For discussion
on 12 March 2018

Legislative Council
Panel on Information Technology and Broadcasting

Key Infrastructure Projects for Smart City Development

PURPOSE

This paper briefs Members on the three key infrastructure projects for smart city development proposed in the 2017 Policy Address, and seeks Members' support for submission of the funding proposals to the Finance Committee ("FC").

BACKGROUND

2. The Chief Executive ("CE") announced in the 2017 Policy Address to push ahead with the following three key infrastructure projects for smart city development:

(a) provide an "eID" for all Hong Kong residents, allowing them to use a single digital identity and authentication to conduct government and commercial transactions online. This will foster the development of a new economic service model that emphasises direct interface with residents and consumers;

(b) launch a pilot Multi-functional Smart Lampposts scheme at selected urban locations to support the building of a smart city with city-wide coverage of data and network. The Smart Lampposts will provide convenient data services and collect various real-time city data, enhance city and traffic management, and complement the future infrastructure development for fifth generation ("5G") mobile communications services in Hong Kong; and

(c) implement the Next Generation Government Cloud Infrastructure equipped with a new Application Architecture

("Next Generation GovCloud") and a Big Data Analytics Platform to support the adoption of new cloud and system development technologies by government bureaux and departments ("B/Ds"), thereby expediting system development of e-government services, improving service level, and enhancing operation efficiency and cyber security.

3. We published the Smart City Blueprint for Hong Kong ("the Blueprint") on 15 December 2017, outlining the vision and mission to build Hong Kong into a world-class smart city. The Blueprint maps out development plans in the next five years, providing a clear and specific direction for smart city development in Hong Kong. The above three projects are included in the Blueprint. We briefed the Panel on the major contents of the Blueprint on 8 January 2018.

PROPOSALS

4. The ensuing paragraphs set out the Office of the Government Chief Information Officer ("OGCIO")'s proposals and funding arrangement for the three infrastructure projects.

eID

5. At present, more than ten countries around the world have already introduced electronic identity card or digital identity to facilitate their residents to access e-government services and other online services, including online banking, checking of medical records, tax returns, voting, etc.

6. We propose setting up a one-stop online eID system, as a key digital infrastructure for smart city, to enable residents to use electronic services and conduct online transactions in a more convenient and secure manner. The proposed eID could be regarded as a common key for digital identity authentication for members of the public to login and access various government and commercial electronic services in a simple and secure manner. eID would be made available for free for all Hong Kong residents to apply and use on voluntary basis.

7. In addition to logging in online accounts of the Government and public / private organisations, eID will support digital signing with

legal backing under the Electronic Transactions Ordinance (Cap. 553) for handling contracts, statutory documents and procedures, important commercial transactions, etc.

8. For e-government services, eID can be connected to different services. For example, it can be used to submit online applications for services like licence renewal, booking of venues, making appointments, etc., or document signing; authorise retrieval of information stored in electronic service system to pre-fill online forms or update address; and, by way of a unified identity authentication, facilitate the development of cross-departmental or institutional electronic services and streamline business processes. This could bring convenience to citizens and result in savings in conventional counter staff and resources. Our long-term goal is to make it mandatory for all government departments and public bodies to support the use of eID with a view to developing more innovative electronic services.

9. Besides, we will actively promote public and private organisations to adopt eID, in order to enable residents to use more online services under a single digital identity, such as online banking, online shopping, online payment and other e-commerce, etc. When designing the eID system, we will make technical provision and open up Application Programming Interfaces ("API") to allow flexibility in supporting future services to be provided by public and private organisations.

10. Currently, government and commercial e-service providers are using different authentication systems to verify users' identity, such as username and password, secure token, SMS, etc. With eID, residents can access various electronic services by way of a single login anytime and anywhere, so that they can enjoy consistent user experience, and avoid the inconvenience of managing different groups of usernames and passwords or carrying multiple secure tokens, thus bringing convenience to their daily living. We believe that the convenient and secure means of authentication through eID will not only facilitate people to access various kinds of electronic services, but also save the cost and time for government departments and commercial organisations, especially small and medium enterprises, in developing and operating individual user authentication systems, which in turn will promote the development of e-commerce in Hong Kong. Having regard to the technology development trend and the public's habit of using smartphones, the registration and use of eID could be provided through mobile applications and other Internet platforms.

11. We will adopt security standards that are widely recognised internationally to ensure that the eID system is secure and reliable. We will also consult the Office of the Privacy Commissioner for Personal Data and relevant government departments to ensure that the procedures are in line with the relevant requirements. In designing the system, we will also make provision to cater for future technology development.

12. After launching the eID system, we will conduct a review of the services and operating arrangements of the Hongkong Post Certification Authority, including the feasibility of providing all digital certificates by the private sector, in the following year.

Financial Implications

13. The estimated non-recurrent cost of the eID project is $112 million, broken down as follows:

Item	**(in $million)**
(a) Hardware	19.1
(b) Software	30.6
(c) System Implementation and Support Services	34.0
(d) Contract Staff	16.6
(e) Site Preparation	0.5
Total	**100.8**
(f) Contingency (10%)	11.2
Grand Total	**112.0**

14. The estimated $19.1 million under item (a) in paragraph 13 above is for procurement of computer hardware, including servers, Storage Area Network, network equipment, etc.

15. The estimated $30.6 million under item (b) in paragraph 13 above is for procurement of computer software, including operating systems for servers, database, monitoring and backup software, eID application software, etc.

16. The estimated $34.0 million under item (c) in paragraph 13 above is for acquisition of system implementation and support services from service providers. The relevant cost also includes system analysis and design, development, testing and installation services, etc.

17. The estimated $16.6 million under item (d) in paragraph 13 above is for hiring contract IT staff who have relevant technical skills and experience to assist in project implementation.

18. The estimated $0.5 million under item (e) in paragraph 13 above is for site preparation, including the network setup, electrical and mechanical works, etc.

19. After the full rollout of the eID infrastructure project, the annual recurrent cost is estimated to be $38.2 million, including hardware and software maintenance, telecommunications network, operational support services, etc.

20. We plan to seek FC's funding approval for implementing the eID project in mid-2018. Subject to FC's approval, OGCIO will invite tenders in the second half of 2018, and the new system is expected to commence operation by mid-2020.

Multi-functional Smart Lampposts

21. In recent years, individual overseas and Mainland cities have been actively exploring the use of smart lampposts, including intelligent lighting systems to enhance energy efficiency and sensors to collect city data. We plan to implement a pilot scheme of replacing some existing lampposts with "Multi-functional Smart Lampposts" in four selected districts in the territory with higher pedestrian flow, including Central / Admiralty, Causeway Bay / Wan Chai, Tsim Sha Tsui and Kwun Tong / the Kai Tak Development Area, to enhance the capability in city data collection and to disseminate more real-time information to the public. OGCIO and the Highways Department, in collaboration with other relevant departments, including the Office of the Communications Authority, the Transport Department, the Tourism Commission, the Environmental Protection Department and the Hong Kong Observatory, have formed an inter-departmental task force to take forward the "Multi-functional Smart Lampposts" pilot scheme.

22. The three-year pilot scheme is expected to replace and install about 400 new lampposts with smart devices in the above selected districts to collect various city data for relevant departments, including –

(a) Transport Department – real-time traffic data including traffic speed, vehicle types and traffic flow, etc., for the convenience of the public, tourists and the industry by making use of the relevant information; as well as monitoring of traffic through closed-circuit cameras;

(b) Hong Kong Observatory – meteorological and related data, including temperature, humidity, wind speed and direction, rainfall amount, UV index, etc., at district level; and

(c) Environmental Protection Department – air quality data and monitoring of illegal dumping at district level.

23. Equipped with sensors, "Multi-functional Smart Lampposts" can collect various types of city data at district level to promote the use of big data analytics in government departments and the public / private sectors, develop innovative smart city services and implement better real-time city management. Besides strengthening meteorological and air quality monitoring / forecasting at district level, the use of sensors with capability in real-time monitoring of traffic and pedestrian flow can facilitate the study and development of innovative applications and services, such as taking prompt action in response to different traffic conditions and incidents to achieve more intelligent and safer land transport. Furthermore, the Government and the industry can also explore using real-time data provided by location services on nearby spots to support the development of related applications. We plan to provide the city data collected from the "Multi-functional Smart Lampposts" free of charge through the data.gov.hk portal, allowing the public to use these data to develop more innovative applications.

24. In respect of telecommunications services, it is envisaged that the fifth generation ("5G") mobile communications network will require the installation of higher density small cells on the streets and high traffic areas to provide 5G services. "Multi-functional Smart Lampposts" are suitable street furniture for mobile network operators to install related cell stations, and to provide free Wi-Fi services for the public and tourists. The design of lampposts would make provision for these uses.

25. The types and objectives of testing of smart devices on the lampposts will depend on the practical needs at different locations. The sensors, devices and communications equipment installed in each lamppost may vary. Since most of the selected pilot districts are developed and densely populated areas, the actual project scope will be mapped out in greater detail based on the operational and development needs of participating departments, as well as the physical environment to ensure that the project will be taken forward effectively to meet the testing targets. The design of "Multi-functional Smart Lampposts" will also take into account future development and application needs.

Financial Implications

26. The estimated expenditure of the "Multi-functional Smart Lampposts" project is about $272 million (at money-of-the-day prices). The annual operating cost of the pilot scheme is about $32 million.

27. Since the selected pilot districts are mostly built-up, densely populated areas and road sections with heavy traffic, we expect the project to encounter challenges and uncertainties during implementation, such as impacts on pavement facilities, traffic, pedestrians, shops, residential buildings, and the existing underground infrastructure facilities and public utility ducts, etc. which suitable assessments and arrangements should be made. We will also need to consult District Councils and the local community. Therefore, we propose to implement the pilot scheme in phases by taking into account practical situations, and start with road sections with fewer technical difficulties.

28. Based on our preliminary assessment of the selected pilot districts, we consider that Kwun Tong and the Kai Tak Development Area will encounter fewer technical difficulties. We will therefore commence the first phase of the pilot in this district, which would help participating departments have a grasp of the design and installation of smart lampposts, operation of sensors, and matters relating to the subsequent works in other pilot districts of replacing lampposts in a larger scale. We plan to install some 50 smart lampposts in the first phase. The exact locations for lamppost installation will be determined subject to the consultation with the relevant District Councils. If everything goes smoothly, we expect the first phase of pilot with some 50 smart lampposts to come into operation progressively before mid-2019. We plan to complete the installation of the remaining 350 smart lampposts before 2021-22.

29. After the "Multi-functional Smart Lampposts" pilot scheme have been in operation for a year, we will conduct a review on the effectiveness and implementation experience, including the management, operation and maintenance of the lampposts, smart devices and systems, with a view to determining the long-term arrangement of the scheme.

Next Generation GovCloud and Big Data Analytics Platform

30. To support the development of digital e-government, we need to reform the existing cloud infrastructure and adopt new application system development technologies, related standards and frameworks, for implementing the Next Generation GovCloud and Big Data Analytics Platform, so that B/Ds can expedite the development and delivery of digital government services. Through resource sharing and adoption of big data analytics and artificial intelligence technologies, we aim to enhance Government operation efficiency, enhance city management, and provide more efficient and reliable public services.

31. The proposed Next Generation GovCloud and Big Data Analytics Platform will be launched in 2020. Apart from implementing the reliable "private clouds" services, we will also make use of "public clouds" services which are highly flexible, elastic, and in compliance with security requirements. The new platform will provide the following central services with economies of scale:

(a)	Infrastructure as a Service ("IaaS"):	Servers, storage, network resources, cloud management platform and related services for operation, maintenance and support
(b)	Platform as a Service ("PaaS"):	On top of IaaS, providing system software, application servers, database management system software and related services for operation, maintenance and support
(c)	Application Architecture:	Agile development technologies, including central application programming interface management, containerisation, continuous integration and continuous delivery technologies, etc.

32. The proposed Big Data Analytics Platform will run on the Next Generation GovCloud. Big data is characterised by its huge volume, large varieties of data sources and data types, and high speed of updating. As a result, the technology adopted for big data analytics systems is more complex than that for general information technology systems, and so the demand for storage space and computing power is much greater. The proposed Big Data Analytics Platform will provide advanced facilities, including big data analytics tools, artificial intelligence cognitive tools, parallel computing management system and a "Digital Highway" which will facilitate exchange and sharing of real-time data among B/Ds.

33. With a hybrid cloud design, the Next Generation GovCloud can be expanded on its system hosting capacity as and when required to meet the growing demand of citizens on digital public services. It can also provide 24-hour monitoring and support services, so that B/Ds can provide digital government services more efficiently and securely, in order to meet the development need of smart government. We will strictly follow government information security policies, guidelines and requirements. Before and after launching the new service platform, we will conduct comprehensive assessments and audits in areas such as information security and privacy.

34. In addition to supporting different types of digital government services, the existing central cloud platforms (including the Government Cloud, the Central Computer Centre Virtualised Infrastructure and the E-Government Infrastructure Services) will also be upgraded and consolidated into the Next Generation GovCloud. Not only would this curtail the maintenance and upgrading costs of individual infrastructure, but would also bring about greater economies of scale. It is estimated that an additional investment of about $570 million will be saved in the five-year period from 2020-21 to 2024-25. Furthermore, as the Next Generation GovCloud will integrate the cloud technologies of both private cloud and public cloud, it can provide timely services to B/Ds according to their actual needs, thereby substantially reducing the time for procuring and installing the required resources. In combination with the new application architecture, the new platform can help B/Ds reduce the development time of IT systems by at least 20% and the development and maintenance costs by about 20%.

35. The Big Data Analytics Platform will facilitate the implementation of more big data analytics projects, such as weather, transport, environment, health, etc. This will assist B/Ds in adopting artificial intelligence technologies to formulate policies and open up

related data for public use. The "Digital Highway" of the big data analytics platform will also assist B/Ds in opening up data collected in city management (e.g. data collected from smart lampposts) in a real-time manner on the map-based interface of the data.gov.hk portal for convenient use by the public in developing more innovative applications.

36. We will leverage on the flexibility of the market, including adopting outsourcing model, for implementing the Next Generation GovCloud and the Big Data Analytics Platform. This will help foster synergy and partnership in the local industry at different levels and areas, and benefit various IT professional and service areas, including project management, IT system integration, data analytics and artificial intelligence. It will in turn facilitate the development of the local innovation and technology industry.

Financial Implications

37. The "Next Generation GovCloud and the Big Data Analytics Platform" project will incur a non-recurrent cost of $533.3 million, with breakdown as follows:

Item	**(in $million)**
(a) Hardware	224.8
(b) Software	90.2
(c) Implementation Services	83.5
(d) Contract Staff	83.8
(e) Others	2.6
Total	**484.9**
(f) Contingency (10%)	48.4
Grand Total	**533.3**

38. The estimated $224.8 million under item (a) in paragraph 37 above is for the procurement of computer hardware, including servers, storage and backup equipment, network equipment, system security equipment, as well as the hardware for the Big Data Analytics Platform, including graphics processing unit, "Digital Highway", etc.

39. The estimated $90.2 million under item (b) in paragraph 37 above is for the procurement of computer software, including virtualisation software, centralised cloud management platform, system security software, API management software, agile development tools and big data analytics platform software, including big data analytics tools, artificial intelligence cognitive tools, parallel computing management system, etc.

40. The estimated $83.5 million under item (c) in paragraph 37 above is for engaging service providers to build the Next Generation Government Cloud Infrastructure, Application System Architecture Platform, Big Data Analytics Platform, and performing independent third party assessments and audits of information security and privacy impact, etc.

41. The estimated $83.8 million under item (d) in paragraph 37 above is for hiring contract IT staff with relevant technical skills and experience to assist in implementing, deploying, managing and supporting the Next Generation GovCloud and the Big Data Analytics Platform, and providing consulting service to all B/Ds.

42. The estimated $2.6 million under item (e) in paragraph 37 above is for other expenditures, including rentals of telecommunication lines, etc.

43. The proposed funding can support the development of 50 application systems and 25 big data analytics projects, covering various areas of Government services. No additional recurrent maintenance cost will be required over the period from 2018-19 to 2024-25. With the continuous development of smart city, B/Ds will have more digital government services and more big data analytics projects which need to use the Next Generation GovCloud and the Big Data Analytics Platform. Through economies of scale, we expect that B/Ds using the Next Generation GovCloud can jointly maintain its operations after 2024-25. No additional recurrent expenditure is thus required.

44. We plan to seek funding approval from FC in mid-2018 to implement the Next Generation GovCloud and Big Data Analytics Platform project. Subject to the funding approval of FC, OGCIO will invite tenders in the second half of 2018, and the new system is expected to be launched by the second quarter of 2020.

ADVICE SOUGHT

45. Subject to Members' support of the proposal of implementing the three infrastructure projects, we will follow the established procedures to seek funding approval of LegCo according to the respective implementation timetables.

Innovation and Technology Bureau
Office of the Government Chief Information Officer
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