil service management reform where civil servants at all levels were for the first time exposed to new organisational and staff management concepts to enhance overall governance. In 1989, a public service reform was launched where financial tools were introduced to make government departments more accountable and cost-effective. In 1999, another civil service management reform was launched to create an open, flexible, equitable and structured civil service framework and a proactive, accountable and responsible culture to meet the challenges with the approach of the 21st century and rapidly changing external environment. It is therefore Government's policy to continue to enhance the effectiveness of the civil service in coping with changes. Now, it is time to undertake another review.

4.23 There has always been the misconception that smart city is all about technologies. Smart city is about sustainability and quality of life, and it requires integrations and applications. It is therefore important for all who know the subjects to play a part in developing a more sustainable and environmentally friendly solution to bring about long-term benefits to the community. There is a pressing need to provide appropriate staff training for all levels of civil servants and enable them to have the right mindset for change. Tailor-made programmes should also be developed for those who are more actively involved in the planning and implementation of projects. It is important that we should have the expertise within the civil service and should not rely solely on outside

consultants to lead the changes. Without the expertise, it is difficult for the Government to exercise more vigilance in project management and selecting the right partners in the development.

Procurement Process

4.24 Experiences in EU indicate that there is a need for better innovation procurement processes. This is something Hong Kong also needs to consider. The industry is pleased to note the Government's intention to revamp the procurement processes and is keen to see greater recognition of the innovative elements of proposals. There is general support for giving special consideration to start-ups which have developed new technologies through Government funding. This arrangement has already been adopted in successful smart cities like Singapore. We note that one of EU's advices on procurement is that due to practical reasons, there could be changes in the course of implementation resulting in a need to change the conditions and develop new technologies. It becomes necessary to have technical standards put in place and avoid engaging a single provider and being locked in solutions that cannot evolve. EU recommends integration of certification standards of new technologies in their procurement rules to ensure consistency in the application of standard requirements across projects. How far this can be applied to Hong Kong is subject to detailed study. However, if it is the trend in other places, Hong Kong needs to ensure that it is not lagging behind and the new technologies developed and certified in Hong Kong are duly recognised under international accreditation systems.

4.25 In designing the procurement process, we find EU's recommendation of a two-stage process worth considering. This will allow small-scale feasibility studies to be conducted by more than one potential bidder so as to identify and test out the most viable solutions. It will encourage competition and enable smaller companies with the innovation and skills to participate in the procurement exercise.

Policy and Legal Framework

4.26 In *the Blueprint*, one of the challenges affecting the growth of a Smart Economy is the outdated legislation and regulation which impede I & T development. Using the initiatives under Smart Living as an example, the present legal regime does not support the development in areas such as biotechnology, artificial intelligence, financial technology (Fintech) which are in fact Hong Kong's strengths. Even an award-winning digital drug dispensing tool presented to one of our focus groups is said to have difficulty going into elderly homes because of the uncertainty over some possible legal complications which no authorities is keen to address. There is also no timetable to review the current law to cater for the new technology. The conservative and passive attitude in some of the Government departments has tremendous negative impact on the willingness of young and old entrepreneurs to use their technical knowledge and professional skills to improve our quality of life. As smart city development is now a Government policy and the support of a legal framework is necessary for the development, it is right time to consider adopting a centralised method to examine the areas in our legal system which require changes and updating.

4.27 The most controversial part of the discussion on barriers to smart city implementation is the general concern about intrusion into one's privacy. In Hong Kong, the Personal Data (Privacy) Ordinance (Cap 486) protects the privacy rights of a person in relation to personal data. In the collection and processing of personal data, the data user should follow the six principles embedded in the law in protecting personal data. These include lawfulness, consent, purposeful, necessity, accuracy and transparency. Smart initiatives can only be viable when there is sufficient data to allow a more scientific analysis of the patterns and needs of the city uncovered in the large volumes of information collected through Internet of Things (IoT) devices by governments and businesses to make appropriate strategic moves and corporate decisions. Big data is therefore useful for analysis of city management subjects like waste management, water management, transportation, security, etc. When the information is collected and filtered through the IoT devices, like internet, wireless connections and other communication mediums, questions will arise on how far the information provided by individual citizens can be used by the governments and businesses, and how far their privacy rights can be protected.

4.28 Concern over privacy is not uncommon in other places where people accord priority to data protection. In *the Consultancy Report*, there is a comprehensive analysis of the issues involved. It is recognised that an integrated platform through IoT, big data, open data and other forms of smart city capabilities does pose risks to the collection and processing of data of large volumes of users' personal activities without their consent. It is also recognised that privacy policies should not denounce the capabilities of smart city technologies. So it is a matter of striking a fair balance, to maximise smart city benefits and to protect the privacy rights of individuals at the same time. In the light of worldwide

development in technologies, different jurisdictions have instituted their own practices to meet their needs but primarily adhering to the principles laid down in the Privacy by Design (PbD) framework suggested by EPIC to augment existing privacy principles which Hong Kong has adopted in its privacy law. The PbD framework aims to provide clarity to data controllers on how to handle personally identifiable data for new ICT technologies and ensure that effective processes are in place for privacy protection. There can also be special measures like Privacy Impact Assessment to identify and mitigate privacy risks in the implementation of new projects, additional requirements for seeking consent, and de-identification in the course of data collection. In Australia, there was extensive public consultation on the nature of personal data which could not be compromised and the law was amended accordingly. To encourage private companies to share information, the Australian government and public organisations took the lead to enable private companies to better understand the risks and appreciate the benefits of data sharing. We believe the same is also applicable to Hong Kong. There should be understanding across the board of how data can be used and integrated in our daily life and how it can help bring improvements, then citizens and corporations are prepared to look for solutions to address concern about privacy risks.

4.29 Protection of consumer rights is another area which has raised concern among general consumers. An example is the development of a QR code payment standard. While the Hong Kong Monetary Authority has set up a working group with the financial sector to develop a common QR code payment standard, there is the general concern about the commission charges which may make operators difficult to enter into business unless the charges are to be shouldered by consumers. On the whole, the current financial regime does not support the development of

financial technology which in turn hampers the development of e-commerce.

Partnership with Neigbouring Cities

4.30 Hong Kong is highly constrained in the use of land and its geographical location at the tip of Pearl River Delta has made it an integral part of the Greater Bay Area. Many of the urban challenges are common to the cities in the Greater Bay Area and some of these cities have already been developed into smart cities, e.g. Shenzhen and Guangzhou. Since commuting to cities in Greater Bay Area will become much easier and faster after the commissioning of the High Speed Rail Link, Hong Kong citizens' living and mobility zone will inevitably be extended beyond the boundary of Hong Kong. The proximity and connectivity with these neighbouring cities will provide opportunities for Hong Kong to address some of its major challenges, as described in paragraph 2.13, such as ageing population, shortage of land for better quality of living and working, lack of testing grounds for new technologies, etc. On the other hand, Hong Kong's experience in environmental protection, data management, quality assurance and control, corporate ethical standards, financing and procurement processes, legal and dispute resolution services are strengths which can be most useful for the smart city development in the Mainland.

4.31 Globally, there is a trend that smart cities within the same region work in collaboration to tackle common urban challenges and address common needs. While each smart city has its own priorities and preserves its own characteristics and work processes, there are bound

to be areas of collaboration which can benefit all citizens in the entire region.

Measurement of Performance

4.32 One of the most important components in smart city development is the means to quantify results and measure performance. Hong Kong should take note of the experiences of some smart cities where data collected is not fully utilised for evaluation and research. The methodology used to collect and analyse the data should be consistent with the new set of smart city performance indicators developed by the International Organization for Standardization (ISO 37122) to allow Hong Kong's performance to be compared fairly against other cities. Through these indicators, Hong Kong would have an objective assessment of the aspects of development, the result of which would demonstrate its strengths and uniqueness as well as the aspects which require attention for making improvements.

Chapter 5
Policy Recommendations

5.1 Smart city development is a worldwide trend. Smart city development is also a national policy and many cities, including those in the Greater Bay Area, are moving fast in building their infrastructure for the next stage of growth - integration. Hong Kong has started to invest in its digital infrastructure substantially since 1998, and its total equipped capacity of external telecommunications facilities will reach 200 Tbps by the end of 2018. With this strong capacity, Hong Kong must develop its overall strategy to make the best use of its infrastructure and talents to maintain its competitiveness and sustainability as an ideal place to live and to work, and also to demonstrate to the world its qualities and potentials to lead, and not just to follow, in this worldwide development.

5.2 Smart city development requires the support of citizens and stakeholders, strong leadership from the Government, an open, fair and dynamic marketplace for the private sector to participate, a supportive environment for the young and the old to learn and to innovate. Successful implementation requires more than a few development plans but an overall strategy and well-integrated roadmaps and well-coordinated action plans. In this Chapter, we put forward our recommendations in three strategic directions to address the barrries and challenges identified in Chapter 4,

(a) Forward-looking: to match the policy direction Hong Kong will take in fostering its economic position and facing the challenges ahead;

(b) Foundation-building: to build up Hong Kong's internal capabilities, including consolidating community support, for moving forward; and

(c) Out-reaching: to strengthen partnership with other city authorities and world-class smart project advisers to tackle common problems and achieve greater results.

Strategic Planning

5.3 Smart city development is to provide a sustainable and favourable environment for quality living, working and long-term development. The direct beneficiaries are the citizens. It is a form of city management to assist the city authorities in tackling urban challenges and therefore cannot be planned and implemented in isolation, without regard to other development strategies. The irony of smart city development is that it aims to keep the citizens and their lives in the city, but in the case of Hong Kong, due to a host of reasons, it has become necessary to explore opportunities for Hong Kong people, especially the younger generation, to live, work and bring up their new families in areas adjacent to Hong Kong. While the latter strategy may enable young people to find their jobs and homes more easily, it may run contrary to the whole idea of diluting the ageing population in Hong Kong, being one of the most common yet difficult urban challenges. However, it does not mean the two are mutually exclusive. The Government's policy direction should allow a strong base at home which provides the best possible support for its people no matter where they live and work, while retaining the economic benefits to finance the provision of this base. In other words, Hong Kong should ensure that it remains the centre of economic activities

and home to new innovations and technologies. To cater for this development, we recommend that:

(a) The Government should develop its long-term strategic plan for Hong Kong not solely for competing with other cities over I & T or other achievements but for addressing the long-term needs of its citizens having regard to Hong Kong's own social and economic characteristics and its unique political environment.

(b) The smart city strategy should be part of the long-term strategic plan for Hong Kong, and should be holistic enough to integrate the development plans under individual themes in a coherent manner, taking into account the stage of development in ICT, the availability of an appropriate legal regime to support the development and growth of new technologies, and the capability of stakeholders to integrate and apply the new technologies to their systems and operations. The strategy should also include a mechanism to ensure compatibility of technologies to be used in different systems of the Government and to provide flexibility for integration with systems used in the private sector.

(c) The current role of the Steering Committee is more on I & T development which is only part of the tools needed to implement smart city initiatives. While the current momentum of implementing the I & T initiatives cannot slow down, there is scope for the Steering Committee to initiate discussions on the formulation of a holistic strategy for smart city development in Hong Kong by involving all Directors of Bureaux and other interested parties.

(d) The Government should develop its own expertise in interpreting international standards on ICT and smart city requirements so as to be able to administer the preparation of documents for procurement and partnerships without relying solely on consultants. As smart city development is new to Hong Kong, the Government should take the lead to provide training and give advice to both the public and private sectors on the meeting of international standards and on compliance matters, and also on the development of contract preparation and procurement systems. In this respect, a dedicated office under OGCIO should be established not only to assist government departments but also the private sectors in ensuring consistency of standards.

(e) In developing the methodology to collect and analyse data consistent with the indicators under ISO 37122, the Government should not lose sight of the new indicators added to indexes compiled by recognised bodies for evaluating different aspects of a city's performance and ensure that the methodology so developed is flexible and user-friendly enough for coping with changes in such evaluation indicators.

Developing Internal Capabilities

5.4 In the case of smart city development, internal capabilities refer to the citizens' support and readiness to change, availability of resources (manpower and funding) and suppliers (technology and expertise), effectiveness of organisational structure and processes, readiness of stakeholders to catch up with the overall trends, etc.

Public and stakeholder engagement

5.5 To most citizens, smart city concept is still very new. They may not be able to appreciate the value it has on their quality of life especially if a lot of investments have to be made for long-term sustainability in natural and social environments. To gain their support, public engagement is a must. Public engagement is not a public relations exercise but an ongoing process to establish a dialogue with people. To ensure that smart city development is financially sustainable, citizens should have the opportunity to indicate their priorities and preferences. In this respect, we recommend:

(a) A task force should be set up within the Government under the supervision of the Steering Committee to initiate and monitor engagement of the public in smart city development. Members of the task force should come from different departments which play a role in various smart projects. The Home Affairs Bureau and the Information Services Department should play a more active role in helping to promote understanding including the organising of activities which enable the public to appreciate the value of having a more efficient service and a more sustainable environment for future generations. This arrangement is to ensure strong top-down leadership but at the same time extensive bottom-up participation.

(b) There should be better utilisation of the current technology display centres through more publicity among parents and schools. By enriching the display contents through storytelling, these venues can serve as good mediums for introducing smart city concepts to the general public.

(c) Small successes breed more successes. Achievements, no matter how small they are, should be publicised and explained to the public so that they can have a better idea about smart city. Concern over intrusion into the privacy of individuals and protection of sensitive information of corporations should be addressed and explained to the public. "Announcements of Public Interest" should be used for promoting smart city concept.

5.6 Stakeholders are interested parties. They are partners in the changing process and should also be involved in the early stage of development. We recommend that:

(a) Workshops, seminars on smart city development should be organised by both the Government and interest groups to continue to promote awareness and encourage discussions among stakeholders. The Government should support these activities through provision of venues, invitation of overseas experts, etc. to enable more activities of this nature to be held. Civil servants are also encouraged to participate in the activities and understand the concerns of stakeholders.

(b) The Government should be positive about establishing a dialogue with stakeholders and be ready to resolve differences with an open mind.

Development of human capital

5.7 In developing strong human capital to support the smart city development, we look at the present and the future. No conscious effort has ever been made to equip the current workforce for the challenges

ahead. In face of current and anticipated shortage of workforce competent in ICT, interim measures to bring in persons from other places who are in possession of the skills and experience required would, to a certain extent, provide some relief to the market. Long-term solution is to build up Hong Kong's own workforce. We recommend that:

(a) There should be more systematic training for school principals and teachers specifically on smart city concepts. Training should also be provided for general teachers who should have access to core STEM/STEAM teachers for advice and guidance. STEM/STEAM teachers should be provided with more structured teaching and coaching so that they can become mentors for other teachers on how innovation can be integrated into regular curriculums and turned into interesting activities to enhance students' learning experience. Teaching guides and materials should be provided with illustrations, examples and case studies to enable teachers to quickly grasp the concepts before they start to develop their own materials.

(b) Hong Kong is weak in R&D. One of the reasons is that Hong Kong students are not well exposed to R&D theories and practices. Suitable training should be provided to teachers in secondary schools and universities so that teachers can become more confident in organizing research projects for their students and encouraging them to participate in research work and competitions starting from a young age.

(c) To allow young people to explore opportunities in the Greater Bay Area and to market their innovative products in the Mainland and overseas markets, more opportunities should

be provided for students to practise Putonghua and English in their daily curriculum.

(d) Attention should also be given to students who are not high achievers in schools as they will form the bulk of the future workforce. VTC can play a more active role in enhancing school leavers' ICT competence and providing continuous education for working adults. There should be special funding to allow institutions like VTC, universities and others alike to organise dedicated courses related to smart city applications and general ICT techniques for all working adults.

Funding and procurement

5.8 Smart city development is costly. The smart city strategy plan, if such is available, should be able to provide a general picture of the financial pressure on the government. During the initial stage, in drawing public support, the government is inclined to financing the projects out of public funds. This kind of "totally funded by the Government" financing methodology is not sustainable and other financing arrangements have to be explored. Hong Kong Government is not short of experience in PPPs which may take various forms of collaboration over ownership, design, building and operation. However the political environment in Hong Kong has presented difficulties to the development of PPPs, as explained in paragraphs 4.10 – 4.12. For smart city projects, PPPs is the only route to success. We recommend that:

(a) The Government and the LegCo should jointly examine the financing models for smart city projects. The discussion can be initiated by the relevant LegCo Panel(s) which may invite practitioners in the I &T field and other sectors including

overseas experts to provide information on their experiences. Both the Government and LegCo should aim to come up with strategies and procurement processes which can facilitate a fair and flexible arrangement to attract private sector participation and allow for evolvement of technologies.

(b) There should be sufficient financial and land support for the development of new technologies for testing, showcasing and marketing. For start-ups, technical mentorship and guidance should be provided through partnership with local universities or other institutions with the requisite knowledge and experience. To address their lack of networking in overseas and Mainland markets for marketing their innovative products, the Trade Development Council and the Hong Kong Economic and Trade Offices should explore ways to help the start-ups in the same way as they helped the SMEs to market their products in overseas markets in the 70s and 80s.

(c) The two-stage procurement method for acquiring innovative technologies currently used in other more established smart cities may be considered. This will allow more technologies to be tested in the first part of the exercise before deciding on the most promising solutions. This means that more opportunities would be given to smallest-scale enterprises and start-ups to prove and test their new products, hence greater competition and innovations.

Organisational structure and culture

5.9 Implementation is an integral part of strategic planning. Establishing a strong management structure to ensure smooth implementation of projects is as important as having strong leadership in formulating development plans and determining roadmaps. A multilevel structure is required to steer the work at different levels of project management and implementation. We recommend that:

(a) The Steering Committee should review its role and consider whether it should be expanded to cover not only I & T development but also smart city strategic planning. If it is considered that the coordination work for smart city development should be taken up by another set-up, it should be borne in mind that smart city development is very complex and it involves many bureaux and departments. The leadership of this new set-up should be no less than one at the Chief Executive or the Chief Secretary for Administration level.

(b) A cross-departmental project team approach should be adopted to oversee the implementation of individual projects. Team members should be given the mandate to make decisions without having to revert to the heads of bureaux and departments all the time. The project teams should maintain close links with the technical team under OGCIO so that any ill practices or mismatch in technologies identified in the process can be referred to the central team for considering whether any standardised best practices can be drawn up for all project teams to note and to follow. Such standardised best practices may be incorporated into future contracts.

(c) More training on project management should be provided across the board for professionals who have a responsibility to look after contracts. Where consultants are hired to oversee projects, such consultants should also receive such training as part of pre-assignment briefing and should adopt the same standard in monitoring and scrutinising the performance of the contractor.

(d) Civil servants at all levels should undergo standardised training to acquire an understanding of smart city concepts so that they will have the right mindset to lead changes within the Government and to work with stakeholders.

Building External Partnerships

5.10 In the long run, Hong Kong as well as neighbouring cities in the region will have to adhere to international standards over the control of environmental damages and in addressing common sustainability issues. Hong Kong should be kept abreast of smart city development in other parts of the world and develop strategies to confront challenges common to our neighbouring cities. With more Mainland graduates coming to Hong Kong to pursue their education in recent years, there is the opportunity for the students in Hong Kong and Mainland cities to be studying together and would one day join hands to tackle these common issues. It is an opportune time for Hong Kong to provide Mainland students with greater exposure to sustainability issues and for the Mainland to provide Hong Kong students and start-ups with the facilities to market their products in Mainland cities. We recommend that:

(a) The tertiary institutions in Hong Kong should develop programmes and courses on sustainability to strengthen students' knowledge about smart city development and other sustainability subjects. There should be more collaboration with the universities in the Mainland for the undertaking of field visits, R&D and other exchange activities to enhance students' learning.

(b) There should be joint working groups between the professionals of Hong Kong and the Mainland to monitor the development of technologies for greater integration between the systems on both sides, and to share information on the procurement processes to ensure compliance with international standards. Where feasible, world-class smart project advisers should be invited to participate in these discussions to update the professionals with world trends.

(c) There should also be joint efforts to examine the issues which may arise due to the integration of systems and sharing of data on both sides. The experiences in other places where different cities under different jurisdictions and legal systems can work together for better results should be useful for Hong Kong.

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