SMART CITY BLUEPRINT 3.0
Advisory Report

The Way Forward

STRATEGIC PARTNERS:

HKGCC
Hong Kong General Chamber of Commerce
香港總商會1861

The Hong Kong Polytechnic University
香港理工大學

J.C.D!Si
賽馬會社會創新設計院

Credit

This report has been produced by Smart City Consortium (SCC) in collaboration with the support of the Hong Kong General Chamber of Commerce (HKGCC) and the Hong Kong Polytechnic University's Jockey Club Design Institute of Social Innovation (JCDISI).

The editorial team is grateful of all the contributions and support received from many stakeholders including SCC's members, HKGCC's Smart City Working Group and HKGCC's members. Through a series of engagement, the editorial team has also received many suggestions from various industry stakeholders and from SCC's MoU partners.

Table of Content

1. Introduction

With the Covid-19 pandemic still casting shadow amongst us, the last two years proved to be challenging for smart city development with fighting the pandemic being the highest priority of all for city managers and the civil servants and front-line workers. Smart city development is a multi-disciplinary topic that requires the engagement of city managers from many different government departments and bureaux. It is a huge challenge for the government to underwrite such a big assignment. Smart city development is therefore a long-term project that will likely involve many iterations of urban planning, legislative amendments, developing new policies, building out new infrastructure, renewing older facilities, adopting the latest innovative technologies, and finding a more balanced and sustainable way to utilize the city's resources to create benefits for its citizens. This iterative process in smart city development has been described by scholars and urban planning professionals as the continuous life cycle of linked objectives to create smarter city managers and smarter city dwellers.

Smart City Consortium (SCC) is once again renewing our advisory recommendations with this report. In preparation for this advisory report, we had engaged our partners like the Hong Kong General Chamber of Commerce (HKGCC), the Hong Kong Polytechnic University's Jockey Club Design Institute of Social Innovation, our members, our different committees, and special interest groups led by industry professionals, academics and our MoU partners to come together to provide us valuable suggestions and recommendations. In soliciting input from the public, SCC has also developed a website[1] to conduct a survey and accept suggestions via email – many of these suggestions are now included in this report.

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

SCC has in the past produced various advisory reports - with our first advisory report[2] in 2016 and with our second advisory report[3] in 2020. Some of the previous recommendations are still relevant and important for considerations. Other op-ed articles and contribution to other reports could also be found in our website (www.smartcity.org.hk).

[1] https://smartcity.org.hk/en/content-detail.php?cid=2&id=601
[2] https://smartcity.org.hk/upload/articles_lv1/0/20190215065411_610.pdf
[3] https://smartcity.org.hk/upload/articles_lv1/0/20200427021602_156.pdf

2. Charting the course in open data roadmap for Hong Kong

As Hong Kong and other cities in the region continue to roll out new smart city applications powered by sophisticated Internet of Things (IoT) and 5G communication technologies, there will be a need to manage vast amount of data being captured. These data need to be properly structured, stored, shared, and analysed to deliver the benefits for all types of end user applications. Open-sourced platforms and open data present great promise to facilitate large-scale data sharing amongst the government, the public and the private sector. As these platforms are being developed, it is imperative that the HKSAR government has an open data roadmap to support governance. A roadmap with a timetable and KPI to ensure that open data assets are consistent, put to good use, creates value for supporting Hong Kong's policy in innovation and technology and smart city development.

The perceived benefits of any open data strategy should not be seen as simply targeting a specific departmental KPI but target the final output and actual value created. The output should be holistically managed by having good leadership (sometimes referred to as stewardship), a standardised open data roadmap and consensus building on timeline for implementation. In the industry, many open standards have flourished such as USB standard, Wi-Fi Alliance, Bluetooth SIG - which engage different stakeholders with both permanent and ad-hoc leadership team in place to handle various chapters, subject matters and sub-groups. The HKSAR Smart Data strategy is not a simple task and this matter calls for the HKSAR government to plan bold and plan big for mandating individual bureaus and departments to also have their own assistant Chief Data Officers to manifest open data strategy downstream at departmental levels.

A Chief Data Officer could be placed under the Efficiency Office for better coordination in open data program

2.1 A leader for open data strategy - Chief Data Officer

As early as 2016, the Smart City Consortium (SCC) has submitted our Smart City Blueprint advisory paper[4] to the government, recommending the government to set up a high-level body dedicated to the gatekeeping of open data. The new establishment has a wide range of responsibilities, including to ensure the government agencies to be "digital by default", with open data strategy supported by an application programming interface (API) in computer readable format, and to "coordinate the major tasks, such as standardization of data and the setting up of a framework to develop guidelines for data definition, collection and processing." In addition, this new government body should "identify and review the relevant laws and regulations for the development of technologies, usage of data, particularly protection of privacy and personal information." Due to the heavy workload for implementing such smart city open data strategy, the advisory report also recommended to create a new post of Chief Data Officer (CDO) for

[4] https://smartcity.org.hk/upload/articles_lv1/0/20190215065411_610.pdf

Hong Kong and this new role could be placed under the Efficiency Office within the Innovation, Technology and Industry Bureau[5] (ITIB).

It was over five years since our first recommendation, there is still no roadmap in sight as to whether the government would implement such holistic plan. While the Chief Executive's Steering Committee on Innovation and Technology[6] is only responsible for *reviewing the progress of the project rather than giving direction*, and various government departments have also responded with window-dressing and piecemeal actions, we believe this require a strong leadership within our HKSAR government to provide both the financial budget and talent resources to enable this position for Chief Data Officer to supervise various bureaus and departments to deliver their KPIs in open data strategy for smart city development. We have also observed the implementation of the strategic framework in common spatial data interfaces (CSDI)[7] with the roadmap at the Hong Kong Geodata store[8] vis-à-vis the implementation of open data with the data.gov.hk, we believe there are still room for improvement for different bureaus and departments in adopting the use of such technologies and tools available from individual bureaus.

As for the task in coordinating a common open data standard, we are concerned about the various obvious problems associated with the fragmentated execution in the current open data initiative for smart city development. As an example, it can be seen in the *Annual Spatial Data Plan*[9] and the *Annual Open Data Plan*[10] released by various departments in December last year. The names of the two programmes appear to be similar - both are covering the departmental goals about open data, but the former focuses on "spatial data", which literally should be a subset, and the latter is a superset covering all the open data, but this is not the case. For example, the *Annual Open Data Plan* (a superset) published by the HKSAR Civil Engineering and Development Department[11] only covers 13 of the 15 datasets in the *Annual Spatial Data Plan* (subset), and this begs the question to ask why the other two datasets were not included. Furthermore, the two documents are not standardised (i.e. there is no standard). For example, one merely lists the past "release date" and the other only has a future "target release date", both of which are less than ideal and is confusing to audience. In another example, the Education Bureau[12] also have published a seven-page of their *Annual Spatial Data Plan* [13](subset) and it was found that most of the datasets listed in it are not actually found

[5] https://www.itib.gov.hk/en/index.html#
[6] https://www.info.gov.hk/gia/general/202004/22/P2020042200311.htm
[7] https://www.csdi.gov.hk/about-us/vision-and-mission
[8] https://geodata.gov.hk/gs/
[9] https://www.rvd.gov.hk/doc/en/annual_spatial_data_plans_22-24.pdf
[10] https://www.cedd.gov.hk/filemanager/eng/content_705/Annual-Open-Data-Plan-2021-CEDD-en.pdf
[11] https://www.cedd.gov.hk/eng/home/index.html
[12] https://www.edb.gov.hk/en/index.html
[13] https://www.edb.gov.hk/attachment/en/about-edb/annual-spatial-data-plans/Annual-Spatial-Data-Plan-for-2022-2024_EN.pdf

in its 16-page *Annual Open Data Plan* [14](superset). Even the ones appearing in both documents, such as the "Secondary School Places Allocation System School Net Boundaries", one with a target release date of 04/2022 and the other with 12/2022, this shows inconsistency caused by input errors or systemic errors.

At the Smart City Consortium, we have no intention to pinpoint these two departments, but these cases serve as reminders to us on the status-quo; especially on how the responsible departments have not been following any guidelines and the lack of such guidelines. This will have causal effect including doubling the effort, generating systemic errors and less than ideal output from the viewpoint of open data policy and implementation.

In summary, in order to make the most out of the massive volume of open data for higher order efficiency, the government should establish the open data standard (architecture and taxonomy) to provide clean, verifiable and authoritative core data fields commonly used for decision making and service delivery. The notion of Single Sources of Truths (SSOT) should be advocated within this data architecture. According to the Singapore government's *Digital Government Blueprint*[15] published in December 2020, SSOTs are designated to make sure the data to be shared safely and efficiently. By re-engineering the data architecture and building on the legal safeguards formalised by the *Public Sector Governance Act* [16], the Singaporean government is able to ensure the comprehensive digitisation of government records with machine readability. This is indeed a good practice that Hong Kong should follow suit.

Open data presents an opportunity for further innovative use to solve problems

2.2 Legislation on open data and sharing of infrastructure

In Hong Kong, there is no legislation on open data which requires certain type of public data to be made public and shared with the public. In 2012, the former mayor of New York City signed a legal document commonly known as the *Open Data Act* [17] which mandates all public data to be made available on a single web portal by the end of 2018. HKSAR Government, however, has not followed suit for many years. The lack of this legal basis has made it very difficult for the wider implementation of open data for departments, bureaus and other stakeholders. If the government doesn't take this leap, the private sector will often be given excuses to do the same. Taking smart mobility as an example, the number of private cars[18] and light goods vehicles has increased by more than 36% in the past 10 years to 626,000 in 2020, while the corresponding parking spaces have increased by just 8% in the same period. Finding a car park is becoming increasingly

[14] https://www.edb.gov.hk/attachment/en/about-edb/annual-open-data-plans/EDB%202021%20Annual%20Open%20Data%20Plan_EN.pdf
[15] https://www.smartnation.gov.sg/files/publications/dgb-public-document_30dec20.pdf
[16] https://www.smartnation.gov.sg/about-smart-nation/secure-smart-nation/personal-data-protection-laws-and-policies
[17] https://opendata.cityofnewyork.us/open-data-law/
[18] https://www.legco.gov.hk/yr20-21/english/panels/tp/papers/tp20210820cb4-1330-4-e.pdf

challenging, and there are often vehicles queuing outside parking lots in the central business districts, or slow driving vehicles to find parking spaces, which aggravate traffic congestion and carbon emissions. Our city urgently needs real-time data on vacant parking spaces to solve this problem. According to the Legislative Council, as of the end of March in 2022, the real-time information on the vacant parking spaces on HKeMobility website[19] covered about 96,000 parking spaces, accounting for just 42% of the parking spaces of private cars and light goods vehicles in Hong Kong, and 74% of government-run car parks.[20] In the absence of corresponding legislation, the authorities could only continue to "encourage" private car park operators to share these data.

Take another example, the smart lamp posts being erected for testing at various districts mainly in Kowloon Bay, Kai Tak and Kwun Tong area. We have received academic researcher's feedback that only the government departments are currently allowed to install and operate the devices and sensors – therefore making these datasets still pretty much trapped. There is apparently a lack of an official channel or standard procedure for any research institutes, NGOs or start-up to initiate a project using these data collected from the smart lamp post for research and development (R&D) purpose. This make the investment into the smart lamp posts less than ideal since there are always innovation capabilities from outside researchers, NGOs and start-ups willing to make use of these devices, sensors and data.

In addition, the cluster of the current smart lamp posts are situated in a few areas only and is not truly representative of modelling the actual data for different Hong Kong cityscape use case scenarios. It is recommended that the next phases of these deployment of smart lamp posts should be implemented at a wider scale, and such project roadmap should be shared with public stakeholders. We also strongly recommend that these devices, IoT sensors and 5G infrastructure should be shared with other start-ups, NGOs and university researchers to achieve wider adoption and to promote Hong Kong as truly open to innovations and technology adoption. Keeping these devices for only HKSAR departmental uses only is simply not a good implementation for I&T policy that was intended for capturing further innovations from the public and for public good. Although we have not devoted any chapter in this report about latest technologies in Internet of Things (IoT) sensors and 5G infrastructure, these types of hardware will often require maintenance, upgrade in firmware and software and any future policy regarding the fair legitimate shared use of these hardware should be opened up to these groups of users to have equal access to latest firmware and software. In light of this, we recommend that the government, perhaps with the new role of the CDO could help to create a strategic framework through legislative amendments to create a standard procedure and protocol for allowing third parties to be able to gain legitimate access to data, sharing the infrastructure through open interfaces, or to

[19] https://www.hkemobility.gov.hk/en/route-search/pt
[20] https://www.legco.gov.hk/yr2022/english/panels/tp/papers/tp202204022cb4-254-5-e.pdf

request for installation of additional sensors (if deem legitimate) to collect data for R&D and testing purposes.

Smart city, IoT and 5G infrastructure available for further R&D use

Another example was that currently there are no 5G base station installed in any of the smart lamp post project. One of the difficulties faced by the mobile network operators (MNO) is to install 5G base station on the lamp post is because the government request the MNO to arrange power provisioning to the base station by themselves rather than utilizing existing lighting circuit for power. This is a critical hurdle given the long application process for applying electricity and civil engineering works approval. A potential solution is for the government to establish a 5G-enabled Smart Lamp post Platform whereby a group of smart lamp posts already have 5G base station pre-installed. In this way, it is much easier to deliver 5G signal coverage for various smart city applications such as autonomous vehicles, outdoor patrol robot, seamless outdoor AR/VR applications for testing purpose or for real operational use. This platform could be implemented with 5G signal coverage provided by the MNOs for "Public Use", so that it is justified to provide electricity power to the 5G base stations from the lighting circuit. In order to speed up the provisioning of many innovative smart city applications, it is of paramount importance that the government's leadership team take lead to cut through some red tape, akin to a paradigm shift and look into the reducing the time and resource to deploy these smart city applications related to capturing data and sharing data.

2.3. Public awareness on data and information security assurance

Data security is another area that requires attention. According to KPMG's Connected Cities report[21], the citizens polled showed an increased willingness to share their data, more than half of respondents in Hong Kong (55 percent) mentioned data security and privacy as one of the top three factors to consider when cities implement new initiatives. It was also seen as a key consideration by those in mainland China GBA cities and other Asian cities. These findings highlighted the need for enhancement of Hong Kong's cybersecurity regulations, to protect both individuals' data and critical government infrastructure from cyberattacks. There is also a need for the city to develop a set of industry-wide security standards for Internet of Things (IoT) devices.

Information security assurance is very important to protect citizens' lives, property, and privacy. We hope that Blueprint 3.0 will strengthen the promotion of "public education on information security", enhance public security awareness, publicity and assist in the promotion of various technology application. There is also a need to educate the public to cope with the ever-changing information security risks, so that citizens can live in a safe and secure life in the city when using public services. Especially now that there are more and more technology-related crimes, many citizens have fallen into phishing email scams, online shopping scams, computer

[21] https://home.kpmg/cn/en/home/insights/2022/01/hong-kong-s-connnected-future.html

ransomware attacks, social media scams, online banking scams, online romances and other online traps. We recommend stepping up the effort to promote "public education on information security" to help raise the public's awareness of information security and reduce the chance of the public falling into these different type of technology-related crimes and potential traps.

At the same time, we also recommend to develop more "public education on information security for domestic home", such as promoting smartphone security, home Wi-Fi security, online banking security, electronic ID security, electronic payment security, etc., which are most closely related to the public. This can help reduce the public's negative experience in using technology, reduce the exposure to unnecessary information security risks, and help reduce public misconceptions and fears about smart city development in general. This strategy could only made our city smarter by having our citizens becoming smarter people.

More public awareness and training for our citizens could reduce the number of cybercrimes

We are pleased to see that the Police Department has recently launched a new search engine to combat and detect scams [22] and the willingness to adopt digital technologies for solving individual problems will continue be the key to our success to become a smart city. Having said that, it is still very important for the citizen at large to be trained and educated against any cybersecurity threats. We do recommend that financial resources are make available for NGOs to curate and deliver a series of workshops and seminars.

As an example, SCC has supported our education partner Tung Wah Group in operating the Geo-spatial Lab (GeoLab) with the Lands Department to offer training, advocacy and driving the availability of datasets and over the last half years, the centres has hosted over 100 online and offline events and have received visitations from students, industry trade associations, and government representatives to get to know more about spatial data and the use of these software for better smart city planning and development amongst government departments and bureaus.

2.4. Enabling the use of GIS data to improve planning, development and construction efficiency

In recent years, the government has planned to develop a number of new areas such as the Northern Metropolis. Three Legislative Councillors, Elizabeth Quat, Chan Siu-hung, and Andrew Lam Siu-lo have advocated the use of technology to innovate infrastructure[23]. They proposed using geographic information system (GIS) to collect, integrate and analyse geospatial data, and display the analysis in an integrated manner which allow stakeholders from various bureaux and departments to make accurate and faster decisions, reducing duplication of research and review, and ultimately speed up planning and construction process of new development

[22] https://news.rthk.hk/rthk/en/component/k2/1669779-20221006.htm

[23] https://www.hk01.com/政情/801045/葛珮帆等議員促-提速建房-及-智慧北都-落實綠色建築

areas. The proposed solution is to build a one-stop data platform with GIS to coordinate infrastructure projects and improve efficiency. In fact, early in the 1990s, large-scale infrastructure projects in Hong Kong had been managed by GIS with detailed records of every screw being used in which part to facilitate maintenance. The Elizabeth Line[24] in the U.K., the European largest infrastructure project, is also managed by this advanced technology. In 2015, the smart city initiatives announced by the Commission on Strategic Development [25]had instructed the Development Bureau/Planning Department[26] to use Fanling North and Kwu Tung North new development area (NDA) with detailed design as a pilot project to explore how to use GIS technology to build a Common Geospatial Information System Platform (CGISP) to "facilitate planning, construction, monitoring and maintenance".

Common Geospatial Information System Platform (CGISP) for better urban planning and public engagement

The proposed solution also points out that when planning new development areas, seven databases used are of different formats recorded in different software and systems, namely: (1) Territory-wide survey for land use classification and annual update of Land Utilization Map in Hong Kong; (2) Pearl River Delta region planning and infrastructure database; (3) Territorial Population and Employment Data Matrix (TPEDM) that supports planning analysis in optimising transport, population and employment distribution; (4) Computer-aided Sustainability Evaluation Tool (CASET) that enables project proponents to systematically analyse environmental, economic and social sustainability of development proposal; (5) Geoinfo One Stop 2 (GOS2) for internal government communication; (6) Statutory Planning Portal 2 (SPP2) for communication with the public; (7) Public Participation GIS (PPGIS) for the public to provide comments on planning and development proposals. Such complex and fragmented data creates a barrier for effective collaboration amongst government departments and makes it very difficult of public engagement during different stages of the planning process.

Therefore, the authority proposed to use CGISP for data collection, analysis and information sharing to assist various applications of urban planning and facilitate public participation. CGISP is capable in integrating data from different parties. As an example, NDA projects usually involve three types of data in planning: lands data (base map, boundary, cadastral, quality, quantity, use and Outline Zoning Plan); engineering data (road, slope, building, transport, water supply and drainage); and environmental data (country park, heritage). This CGISP platform allows stakeholders to view, search, compare, analyse and share project information so that all parties can follow up on the development. However, these efficiency-improving measures have not been implemented over the years and SCC recommends that this CGISP proposal should be adopted.

In addition to the above , all three legislators have also recommended a the

[24] https://www.bbc.com/news/uk-england-london-61505172
[25] https://www.pico.gov.hk/en/CSD_2015_2017/csd_3_2015e.pdf
[26] https://www.pico.gov.hk/en/CSD_2015_2017/csd_3_2015e.pdf

government to upgrade the current Census and Statistics Department to become a Big Data Bureau[27] to better manage open data projects.

2.5 Datasets for improving street safety and smart mobility

Hong Kong is already one of the most efficient cities when comes to public transport, however we still see safety risks of all kinds – especially for reckless driving, trees fallen on streets weighing a few tons and irresponsible pedestrian. Although it is difficult to predict any fatal accidents, it is very useful if datasets (E.g., accident hotspots, hiking trails, trees database) are made available through the open data framework mentioned in previous section. As an example, the tree management office has now taken over the Jockey Club sponsored smart city tree management project which covers 8,000 trees in Hong Kong[28]. With the data collected on the lean angle of trees, geographic location data available, innovative start-up companies could create mobile apps for citizens to plan their journey well – avoiding certain roads for pedestrian walking and for driving.

Figure 1. Trees management programme by PolyU

One of the student projects awarded at a student competition at the Geo-Spatial Lab[29] indeed focused on identifying traffic accident hotspots using map data and external data reported about accidents – and this helped to identify some potential safe and smart solutions (See Figure 2)


Figure 2. Student project at Geo Spatial Lab

[27] https://www.hk01.com/政情/763485/議員聯手推智慧綠色城市-促立法限碳排放-統計處改組大數據局
[28] https://www.polyu.edu.hk/media/media-releases/2021/0823_polyu-develops-smart-tree-management-system-and-transfers-technology/
[29] https://csdigeolab.gov.hk/en/

When comes to smart mobility, one of the most frustrating moments is to comprehend the progress in enabling innovations such as motor vehicle ridesharing (a.k.a. carpooling), electric scooters, electronic payment for taxis and autonomous vehicles.

Will there be self-driving robots that clean our streets in the future? The answer is an absolute yes according to a discussion during the Social Innovation Regional Forum at the Hong Kong Polytechnic University's Jockey Club Design Institute for Social Innovation about ageing population, how to plan for city resilience[30]. One of the problem raised was the shortage in younger generation willing to work on the streets as cleaners[31]. Clearly, our healthy aged citizens should be well respected as skilled resources, instead of pushing garbage trolleys in dangerous street traffic if autonomous self-driving cleaning robots are allowed to be on the streets. This is already being put to test in Singapore[32] and in China[33] and these type of use cases of autonomous vehicles (AV) will require different class of licenses from the authority bringing benefits with the AV technologies, artificial intelligence and 5G infrastructure - deployed to fulfill municipal and environmental duties while keeping the street cleaners safe. Other AV technologies such as the C-V2X[34] and MobiPro[35] will benefit from reliable street and map data; and this will become important indicator for our future success for these program.

Figure 3. Autonomous Street Sweeping robot (WenWeiPo Website)

In Singapore, ridesharing is allowed based on a private hire car vocational license (PDVL) since 2016.[36] Ridesharing allows more passengers to travel towards the same destination with some private car owners - thereby bringing mutual benefits. While this may be different from the current regime for rental cars and taxi licenses, the Transport Department (TD) should still

[30] https://www.popcast.tv/sirf2021/web/images/forum/Forum_Post_Event_Summary_ENG.pdf
[31] https://www.scmp.com/news/hong-kong/health-environment/article/2163166/its-dirty-job-dont-treat-them-trash-hong-kongs
[32] https://www.nea.gov.sg/media/news/news/index/proof-of-concept-trials-of-autonomous-environmental-service-vehicles-commence-in-designated-testbed-environments
[33] https://www.wenweipo.com/s/202108/02/AP6107c31de4b08d3407d1bcf8.html
[34] https://www.hkt-enterprise.com/en/cases-trends/how-will-5g-technology-change-the-automotive-indus
[35] https://bit.ly/3EKXCIi
[36] https://www.lta.gov.sg/content/ltagov/en/newsroom/2016/4/2/new-regulations-for-private-hire-car-drivers-and-vehicles-to-better-protect-commuter-interests.html

enable the discussion of having this in place by way of legislation amendments. We are in the opinion that ridesharing could be included as a feature into the HKeMobility app with a ridesharing service offered by the government. Offering ridesharing services by private vehicle owners is not any different from the TD offering smart parking meters in Hong Kong. The last TD's contract of the HK smart meter project is worth HK$680M[37] was carried out by PCCW with a foreign technology company called Flowbird. This was a huge undertaking benefiting vehicle owners mostly. Ridesharing on the other hand immediately benefits both the vehicle owners and the casual passengers.

As for electric-powered small size vehicles and pedal-powered bicycle, we believe the transport department should also regulate these road users. For any electric-powered small size vehicle without brakes and seats (E.g., single wheel unicycle or parallel-mounted standup), we recommend to only allow the use of these in specific leisure playground. For other electric-powered small size vehicles and pedal-powered bicycles with brakes, we recommend a new regulatory licensing regime including buying 3rd party liability insurance. And for electric-powered scooters and single wheel unicycles, this has been a constant cat and mouse chase trying to catch the offenders (See Figure 4). There are also many abandoned bicycles in the streets and this situation is similar to the abandoned motorcycles which have been dealt with recently through the office of the Ombudsman[38] and potentially through new legislative amendments. It is about time that our government through the TD to look seriously into regulating the proper use of these motorized vehicles and pedal-powered bicycles. These are road users and should be regulated the same way as other registered vehicles. At this point, we are only recommending those vehicles installed with mechanical brakes to be regulated and those without mechanical brakes should be banned from using the road and only strictly allowed in private property or designated leisure parks.

Figure 4. Youth riding an electric scooter crossing a street (Chun, 2022)

[37] https://www.parking.net/parking-news/flowbird/trusted-by-hkt-for-their-smart-city-program
[38] https://ofomb.ombudsman.hk/abc/en-us/press_releases/detail/346

On another subject, we also think that the mandatory installation of electronic payment terminals should be enforced for taxis in Hong Kong as an equal access option for passengers like bus, trams and ferries or consumers shopping at local supermarkets. The benefits brought by having electronic payment options in taxi are great for riders and taxi drivers alike. It is the quickest and easiest way to pay for a fare minimising traffic jams starting while the rider pays. Taxi drivers can get now easy access to the latest contactless card readers that are powered by mobile phones. In addition, the Faster Payment System (FPS) and bank services such as PayMe could already provide simple solution for fast and efficient payment. Reducing the use of physical coins and notes for taxi fare can also help reduce transmission of any germs that may could be spread easily through the use of traditional coins and notes.

On another note, and related to relieving major congestion in high traffic district, was the Electronic Road Pricing (ERP) project first proposed by TD in 1980 [39], and revised during different government regime [40], we would like to follow up on the latest project schedule on the ERP pilot scheme[41] in Central CBD which was proposed by TD (Figure 5). We recommend the TD to actively engage the public with explanations of the roll out timeline and roadmap. Taking into considerations of that the ERP also have dependency on the wireless radio frequency identification system (RFID) and with automatic number plate recognition (ANPR) system, it would make sense to also let the public know of the functional features of these sub-systems - especially the plan in integrating with another measure such as the Free-Flow Tolling System (FFTS).

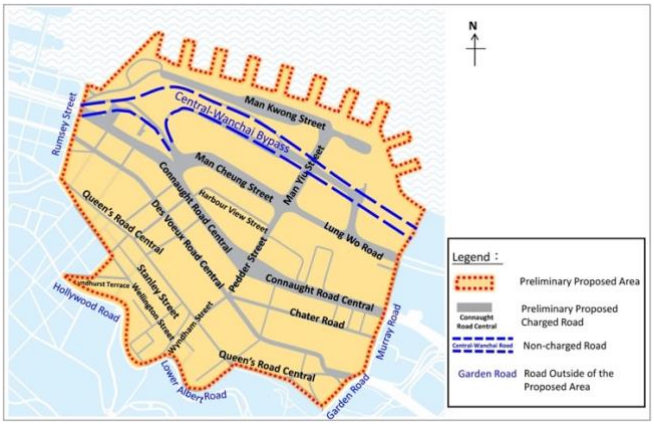

Figure 5: Source: Transport Department (2019)

Early in September 2022, the TD announced that they will conduct a travel characteristic survey to collect up-to-date information on the citizens' travel patterns and behavior[42] ; and these data could provide empirical evidence for future planning on transport infrastructure and policies. At SCC, we

[39] https://www.td.gov.hk/mini_site/erpgovhk/erp_in_hk.html
[40] https://www.info.gov.hk/gia/general/201606/22/P201606220362.htm
[41] https://www.legco.gov.hk/research-publications/english/essentials-2022ise12-electronic-road-pricing-schemes-in-selected-places.htm
[42] https://www.news.gov.hk/eng/2022/09/20220905/20220905_152607_634.html

believe additional focus groups would be necessary to include elderly and physically handicapped citizens whose current travel patterns may not be indicative of the travel mode and habit they wished for.

3 . An environment for smarter living

Besides spending time outdoor, most humans spend 90% or more of their time indoors and there is clear evidence of the direct impact of buildings in our health[43]. For example, the COVID-19 pandemic exposed how buildings can promote or hinder the transmission of airborne diseases. A healthy building enhances the health and wellbeing of its occupants. It considers a handful of factors including air quality, comfort (E.g., Thermal, Lighting and Noise), safety and security. This is not only good for the occupants, but also for businesses, as research shows that healthy buildings increase property value and workers' productivity[44]. A healthy building is also relevant to our net-zero emission goals as it promotes a sustainable use of materials and an efficient use of resources. As recommended in our previous advisory reports, smart building technologies and Internet of Things (IoT) are important as they can enable a real time visibility of the building's health through collections of various built environment data. These data can be used by the facility managers as well as the occupants to make better daily decisions. Hong Kong should create initiatives to motivate building owners and tenants to pursue healthy building initiatives as well as promoting recognized standards in this field. Hong Kong Green building Council has prepared a detailed guideline[45] for practitioners and build environment professionals to learn more about the need to adopt smart green technology for buildings to achieve environmental goals and net-zero targets. Furthermore, Hong Kong government could set the example and monitor building health parameters (e.g., Air Quality, Temperature, Light, Noise, Occupancy) in public spaces using IoT sensors and share this information with the general public in the open data platform as mentioned earlier in chapter 2.

Many buildings in Hong Kong are over 50 years old and we also have an ageing population

3.1 Double-Ageing – Ageing buildings and Ageing population

Hong Kong is still one of the highest densely populated world cities and with many buildings aged over 50 years old today, many of these buildings will require retrofitting and proper maintenance, we believe the government could encourage and support further study into some innovative form of economic incentives and / or programs to engage start-up technology companies to provide retrofitting some smart building technologies and IoT platform to deliver retrofitting and remodelling services in addition to the current rehabilitation scheme by the Urban Renewal Authority (URA). Currently, multi-tenants buildings are managed by either developers or externally sourced property management companies, often counting on building owners' incorporated bodies. According to an earlier report by The Hong Kong Polytechnic University's Jockey Club Design Institute for Social

[43] https://9foundations.forhealth.org/wp-content/uploads/2020/02/9_Foundations_of_a_Healthy_Building_February_2017_R1.8.pdf
[44] https://www.ey.com/en_us/real-estate-hospitality-construction/sustainable-healthy-buildings-meeting-real-estate-expectations
[45] https://www.hkgbc.org.hk/eng/resources/publications/Files/HKGBC_Smart-Green-Building-Design-Best-Practice-Guidebook.pdf

Innovation[46] [47], many buildings in Hong Kong will be 70 years old in 20 years' time and the buildings' occupants are equally ageing as well[48]. This is why these city building environments and infrastructure will need to be improved significantly in the next 10 years to catch up with renewal our living environment. The following diagram depicts the Double Smart approach (Figure 6) that has been proposed earlier in our previous advisory report.

Open data presents an opportunity for further innovative use to solve problems

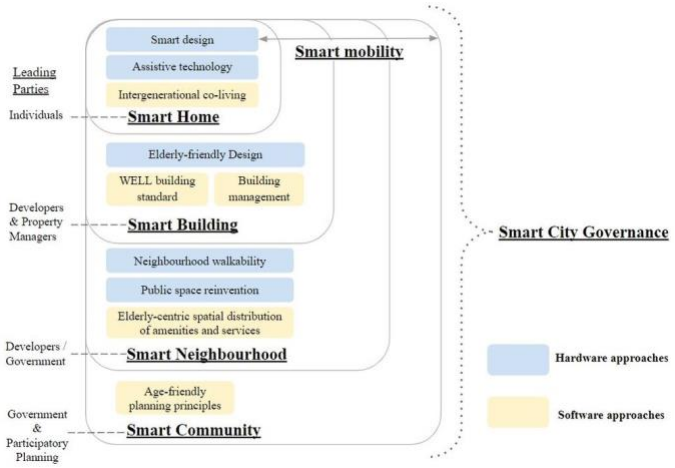

Figure 6. Double Smart Approach to Double-Ageing Problem (PolyU DISI, 2020)

In creating better living environment, the government could also explore various partnerships with NGOs and property management companies to play a role for funding and operating the retrofitting of these older buildings and communities similar to the transitional housing program which partners with NGOs and use latest modular integrated construction (MIC) technologies[49] to fulfill the objectives for supplying sustainable temporary housing option.

3.2 Environmental assessment and carbon credit trading

Somewhat related to both smart mobility and smart environment, is how our government should prioritise the electrification of transportations including enabling infrastructure for all type of vehicles (passenger cards, taxis, buses, electric ferries, etc) and quantify not only the GHG reductions, but also with improved air quality. In addition, it is also recommended to find ways to improve the walkability and comfort of pedestrian streets, also taking into considerations into universal design – being inclusive by adding more trees, shadings or chairs, and enlarging pedestrian only zones. In SCC's previous advisory report, we have also made recommendations and

[46] https://www.polyu.edu.hk/cpa/excel/en/201805/viewpoint/v1/index.html
[47] https://www.researchgate.net/publication/341270546_Tackling_Double_Ageing_with_Double_Smart
[48] https://www.hkip.org.hk/merit-4-tacking-double-ageing-with-double-smart
[49] https://mic.cic.hk/en/MicProjects

support the government to continue its Walkability strategy plan[50] with more walkability program and to create more suitable walking pathways, decluttering the roads and pavement for elderly and the handicapped citizens, etc.

Renew Hong Kong's biodiversity strategic plan for better ecological assessment with new development areas.

In parallel, we also recommend the listed company and their supply chain - industry stakeholders to conduct a study with deep decarbonization pathways analysis[51] with the help of economic models to help identify least cost emissions reduction pathways for Hong Kong and share the results with the public. We have also received suggestions that our Environment Bureau could price pollution based on emission volume and offers carbon pricing, to provide market incentives for efficient resource management. Once we have an incentive scheme in place, it is therefore possible to include Scope 3 emissions (e.g., carbon-intensive imported items like steel and cement) in the city's decarbonization plan.

It was also recommended that the newly formed Environment and Ecology Bureau (EEB), perhaps through their annual open data plan[52] could share with the public any quantitative data on physical risk analyses from climate change that have been conducted and provide any recommendations for the citizens – on any preventive climate adaptation mitigation measures against adverse weather conditions (E.g., flood gates for sea level rise) in low-lying area. With the vast amount of land reclamation with projects like the Lantau Tomorrow and the Northern Metropolis, there should be new projection models, assessment, and master plan for ecological conservation for wetland and marine diversity protection. This is a public engagement opportunity for the EEB to engage our citizens by way of organizing townhall meetings and conducting further consultations and educational site visits. The last report named Hong Kong Biodiversity Strategy and Action Plan which was published earlier in 2016 [53] and this is now a good time to renew this report.

[50] https://www.td.gov.hk/en/transport_in_hong_kong/pedestrians/w_city/index.html https://www.td.gov.hk/en/transport_in_hong_kong/pedestrians/w_city/index.html#:~:text=To%20develop%20Hong%20Kong%20into,mobility%20bringing%20about%20transport%2C%20social%2C

[51] https://www.csis.org/analysis/climate-solutions-series-deep-decarbonization-pathways

[52] https://www.eeb.gov.hk/sites/default/files/en/node4964/annual_opendata_eng_22-24.pdf

[53] https://www.afcd.gov.hk/english/conservation/Con_hkbsap/files/HKBSAP_ENG_2.pdf

4. Enabling next level government digitalisation roadmap

To facilitate the digital transformation of Hong Kong, it is important to promote the literacy of up-to-date technologies such as artificial intelligence (AI) among the public and particularly the civil servants who are the backbone of the government. While the newly established Civil Service College[54] has goals of enhancing "leadership development, interaction and communication with the public, innovation and technology applications", it does not pinpoint how to build a digital government capable of meeting citizens' and businesses' current and future needs. Our neighbour Singapore has driven the digital transformation with a different approach.

Digitalize our workforce by way of providing essential KPIs in digital literacy

Singapore's Smart Nation and Digital Government Office (SNDGO)[55] has an implementation management structure - GovTech[56] (now 6 years old) which announced a blueprint for digital government with a five-year plan in 2018, one of the goals is to upgrade the digital competency of civil servants. It required 14% or 20,000 of the public officers to attend training in data science and analytics, and all 20 ministries to submit plans to use AI in decision making with an aim to broaden digitalisation within the government. As of end 2021, these targets have all been met. SNDGO further set new targets [57] for 2023 – providing all public officers to have basic digital literacy skills and ministry families to have at least one AI project for service delivery or policymaking. In addition, it also mandated to have 10 cross-agency high-impact data analytics projects per year, data sharing for cross-agency projects within 7 working days, 30-50 transformative digital projects, as well as 90-100% of core data fields in machine readable format and transmittable by API.

These initiatives align with its *Research, Innovation and Enterprise 2025 Plan* (RIE2025)[58], the country's third five-year plan, launched at the end of 2020 to accelerate the development, translation and adoption of key technology areas like AI, cybersecurity and quantum computing. As SNDGO points out that digitalisation does not only allow the government to perform service delivery and operations more cost effectively, but also transforms policy formulation and evaluation which enables the authorities to respond to citizens' and businesses' needs in a more agile manner.
To increase Hong Kong's competitiveness, the government should also proactively adopt AI for policy making. By setting clear, hard targets and guidelines, it makes it easier for the civil servants to follow. At the same time, the government also needs to rethink its operating model to build data-driven culture and organisations so that the whole government can move forward in a more concerted manner, and Hong Kong can be able to meet the global challenges brought by the digital transformation.

[54] https://www.csb.gov.hk/english/admin/civil/2825.html
[55] https://www.smartnation.gov.sg/about-smart-nation/sndgg
[56] https://www.tech.gov.sg/who-we-are/our-role/
[57] https://www.smartnation.gov.sg/files/publications/dgb-public-document_30dec20.pdf
[58] https://www.nrf.gov.sg/rie2025-plan

5. R&D and Industry 4.0 to drive economic prosperity

Although the government has invested more than HK$100 billion in I&T in the past few years, the industry only accounted for 1% of GDP [59]in 2020, while financial services, trading and logistics [60] accounted for 23 and 20% respectively. Across the border in Shenzhen[61], core digital economy industries made up more than 30% of the city's GDP last year, driving its economic aggregate to over RMB 3 trillion. As the *14th Five-Year Plan* strongly supports Hong Kong to develop as an international I&T centre, we should seize the opportunity and catch up. If Hong Kong is to increase the proportion of I&T industry in GDP to 20% within the next ten years, one expedient way is to encourage Chinese and overseas tech giants to move their headquarters to Hong Kong. This would help to create a favourable business environment for technology companies and start-ups, while also providing new employment opportunities for local and overseas talent.

The U.S. city of Austin has provided a useful model. It cemented its status as a technology hub[62] after convincing software giant Oracle[63] to relocate its headquarters from California. The city is now home to secondary offices of many of the country's largest tech companies, including Apple, Google, Amazon, Meta and SpaceX. A study from Our Hong Kong Foundation[64] also cited the example of Shanghai and Boston which both introduced major enterprises and research institutes to create an environment conducive to the development of local start-ups and value-added industries.

Hong Kong can still play chase up with neighboring economies in I&T if we could provide more incentives.

5.1 Increase our R&D investment to at least 1.5% of GDP

According to data collated (Figure 7) in 2018 by Nature magazine[65], Hong Kong is lagging way behind other Asian economies in research and development. Scholars have also been writing about this comparison (Wang, 2018) specifically addressing the need for government intervention and support to private industry to take lead to commercialising the intellectual property and research outcome. Wang (2018) specifically addressed the huge disparity between Hong Kong and Singapore in which more private enterprises are willing to apply for patents in Singapore.

[59] https://www.censtatd.gov.hk/en/web_table.html?id=220
[60] https://www.censtatd.gov.hk/en/web_table.html?id=188
[61] http://www.szzx.gov.cn/content/2022-04/12/content_25052370.htm
[62] https://techcrunch.com/2022/04/06/how-austin-texas-has-evolved-into-a-city-of-unicorns-and-tech-giants/
[63] https://www.cnbc.com/2020/12/11/oracle-is-moving-its-headquarters-from-silicon-valley-to-austin-texas.html
[64] https://ourhkfoundation.org.hk/sites/default/files/media/pdf/OHKF_Biotech_EN.pdf
[65] https://media.nature.com/original/magazine-assets/d41586-018-05505-2/d41586-018-05505-2.pdf

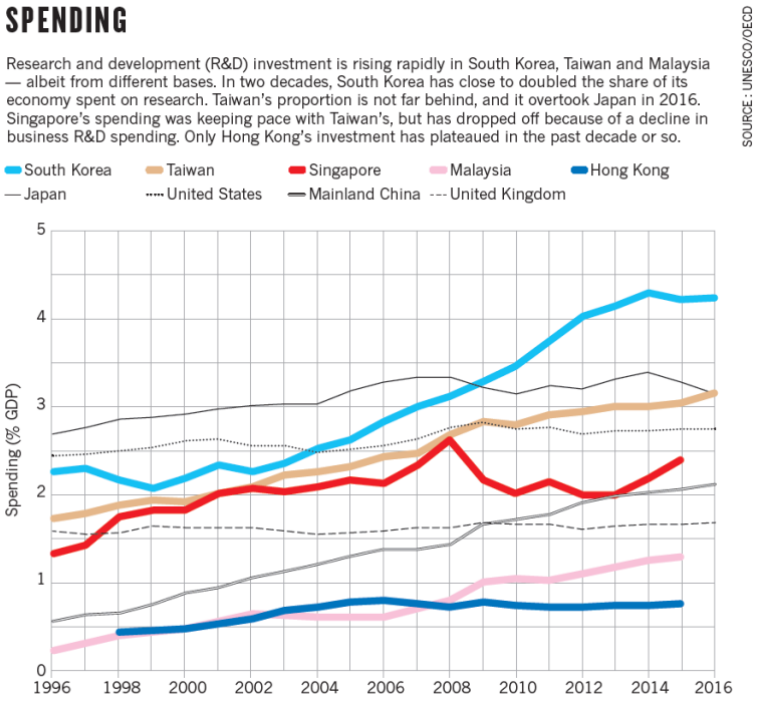

Figure 7. Five in Asia, Nature Magazine (2018)

Hong Kong has yet to reach its original goal of investing into R&D with 1.5% GDP

In the last ten years, one of the achievements of the current government in promoting innovation and technology (I&T) is the increase of research and development (R&D) expenditure as a percentage of gross domestic product (GDP) from 0.74% to 0.99%[66] during the five-year term. However, this is still not reaching the original goal of 1.5%.[67] The government has stepped up its financial support to develop I&T, but the investment is far from enough to enable us be ranked among the top amongst global competition.

The success of Israel, nicknamed "start-up nation", is mainly contributed by the continuous investment in R&D of innovative and high technology over the past five decades. Since the 1970s, the country has been keen on developing I&T. In 2018, its R&D spending accounted for 4.94% of GDP[68], over twice the Organization for Economic Cooperation and Development (OECD) average of 2.26%. During the COVID-19 pandemic, modest adverse impact was seen in Israel[69] compared to other developed countries. However, the high-tech companies today already account for 40% of Israeli Tel Aviv Stock Exchange 35 Index[70] (or TA-35, similar to the Hang Seng Index in Hong Kong), and contribute more than 40% of the country's exports. Though workers in high tech companies only account for 10% of the labour force, they provide 25% of Israeli income taxes. Shenzhen also drives economic growth through R&D in I&T. In 2020, the local R&D expenditure accounted for 5.46% of GDP. If Hong Kong wants to

[66] https://news.rthk.hk/rthk/ch/component/k2/1650162-20220525.htm
[67] https://www.info.gov.hk/gia/general/202206/01/P2022060100329.htm
[68] https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=IL-CN-KR-CH&most_recent_value_desc=true
[69] https://www.timesofisrael.com/imf-says-israel-managed-pandemic-exceptionally-well-warns-of-significant-risks/
[70] https://innovationisrael.org.il/sites/default/files/The%20Israel%20Innovation%20Report%202021.pdf

breakthrough in this field, the relative investment in R&D must be persistent and intensified. Therefore, the government should increase R&D spending to at least 1.5% of GDP in the next few years. Otherwise, in today's fierce global competition in I&T, slow advancement in this area will only lead to slow down.

According to data from the open data portal, the following chart (Figure 8) shows that there is indeed a negative growth[71] in the number of applications granted for Patent Application Grant (PAG) being offered by the HKITF [72]for supporting the Hong Kong's industry to innovate.

Patent Application Grant is experiencing negative growth for three consecutive years.

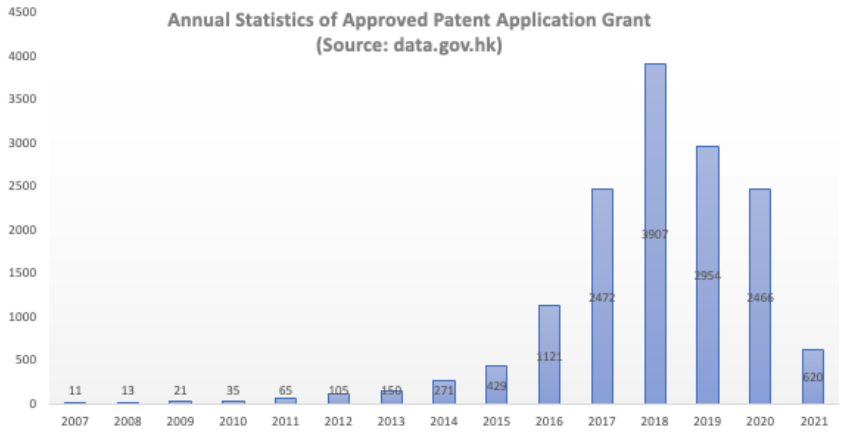

Figure 8: Annual Statistics Approved Patent Applicant Grant

In order to encourage the industry to generate more intellectual property or to actively pursue licensing of existing intellectual properties from the research centre and universities.

We have the following recommendations :

i) Set up an IP platform entity (a government-owned limited company) to help actively seek licensees from Hong Kong and overseas to commercialise the different intellectual properties rather having each institute trying to manage their own commercialisation effort. Ideally, this should be setup with industry stakeholders like various trade associations and chambers of commerce. This new platform entity should be operated as a limited company similar to HK Education City Limited[73].

ii) One of the recommendations is to lower the royalty license fee (or subsidised by another new ITF funding) currently being charged by various universities and research centres. An invention in itself is difficult to receive a valuation unless the product or service offerings are commercialised. This commercial negotiation process is often

[71] https://data.gov.hk/en-data/dataset/hk-itc-team1-annual-itf-approved-pag-stat
[72] https://www.itf.gov.hk/en/funding-programmes/fostering-culture/pag/index.html
[73] https://www.edcity.hk/hq/en/content/aboutus

plaguing the process of the investor and technology/patent owner. This has been specifically brought up as an issue during a recent forum with representatives from over 20 technology related trade associations.

iii) Enhancing the current patent application grant (PAG)[74] being offered to Hong Kong company and citizens by doubling or tripling the offer today. Currently, an individual or a company can only apply for one PAG per lifetime. The data already shows that there is a slowdown in growth in PAG applications. Companies that have success in applying PAG are more likely to have success and great inventive ideas that are patentable.

The above recommendations are not by any means a concrete operating plan but serve as a reminder that IP development and technology innovations does need the Government to provide continuous support (as in Israel and Korea) mentioned earlier in this chapter. There is evidently a trend of negative growth from within the industry itself and this contradicts with promoting Hong Kong as a technology hub and IP Hub. SCC highly recommend Innovation and Technology Fund (ITF)[75] to work closely with HK Intellectual Property Department to plan ahead for the KPIs require to increase the rate of commercialisation and generation of intellectual property from Hong Kong-based companies and research centres. The increase of output in this area will directly impact the output of any effort in reindustrialisation, technology transfer, providing employment and ultimately economic output for Hong Kong.

Hong Kong will need to integrate to other GBA cities for attracting talent

5.2. Integrating with GBA for both talent and R&D

In the long run, however, Hong Kong should take the lead in cooperating with platforms in Greater Bay Area (GBA) cities to establish large-scale cross-border biotech research institutions, share funds and facilities, and promote inter-institutional cooperation, given Hong Kong's world-class educational and research institutions. While we can leverage our strengths in medical research and other breakthrough inventions, we should connect China and foreign countries to further promote China's technological breakthroughs in frontier fields. With these measures in place, we can turn Hong Kong into a talent magnet and a tech hub with tighter integration with the GBA. Higher education cooperation in GBA has gained traction in recent years, with a number of Hong Kong universities setting up branches or campuses across the border. The 2019 Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area [76] has made clear the goal to support higher education institutions from Guangdong, Hong Kong and Macao in their aim to establish jointly run education institutions. The joint development of academic programs, labs and research centres in

[74] https://www.itc.gov.hk/en/fund_app/patent_app_grant.html
[75] https://www.itf.gov.hk/en/home/index.html
[76] https://www.bayarea.gov.hk/filemanager/en/share/pdf/Outline_Development_Plan.pdf

fields where they have a competitive edge is also encouraged, the document said.

This initiative can greatly expand the talent pool of Hong Kong and GBA. Therefore, the Hong Kong government should further encourage Hong Kong's world-class high-quality universities and institutions to set up new campus in GBA. Through fostering path-breaking research and creating transformative student experiences, the HK-GBA campus can enable students to capitalise on the region's dynamic and rapidly evolving business and research environment, open up more opportunities for collaborative innovation, so that young people can show their full strengths. This will also solve the shortage problem of space for development of local universities while the new establishment can strengthen young people in GBA the sense of internationalisation and help realise the potential of the region.

We strive to build Hong Kong into a world class smart manufacturing and smart city. As manufacturers advance toward their broader digital transformation specifically through smart manufacturing initiatives, ecosystems can make a significant difference in the speed and scale of their efforts. In particular, when manufacturers engage their business partners or networks to solve specific business challenges or opportunities, they can make better progress. The electronics industry accounts for more than 70% of Hong Kong's total exports[77], and the electronics industry is closely related to innovation and technology. Therefore, the government could consider establishing a R&D centre for microchips design and manufacturing locally. Through cooperation with local universities and enterprises, it can be used to produce semiconductor chips for scientific research or commercial use in small batches with smart manufacturing initiatives. It would also help to cultivate local talents and drive the development of the smart manufacturing and become value-added to the overall GBA strategy.

We hope that different R&D centres and local universities will collaborate to develop more projects together with the industry for promotion on "re-industrialization". Such collaboration will further provide more use case scenarios for real application that are conducive to the return of high-value-added projects. Taking the electronics industry as an example, manufacturers of electronic industry in Hong Kong mainly conduct research and product design. The support by the government for high value-added projects and the entire chain of industry, including raw materials, basic software and hardware programming and development, smart manufacturing equipment, and smart production lines, R&D, and production software (EDA, PHM), etc. are the major factors for the win-win situation. Therefore, it is suggested that the government to increase the amount of financing and research funding for deployment of smart manufacturing.

Moreover, we found that many R&D project deliverables have not been "commercialized" at the final research stage. One of the major factors goes

[77] https://research.hktdc.com/en/article/MzExMzM1NDk1

to the reliability & safety of system and products. This is one of the very few measures or standards to facilitate the R&D project deliverables to commercialization. It is necessary to set up an office for the transformation of the R&D deliverables so that the relevant technologies, systems or products become commercialized and thus enter the market in Hong Kong. As an example, one of the InnoHK research centres, Centre for Advances in Reliability and Safety (CAiRS), works to enhance the reliability and safety of advanced products and systems, which contributes to the development of smart manufacturing & smart city in Hong Kong. One of their research and service areas is focused on Prognostics and Health Management (PHM) to predict component failures and increase system performance of industries for all types of components built for infrastructure, mechanical and electronic devices. CAiRS' mission is to develop new approaches using AI and advance technologies for customised management to ensure the reliability and safety of products and systems which is readily applicable to different industries including advanced manufacturing sectors, electronic products, transportation, sensors, microelectronics, public utilities, IoT products, telecommunication, robots, and medical devices. CAiRS could provide solutions to enhance the performance on products reliability and system safety which could speed up and foster the R&D project deliverables to commercialization.

5.3 Commercialization and smart manufacturing

Research centres and local university to collaborate more for industry 4.0 opportunities commercializing intellectual property

With the blessing and support of the Central Government, tighter integration with other GBA cities, the national 14-5 plans have given room for the new government to elevate Hong Kong to become a strategic hub for innovation and technology[78] for the new economy businesses[79] to drive future growth. In this context, we have received valuable input from industry veterans, local researchers and academia that has been part of our pool of advisors.

One of the key considerations that had been discussed over the years was how to improve the yield and the pace of commercialisation of intellectual property, human capital, and research output to become industry-ready – bringing benefits to human, enterprise, researchers and advancing our knowledge economy. As the world shifts from fighting the pandemic to recovery, many industrialists believed in the need to advance our manufacturing to higher order output segment adopting latest outcome from scientific and applied research programmes.

Advancement in smart manufacturing (especially those involving artificial intelligence, safety testing) matters because it provides resilience and often provides highly skilled labour opportunities. It also provides opportunity for commercialisation of innovation and research output. This could be a key to trade deficit reduction and contributes disproportionately to environmental

[78] https://www.policyaddress.gov.hk/2021/eng/pdf/publications/14-5/06_International-Innovation-and-Tech.pdf

[79] https://www.scmp.com/comment/insight-opinion/article/2105149/time-hong-kong-define-new-economy-amid-talk-third-board

sustainability issues. Nowadays, the importance of smart manufacturing is undeniable one of the key investment areas for other economies in the region. In the global stage of competitiveness, Hong Kong is best positioned for smart manufacturing with the applications of industrial internet of things (IIoT), 5G, cloud and edge computing, artificial intelligence (AI), blockchain, metaverse, vision systems and other advanced technologies. We do believe the new AMC operated by the HKSTP at Tseung Kwan O and the InnoHK programme[80] are only just the beginning of our Hong Kong's digital transformation and industry 4.0 journey.

As the pandemic has brought along changes to many industries in creating economic output and ultimately value to our society, we should engage in the wider smart manufacturing ecosystems to speed up digital transformation and drive results ready for the next normal. Smart manufacturing technologies include not only production automation, IoT utilization, process & scheduling optimization, it extends well into automatic anomaly detection, diagnostics and prognostics that keep many types of industrial systems to function as expected. It would significantly increase manufacturing competitiveness in terms of productivity, quality, reliability, and safety. Furthermore, this adoption will effectively offset high cost in labour involved in maintenance in buildings management, public transportation, and telecom infrastructure.

Smart Manufacturing for high value-added industry making good use of land available from North Metropolis

Figure 9: Launch of InnoHK, Centre for Advances in Reliability and Safety

The National Development and Reform Commission of People's Republic of China and seven other government departments released a 14th Five-Year Plan (the plan) for the development of smart manufacturing. The plan announced several developmental targets by 2025, including achieving digitalization in 70% of manufacturing enterprises above designated size and fostering more than 150 professional providers of smart manufacturing solutions. With the support from the Central Government to create

[80] https://www.cairs.hk/en/news_detail/index/36

opportunities for closer co-operation in the GBA, the Shenzhen-Hong Kong Innovation and Technology Co-operation zone could be pursued and enhanced. With this plan in mind, we could make use of 5G, Big data, Blockchain, AI etc. to create smart scenarios, smart factories, smart supply chains to develop smart manufacturing. We strongly recommend additional fiscal support and talent support to professional service providers of smart manufacturing solutions to encourage the development of high-quality standards in reliability and safety. This would cover new industries and new business models to promote application standards in smart manufacturing. In alignment with the government's policies. In April 2022, HKSTP has unveiled the Advanced Manufacturing Centre (AMC) at Tseung Kwan O InnoPark and other new development area proposed by the Northern Metropolis Land Development strategy[81]. The 2.71-hectare manufacturing centre is set to provide services for logistics, warehousing, prototyping, low-volume assembly, and cleanroom-enabled space for smart manufacturing of high-value added industry segment.

The National 14th Five-Year Plan and the Outline of Development Plan supports the positioning of Hong Kong's development into an international centre for I&T and states that Hong Kong should develop in the areas of high-end and high value-added service industries. How to reinforce and strengthen Hong Kong's role as an International I&T Centre and to create a rival to Silicon Valley are our goal and mission. Hong Kong is striving to expand the industries where the city enjoys clear advantages. These include strong applied research centres in HK and top-tier manufacturing partners in China & Hong Kong, low taxes, minimal tariffs, open business environment, world class infrastructure, multicultural talent pool. there is also the intention to strengthen the development of the innovation and technology (I&T) industry, promote re-industrialization and develop a complete ecosystem embracing the I&T industry with supporting investment and financing services (I&T industry ecosystem). It is necessary to attract large-scale domestic and foreign technology companies to foster the international high-tech hub in Hong Kong.

We propose to offer a multitude of favourable commercial engagements to ensure and attract enterprises to invest and locate in Hong Kong. For example, a Public-private partnership (PPP) model. This is a long-term contract and cooperation between a private party and a government agency for providing a public asset or service, in which the private party bears significant risk and management responsibility. The PPP model is well-established for the construction of economic and social infrastructure which could give an assurance of reduced rental and housing prices, so as to attract more high-tech enterprises to select Hong Kong as their prime location

[81] https://www.policyaddress.gov.hk/2021/eng/pdf/publications/Northern/Northern-Metropolis-Development-Strategy-Report.pdf

5.4 Exporting our I&T with Smart-City-As-A-Service (SCaaS) for ASEAN countries

The United Nations estimated that 68% of the world's population[82] would be living in city by 2050, making the cities very crowded. The influx of people is due to more work opportunities there. To solve the accompanying problems such as housing, security, and employment, further development in city planning to become smart cities has become a global consensus. Due to the project size, different research reports anticipated great business opportunities in these smart cities. For example, research firms CB Insights [83] and Frost & Sullivan[84] both predicted that by 2025, the global value of smart city would range from US$1.4 to US$1.56 trillion.

Exporting HK's innovations and technology products and solutions for our neighbours in ASEAN countries.

The world economy is still recovering from the damage brought by the COVID-19 pandemic. However, the International Monetary Fund predicted in July this year that the economy of the five ASEAN countries[85] (Indonesia, Malaysia, the Philippines, Thailand, and Vietnam) would rebound rapidly (2022: 5.3%; 2023: 5.1%), far above the advanced economies (2022: 3.2%; 2023: 2.9%). Among them, the demand for smart city services is especially high. For example, Vietnamese manufacturing industry has emerged and developed rapidly, but the country's infrastructure, including water supply systems, waste collection and treatment, street lighting, grids, transportation systems, education and healthcare cannot keep up with the economic development. Recently, the Vietnam government has formulated a series of national policies[86] for the development of smart city. However, as of to date, Vietnam is still in its infant stage. With reference to the Spanish IESE Business School *IESE Cities in Motion Index 2020*[87] (ICIM), Ho Chi Minh City, was only ranked 127th. The city needs to catch up in the areas of human capital (156th), governance (158th), economy (142th), technology (125th) and more.

According to the government trade data,[88] ASEAN economies are Hong Kong's second largest trading partner, and one of our four largest foreign direct investment destinations. Furthermore, Hong Kong remains strong in the world's smart city ranking of which the latest position is 10th, according to the latest ICIM report. Based on this reason, Hong Kong should be able to export our expertise and experience of smart city development to ASEAN economies to capture a large share of the huge business opportunity. This

[82] https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
[83] https://www.cbinsights.com/research/what-are-smart-cities/?utm_source=CB+Insights+Newsletter&utm_campaign=906d99c5d1-ThursNL_05_16_2019&utm_medium=email&utm_term=0_9dc0513989-906d99c5d1-90128738
[84] https://www.frost.com/news/press-releases/frost-sullivan-global-smart-cities-market-reach-us156-trillion-2020/
[85] https://www.imf.org/en/Publications/WEO/Issues/2022/07/26/world-economic-outlook-update-july-2022
[86] https://english.mic.gov.vn/Pages/TinTuc/139196/Vietnam-issues-ICT-reference-framework-for-smart-city-development.html
[87] https://media.iese.edu/research/pdfs/ST-0542-E.pdf?_ga=2.186347754.299159587.1598855976-1424834266.1598855976
[88] https://www.tid.gov.hk/tc_chi/ita/fta/hkasean/index.html

will not only inject impetus into local economy but also provide quality employment opportunities for local talents. Smart-City-as-a-Service (SCaaS) could be developed as a solution to help Hong Kong's industry to reach scale and additional market.

6. Update our financial policies to turn Hong Kong into a FinTech, IP and Art hub with technology funding to support these growth industry

To facilitate a flourishing ecosystem for start-ups, in addition to strong talent pools, an open attitude to new ideas and foreign talents, active venture capital funds, regulation of cryptocurrency and digital assets, liquidity in capital markets and government support, these are all important to have policies that keep pace with time for retaining talents and attracting funds.

Hong Kong can still play catch-up with sound legal, financial, logistic infrastructure to support cultural industry and extend to become an IP hub and Art hub.

In recent years, Singapore has become a fertile breeding ground for unicorns (start-up companies valued at or over US$1 billion). According to the Economist magazine[89], Singapore ranked seventh amongst the top 12 cities with the most unicorns over the past 10 years, Singapore's up-to-date financial technology policies have made it attractive to tech unicorn start-ups looking to establish their Asia-Pacific headquarters. According to the consulting firm EY[90], EY estimates that the total value of global cross-border payments is expected to reach US$156 trillion this year. As part of the pre-emptive move and anticipating the huge business opportunities this can bring, the Monetary Authority of Singapore (MAS) introduced the *Payment Services Act 2019* in January 2020[91]. This law streamlines cross-border business activities by grouping seven forms of payment, including digital payment tokens and cryptocurrency under one licensing framework.

Even if money does not flow through Singapore, the transfer of funds by Singapore payment service providers is subject to MAS[92] regulations and needs to meet the compliance requirements of financial institutions. Such a framework allows complying cross-border payment companies to promote their business and collaborate with other financial institutions, while safeguarding against money laundering. In Hong Kong, however, banks are regulated by the Hong Kong Monetary Authority, while the Customs and Excise Department supervises the licensing of cross-border remittance companies. This division of regulatory capabilities hinders the development of FinTech services and will be very difficult structurally for the efficient regulation and monitoring of any new policies.

To help local start-ups develop cross-border remittance and payment services, attract global payment companies to Hong Kong, and to explore the use of various new forms of cryptocurrency payments, the government should consider following Singapore's lead by integrating regulatory frameworks for various payment methods, including cross-border remittance, stored value facilities (e-wallets) and encrypted payments. Additionally, there is plenty of opportunities for Hong Kong tech ecosystem

[89] https://www.economist.com/business/can-silicon-valley-still-dominate-global-innovation/21808708
[90] https://www.ey.com/en_gl/banking-capital-markets/how-new-entrants-are-redefining-cross-border-payments
[91] https://www.mas.gov.sg/-/media/MAS/Regulations-and-Financial-Stability/Regulations-Guidance-and-Licensing/Payment-Service-Providers/Guide-to-the-Payment-Services-Act-2019.pdf?la=en&hash=B03712F4EEEE907C39BA2C12DE63A545495EE1C2
[92] https://www.mas.gov.sg/news/speeches/2021/payment-services-amendment-bill

to tap the growing need for technologies in KYC, AML, RegTech, compliance, cybersecurity, wallet, digital identity, blockchain-based authentication and chipset technologies. The mBridge project from BIS[93] which has successfully conducted cross-border payment with four central banks will prove to be important for maintaining the edge in cross-border payments[94] in the Central Bank Digital Currency (CBDC) realm. Furthermore, the new Virtual Asset Service Provider (VASP) license regime regulated by the Securities and Future Commission (SFC) and recently gazzetted[95] will become a crucial indicator to measure the growth in this segment. Hong Kong's two technology parks (namely the Cyberport and HKSTP) both have many promising FinTech start-up companies that would benefit from a clearly articulated legal framework for implementation and scaling to grow. There is a current lack of legal framework to support the tokenization of asset through blockchain technologies (namely Non-fungible Token) and many firms are fleeing to other jurisdictions to execute the same. HKTDC Research has published widely about the opportunities on how traditional industry, cultural industry, art and collectibles, brand, music and film enterprises could explore Metaverse [96]as a way to open door to more opportunities – as a new ecosystem. When comes to innovations in using blockchain technologies, a recent report by Coindesk has recently revealed that the Hong Kong Polytechnic University is the world's number 1[97] in the use of blockchain technologies for both education, projects and for applied research.

In addition to renewing the Hong Kong business model to advance its role in FinTech, smart manufacturing, there are also opportunities to look deeper into the economic benefits of advancing the service industry in exhibitions, conventions, hotels and tourism market with these new technologies. A locally listed resort entertainment company (APE Digital Creations, 2022) has now ventured out into the Metaverse and had been advocating the concept of ResortVerse[98] to push the tourism industry back on track in the region. Another local media start-up company recently has launched its Metaverse Asia Expo[99] [100] project and they too believe that SMEs could capture the opportunity to extend their digital business roadmap, branding and awareness by way of exhibiting virtually in the metaverse.

Since the outbreak of the pandemic, both Hong Kong and Macao have suffered substantially from the lockdown and travel restrictions. One of the strategies is to follow suite like Shanghai city to have a metaverse masterplan policy[101] for an integrated tourist and business travel that

[93] https://www.bis.org/publ/othp40.htm
[94] https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm
[95] https://www.gld.gov.hk/egazette/pdf/20222625/es32022262516.pdf
[96] https://research.hktdc.com/en/article/MTA0ODE0MjE4MQ
[97] https://www.coindesk.com/layer2/2022/09/26/best-universities-for-blockchain-2022-coindesks-methodology/
[98] https://resortverse.io/whitepaper/
[99] https://starbiz.net/metaverse/metaverse-asia-expo-2022-what-future-does-metaverse-hold
[100] https://www.metaverseasiaexpo.com/
[101] https://www.shanghai.gov.cn/nw12344/20220708/ab632a9b29b04ed2adce2dbcb789412c.html

combines FinTech, Business travellers and tourists to Hong Kong. It has been proven that sports events like the Rugby-Sevens and the Standard Chartered marathon could bring excitement and hope and patronage to Hong Kong. By adopting a metaverse strategy, HKSAR could become a super connector to the world of new consumers or prosumers that are willing to pay for premier services, curated experience, all kinds of merchandise goods and continue to support the growth of this decentralised mixed reality ecosystem. An informal poll at the community organised by the NFT Association of Hong Kong[102] reveals that most of the participants believes that there is a need for a Hong Kong Metaverse strategy much like Shanghai city. HKTDC have also expressed in another report[103] that the early adoption of the Metaverse strategy could still see market challenges and slowdown due to the recent crypto market crashes and the economic recessions that had been plaguing many economies.

TVP funding for SMEs to apply for user case application in Metaverse and Art Tech

In one of the research reports from Our Hong Kong Foundation (OHKF), it points out one of the key drivers for the need for more cross-industry support to the art and culture industry is to present an opportunity to adopt new technologies such as augmented reality, virtual reality, metaverse, AI, cloud, big data, blockchain, and chipsets[104]. The strategic advantages brought along by innovations from Art Tech[105] and Metaverse[106] had also been presented by in their reports. Other practitioners have also advocated that Hong Kong would benefit much from the protection of intellectual property to effectively support the trading of art in Hong Kong[107]. Hong Kong is a freeport and is well-trusted in finance, asset management, legal, IP protection and logistics. These service-based and professional service economy could benefit much from the growth in including technologies in the art and culture industry – thereby transforming Hong Kong to become an IP hub and an Art hub. Currently, there is no funding dedicated to promoting art tech in Hong Kong with the mandate of promoting cross-sector collaboration between the art and technology sectors. As an example, the Technology Voucher Programme (TVP) under the Innovation and Technology Fund (ITF) should diversify the nature of its supported projects and broaden funding guidelines, to include art tech, metaverse projects that inspire innovation and bear creative value. Specifically, we also echoed OHKF's recommendation to build cultural and art IP database[108] (data infrastructure) that conforms to open data programme / spatial data initiatives with the data.gov.hk and geodata.gov.hk respectively and to also think of how Hong Kong could support cultural IP trading by looking into following international standard such as the Art ID Standard[109]

[102] www.nfta.hk
[103] https://research.hktdc.com/en/article/MTE0MjM0ODQzNw
[104] https://mp.weixin.qq.com/s/N6WHd9W4uOehiVF--EXuvg
[105] https://www.ourhkfoundation.org.hk/en/media/34/arts-innovation/arts-innovation-innovating-creative-cultures%E2%80%94arts-tech
[106] https://www.ourhkfoundation.org.hk/en/report/34/arts-innovation/arts-innovation-policy-research-series
[107] https://www.youtube.com/watch?v=RSIxO0nLiic
[108] https://ourhkfoundation.org.hk/sites/default/files/media/pdf/Arts_Innovation_Report_2022_May11.pdf
[109] https://www.artidstandard.org/standard

with projects like Artracx[110]. which adopts W3C endorsed Decentralised ID[111] (DID:ART) and blockchain technologies to support authentication, trading in IP, art and collectibles in Hong Kong giving the traditional industry like financial advisory, escrow, insurance, legal, MICE, storage and logistics more business opportunities. This was recently discussed widely at the art tech forum at Cyberport during FinTech week.

In a recent discussion forum (Figure 10) about the Environmental, Social and Governance (ESG) held at the City University Hong Kong organized the Digital Asset Series[112] , expert speakers have shared that there was a lack of carbon credit trading exchange in Hong Kong.

Figure 10: ESG forum at Digital Asset Series

Carbon trading and exchange to help achieve environmental and net-zero targets.

It would be logical for Hong Kong to disrupt itself with the Hong Kong Monetary Authority speeding up the development for trading exchanges or virtual asset service providers (VASP) to set up their business model to prepare for accepting carbon credit trading. The Cross-Agency Steering Group have announced the feasibility of carbon market opportunities[113] and will be working towards developing Hong Kong as a regional carbon trading centre. According to the Friends of Earth (HK)'s article[114], Hong Kong will require both the government, finance professionals and blockchain technology experts to work together to educate more people to learn more about ESG and bringing green and sustainable finance closer to our societal environmental goals to achieve net-zero targets.

In summary, Hong Kong will benefit much from healthy regulation in adopting latest technologies in financial markets, this will fuel growth, deal flows, transactions, and liquidity – which ultimately will help maintain Hong Kong's status as an international financial hub.

[110] https://www.youtube.com/watch?v=RSIxO0nLiic
[111] https://www.w3.org/TR/did-core/
[112] https://digitalassetseries.org/
[113] https://www.hkma.gov.hk/eng/news-and-media/press-releases/2022/06/20220621-5/
[114] https://bit.ly/3RZemie

7. Paradigm shift in leadership and organization culture - setting up a special task force with external industry actors – forming smart city clusters

Leadership matters and external actors are both equally important to smart city development

Following our Chief Executive's mandate in KPI-led leadership culture, we also believe the government should capitalize the knowledge, resources, and capabilities of external actors to provide the impetus for sustainability to advocate, give directions and implement smart city projects by way of creating fiscal budget and externalizing the organization administrative structure to tackle the immense task ahead in the long-term development in smart city initiatives. According to Borins (2002), leadership in innovations will inevitably lead to innovative and alternative structures involving interorganizational collaboration simply because the project initiators are themselves in the frontline. External actors (Figure 11) played an important role and are often part of the ecosystem to create critical input and feedback loop to the system to maintain its healthy growth. At the 2021 Social Innovation Regional Forum[115] hosted by the Hong Kong Polytechnic University's Jockey Club Design Institute of Social Innovation, Dr. Norah Wang shared that the third sector and the government should explore deeper to create more social innovations for our society.

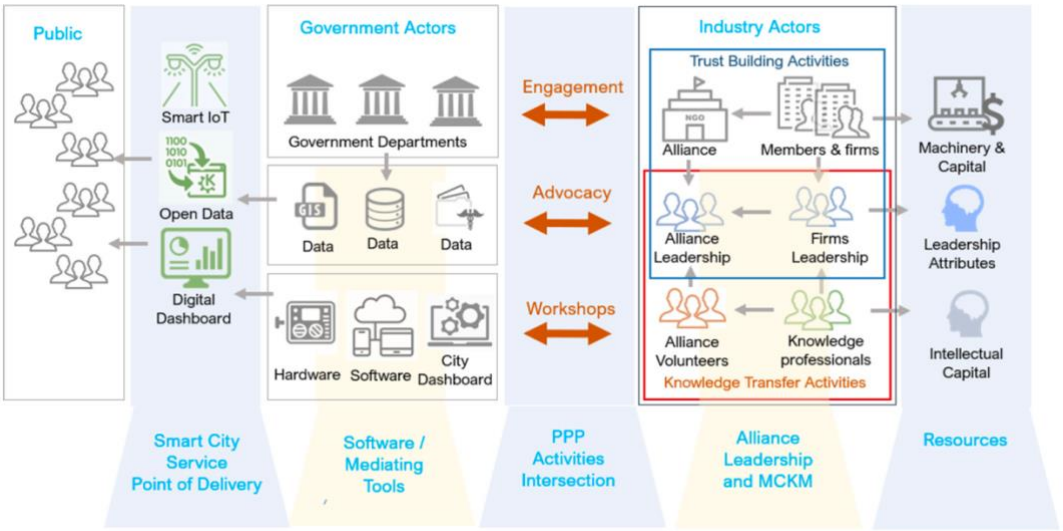

Figure 11. *PPP smart city leadership, actors and collaborative activities (*Chun et al, 2021)

In the existing organizational structure within our government, currently, these tasks are being delegated to individual departments as an adjunct duty only – often working in silos. With the ability to provide external intervention, external actors could provide effective and impactful contribution as part of a special smart city task force if additional financial resources (akin to a new smart city development administrative fund) is made available for applications by NGOs and alliance organization. In the past, many trade associations, NGOs and professional bodies like SCC

[115] https://www.popcast.tv/sirf2021/web/images/forum/Forum_Post_Event_Summary_ENG.pdf

A smart city task force and a development fund for administrative work.

have provided valuable contributions (albeit limited in resources) by effectively engaging and educating the public, hosting industry events, mass collaboration, knowledge transfer, public communications, and advisory services – essentially bridging between many stakeholders with a mission to advance the pace of smart city development in Hong Kong. At SCC, we see that this is very important and one such example of a successful mass collaboration[116] [117] was cited in our paper published in the World Health Organization's research database with the HKSAR Covid-19 dashboard[118] which was initiated by SCC and facilitated by various bureaus and departments. This is well recognized by many as a successful public-private partnership project to fight the pandemic early in 2020 with the support of geo-location data and by external alliance organization (Chun et al, 2021).

Successful programmes in the past have been absorbed by the government once it has found firm footing and traction. Such examples are abundant, but one stands out is the Native-English Teacher programme (NET) which was inspired many moons ago by a NGO called Chatteris Educational Foundation, with the fiscal support from the Hong Kong Jockey Club (HKJC). These were project-based funded programmes initially endorsed by the then Education Development Bureau (EDB) some thirty years ago for enhancing the authentic English-learning environment in Hong Kong's public schools. In 1998, the EDB have started and implemented its own native English Teacher programme[119] following an announcement in the 1997's Chief Executive's Policy Address[120].

In another view, as part of our research in the effectiveness of forming smart city clusters with other cities in the GBA area, we have the following recommendations for Hong Kong. Hong Kong and Shenzhen could deepen their strategic partnership to explore synergy by combining their respective strengths in industry, academia, and research through platforms such as the Intelligent Network Connectivity System or the development of the Loop. When developing the smart economy, Hong Kong could also consider how to leverage the role it can play in promoting Belt and Road cooperation, such as establishing information-sharing networks with relevant national and regional governments. (Yeung and Lu, 2020). For Macao and Guangzhou, there are also different stages of deploying smart city initiatives and digital infrastructure (Table. 1). In summary, the development of the smart city initiatives will continue to require project governance and knowledge expertise over and beyond the current administrative leadership traits and skillsets of the current government. Collaborating with regional cities in the GBA will also become an important attribute for bringing success in various cross-border business and smart city initiatives.

[116] https://www.emerald.com/insight/content/doi/10.1108/IJOA-01-2021-2604/full/html?skipTracking=true
[117] https://pesquisa.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/pt/covidwho-1373710?lang=en
[118] https://chp-dashboard.geodata.gov.hk/covid-19/en.html
[119] https://www.yearbook.gov.hk/2006/en/07_07.htm
[120] https://www.policyaddress.gov.hk/pa97/english/patext.htm

Element	City			
	Hong Kong	***Macau***	***Guangzhou***	***Shenzhen***
Policy	Smart City Blueprint	Cooperate with Alibaba to further develop smart city	3 year (2020-2022) strategic plan for digital infrastructure development	Implement goal of "Six Ones" policy in 2020, focus on digital integration
People	eID	Citizen email box Gov eCert services	Gov.eID system	Gov.eID system
Logistis	Pilot project on vehicle-to-Everything (v2x)	Collect data from public transportation and roads for real time analysis	Smart roads Production eco-system for autonomous car	Announced 16 policies to support (v2x) and autonomous car developments
Capital	Virtual banking Faster Payment System	Cashless payment system	Cashless payment system	Cashless payment system Applied Stock Connect (HK & Shenzhen)
Information	Next Generation Government Cloud Services	Cross government departments big data platform	Setup standard for data collections Collect real city data for cross department uses	city level big data platform Requests all department deploy their public services to government cloud
Digital Infrastructure	Optic Fiber Network 5G network	Optic Fiber Network	80,000 5G stations 34,000 Smart Lampposts by 2022	Optic Fiber Network 40,000 5G stations, citywide full coverage

Table 1. Four major cities comparison (Yeung & Lu, 2020)

This topic of organization effectiveness in public management and the new narrative in smart city clusters are systemically far too wide to be covered by this paper, however we strongly believe that in order to sustain smart city development, we do recommend the ITIB to investigate the feasibility of planning a fiscal budget for a smart city development special task force and an administrative fund for NGOs to continue chartering in smart city development in Hong Kong.

8. Social inclusion – Smart City for all

Finally, we observe the need for all of us as practitioners, engineers, architects, city planners and city managers to commit to developing a smart city Ready-for-All – with social inclusion as the key objective. This could be achieved by way of improving accessibility in public and commercial spaces such as the public facilities, public transport interchange, MTR and footbridges to support disabled persons, children, the elderly, or people using strollers and/or carrying heavy luggage.

Inclusive society, Universal design, Smart City for All

Figure 12 : Smart City for ALL

It was widely discussed recently at a forum organized by the Social Enterprise Summit's Smart City for ALL forum sponsored by the Home and Youth Affairs Bureau (Figure 12) – addressing the most neglected area in the planning and implementation of smart city service is to take care of the universal design and accessibility. Take an example of the policy we have had to resort to during the fight against the pandemic, it requires our citizens to have a decent mobile smart phone installed with the LeaveHomeSafe App and after two years, we could finally add companions of aged over 65 and minors[121]. Despite this, there are still a large group of our citizens (E.g., vision-impaired, elderly) that could not use LeaveHomeSafe.

According to the information shared at this forum, a significant part of the vulnerable segment of the population in Hong Kong still has limited access to the Internet – either because of the lack of such technological equipment or without adequate knowledge in using the Internet - with 49% of aged 65 or above do not know how to use a personal computer; 34.9% of the very low income families with less than HKD 10,000 monthly income and without a personal computer with internet access. About 42.4% of individuals with low education (primary level or below) have only used a computer in the last 12 months. When come to using technology to enjoy any new smart government public services, these group of vulnerable citizens will be discriminated and left out. To solve this problem, there are key

[121] https://www.news.gov.hk/eng/2022/09/20220927/20220927_162345_266.html

recommendations to incorporate web accessibility design for designing all kinds of websites and apps. This is just one of the many recommendations made that smart city development should specifically investigate deeper and adopt designing for diversity, equity, and inclusion (DEI) related principles - universal design.

9. Reference

1. APE Digital Creations (2022). Whitepaper on Retroverse virtual world resorts. Retrieved from https://resortverse.io/whitepaper/

2. Arcadis (2021) Hong Kong Smart Green Building Design Guidebook. Retrieved from https://www.arcadis.com/en/projects/asia/hong-kong/green-building-guidebook

3. Borins, S. (2002). Leadership and innovation in the public sector. *Leadership & Organization Development Journal*.

4. Chun, D. J. Y., Nabsiah, W. A., & Tan, C. L. (2021). Successful collaboration between smart city consortium and Hong Kong Government in Covid-19 dashboard: the case of leadership in practice. *International Journal of Organizational Analysis*.

5. KPMG (2021). Hong Kong's Connected Future Report 2021- Building a smarter and greener city. Retrieved from https://assets.kpmg/content/dam/kpmg/cn/pdf/en/2022/01/hong-kong-s-connnected-future.pdf

6. Wang, J. (2018). Innovation and government intervention: A comparison of Singapore and Hong Kong. *Research Policy*, *47*(2), 399-412.

7. Yeung, G., & Lu, C. (2020, October). Comparison of smart city policies and practices among Hong Kong, Macau, Guangzhou and Shenzhen in the Greater Bay Area in South China. In *2020 5th international conference on universal village (UV)* (pp. 1-6). IEEE.