



Innovation and research in GBA

Figure 1 – R&D expenditure as a percentage of GDP in GBA cities (2010, 2015 and 2020)

	2010 (%)	2015 (%)	2020 (%)
Shenzhen	3.48	4.18	5.46
Dongguan	1.22	2.36	3.54
Zhuhai	1.74	2.64	3.26
Guangzhou	1.79	2.10	3.10
Huizhou	1.11	2.03	3.00
Foshan	1.65	2.45	2.67
Jiangmen	0.97	1.80	2.45
Zhongshan	1.92	2.36	2.35
Zhaoqing	0.64	1.00	1.08
Hong Kong	0.75	0.76	0.99
Macao	0.05	0.14	0.20

Figure 2a – Number of invention patents registered by entities in GBA, 2012-2020

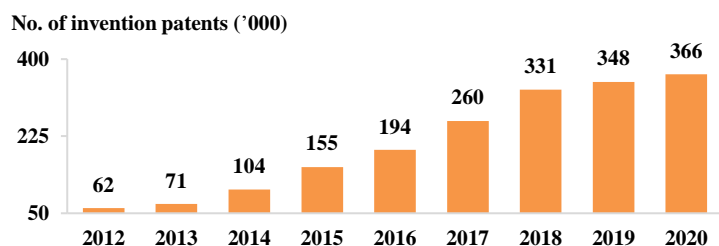


Figure 2b – Number of invention patents among major bay areas, 2020

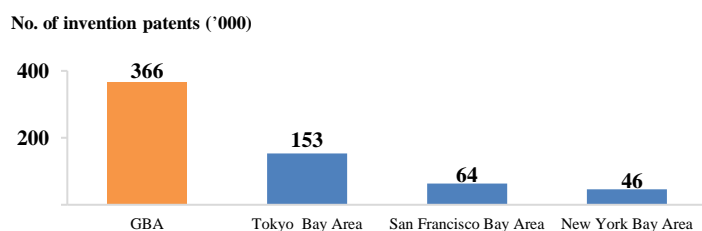
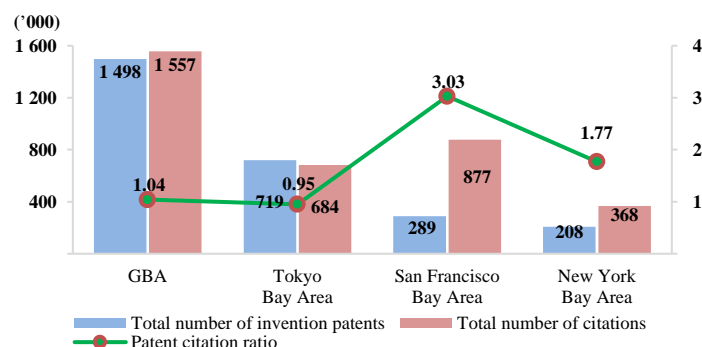


Figure 3 – Patent citation ratio among major bay areas, 2016-2020^(a)

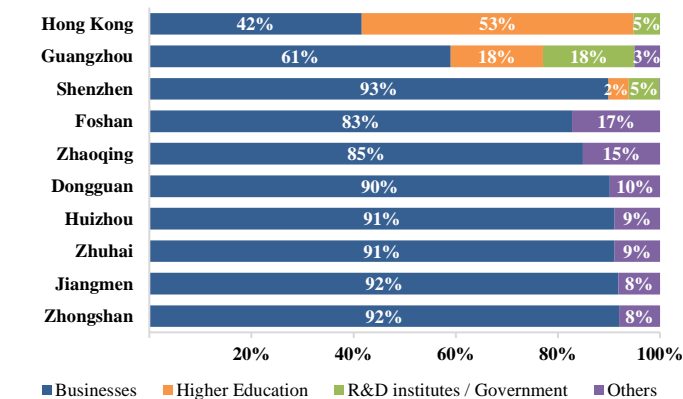


Note: (a) Reference period of the ratio covers 2016-2020.

Highlights

- The Guangdong-Hong Kong-Macao Greater Bay Area (“GBA”) comprises the two Special Administrative Regions of Hong Kong and Macao, as well as nine cities in the Guangdong Province. In February 2019, the central government promulgated the Outline Development Plan for GBA outlining a number of strategic development objectives for the bay area. These include building a globally influential international innovation and technology (“I&T”) hub in GBA, catching up with those bay areas of New York, San Francisco and Tokyo.
- The development of an international I&T hub is inseparable from research and development (“R&D”) and innovation activities. In recent years, GBA cities have continued to increase investment in R&D activities (**Figure 1**). To this end, Shenzhen is the clear leader through spending more than 5% of its GDP on R&D activities in 2020, which was higher than those of developed economies like Germany (3.1%), Japan (3.6%) and South Korea (4.6%).
- By continuously increasing R&D expenditure, GBA has seen an uninterrupted increase in the number of invention patents over the years to some 366 000 in 2020 (**Figure 2a**). The figure was 2.4 times, 5.7 times and 8.0 times that of Tokyo Bay Area, San Francisco Bay Area and New York Bay Area respectively (**Figure 2b**).
- Despite the increased number of invention patents in recent years, there is room for GBA to raise the overall quality of its patents. Technologists often use the patent citation ratio, calculated by dividing the number of citations by the total number of invention patents, to measure the impact of patents. More specifically, the higher number of citations received by a patent in subsequent patent documents can be interpreted as a sign of an economically important invention. During 2016 to 2020, GBA’s patent citation ratio stood at a relatively lower level of 1.04, which paled in comparison with that for San Francisco Bay Area which is considered by experts as best in class (**Figure 3**).

Figure 4 – Composition of R&D expenditure in GBA cities, 2020^{(a), (b)}



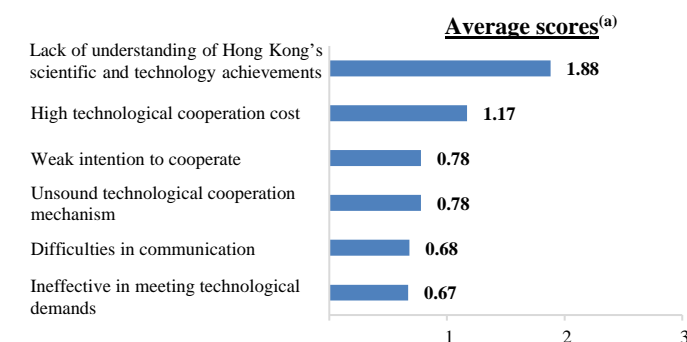
Notes: (a) Figures for Macao are not available.
(b) There is no further breakdown for R&D expenditure incurred by non-business sectors in Foshan, Zhaoqing, Dongguan, Huizhou, Zhuhai, Jiangmen and Zhongshan.

Figure 5 – Hong Kong universities with top-100 QS World University Rankings by subjects, 2021

Subject	University ^(a) (Rank)
Electrical & Electronic Engineering	HKUST (20), HKU (36), CUHK (65), CityU (72), PolyU (92)
Computer Science & Information Systems	HKUST (30), CUHK (31), HKU (43), CityU (68)
Mathematics	HKUST (36), CUHK (37), HKU (53), CityU (86)
Chemical Engineering	HKUST (32), HKU (63)
Chemistry	HKUST (31), HKU (52), CUHK (95)
Physics & Astronomy	HKUST (37), HKU (66), CUHK (99)

Note: (a) HKUST = The Hong Kong University of Science and Technology;
HKU = The University of Hong Kong;
CUHK = The Chinese University of Hong Kong;
CityU = City University of Hong Kong; and
PolyU = The Hong Kong Polytechnic University.

Figure 6 – Reasons for high-tech industrial firms in PRD region not using Hong Kong technology support



Note: (a) Respondents were asked to select the top three reasons for not using Hong Kong technology support and grade these reasons based on their importance, with "3" being the most important and "1" being the least important.

Highlights

- The vastly varying quality of individual invention patents inevitably raises the concerns over the basic research strengths of GBA. Broad consensus has been reached on the importance of basic research in enhancing the quality of inventions. Advance in basic research increases the productivity of research efforts, and generates new opportunities for further breakthroughs of technology know-how.
- Research institutions especially universities typically have advantage in basis research. Research by higher education institutions is an area where Hong Kong has comparative advantage as a significant share of its R&D expenditure already comes from this sector (Figure 4). The corresponding expenditure accounted for 0.53% of Hong Kong's GDP in 2020, compared with 0.18% for Guangdong Province as a whole. Internationally, Hong Kong is also renowned for its basic research in rankings of local universities and their R&D capability. According to the Quacquarelli Symonds ("QS") World University Rankings 2021, GBA had five of the world's 100 universities and all of them were located within Hong Kong. More specifically, they occupied high international positions in many individual subjects related to science and engineering (Figure 5).
- Hong Kong's strength in basic research should provide it with considerable potential for synergistic growth in partnership with the Mainland cities in GBA which are strong in applied scientific research. The Government is taking forward the development of the Shenzhen-Hong Kong Innovation and Technology Co-operation Zone in full swing, as well as implementing other policy measures to accelerate cross-border technology and talent flows.
- However, there remain barriers to overcome before other GBA cities can increase their use of services and technology support from Hong Kong. According to a survey conducted by the University of Hong Kong in 2021, some 90% of domestic-funded firms in the Pearl-River Delta ("PRD") region never used Hong Kong's technology support for various reasons – ranging from lack of understanding of Hong Kong's scientific and technological achievements and high cost to implement cooperation initiatives, to concerns regarding communications and perceived ineffectiveness in meeting their technological demands (Figure 6).

Data sources: Latest figures from Census and Statistics Department, Bureau of Statistics of Guangdong Province, Statistics and Census Service of Macao, Guangzhou Daily Data & Digit Institute, QS World University Rankings, and the University of Hong Kong.