Understanding the smart city race between Hong Kong and Singapore

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ABSTRACT

Since the 2000s, Hong Kong (HK) and Singapore (SG) have been working to reinvent themselves as smart cities. Despite their similarities, SG has consistently ranked ahead of HK on several smart city indices. To explain this gap, the smart city initiatives of both cities were categorized using a six-factor typology of public sector innovation. Further analysis indicated that SG was ahead of HK because its government has been more aggressive in funding and fostering innovation. This paper suggests that a government's financial support for public sector innovation, as well as its ability to redirect resources within the public sector and get citizens involved, will catalyse transformational efforts into a smart city.

IMPACT

Public sector innovation is crucial for smart city development. This paper compares progress in Singapore and Hong Kong (HK). Although similarly competitive in many areas, SG is ahead of HK in rankings. Why does this disparity exist? What forms of public sector innovation are crucial for smart city development? This paper answers these questions for policy-makers by examining the role of public sector innovation in driving smart city developments, and underscores the importance of research and development within the public sector.

Introduction

The cities of Hong Kong (HK) and Singapore (SG) are often compared as a result of their similarities—a colonial history (Kratoska, 2006; Onimaru, 2019; Tan, 1997), values and culture (Chia et al., 2007), relatively high levels of human development (Delang & Yu, 2015; Ramesh & Holliday, 2001), strong economic competitiveness (Li et al., 2013; Schwab, 2018), as well as being two of the four 'Asian tigers' and important regional transport and financial hubs (Huat et al., 2004; Jarvis, 2011; Woo, 2015). The IMD World Competitiveness Center ranked HK at third place in 2018, second in 2019, and fifth in 2020; SG was ranked second in 2018, and first in both 2019 and 2020. A separate ranking by the Global Competitiveness Report ranked HK at fourth place in 2018, third in 2019; while SG ranked second in 2018 and first in 2019 (at the time of writing, rankings were not available for 2020). Overall, the two cities are very close rivals in global rankings of governance and development, and they are in competition for foreign investment and global talent.

Although SG and HK have been relatively close rivals in various areas, SG has consistently ranked ahead of HK on indices related to smart cities. These include the IMD Smart City Index 2020 which ranked SG first and HK 32nd, the Global Innovation Index 2020 where SG ranked eighth and HK ranked 11th (Cornell University, INSEAD, and WIPO, 2020),

and the IESE Cities in Motion Index 2019 which ranked SG ranked seventh and HK 11th (Berrone et al., 2019). The disparity is curious, especially since the governments of both cities had been proactively seeding and steering various initiatives to transform them into smart cities.

An agenda to foster smart cities is not limited to SG and HK—it is a significant concern for many international city governments. Therefore, understanding the factors which influence the development of smart cities is important. It would also contribute to the literature on public sector innovation (PSI): the generation or implementation of novel ideas or ways in the public sector (Demircioglu, 2019; Hartley, 2005; de Vries et al., 2016). In order to do so, this paper examines the development of the two cities prior to the Covid-19 pandemic (WHO, 2020). The pandemic triggered smart cities to utilize technology to contain the spread of the Covid-19 virus (Das & Zhang, 2020). It is too early to analyse global smart city responses to the pandemic, so this is not discussed in this paper.

This paper compares PSIs in HK and SG. The first section introduces the concept of the smart city and its positioning in the global context. Next, the smart city initiatives of the two cities are categorized using the typology developed by Chen et al. (2019), and analysed accordingly. Finally, implications and suggestions for future research are presented.

What are smart cities?

The term 'smart city' has been increasing in popularity in the past two decades and is an exciting new area of research into the public sector. Classically, cities are defined as places with more concentrated economic activities, naturally resulting in a denser network of producer and consumers (Marshall, 1920).

Population densities of cities have been increasing, leading to rising consumption, environmental pollution, and social issues (Albino et al., 2015; Turcu, 2013). Governments need to juggle multiple priorities, including environmental sustainability, quality of life, economic prosperity, physical infrastructure and alleviation of social problems. However, the scope and complexity of these challenges, coupled with limited resources, have compelled local governments to explore solutions to improve monitoring and governance of cities. One solution is the transformation of traditional cities into smart cities.

Research into smart cities, also called 'intelligent' or 'digital' cities, began towards the end of the 20th century. Although there is no universal definition for a smart city, a literature review indicated that there were three common ways of conceptualizing smart cities (Meijer et al., 2016). Smart cities are distinguished from traditional cities by their focus on deploying ICT for the operation and governance of the city (Lee et al., 2013; Odendaal, 2003; Walravens, 2012; Washburn et al., 2010). Smart cities are also 'cities with smart people' (Meijer & Bolívar, 2016, p. 396): where a sizeable proportion of the adult population consists of university graduates, and the highly-educated populace fuels the development of the city (Lombardi et al., 2012; Shapiro, 2006). Lastly, smart cities are densely networked and foster innovation through collaborations between citizens, businesses, civic organizations and the government (Kourtit et al., 2012; Yigitcanlar et al., 2008). Albino et al. (2015) argue that smart cities are citizen-centric and are marked by collaborations with various stakeholders to provide public services and to build human capital.

Smart technologies, especially ICT, can be used to improve the flexibility, efficiency and sustainability of these programmes and services, and ultimately improve the wellbeing of citizens (Harrison et al., 2010; Mohanty et al., 2016). Therefore, many governments have tried to introduce smart city initiatives (Caragliu et al., 2011; Martin et al., 2018; Niculescu & Wadhwa, 2015). These smart city initiatives are primarily PSIs—the local government lays the physical infrastructure, drives technological adoption across the city, develops new services and programmes, and ropes in private actors for collaborations. PSIs are a special class of innovations which are initiated by public sector organizations (PSOs), rather than by private actors, in response to social needs and demands (de Vries et al., 2016). Cities also face competition from the private sector. As the private sector introduces new technologies to consumers that augments their worldviews and lifestyles, consumers expect higher standards of service delivery from the public sector. Therefore, PSOs have to keep abreast of technological advancements in the private sector and respond in kind. Higher expectations of public services compel the public sector to innovate as a core activity (Albury, 2005; Hartley et al., 2013).

Methodology

The objective of our study was to examine the similarities and differences between SG and HK which affected their progression towards becoming smart cities. The plans and blueprints used for our analysis were publicly available. These initiatives had either been implemented, or were in progress during 2014 to 2019. This time period was chosen because 2014 was the year where SG officially launched its Smart Nation Initiative (Lee, 2014), while HK released its Smart City Blueprint in 2017. Initiatives that were planned for in the period, but launched later, were also included in order not to exclude key initiatives. For example, in HK, a key initiative, providing an electronic identity (later named 'iAM Smart'), to all citizens, was proposed in 2017, but was launched in December 2020 (OGCIO, 2020) . Interim updates and official launches of an initiative were counted as one initiative in order to prevent duplication. For instance, SG's 'Smart Yuhua' project was piloted in 2015 and launched in 2016, but the pilot and launch phases were counted as a single innovation. Our sources of information about the smart city initiatives included HK Legislative Council (2019) and the Smart Nation and Digital Governance Office (2019a and b).

The implementations were classified according to the six-factor typology of PSI suggested by Chen et al. (2019), who defined PSI as 'the development and implementation of a novel idea by a PSO to create or improve public value within an ecosystem' (p. 7). They proposed that PSI takes place under different processes ('foci') and contexts ('loci'). PSI could be focused on strategy, capacity and operation, and the innovation could take place internally within the PSO, or externally through collaborations with external stakeholders. PSI in strategy focus would entail an authorizing process to codify the mission, principles or policies of the PSO, and the ratification of new agreements to meet the needs and obligations of external stakeholders. PSI in capacity focus involves processes which enable the PSO to have the necessary resources and capabilities

to fulfill its mandate, including partnerships with external stakeholders. PSI in operation focus involves the entire suite of processes that translate the PSO's strategies and policies into tangible programmes and services which fulfill the PSO's mandate, and it might involve co-creation or co-production with external stakeholders.

Although there were existing typologies for PSI, Chen and colleagues developed a new typology because the existing typologies were primarily for the private sector and could not comprehensively account for a PSO's interactions with external stakeholders. Furthermore, some of these typologies failed to delineate different types of innovations, resulting in overlaps across categories (Demircioglu and Audretsch, 2020; Hartley, 2005; Moore & Hartley, 2008). As shown in Table 1, there are six typologies derived from the focus by locus framework (Chen et al., 2019).

As noted by Chen et al. (2019), the initiatives might entail more than one typology of innovation. However, their roadmap outlined a coding priority of typologies (Chen et al., 2019, p. 46): the highest priority being given to mission innovation and policy innovation; middle priority being given to management innovation and partner innovation; and the lowest priority being given to service innovation and citizen innovation. Note that the priority is meant to facilitate the ease of coding and it does not reflect the importance of each typology towards generating public value. Nevertheless, initiatives which clearly embody more than one typology would be coded under a second typology. For instance, an initiative with both service and partner innovation components but primarily focusing on service innovation would be coded as 'service/partner'.

Table 1. Six-factor typology (Chen et al., 2019).

Locus	Focus	Innovation	Classification criterion
Internal	Strategy	*Mission innovation*	The core innovation changed the worldview, purpose, or mission of the organization.
Internal	Capacity	*Management innovation*	The core innovation improved the organization's ability to deliver public value through introducing new internal management practices, processes, structures, or techniques.
Internal	Operation	*Service innovation*	The core innovation came from within the organization and it introduced new programmes or services.
External	Strategy	*Policy innovation*	The core innovation defined new obligations or benefits for external stakeholders.
External	Capacity	*Partner innovation*	The core innovation improved the organization's ability to deliver public value through partnering with specific organizations.
External	Operation	*Citizen innovation*	The core innovation involved citizen co-creation or co-production.

Overall, secondary typologies form a minority of the analysis. Five out of 20 initiatives in HK and 10 out of 66 initiatives in SG had secondary typologies.

Analysis of smart city initiatives

Summary of initiatives in HK

According to the April 2019 report on the HK's Smart City progress, a total of 20 initiatives had been implemented partially or in full since 2017. Details of these initiatives can be found in Table 2. None of the initiatives in HK's blueprint could be categorized under mission innovation and citizen innovation. In terms of locus, nine initiatives (45%) were purely internal, six initiatives (30%) were purely external and five initiatives (25%) had both internal and external loci.

Two initiatives (10%) were purely strategy focused, six initiatives (30%) were purely capacity focused, and seven initiatives (35%) were purely operations focused. Five initiatives (25%) were a mix of focus on capacity and operations. The most common innovation was service innovation, which characterized 12 initiatives (60%), five of which overlapped with partner innovation. This was followed by partner innovation with nine initiatives (45%), including the five initiatives that overlapped with service innovation. The remaining initiatives were categorized as management ($N = 2$, or 10%) and policy ($N = 2$, or 10%) innovations.

Summary of initiatives in Singapore

A total of 66 initiatives was highlighted in press releases issued by the SG government from 2014 to 2019. Unlike HK, SG's initiatives covered all of the six typologies. Details of the initiatives can be found in Table 3: 40 of the initiatives (61%) were purely internal, 22 initiatives (33%) were purely external and three initiatives (5%) had both internal and external loci.

Nine initiatives (14%) were purely strategy focused, 17 initiatives (26%) were purely capacity focused, and 28 initiatives (42%) were purely operations focused. Eleven initiatives (17%) were a mix of focus on capacity and operations. The most common innovation was service innovation which characterized 30 initiatives (45%), three of which overlapped with partner innovation, and two overlapped with management innovation. This was followed by partner innovation with 20 initiatives (30%), three of which overlapped with service innovation, and five overlapped with citizen innovation. Citizen innovation ($N = 9$, or 13.6%) was also significant, as was management innovation ($N = 8$, or 12.1%) and mission innovation ($N = 8$, or 12.1%), and policy innovation ($N = 1$, or 1.52%). One

initiative, the iExperience, was not classified because it was merely a public education event and it did not lead to any tangible outcomes.

Comparing PSI in HK and SG

Figure 1 provides an overview of our analysis. Service innovation was the most common type of innovation in both cities; they pursued similar goals such as improving access to public Wi-Fi (Wireless@SG in SG in 2015 and Wi-Fi.HK in HK in 2018) and public data (Data.gov.sg in SG in 2015 and the open data platform in HK in 2019).

Beyond direct provision of services, both cities used public–private partnerships to deliver public services. For instance, SG's Land Transport Authority (LTA) had partnered with local universities and commercial areas to test the deployment of autonomous vehicles (AV) for public transport. Similarly, HK's Transport Department worked with transport operators to provide commuters with open data of timings for bus and train services. Despite many similarities, SG and HK also had many differences, which explains SG's lead over HK in the smart city race.

SG had around 2.5 times the number of capacity-focused innovations (both management innovations and partner innovations) as HK. SG had more initiatives to support capacity building. This was evidenced by both cities' initiatives to migrate

government services to cloud-based infrastructures. The HK government opted to launch a government cloud platform (GovCloud) to host and deliver e-government services. Similarly, the SG government launched a five-year blueprint in 2018 to migrate its services to a cloud-based infrastructure. However, SG took additional steps to restructure its agencies and departments to support the migration and the subsequent deployment of digital services. The Infocomm Development Authority spun off a new agency, the Government Technology Agency (GovTech, 2016), to provide infrastructural support and deliver e-government services to the public. GovTech also houses Hive: an innovation space which seeks to mimic the entrepreneurial and agile environment of a start-up and develops smart applications for the government.

Compared to HK, the SG government appeared to be more proactive in promoting innovation from within, soliciting feedback and contributions from private actors, and exercising leadership over private actors. This proactive stance is likely to be the driving force which translates the government's strategy and capacity-building efforts into the actual design and delivery of operational services and programmes. The differences in outcomes were significant. SG had around four times as many operations-focused innovations as HK. Further breakdown of operations-focused innovations into service innovations and

Table 2. HK's smart city initiatives with brief descriptions (HK Legislative Council, 2019; OGCIO, 2020).

	Implementation	Type of innovation
1	Electronic identity in e-government (iAM Smart)—For HK residents to have a single digital identity to access and conduct transactions online with the government	Service
2	Electronic identity (iAM Smart) in other organizations and private companies—For HK businesses to access and conduct transactions online with the government and for business purposes	Partner/service
3	Next generation government cloud infrastructure (GovCloud) private cloud—A government-wide online platform hosting government services	Management
4	Next generation government cloud infrastructure (GovCloud) public cloud—Extension of private cloud to be more flexible and secure, creating a hybrid model of GovCloud	Management
5	Big Data analytics platform—Provides tools for public sector departments to further projects requiring Big Data analytics	Partner/service
6	Multi-functional smart lampposts pilot scheme—The installation of smart lampposts, sharing of data collected with the public and provide free Wi-Fi service to the public	Service
7	Multi-functional smart lampposts pilot scheme—Engaging of mobile network operators to install and operate 5G base stations	Partner
8	Wi-Fi connection to public establishments—Provision of free Wi-Fi at government venues and hospitals in partnership with private sector service providers	Service/partner
9	Wi-Fi connection to other public places—Meeting demand for public places to have free Wi-Fi in the absence of a private sector service provider	Policy
10	Wi-Fi connection to social welfare organizations—Provision of Wi-Fi to social welfare organizations to encourage use of technology	Service
11	Open data—Release of datasets via the PSI portal for public access	Service
12	Open data for public transport timings—Partner with transport service providers to provide public transport timings to the public	Service/partner
13	Pro-innovation government procurement policy—Policy to increase technical weighting of innovative suggestions in government tenders	Policy
14	Faster payment system to banks—Enable instant transfer of money using a cell phone number or email address across banks	Service
15	Faster payment system to government—Enable convenience of paying government bills and taxes via scanning of QR code	Service
16	Artificial intelligence (AI)—Investment in AI for development of smart city solutions	Partner
17	Smart City Digital Hub*—Set up at the HK Science Park for the purpose of developing smart city solutions	Partner/service
18	Smart Government Innovation Lab (Smart Lab)*—For businesses to test out their products for the government	Service
19	Smart Lab Thematic Website*—A website for the public sector to share challenges faced and to invite the private sector to participate to share technology solutions	Partner
20	Technology Fora (also part of Smart Lab)*– A collaboration between Cyberport and the HK Science Park for industry players to share technology solutions and successes	Partner

*The components of one large programme have been separated into major sections to better capture unique initiatives.

Table 3. Singapore's smart city initiatives with brief descriptions (Smart Nation and Digital Governance Office, 2019a and 2019b).

	Implementation	Type of innovation
1	Labs on Wheels—Programme to prepare citizens to be ready for digital world via interactive showcase to schools and community	Service
2	'Ask Jamie' bot—Chat bot on public service sites to provide quick response to frequently asked questions	Service/management
3	MyTransport App—Government service to provide public transport and road traffic information	Service
4	Smart Nation Programme Office—New office formed under the Prime Minister's Office (PMO)	Management
5	Accreditation@SGD—Accredit citizens and industry players to be qualified contenders for public sector procurements	Partner/citizen
6	OneService App—For citizens to report municipal issues	Citizen
7	Blk 71 San Francisco—Co-working space, built start-up and connected globally	Partner
8	Data.gov.sg—Sharing of public data	Service
9	Cyber Security Agency—Set up of new national agency to protect SG's cyber security	Management
10	Build Amazing Start-ups Here (BASH)—All-in-one start-up facility	Partner/citizen
11	Smart Yuhua Pilot /My Smart HDB Home@Yuhua—Pilot of smart housing estate technology in selected estates	Service
12	Playmaker programme—Exposing pre-schoolers to computational thinking	Service
13	Smart transport roadmap—Improving public transport with smart technology	Mission
14	iExperience—A public technology exhibition	Unclassified
15	HealthHub—Provide access to family health records	Service
16	Hive—Set of offices to develop smart technology for SG's ministries	Management
17	Wireless@SG—Provision of internet access in public areas	Service
18	National Steps Challenge—Distribution of step-trackers and rewards to encourage healthy living	Service
19	Tech Able—Integrated assistive technology space	Service/partner
20	Future of Us—Exhibition of future technology with collaborations with tertiary students, faculty and others	Citizen
21	Research, Innovation, Enterprise 2020 plan (RIE2020)—Commitment of $19 billion to fund innovation	Partner
22	Smart Nation Fellowship Programme—Brings together data scientists and technologists to collaborate with the SG government	Citizen
23	Jurong Innovation District (JID)—Industrial park	Partner
24	Code@SG—Policy to teach young people coding and computational thinking	Policy
25	TechSkills Accelerator (TeSA)—Help working professionals to improve tech-skills	Partner
26	First 3D printing centre	Service
27	FinTech Office—For development of private sector capability in FinTech and as a one-stop hub for FinTech	Service/partner
28	IDM Smart Nation Award—Recognize citizen innovations	Citizen
29	Green Wifi—Extending of public Wi-Fi from indoors to outdoors	Service
30	Collaboration (LTA and Industry players)	Partner
31	BCA Skylab—Advanced test facility for industry players	Partner
32	Centre of Excellence for Testing & Research of AVs (CETRAN)	Partner
33	Collaboration between USA and SG	Partner
34	Project Bus Stop—Pilot of multifunctional bus stop to enhance commuter experience	Service
35	Looking Glass @ MAS—FinTech innovation lab	Partner/citizen
36	govBuy—Platform to connect freelance specialists to government projects	Partner/citizen
37	GovTech and IMDA—Formed from restructuring	Management
38	Human Performance Centre—Use of smart tech to enhance local national security operations	Service
39	Cybersecurity Strategy—SG's vision and goals for cyber security	Mission
40	Cyber Security Lab—Shared infrastructure for R&D community	Partner
41	Self-driving bus at Nanyang Technological University, in partnership with Volvo	Partner
42	CleanTech Park—SG's first eco-business park	Partner
43	SGInnovate—To help entrepreneurial scientists build tech startups	Partner/citizen
44	Lighting systems for public roads	Service
45	Gov.sg Bot—One-stop information across government agencies	Service/management
46	LTA and AV—Collaboration of LTA with public institutions to develop use of autonomous vehicles	Partner/service
47	Video consultation for healthcare	Service
48	Data Science Consortium—Collaboration between universities, scientists and researchers to use technology to provide solutions	Partner
49	AI SG—Mission to build national capabilities in AI	Mission
50	Paynow—Peer-to-peer funds transfer service using mobile number	Service
51	Parking.sg app—Using an app for short term parking instead of use of coupons	Management
52	National digital identity—A single digital identity for every citizen for convenience and safety in transacting with private and public sectors	Service
53	E-payments drive—Mission to move nation towards use of e-payments	Mission
54	Smart Nation Sensor Platform—Tracing and analysing data pertaining to housing, amenities and public infrastructure	Service
55	Smart Urban Mobility—Improvements to urban infrastructure to improve mobility	Service
56	MyInfo Developer and Partner Portal—For developers to safely build and test solutions	Service
57	First AV test centre	Service
58	SkillsFuture for ICT (SF for ICT)—Mission to boost individuals' and corporates' ICT skills	Mission
59	CorpPass—Corporate login for account and transactions with Singapore government	Service/management
60	Digital Economy Framework—Priorities in developing digital economy of SG	Mission
61	Digital Readiness Blueprint (DGB)—Facilitating technology literacy and adoption of technology	Mission
62	Moments of Life App (MOL)—Improving parents' access to children's information and services	Service
63	SingPass App—Mobile app to access individual login account for transactions with government	Service
64	SG Quick Response Code (SGQR)—World's first unified QR payment code	Service
65	GoBusiness—Portal for businesses to apply for licenses	Service
66	Digital Defence added to Total Defence—Official addition of digital defence as a key aspect of national security	Mission

citizen innovations revealed that SG had 30 service innovations, which was around 2.5 times that of HK. In addition, SG had nine citizen innovations, while there were none in HK. An indicator of the government's proactive stance and commitment to innovation is the number of internal innovations initiatives which were started by the government without assistance or investment from private actors.
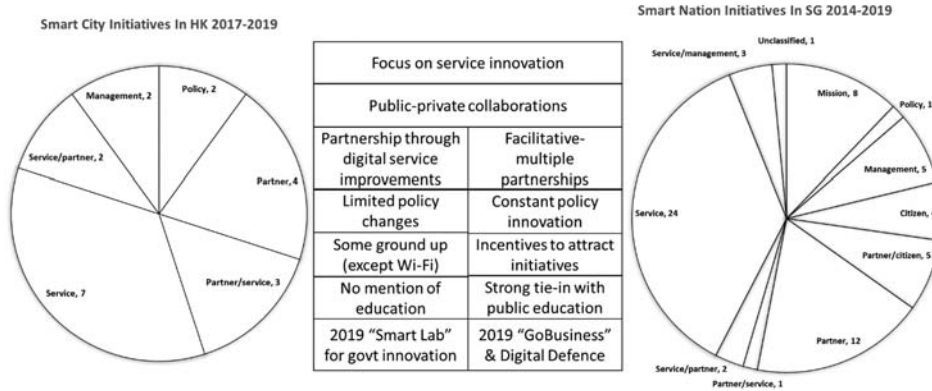
The road so far – Focus and progress

Smart City Initiatives In HK 2017-2019

Focus on service innovation	
Public-private collaborations	
Partnership through digital service improvements	Facilitative-multiple partnerships
Limited policy changes	Constant policy innovation
Some ground up (except Wi-Fi)	Incentives to attract initiatives
No mention of education	Strong tie-in with public education
2019 "Smart Lab" for govt innovation	2019 "GoBusiness" & Digital Defence

Smart Nation Initiatives In SG 2014-2019

Figure 1. Comparing focus and progress in HK and SG.

About 61% of SG's initiatives were purely internal innovations, which is higher than HK (45%), and reflects a greater priority to innovate from within the public sector.

Unlike HK, we found that SG had initiatives to encourage citizen contribution and feedback. For example, the Lee Hsien Loong Interactive Digital Media Smart Nation Award was launched to recognize students who completed projects of social value in alignment with the Smart Nation plan. There were also initiatives to build up public interest and capability for co-creation of solutions in the future with the public sector, such as the introduction of coding to primary school students under Code@SG and the upskilling of the labour force in ICT under the TechSkills Accelerator (TeSA). The SG government also built an integrated start-up space, aptly named BASH (Build Amazing Start-ups Here), to house entrepreneurs, investors, incubators and accelerators —the key players within the tech value chain. HK did not have any comparable initiatives.

The role of public–private partnerships

The SG government has a long record of being deeply involved in the country's research and development (R&D). The SG government has provided resources and incentives to promote R&D in specific sectors, along with developing specialized committees and setting up key policies and support structures to move innovation along. R&D in SG's public sector also saw a large boost with the nation rapidly adopting smart technology for the provision of public services. The SG government acted as a broker by facilitating collaborative solutions with both the profit and non-profit sectors. Thus, PSIs in SG could not be clearly defined due to frequent partnerships and constant efforts to adopt solutions from the private sector.

On the other hand, HK's government has a non-interventionist approach towards R&D. Innovation in the city has traditionally been propelled by private entities and responses to market needs and
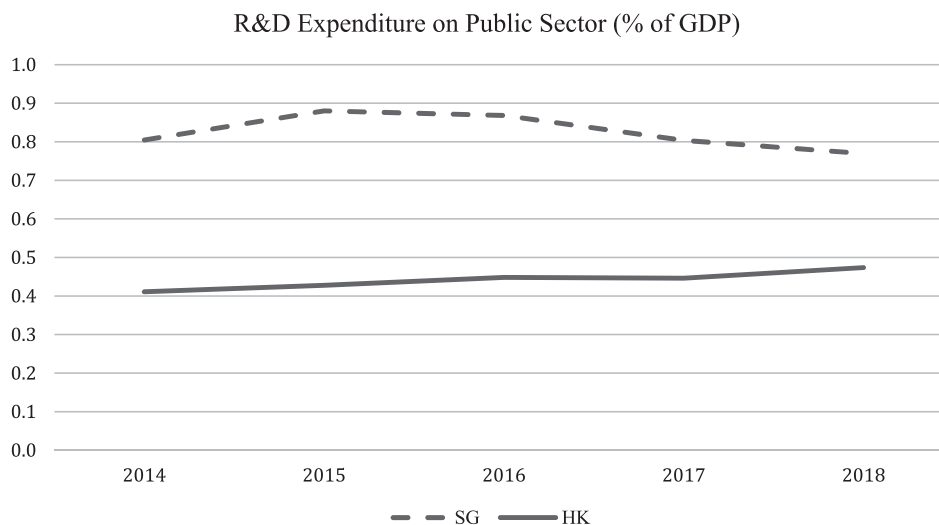
R&D Expenditure on Public Sector (% of GDP)

Figure 2. R&D expenditure on the public sector as a percentage of each city's GDP. Note: Based on data retrieved on 23 February 2021 from official data of SG and HK (SG Department of Statistics, 2020; Census and Statistics Department of Hong Kong, 2020).
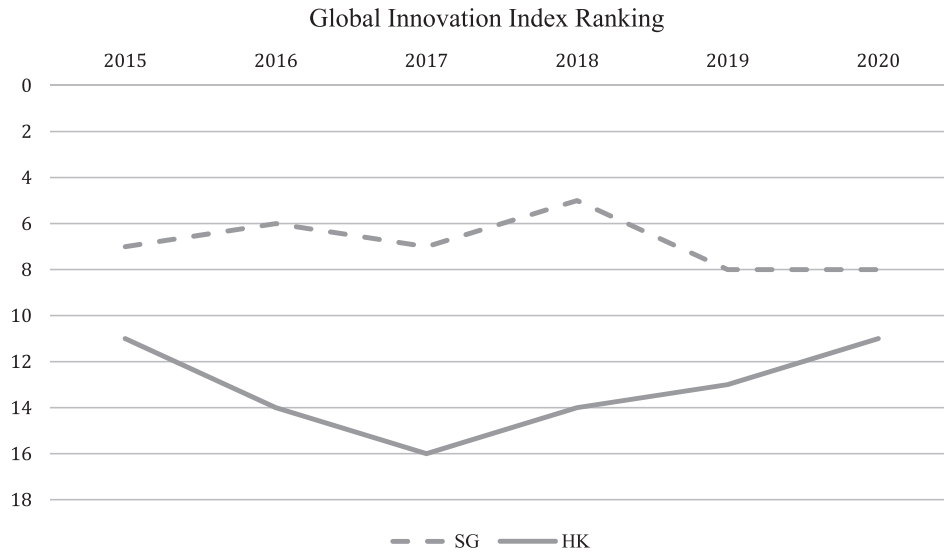
Global Innovation Index Ranking

Figure 3. Global Innovation Index Ranking of SG and HK by year (2015–2020). Note: The numbers on the vertical axis represent ranking.

demands. The city's budget for R&D was far lower than SG's. HK adopts a strategy of waiting for the private sector to initiate innovations. While this creates a culture of ownership and creativity, the lack of fiscal support and incentives results in slower progress. Furthermore, HK has had a very low proportion of firms engaging in any product or process innovation since 2008 (3.9% of firms) (Cautherly, 2019). For instance, no private organization was willing to step forward for the provision of Wi-Fi access to small parks, the sitting-out areas in rental housing estates nor some public hospitals, possibly due to the overall costs, liabilities and lack of business returns.

Since 2014, SG consistently spends higher than HK on R&D in the public sector as a percentage of GDP (see Figure 2). While HK earmarked around 0.45% of its GDP for R&D in the public sector in 2017, the proportion was almost twice as much in SG at 0.80%, reflecting a stronger commitment to foster

innovation in the public sector. Since 2015, the Global Innovation Index for SG has been consistently higher than for HK—this might be partly attributed to the continuing financial support from government. In October 2017, HK announced a plan to double its R&D expenditure over the next five years—earmarking HK$45 billion for smart city development (Sun, 2017). Since then, HK's global ranking on the Global Innovation Index (see Figure 3) has risen from 16th in 2017 to 11th in 2020.

Although SG started its smart city plans about three years earlier than HK, this is not likely to be the main reason for SG's lead over HK in the smart city rankings. From the standpoint of PSI, the SG government was more proactive in promoting innovation within the public sector, soliciting feedback and partnerships with private sectors, and exercising leadership to push for smart city transformation. This is evidenced by the greater
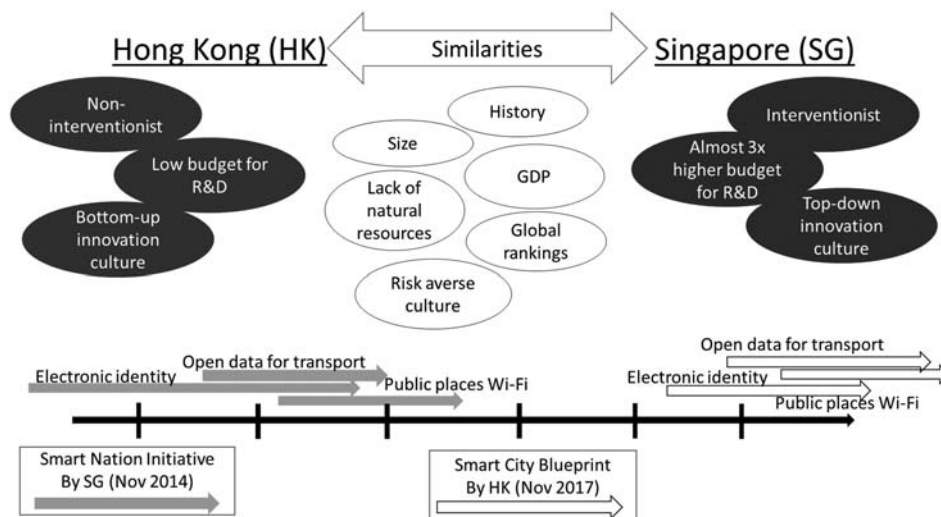

Figure 4. Summary of similarities and differences of initiatives being implemented in HK and SG.

number and proportion of internal innovations pioneered by the government without support from private actors. The SG government also prioritized capacity building and allocated a larger portion of its budget to fund R&D, which likely contributed to the larger number of public programmes and services.

Discussion

Figure 4 presents a visual summary of the timeline, similarities and differences of the two smart cities. For HK, apart from entering late into the game, the baseline innovation culture and commitment from the government also influenced progress. To overtake SG in the smart city race, the HK government needs to re-examine its relatively conservative approach towards various aspects of its smart city plan.

However, the SG government has not always been successful in its ventures. By taking a heavily interventionist approach in steering the city, it also has to shoulder the blame and consequences when its initiatives fail or result in negative/unexpected outcomes. For example, the 2018 SingHealth data breach led to the theft of personal data from 1.5 million patients, generating considerable backlash and public mistrust towards SG's cybersecurity (Tham, 20 July 2018) amid ongoing efforts to centralize the healthcare data of its citizens (Tham, 3 August 2018). SG had to suspend the rollout of several Smart Nation projects for two weeks while the government reviewed its cyber-security policies (Tham, 21 July 2018).

There are several limitations to the study reported in this paper. As the analysis was carried out from a PSI standpoint, it did not account for the differences in the cities' histories, cultures, political structures and institutions, which would likely influence the developmental trajectory into smart cities. The number of initiatives, while indicative of the government's priorities and efforts, might not necessarily reflect the cities' degree of 'smartness'. Further studies could be conducted to examine whether the initiatives had been effectively implemented, whether the initiatives achieved their intended outcomes, the number and profile of citizens affected by these initiatives, as well as the impact of these initiatives on citizens' quality of life and resolution of the cities' problems. The analysis in this study also depended largely on the official reports of city governments. These might not fully capture the progress of these cities if crucial information were omitted from the reports. For example, the HK government reported GovCloud in their smart city update, but a similar five-year blueprint for SG was not highlighted by the SG government when it took stock of its smart city initiatives. Future studies might consider collecting data from other sources, such as interviewing policy-makers and government employees, to have a more comprehensive picture of public sector initiatives in the city.

Conclusion

Both HK and SG need to thrive economically, while ensuring sustainable development and building up capital for the future. While the two cities are unique, one would expect more similarities in their global standing as smart cities. The comparison of the two cities in this paper sheds light on how PSI and governance has affected the development of the cities. Smart city initiatives often require support from both the public and private sectors. Both the design and delivery of public services need to change, so innovation needs to come from within the public sector. Using private sector resources and funding, the SG government has been more effective than HK in creating a smart city. However, it has also been more exposed to criticism when initiatives have failed. The paper shows that the development of smart cities is also accompanied by new challenges, such as the risk of cyber-attacks and citizens' reluctance to use new technologies. Governments need to be prepared to handle these challenges. Future studies should examine how well the governments of smart cities have adapted and innovated in response to the Covid-19 pandemic.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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