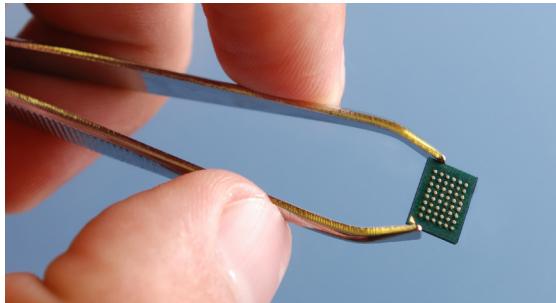




Roadmap to building a citizen-centric Smart GBA Region

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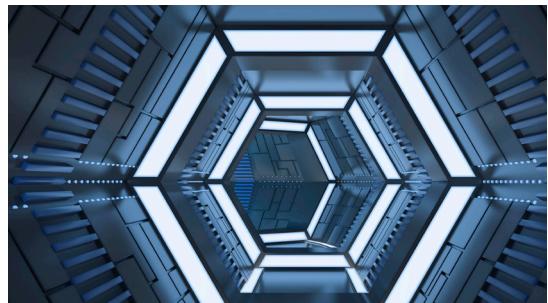
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Introduction

As part of the 13th Five-Year Plan, the Guangdong-Hong Kong-Macau Greater Bay Area (GBA) is an important national economic development strategy for China. The development of the area was officially incorporated into the work report of the Chinese Central Government in March 2017. The GBA consists of Hong Kong, Macau and nine other cities in the Pearl River Delta region (Guangzhou, Shenzhen, Zhuhai, Foshan, Jiangmen, Zhaoqing, Huizhou, Dongguan and Zhongshan) comprising a total population of 70 million. In 2017, the total GDP of the area was US \$1.5 trillion, equivalent to 12% of the national economic aggregate and ranking the region as the world's 15th largest economy (ahead of Spain). ¹ The GBA initiative aims to leverage the complementary capabilities of the "9+2" cities to create synergies that will enable the region to reap benefits that would otherwise not be attainable by any individual city alone. Enhanced infrastructure linkages and deeper collaboration among the cities will not only create business opportunities, but also have the potential of elevating the global competitiveness of the region as a whole. In fact in the recent China report of the 2018 APEC CEO Survey, 69% of Chinese companies reported seeing high or considerable linkage of the GBA region to their company's growth strategies.²

At the same time, individual cities in the GBA have adopted different development strategies, with more developed cities in the region focussing on becoming "smarter" through investment in innovative technology and adoption of e-government initiatives. Such development can enable a stronger economy and allow residents in these cities to enjoy a higher quality of life. However, developing these cities in silos will limit the potential of the region in maximising its values from synergetic development. This report will explore the prospects for the GBA to develop into a "Smart Region" (instead of 11 smart cities) and PwC's recommendations for this to occur. Much like a smart city that aims to use innovation and technology to address urban challenges, enhance the effectiveness of city management and improve quality of living as well as sustainability, efficiency and safety³, a Smart Region continues to remain citizen-centric and executes this concept on a broader scale.

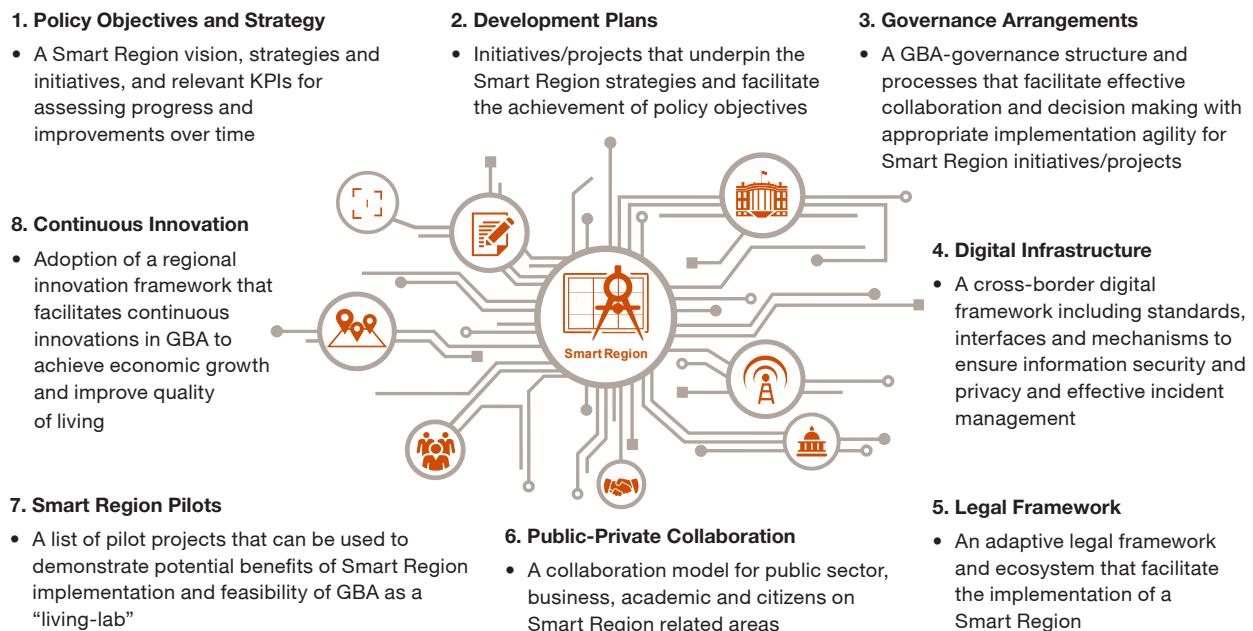
The development of a Smart GBA Region will strengthen connectivity, enhance capital flow in the region, nurture innovation, facilitate information and intellectual capital exchange, attract talent and make it easier for firms to do business, particularly in a rapidly transforming economy where speed and security of information flow is of the essence. Addressing urban challenges at a regional scale such as climate change will also require sharing of data for collective solutions. However, getting there requires holistic consideration on the Smart Region Framework while remaining attuned to the local context.

Unlike the bay areas of Tokyo, San Francisco and New York, the GBA functions in the context of a "one country, two systems", as China, Hong Kong and Macau have different legal, data, privacy and regulatory policies that need to be reconciled through collaboration. Implementing the concept of Smart Region in an orderly and managed manner will strengthen the benefits of "one country, two systems" while minimising risks.

Chapter 1: Critical building blocks for a Smart Region

In developing a Smart GBA Region that will bring about economic growth and higher quality of life for the residents of the region, it will be critical to holistically consider the key building blocks of a Smart Region. The Smart Region Framework provides further details on the eight key building blocks that a Smart GBA Regional development should take into account.

Figure 1: Smart Region Framework



Source: PwC

Beyond the necessity of setting a collective Smart Region Vision, it will be key to formulate regional development plans to pave the way towards the vision, establish governance arrangement to monitor and review progress, set up an interoperable digital infrastructure to facilitate secured information sharing as well as harmonise essential components of the legal framework to enable the effective functioning of this legally and administratively diverse region. To demonstrate the benefits of the Smart GBA Region, pilot projects could be developed, with cross-city and multi-stakeholder collaboration. An innovation framework that is driven by the GBA governance

body should also be formulated, steered and updated over time to enable continuous innovation in the region.

The section below highlight four initial areas that will need to be considered under selected critical building blocks for a Smart GBA Region. These include developing a governance structure and harmonising interoperability standards, harnessing digital identity technology, employing cross-border electronic payments and implementing a comprehensive legal infrastructure.

a. Development of governance structure and harmonisation of interoperable standards

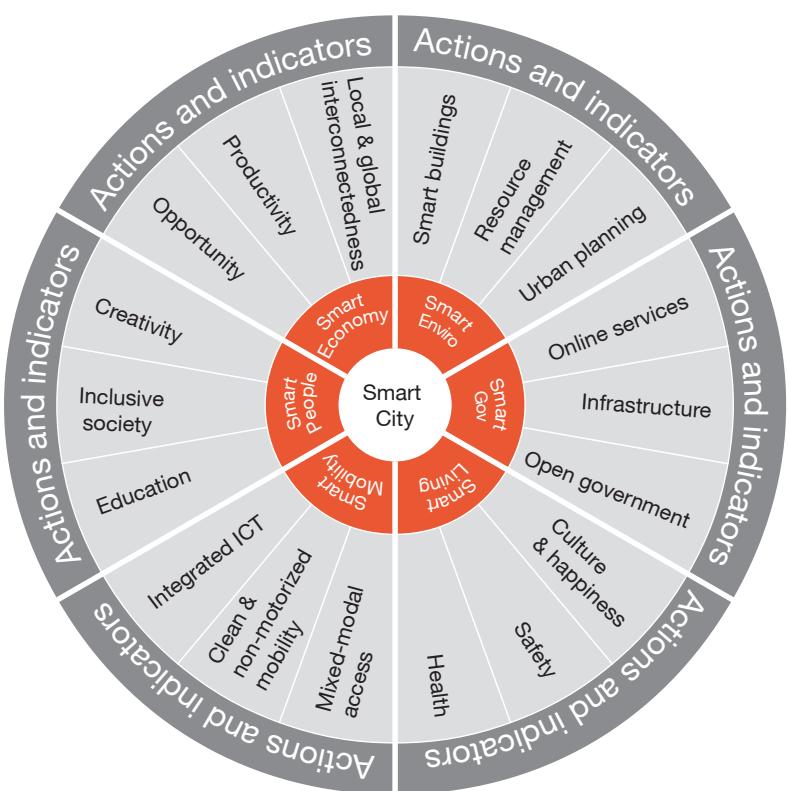
Standards provide a common language with which to exchange knowledge and information as well as to evaluate the performance of development. It enables diverse systems to work together, facilitates efficient and secure data exchange and informs governance body on the performance of initiatives through agreed and standardised target-setting around specific indicators.

Smart city standards usually include ICT standards, service standards, management and assessment standards, and information security standards.⁴ These are also applicable for a Smart Region (as outlined in Appendix).

To evaluate the performance of Smart Region development, references can be made to technical standards set up by standards development organisations (SDOs) at the international, regional and local level. For instance, the International Organisation for Standardisation (ISO) has developed standards in relation to measurement of city services and quality of life. These identify 100 indicators that cities should track to allow them to benchmark progress.ⁱ The Smart Cities Wheel proposed by Boyd Cohen⁵ references six key components of a smart city upon which these indicators can be mapped, namely, smart government, smart living, smart mobility, smart environment, smart economy and smart people.ⁱⁱ

In China, the National Smart Cities Standardisation Coordination Group and National Smart Cities Standardisation General Working Groupⁱⁱⁱ were set up to drive standardisation efforts, including the development of smart city evaluation system for assessing development of Chinese smart cities. National standards adopted in China are called “GuoBiao (GB)”, which are issued by the Standardisation Administration of China (SAC).^{iv}

Figure 2: Smart Cities Wheel



Source: Boyd Cohen

ⁱ The Technical Committee (TC) on sustainable cities and communities (ISO/TC268) under the International Organisation for Standardisation (ISO) has developed these standards (i.e. ISO37120:2014 which was recently updated to ISO37120:2018).

ⁱⁱ There are other SDOs that have developed standards around ICT and other aspects of city management such as the International Electrotechnical Commission (IEC), International Telecommunication Union (ITU) and the Institute of Electrical and Electronic Engineers (IEEE). Areas where they have conducted standardisation includes health informatics, intelligent transportation system and energy management amongst others.

ⁱⁱⁱ Construction and Evaluation of New Type Smart City in China, General Working Group on Chinese Smart Cities Standardization, <http://www.wfao.org/wp-content/uploads/wurc/China-smc construction&evaluation-515.pdf>

^{iv} The SAC is the SDO authorised by the State Council of China to manage, supervise and co-ordinate standardisation work in China.

Setting common standards and frameworks across the GBA will support the creation of government policies and legislation, improve interoperability of devices, open market access, encourage innovation, facilitate information and data exchange, and provide consumers with more choices of accessible products and services.

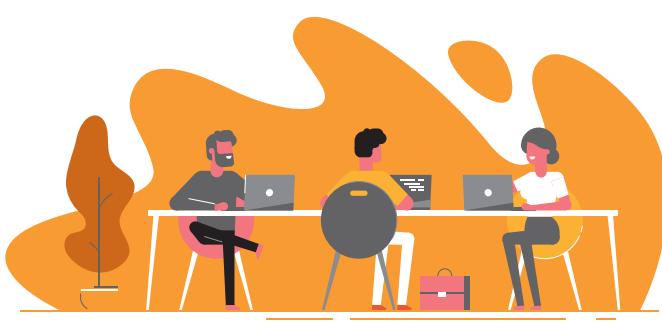
However, these standards such as the set of ISO indicators may not suit every city, let alone region. This will require coordinated efforts in adapting and rationalising their application as well as time for harmonising data definition and other processes.⁶ It is necessary for regulators across the three jurisdictions to determine which indicators best represent the aims of the GBA and which should be used for public reporting or service monitoring. Targets could then be set against the selected set of indicators to assess policy outcomes, and guide the policy formulation and the operation of governments.

It is also worth considering whether the GBA should define a set of standards that combine both international and local standards, which will also reflect unique characteristics specific to the GBA region. Countries including China, Spain and Singapore, already actively participate in and promote international standards, with adjustment to the local context.

For example, the European Union promulgated a Directive on Infrastructure for Spatial Information

in Europe (INSPIRE) in May 2007, with the vision of making harmonised and high quality spatial data readily available for formulating, implementing, monitoring and evaluating European policy starting from environmental policy as well as facilitating access by citizens and business at local, regional, national and international levels. In 2012, a study in the United Kingdom examined the benefits of INSPIRE to the environmental protection activities of the Department of Environment, Food and Rural Affairs (DEFRA) and concluded that the more efficient access to information could lead to benefits amounting to £70 – £130m per annum for the department^v. Development and harmonisation of interoperability standards within GBA have to be underpinned by a robust governance structure that helps coordinate and liaise among GBA governments and international organisations, as well as develop (or adapt) and maintain these standards as part of Smart Region development.

China, Hong Kong and Macau have yet to have a dedicated agency responsible for coordinating and promoting Smart Region development. By drawing upon the experience of leading cities, if a dedicated “Smart Region agency” were to be set up or assigned in the future, consideration should be given to the position of the agency across the 11 cities to coordinate cross-governmental efforts, its accessibility to an authority for leadership support and the availability of expert advice on Smart Region development.



^v UK Location Council (May 2012), UK Location Programme Benefits Realisation Strategy Final, https://data.gov.uk/sites/default/files/Benefits%20Realisation%20Strategy%20v2.0%20Final_10.pdf

b. Wider adoption of digital identity technology

The electronic ID (eID) system, promulgated in the 2017 Policy Address and expected to launch in 2020, will act as the digital identity system that Hong Kong residents can use to access most online transactions requiring authentication.

Harnessing digital identity technology amongst the cities in GBA will be a critical aspect of building a Smart GBA Region, facilitating people-flow and offering GBA inhabitants a consistent user experience. The appropriate and secured

use of digital identity technology within the GBA will offer a common, shared and safe platform for the delivery of services such as healthcare (electronic health records) and banking (electronic “KYC” and electronic cheques). The application of digital identity technology can also be extended to individual businesses. Mutual recognition of digital identity can facilitate cross-border business transactions and company formulation across the three jurisdictions.

c. Employment of cross-border electronic payments

The employment of cross-border electronic payments across the GBA region will enhance cash flows, trade and the prospects for collaboration among Hong Kong, Macau and mainland Chinese businesses. Vendors will be able to drive transaction volumes by enabling customers to easily settle their payments in

Renminbi, Hong Kong dollars or Macau patacas, regardless of where they make the payment. Already mobile payments apps such as Tencent Holdings’ WeChat Pay⁷ and China UnionPay’s QR mobile payment⁸ have started offering these services to target consumers travelling frequently in the Greater Bay Area or to and from mainland China.

d. Implementation of an adaptive legal infrastructure

The nine cities of the Guangdong province operate under the People’s Republic of China (PRC) civil law system. However, Hong Kong and Macau have constitutions under the “one country, two systems” principle and therefore have legal systems independent from mainland China. Hong Kong retains the common law system whereas Macau’s legal system is broadly based on Portuguese civil code.⁹ As these different legal systems will pose challenges for implementing a common infrastructure, there is a need to strengthen institutional cooperation and collaboration across the region.

The implementation of a comprehensive legal infrastructure is vital to ensuring the success of the Smart GBA Region. Specifically, there is scope for considering developing coherent, cross-border legislation for GBA related to data protection, electronic transactions, electronic procurement, open data and disclosure of public sector information as well as dealing with disruptive technologies.

Chapter 2: Regulatory enforcement mechanism in a cross-border context



Apart from the legal infrastructure, cities in the GBA region diverge in terms of currency, taxation, investment rules and even laws on environmental protection. The challenges of implementing a coherent regulatory enforcement environment are further exacerbated in this cross-border context. It is worth considering the implications of regulatory enforcement on information security, anti-money laundering and privacy in a Smart GBA Region.

a. Information Security

Building strong cybersecurity defences in the Smart GBA region will be a necessity to protect government systems across the three jurisdictions against cyber-attacks. It is also critical to remain vigilant on the potential of attacks on other critical infrastructures/systems outside of the government such as telecoms, transportation, banking and utilities. There is therefore a need to educate companies and individuals in the region to be aware of security threats particularly with personal and transactional data.

For instance, as part of Guangzhou's report on smart city development titled 'Opinions for Implementing Smart Guangzhou' they have specified initiatives to protect information security. Namely to construct an information

security early warning and emergency command system, to develop an e-government remote disaster recovery centre as well as to promote the establishment of similar off-site disaster recovery systems for key industry information systems.

According to the HKSAR Chief Executive's 2018 Policy Address, in order to cope with the rising challenges on law enforcement brought about by technological development, Hong Kong will adopt a four-pronged strategy covering "application", "research and development", "analysis" and "fortification" of innovation and technology to enhance the capabilities of law enforcement agencies. "Fortification" in particular includes fortifying cyber security.

b. Anti-money laundering

The risks of money laundering is obviously heightened in the cross-border context as it is vital to consider the implications of this for a Smart GBA Region. In Hong Kong, there are already a wide range of AML/CFT/CDD (anti-money laundering/countering the financing of terrorism/customer due diligence) requirements in place that are based on internationally agreed approaches to tackle this. Regulatory technology or RegTech can also be explored to a greater degree in the Smart Region context.

One solution that could be applied is the implementation of a de facto Blockchain standard for the GBA¹⁰ comparable to the European

Blockchain Partnership signed in April 2018.¹¹ Such a standard would ensure the interoperability of Blockchain services across the GBA region and would ease the legitimate movement of money and tackle illegitimate activity. Compliance with laws such as KYC obligations under the AML regime would be quicker, easier and more accurate for financial institutions. In particular for clients based in a different jurisdiction within the GBA to where the financial institution is based. It would also improve the accuracy of the data lenders can access to that supports decision making on offering financing to businesses as well as reduces the risk of fraud.



c. Privacy

Given the interconnected nature of technology in potential areas such as e-commerce, Big Data and Blockchain in the Smart GBA Region, privacy and managing shared information is a key concern for the citizens residing there. The sensors that are deployed in an IoT platform for example will be collecting data including personal information. This has the potential to lead to

privacy issues where hackers can view and collect personal user data. Privacy protection measures need to be implemented to promote trust among residents in the region. For instance, what is the right level of privacy? Regulators across the jurisdictions need to wrestle with these questions as a balance has to be attained between public and private interests.

Big Data, data sharing and data protection

Big Data is a critical part of enabling smart cities and by extension the Smart GBA Region to process large volumes of real-time and historic data in order to draw applicable and valuable insights. Yet wider usage of data will also give rise to privacy concerns. For example data can be reused for new or additional purposes without an individual's consent. There is also a lack of transparency on the processes behind Big Data analytics, which may potentially be used to produce differential treatment.

In order to support the GBA as a Smart Region, it is necessary to monitor, review and revise guidelines on Big Data security and privacy by leveraging global best practices and thus improving the current legislation framework particularly around cross-border transfer of personal data. It is also important to protect sensitive data, for example data that has security or privilege limitations, legal or commercial sensitivity, or competition, operational and privacy concerns.

China has not yet enacted legislation that specifically addresses the collection, storage, transmission and operation of personal information within the context of smart cities. However, China's Internet Security Law (Cyber Security Law) took effect in June 2017 and looks at how business processes, IT architectures and data protection strategies are handled in order to protect information (such as research, financial and personal data).¹² There are also a few provisions in the PRC laws and regulations that address the protection of personal information, typically regulating a specific industrial sector, e.g. the telecommunication sector, or relate to certain information of a specific nature, e.g. individual financial credit information, consumer information, population health information and medical records.

Chapter 3: Current initiatives in Hong Kong that contributes to making GBA a Smart Region

In developing a Smart GBA Region, it will be key to demonstrate its values to drivers of the development and residents staying in the region. Hong Kong will be well placed to serve as a “living lab” for showcasing use cases (and relevant data) of the application of innovation and technology solutions to address urban challenges in the GBA region¹³. As a living lab, Hong Kong can demonstrate a variety of smart initiatives:

- Aim to be citizen-centric and solve the problems facing residents
- Connect existing platforms and infrastructure to maximise value
- Promote collaboration among the public sector, private sector and citizens
- Ensure data is easily accessible for innovation and operation purposes, accounting for appropriate security and privacy measures
- Embed the spirit of design thinking into the design and operation of the city

In addition, Hong Kong is currently undertaking several ventures in the financial services and technology sectors that are contributing to its development as a smart city and thereby indirectly serving to enhance the GBA from the perspective of a Smart Region. Climate change can be a critical issue to be addressed by the region collectively. Hong Kong’s role as an international finance centre and Renminbi hub makes it the perfect location for raising green bonds and is already leading a HK \$100 billion Green Bond Programme.

In the sphere of financial services, smart banking initiatives have been announced by the Hong Kong Monetary Authority (HKMA) and the Securities and Futures Commission of Hong Kong (HKSFC) such as Faster Payment System, virtual banks, Open API, KYC Utility and cross-border client onboarding (non-face-to-face).

Financial services

i. Faster Payment System

In mid-September the HKMA introduced the Faster Payment System (FPS), a payment financial infrastructure that allows instant retail payments, settlement, and fund transfers between banks and non-banking financial facilitators. By supporting both Hong Kong dollar and Renminbi payments, the system takes steps to encourage cross-border payments in the Smart GBA Region. It promotes user-friendly fund transfers by enabling the use of a mobile number or email address as an account proxy for the person being paid. By increasing connectivity among banks it lays the groundwork for a mutual e-wallet between mainland China and Hong Kong in longer term.

ii. Virtual bank

The HKMA has promoted the development of virtual banks with the view that they advance the application of financial technology and innovation in Hong Kong and offer a new kind of customer experience. In addition, they will promote financial inclusion by targeting the retail segment, including small and medium-sized enterprises (SMEs). Virtual banks will support ambitions for the GBA region to become a technology hub, by nurturing Hong Kong, Macau and mainland Chinese FinTech start-ups and their collaborations with traditional banks to target retail customers and SMEs.

iii. Open API

Open API (application programming interface) in the context of the Hong Kong banking sector is a system that provides recognised third-party service providers with a network of financial institutions' data through the use of an API. Businesses, including retailers and e-commerce platforms, can create apps and services using bank data for example integrating foreign exchange and payment services to offer end-to-end packages for holidays or healthcare.¹⁴ This will enable Hong Kong FinTechs to remain competitive by offering customers an enhanced digital experience. However, it will also create synergies with other mainland Chinese companies in the GBA that have already adopted the open banking system, from industry giants like Tencent Holdings and Alibaba Group Holding to smaller providers offering complementary services.¹⁵

iv. KYC Utility

The Hong Kong Financial Services Development Council argues for the need for a sector wide KYC utility (KYCU) across Hong Kong's financial services industry – to address AML/CFT/CDD requirements.¹⁶ This is a third-party platform that manages customer data (including identification and verification) across banks to reduce cost and duplication and enable banks to make decisions on risks. Having a single source of customer data or documents eliminates the need of a customer to provide KYC documentation to every bank, and may shorten the turnaround time for new account opening. Blockchain technology can also facilitate the setup of a KYCU using mutually distributed ledger technology to create a safe storage of data that a customer can provide access to if they choose to.¹⁷ In the context of the GBA region, a KYCU can help to improve cross-border financial integration and tackle money laundering among the three jurisdictions by ensuring international and domestic regulatory requirements are met.

v. Cross-border client onboarding (non-face-to-face)

Client onboarding can be made easier by putting in place the groundwork for the digital identification of customers, both individuals and entities. Although non-face-to-face account opening is allowed under Hong Kong's current KYC and on-boarding regulations, the process can be inefficient and challenging. Financial institutions should be allowed to use other technologies or methodologies to establish the true identity of the customer, particularly given government issued biometric forms of identification are better at confirming identity than the sight or copy-based systems that are currently more common in Hong Kong.

In the context of the GBA region, putting in place non-face-to-face processes will simplify the onboarding of Macau and mainland clients in Hong Kong and facilitate greater cross-border collaboration. Mainland China has an established FinTech market and is home to the largest billionaire population in the world with huge growth potential in terms of wealth creation. Considering these two factors, Hong Kong financial institutions need to be well positioned to meet the needs of these Chinese clients, particularly those in the GBA, and need to be able to on board these customers effectively and securely.

Technology

vi. Electronic identification

Hong Kong's OGCIO has outlined the provision of an "electronic identification (eID)" for all Hong Kong residents as a key infrastructure project in its smart city development. This electronic identification will allow residents to make use of a single digital identity and authentication to conduct government and commercial transactions online.

In order to facilitate system integration in the GBA region, the next stage involves the mutual recognition of accredited foreign providers of eID services for non-local individuals.

vii. Cloud infrastructure

The OGCIO also plans to reform the existing cloud infrastructure and adopt new application system development technologies to support the development of a digital e-government. The aim is to implement a 'Next Generation GovCloud and Big Data Analytics Platform' to enable government departments to speed up the development and delivery of digital government services. In the context of the GBA region, next step will be to set common standards of cloud computing among the three jurisdictions in terms of security, interoperability and management.

Chapter 4: What recommendations does PwC have for the GBA to develop into a Smart Region?

Harmonisation of standards and digital identity

In order to facilitate the integration of infrastructure and data sharing, a set of common standards and protocols should be agreed and coordinated amongst the 11 cities in the region. Together with the adoption of interoperable digital identity technology, this will enable the establishment of an integrated, adaptive and secured digital infrastructure that supports

information sharing among the jurisdictions and enhances the ease of future adoption of emerging technologies. Such development will need to be underpinned by a robust governance arrangement that is able to provide direction, monitor and review development as well as enable cordial coordination across the individual cities.

Legal infrastructure

Hong Kong is well poised to play a leading role in terms of the development of adaptive legal infrastructure in the Smart GBA Region given its comprehensive rule of law and regulatory systems that are assessed against international standards. In addition, Hong Kong has a large pool of local and international legal talent who can offer a full-suite of service offerings that support businesses on opportunities that the GBA presents.

Facilitating mergers of law firms within the GBA will enable partnerships that are completely aligned in terms of financial and operational interests. This will help offer integrated legal services for the region. Again Hong Kong can lead in this regard by implementing policies for further

collaboration between law firms within the GBA. Additionally they can promote the standardisation of company secretarial systems and criteria for filing requirements within the region. Article 7 of the Closer Economic Partnership Arrangement (CEPA) also promotes supporting professional institutions in legal and dispute resolution both in mainland China and Hong Kong by building co-operation and exchange platforms to improve business exchange and collaboration.

In order to foster the New Economy in the GBA, attention must also be paid to laws regarding the protection of intellectual property. There is scope for regulators to explore the use of Hong Kong intellectual property laws by GBA residents regardless of whether or not it involves cross-border activity.¹⁸

Taxation framework

There is need for the harmonisation of individual tax burden within the Smart GBA Region. Currently, Hong Kong residents working in the GBA can be subject to tax in both Hong Kong and mainland China. One way to incentivise Hong Kong residents to work in the GBA is by providing tax incentive (which currently offered by Shenzhen Qianhai and Zhuhai Hengqin) for the ones who are required to pay China individual income tax.

The development of the GBA also creates the need for cross-border transactions and collaboration amongst GBA cities. This is at odds with the significant tax administrative burden required to arrange for tax clearance. Regulators across the three jurisdictions can work together for protocol to ease this burden. For example, the Chinese tax authorities can reduce the administrative procedures in applying for tax clearance on fees received from group companies based in the Mainland China with respect to the services rendered by the headquarters in Hong Kong.

Additionally the three jurisdictions can encourage investments in the GBA by granting tax relief/super tax deductions. In particular, PwC recommends expanding the scope of super tax deductions to cover both in-house and subcontracted R&D activities conducted in GBA. For example, allowing Hong Kong profits tax relief or deductions for plant and machinery and intellectual property used in the GBA, which encourage the flow of people, capital and goods within the region. Finally, the three jurisdictions can simplify the procedures for tax reporting for individuals or companies who are based in GBA.



Conclusion

By developing the GBA into an integrated and citizen-centric Smart Region, Hong Kong, Macau and mainland China governments can promote synergies across the eleven cities in various areas including financial services, research and development and public service provision amongst others. Data sharing will be critical with respect to coordinating and addressing urban challenges and promoting sustainability, liveability and safety of the region. Regulators need to adopt an eco-system approach to formulate the way forward that accounts for standards harmonisation, digital identity as well as implementing a cohesive legal infrastructure and taxation framework.

The next critical layer in terms of protection involves the implementation of a privacy and cybersecurity regulatory enforcement mechanism and an industry regulatory framework in a cross-border context. This is something that requires collaboration between regulators across the three jurisdictions. In addition to the above factors, supported by world class infrastructure and governance, will maximise the value of GBA under the “one country, two systems” and transform the GBA into a high powered region that is innovation driven, anchored as a science and technology hub with an unrivalled concentration of talent, capital, citizen-centric services and high quality of life.

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Thank you to Kate Shieh for her contributions to the report.

Appendix

ICT standards	Defines key Smart Region technologies, hardware and software which gives users improved flexibility in cross-sectoral co-operation.
Service standards	Provides technical models and a guide for application for the development of typical sectors in the Smart Region including government, mobility, energy and community, for example.
Management and assessment standards	Includes standards for strategic planning, operational methods, implementation, and administrative management and assessment methods in the process of Smart Region development.
Information security standards	Standards to ensure security of data, technology, and management across the Smart Region.

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