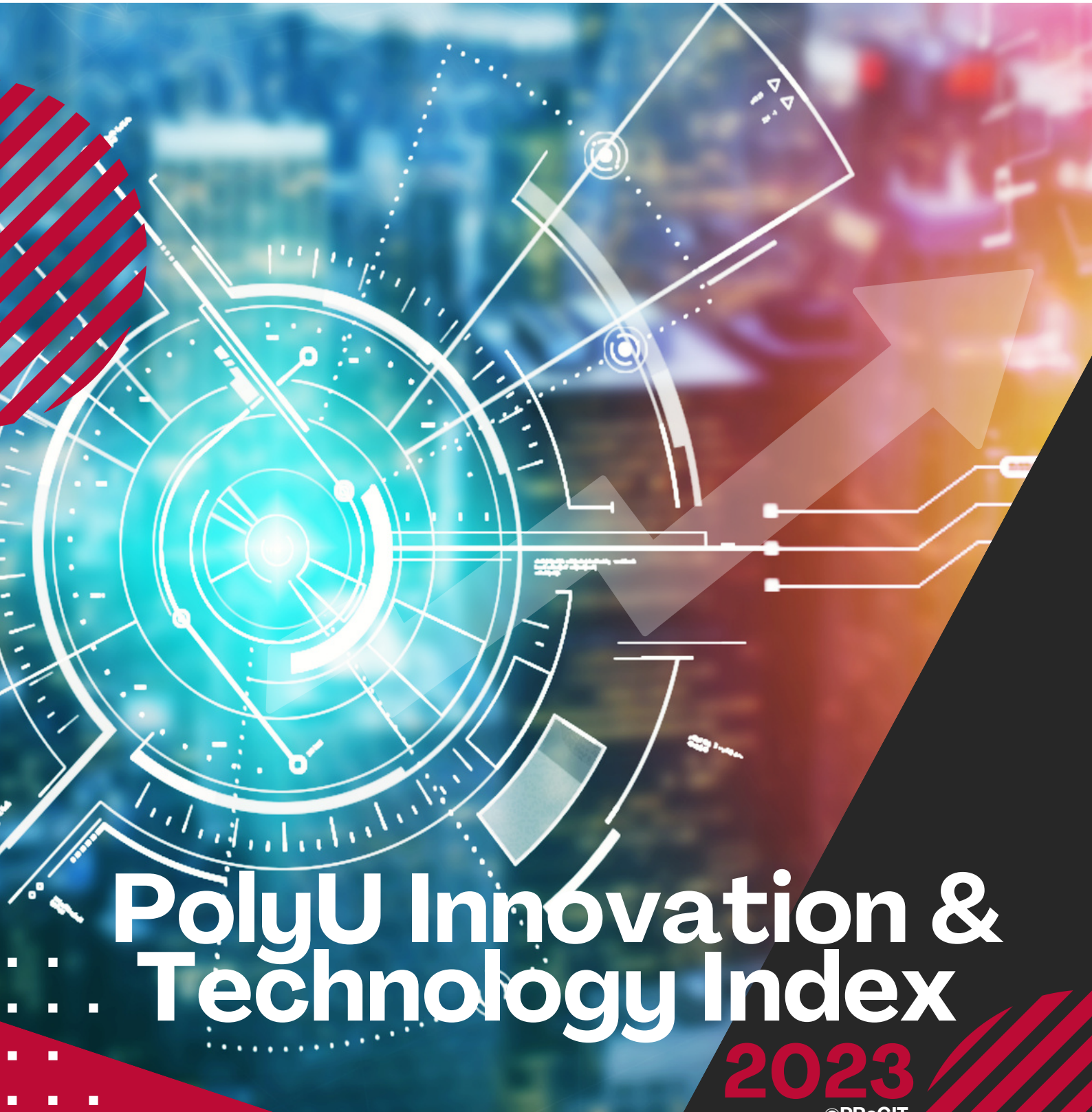
THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Policy Research Centre for Innovation and Technology
科技及創新政策研究中心



PolyU Innovation & Technology Index

2023

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PolyU Innovation and Technology Index Report

Executive Summary

Nations across the globe are fervently cultivating their Innovation and Technology (I&T) sectors in response to the advent of transformative technologies, such as Web 3.0, Blockchain, Carbon Neutrality, ChatGPT and other cutting-edge innovations. To foster sustainable and superior I&T industries, the United States, Europe, Japan and China have meticulously crafted corresponding policies and strategies.

The Hong Kong Polytechnic University (PolyU) has undertaken the development of a comprehensive assessment tool known as the PolyU Hong Kong Innovation and Technology Index. The Index is derived from Hong Kong's Innovation and Technology Development Blueprint, which outlines four key development visions. Moreover, the formulation of the Index draws upon the guidance provided by the Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China, as well as the Long-Range Objectives Through the Year 2035.

The evaluation framework of the PolyU Hong Kong Innovation and Technology Index encompasses two hierarchical levels. At the first level, the indicator system was categorised into five distinct aspects: Research and Development (R&D), Start-up, Talent, Industry and Impact. The proportions of each part are 30%, 30%, 15%, 5% and 20% respectively, and the grading system is based on a scale of 10 points. Each of these aspects represent essential dimensions of I&T advancement. To assess the I&T Index of all 34 regions in Greater China, which includes Taiwan and Macao, and to evaluate the I&T status of the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) within the global context, a rigorous two-round data processing approach was employed. The Z-method and min-max methods were specifically utilised to conduct this evaluation, considering the unique characteristics and dynamics associated with I&T across the GBA, San Francisco Bay Area, New York Bay Area and Tokyo Bay Area, which collectively constitute the four major Bay Areas worldwide.

Based on the 2020 data, Hong Kong has obtained the 7th position in Greater China's I&T Index, while the GBA has achieved the commendable 3rd position among the four prominent bay areas globally. Looking towards the future, predictions have been formulated regarding Hong Kong's anticipated ranking in the I&T sphere by 2032. Should the goals outlined in the Innovation and Technology Development Blueprint be successfully realised, Hong Kong is projected to ascend to the 3rd position within Greater China. Building upon these insightful findings, seven targeted policy recommendations have been formulated.

These recommendations serve as a strategic response to enhance Hong Kong's innovation and technology landscape, bolstering its competitive edge and fostering sustainable growth in this vital sector:

1. Increase R&D Expenditure and Encourage Patent Licensing;
2. Support I&T Start-ups and Establish the I&T Ecosystem;
3. Retain and Attract I&T Talents, and Improve the Public's Innovation Awareness;
4. Leverage Hong Kong's Strategic Positions to Accelerate New Industrialisation;
5. Harness the Green Economy and Enhance I&T Development;
6. Embrace the Digital Economy with the Innovation Evaluation Framework; and
7. Accelerate GBA Integration for Building a Leading International Innovation and Technology Hub.

The Policy Research Centre for Innovation and Technology (PReCIT) is dedicated to bolstering Hong Kong's I&T ecosystem, while concurrently striving towards the GBA's ambitious vision of emerging as China's preeminent I&T hub, akin to a Silicon Valley. To realise this objective, PReCIT remains steadfast in its efforts to attract accomplished I&T talents from around the globe, establish a globally recognised innovation centre, and solidify Hong Kong's competitive position within an increasingly challenging global milieu.

To effectively fulfil its mandate, PReCIT diligently undertakes the task of continually monitoring and refining its evaluation system. This meticulous approach ensures the system's integrity and reliability, while also fostering transparency in selecting and utilising data sources. By upholding the highest data integrity standards, PReCIT safeguards the credibility of its assessments and optimises the value of its insights, thereby enabling policymakers to make informed decisions with far-reaching implications for Hong Kong's I&T landscape.

In an era defined by relentless global competition, PReCIT's unwavering commitment to refining its evaluation system, maintaining data transparency, and providing invaluable insights stands as a testament to its dedication to supporting Hong Kong's I&T aspirations. Through these concerted efforts, PReCIT endeavours to propel Hong Kong towards a future marked by sustained growth, enhanced global recognition and continued excellence in the I&T realm.

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1. Background

Since the 1980s, Hong Kong's economic landscape has undergone notable transformations, characterised by a significant decline in the manufacturing sector's contribution to the Gross Domestic Product (GDP). Consequently, the economy has experienced a pronounced shift towards a service-oriented model, which presently accounts for an impressive 93.5% of GDP as of 2021 (Hong Kong Major Social and Economic Indicators, 2021). Against the backdrop of today's intricate and volatile international political and economic climate, the landscape of global competition has intensified considerably.

A compelling illustration of this heightened competition is evidenced by the substantial investments made by the United States in 2022. Allocating hundreds of billions of dollars, the Nation has placed a strategic emphasis on bolstering domestic semiconductor manufacturing capabilities and fostering advancements in research and development (R&D). Furthermore, attesting to the intensifying competition, the European Commission introduced The European Chips Act in 2022. This sweeping initiative aims to provide extensive support, over 43 billion euros, to bolster chip production capacities and facilitate related projects (Hong Kong Innovation and Technology Development Blueprint, 2022).

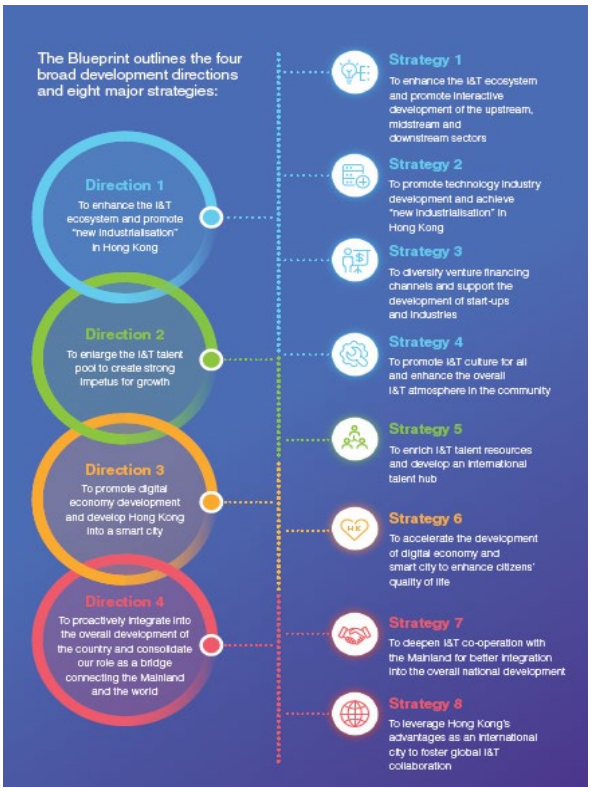
On December 22, 2022, the Hong Kong Special Administrative Region Government unveiled the "Hong Kong Innovation and Technology Development Blueprint", which serves as a guiding framework for the future trajectory of innovation and technology (I&T) in Hong Kong. This blueprint, complemented by the "Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through the Year 2035", released in March 2021, delineates a comprehensive roadmap for the next five to ten years of I&T development in the region. Anchored by four principal development directions, the Blueprint aims to fortify the I&T ecosystem, propel "new industrialisation" in Hong Kong, augment the pool of I&T talent as a catalyst for robust growth, foster digital economy expansion, transform Hong Kong into a smart city and actively integrate with the overarching national development agenda. The Blueprint also aims to nurture Hong Kong’s role as a bridge connecting Mainland China and the global community. The four directions, eight strategies and four development visions stated in the Blueprint are shown in Figure 1.

Specific targets within the Blueprint's ambit have been delineated across crucial domains, encompassing R&D, start-up enterprises, talent cultivation and industry advancement. For instance, an ambitious target has been set to increase the Gross Domestic Expenditure on R&D (GERD) as a ratio to GDP, aiming for a rise from 0.74% in 2016 to 1.3% by 2027. Moreover, the Blueprint seeks to elevate the manufacturing sector's contribution to GDP from 1% in 2022

to an envisioned 5% by 2032, thereby underscoring the commitment to invigorating industry development. To catalyse R&D initiatives and facilitate the commercialisation of research outcomes, the Hong Kong Government has instituted the Committee on Innovation, Technology, and Industry Development, concurrently with the development of critical I&T infrastructure.

The landscape of I&T advancement is dynamic. The Hong Kong Government, through the strategic Blueprint and institutional measures, proactively endeavours to position Hong Kong as a hub of innovation excellence, poised for sustainable growth and profound contributions to societal progress.

Despite the establishment of targets within the Innovation and Technology Development Blueprint, the exact positioning of Hong Kong *vis-à-vis* other regions within Greater China and the global landscape remains uncertain. A comprehensive understanding of the gaps between Hong Kong and other advanced I&T hubs is imperative for informed decision-making regarding Hong Kong's I&T development trajectory.



	Development Vision	2016 (Figures of 2014)	2022 (Figures of 2020)	2027 (Figures of 2025)	2032 (Figures of 2030)
1. R&D					
1.1	Gross Domestic Expenditure on R&D (GERD) as a ratio to GDP	0.74% (HK$16,727 billion)	0.99% (HK$26,554 billion)	1.3%	2%
1.2	GERD per capita	HK$2,306	HK$3,575	HK$5,000	HK$9,000
1.3	Public: Private Ratio of R&D Expenditure	56:44	58:42	50:50	40:60
2. Start-ups					
2.1	Number of start-ups operating in co-working spaces, incubators and accelerators	1 065	3 755 (2021)	About 5 000	About 7 000
2.2	Number of unicorn enterprises (accumulative)	0	12	18	30
3. Talent					
3.1	Number of I&T practitioners	35 450	45 310	60 000	No less than 100 000
3.2	Number of I&T practitioners per 1 000 labour force	9.15	11.56	16.54	28.05
4. Industry development					
4.1	Contribution percentage of manufacturing sector to GDP (at basic prices)	1.2%	1.0%	1.5%	5%

Figure 1: Four Directions and Eight Strategies (left) and Four Development Visions (right)
Source: Hong Kong Innovation and Technology Development Blueprint (2022)

Various academic institutions and governmental bodies release reports on innovation and development indices, which have significant influence and serve as reference. However, these

reports predominantly focus on countries or economic regions and often fail to offer precise guidance for local governments on formulating specific policies and strategies tailored to the I&T industry. For instance, the Global Innovation Index 2022 assesses 137 economies, while the Global Innovation Hubs Index 2022 evaluates 100 cities or metropolitan areas on a global scale. Similarly, the European Innovation Scoreboard 2022 primarily concerns EU member states and non-EU countries, while the China Regional Innovation Capacity Evaluation Report provides insights into the innovation development levels of 31 regions within Greater China. Regrettably, these reports do not facilitate a direct comparison between the innovation levels of different regions. Also, as these reports do not align with the four principal targets outlined in the Innovation and Technology Development Blueprint, thus there exists a dearth of specificity in the I&T development policies of the Hong Kong Government.

This prevailing gap in comprehensive assessments and benchmarking frameworks necessitates the development of a tailored approach that accounts for the unique context of Hong Kong's I&T landscape. Such an approach would offer precise insights, allowing the Hong Kong Government to make well-informed decisions regarding policy formulation and strategy development, as well as aligning with the specific goals outlined in the Blueprint. By addressing these gaps, Hong Kong can proactively chart its course towards becoming an exemplary I&T hub, leveraging its distinctive strengths and maximising its contributions to the global I&T ecosystem.

In order to address this existing gap, our evaluation system is predicated upon four pivotal development targets. Our primary objective is to discern the relative position of Hong Kong in the realm of I&T development. This is accomplished through a two-fold approach. Firstly, we aim to comprehensively compare Hong Kong and other regions within Greater China, thereby determining its relative standing in the national I&T landscape. Secondly, we endeavour to evaluate the state of I&T development within the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) in relation to three other prominent Bay Areas worldwide: the San Francisco Bay Area, New York Bay Area[1] and Tokyo Bay Area[2].

[1] The United States Office of Management and Budget utilises two definitions of the urbanised area: the metropolitan statistical area (MSA) and the combined statistical area (CSA). In this report, we use MSA to define New York Bay Area, also called 'New York Metro Area'.
[2] The Tokyo Bay Area, also called the 'Tokyo Megalopolis Region' or 'Greater Tokyo Area', includes Tokyo, Saitama, Chiba and Kanagawa prefectures.

2. Methodology

2.1 Key Performance Indicators

The assessment framework presented in this report encompasses a hierarchical structure that comprises of two tiers of key performance indicators (KPIs), thereby facilitating a comprehensive evaluation of I&T development. The first tier, referred to as 'Tier 1 indicators', is underpinned by the four development visions delineated within the Innovation and Technology Development Blueprint. These visions encompass R&D, Start-ups, Talent, Industry and Impact. To ensure the robustness and reliability of the evaluation system, corresponding Tier 2 indicators have been established, which align with each Tier 1 indicator. Collectively, a total of five Tier 1 indicators and fourteen Tier 2 indicators have been proposed, as presented in detail in Table 1 and Table 2 of this report. The ranking is the weighted average of the following factor scores:

- R&D: 30%
- Start-ups: 30%
- Talent: 15%
- Industry: 5%
- Impact: 20%

Currently, equal weightage is assigned to each Tier 2 indicator within the framework. However, it is essential to note that this weighting may be subject to adjustments in light of future stakeholder engagement and public input, thereby ensuring the system's responsiveness to evolving needs and perspectives. By adopting this evaluative approach, our aim is to provide a comprehensive analysis of I&T development in two distinct areas. Firstly, we seek to ascertain Hong Kong's relative position in the landscape of I&T development, particularly in comparison to various regions within Greater China, including Macao and Taiwan, notwithstanding the limitation of certain missing data points at present. The second area of investigation in this report pertains to the development of the GBA as a prominent international I&T hub, as explicitly outlined in the 14th Five-Year Plan. Given Hong Kong's status as the preeminent international city within the GBA and its pivotal role in driving I&T development, it holds significant relevance within this context. Accordingly, our analysis encompasses a comparative examination that involve three other notable Bay Area regions of global influence. It should be noted that the same Tier 1 framework and weightage are applied to the assessment of Hong Kong with other regions in Greater China, and GBA with the three other prominent Bay Areas worldwide. However, Tier 2 indicators are different because of the differences in scope and availability of data.

Table 1: Key Performance Indicators and Data Sources for Hong Kong and Other Regions in Greater China

Tier1	Tier 2		Data Source
1. R&D			
	1.1A	Gross Domestic Expenditure on R&D (GERD) as a ratio to GDP	*STATISTICAL BULLETIN OF NATIONAL SCIENCE AND TECHNOLOGY FUNDING INVESTMENT IN 2020*, *2021*
	1.2A	GERD per capita	*CHINA STATISTICAL YEARBOOK*, 2021
	1.3A	Public: Private Ratio of R&D Expenditure	*CHINA STATISTICAL YEARBOOK ON SCIENCE AND TECHNOLOGY*, 2021
	1.4A	Number of domestic patent applications	*CHINA STATISTICAL YEARBOOK*, 2021
2. Start-ups			
	2.1A	Number of start-ups operating in co-working spaces, incubators and accelerators	*CHINA TORCH STATISTICAL YEARBOOK*, 2021
	2.2A	Number of unicorn enterprises	*GLOBAL UNICORN INDEX 2021*
	2.3A	Hi-tech profits	*CHINA STATISTICAL YEARBOOK ON SCIENCE AND TECHNOLOGY*, 2021
	2.4A	Average venture capital deal size	*VENTURE CAPITAL DEVELOPMENT IN CHINA*, 2014
3. Talent			
	3.1A	Number of I&T practitioners	*CHINA STATISTICAL YEARBOOK*, 2021
	3.2A	Number of I&T practitioners per 1,000 labour force	*CHINA STATISTICAL YEARBOOK*, 2021
4. Industry			
	4.1A	Contribution percentage of manufacturing sector to GDP (at basic prices)	*CHINA STATISTICAL YEARBOOK*, 2021
5. Impact			
	5.1A	Number of employed persons in start-up companies	*CHINA TORCH STATISTICAL YEARBOOK*, 2021
	5.2A	High-technology exports	*CHINA TORCH STATISTICAL YEARBOOK*, 2021
	5.3A	Air quality	*CHINA STATISTICAL YEARBOOK ON ENVIRONMENT, 2021*

Note: '5A.3 Air quality' refers to annual average concentration of PM2.5 (μg/m3).

Table 2: Key Performance Indicators and Data Sources in Four Bay Areas

Tier1	Tier 2		Data Source
1. R&D			
	1.1B	GERD as a ratio to GDP	*statista and gov. statistical office*
	1.2B	GERD per capita	*statista and gov. statistical office*
	1.3B	The number of patent cooperation treaty (PCT) patents	*Global Innovation Hubs Index*, 2022
	1.4B	Effective inventory of invention patents	*Global Innovation Hubs Index*, 2022
2. Start-ups			
	2.1B	The number of leading innovative enterprises	*Global Innovation Hubs Index*, 2022
	2.2B	The number of unicorn enterprises	*Global Innovation Hubs Index*, 2022
	2.3B	Market value of high-tech manufacturing enterprises	*Global Innovation Hubs Index*, 2022
	2.4B	Venture capital	*Global Innovation Hubs Index*, 2022
3. Talent			
	3.1B	The number of supercomputers	*Global Innovation Hubs Index*, 2022
	3.2B	Number of top 200 world-leading universities	*Global Innovation Hubs Index*, 2022
4. Industry			
	4.1B	Contribution percentage of manufacturing sector to GDP (at basic prices)	*statista*
5. Impact			
	5.1B	Number of employed persons in professional, scientific and technical services	*Gov. statistical office*
	5.2B	Annual operating income of listed companies	*Global Innovation Hubs Index*, 2022
	5.3B	Foreign direct investment	*Global Innovation Hubs Index*, 2022

2.2 Calculation

2.2.1 Setting Reference Years

In order to uphold the integrity and validity of the data utilised in our analysis, a reference year has been established for each indicator. Specifically, the reference year selected for the purpose of comparing the I&T index between Hong Kong and Greater China is 2020. Similarly, the reference year chosen for the evaluation of the four Bay Areas is 2021. By aligning our assessments with these designated reference years, we aim to ensure consistency and accuracy in the comparative analysis conducted within the framework of this study.

2.2.2 Imputing for Missing Values

When data on the designated reference year is not readily available, we have adopted a suitable imputation approach to ensure the inclusion of representative values. In such cases, we rely on data from the preceding year or employ comparable values to substitute for the missing information. For instance, the GDP values for each Bay Area are only available up to 2020, whereas our reference year is 2021.

As we examine the four Bay Areas, it is important to acknowledge that they do not adhere to a uniform statistical standard, which consequently leads to the absence of certain data points within specific Bay Areas. For instance, when assessing the percentage of GDP at basic prices of the manufacturing sector in the Tokyo Bay Area, we utilise comprehensive data for Japan as a whole as a proxy measure. This methodology enables us to maintain a comprehensive evaluation, while also addressing the limitations posed by the non-uniformity of statistical standards within the four Bay Areas.

2.2.3 Determining Z-Score

Given the inherent disparities in data sources and scales, we have adopted the Z-Score method as a means to standardise the data. This statistical technique facilitates the comparison of data across varying units and scales by transforming each data point into a standard score. The Z-Score is obtained by calculating the difference between the data point and the mean value, which is then divided by the standard deviation:

$$z = (\mathrm{x} - \mu)/\sigma$$

where

z is the standardised z-score of a single indicator;
x is the raw data of a single indicator;
μ is the mean of the raw data of a single indicator for all regions or Bay Areas;
σ is the standard deviation of the raw data of a single indicator for all regions or Bay Areas.

By employing the Z-Score method, we can effectively normalise the data and enable meaningful comparisons across different indicators, thereby facilitating a comprehensive evaluation of the I&T landscape.

2.2.4 Calculating Re-scaled Scores by Minimum and Maximum Method

Given the notable variations in datasets, it is imperative to address potential outliers that may distort the final results. Furthermore, the Z-Score method occasionally yields negative values, which are unsuitable for comparative purposes. To overcome these challenges and ensure meaningful comparisons, we employed the Minimum and Maximum (Min-Max) method in this report. By reclassifying the Z-Scores within a standardised range of 0 to 1, we enhance the interpretability and comparability of the data. The formula used for the Min-Max method is as follows:

$$y = \frac{(x - \min(x))}{(\max(x) - \min(x))}$$

where

y is the min-max normalised value of the z-score of a single indicator;

x is the z-score of a single indicator,

max (*x*) is the maximum value of the z-score of a single indicator for all regions or Bay Areas;

min (*x*) is the minimum value of the z-score of a single indicator for all regions or Bay Areas.

By applying the Min-Max method, we effectively rescale the Z-Scores, ensuring a consistent range and facilitating robust comparisons across various indicators. This approach enhances the reliability and accuracy of our evaluation within the realm of I&T assessment.

2.2.5 Calculating I&T Index Scores

The methodologies outlined earlier are employed to calculate the *y*-values for each Tier 2 indicator. Subsequently, these *y*-values are multiplied by their respective weighting factors and aggregated to derive the composite Tier 2 indicator scores, encompassing I&T indices for each province, region, or Bay Area. Next, all Tier 1 indicator scores are redistributed according to the above proportion in Section 2.1, and it is assumed that the total score is 10. Finally, the scores corresponding to the individual Tier 1 indicators are summated, culminating in the overall I&T Index score. Through this comprehensive evaluation process, we attain a holistic assessment of the I&T landscape, providing valuable insights into the respective regions' or Bay Areas' performance and progress.

3. Results

3.1 Comparison of the I&T Index between Hong Kong and other Regions in Greater China

Within the realm of the 34 regions[3] in Greater China, Hong Kong attained a good Innovation and Technology Index score of 3.53, securing a commendable 7th position. This noteworthy achievement places Hong Kong in a position of prominence among its regional counterparts. The top six regions, in descending order, are as follows: Guangdong (6.77), Jiangsu (5.20), Beijing (4.72), Zhejiang (4.61), Taiwan (4.28) and Shanghai (3.89). Table 3 shows these results.

Table 3: Top 10 I&T Regions in Greater China

Rank	Region	Overall	R&D	Start-ups	Talent	Industry	Impact
1	Guangdong	6.77	2.03	2.08	1.00	0.46	1.20
2	Jiangsu	5.20	1.88	1.21	0.86	0.48	0.77
3	Beijing	4.72	2.22	1.68	0.15	0.14	0.52
4	Zhejiang	4.61	1.66	0.91	0.83	0.46	0.75
5	Taiwan	4.28	1.65	0.31	1.13	0.48	0.71
6	Shanghai	3.89	1.74	1.03	0.26	0.32	0.54
7	**Hong Kong**	**3.53**	**0.82**	**1.09**	**0.29**	**0.00**	**1.33**
8	Fujian	3.00	1.37	0.51	0.39	0.41	0.32
9	Shandong	2.90	1.22	0.30	0.31	0.47	0.60
10	Anhui	2.63	1.23	0.33	0.26	0.39	0.42

Hong Kong's performance across the Tier 2 indicators demonstrates a mixed outcome. It attained lower scores in the Number of domestic patent applications (KPI 1.4A) and the Number of employed persons in start-ups (KPI 5.1A), while showing higher scores in venture capital deal size (KPI 2.4A), High-technology exports (KPI 5.2A), and Air quality (KPI 5.3A). These outcomes shed light on Hong Kong's strengths in areas such as a vibrant free economy, flourishing trade activities and an environmentally sustainable and liveable ecosystem.

Turning to the Tier 1 indicators, Hong Kong's performance revealed shortcomings in the domains of Start-ups (KPI 2.1A), Number of unicorn enterprises (KPI 2.2A) and High-tech profits (KPI 2.3A). While the Number of I&T practitioners (KPI 3.1A) remains relatively low, when considering the Number of I&T practitioners per 1,000 labour force (KPI 3.2A), Hong Kong exhibits a comparatively higher ratio, highlighting its capacity to nurture and attract talents within the Talent aspect. Concerning the Industry indicator (KPI 4), Hong Kong's

[3] The selection of 34 regions is according to "中华人民共和国行政区划" published on 15/6/2005: "At present, China has 34 provincial-level administrative regions, including 23 provinces, 5 autonomous regions, 4 municipalities directly under the Central Government, and 2 special administrative regions." https://www.gov.cn/guoqing/2005-09/13/content_5043917.htm

contribution to GDP from the industry sector (KPI 4.1A) remains minimal, aligning with the prevailing economic structure of the region. The comparison of top 10 High-tech Export Regions in Greater China is shown in Figure 2 while the number of I&T practitioners and practitioners per 1,000 labour force in Greater China are shown in Figure 3.

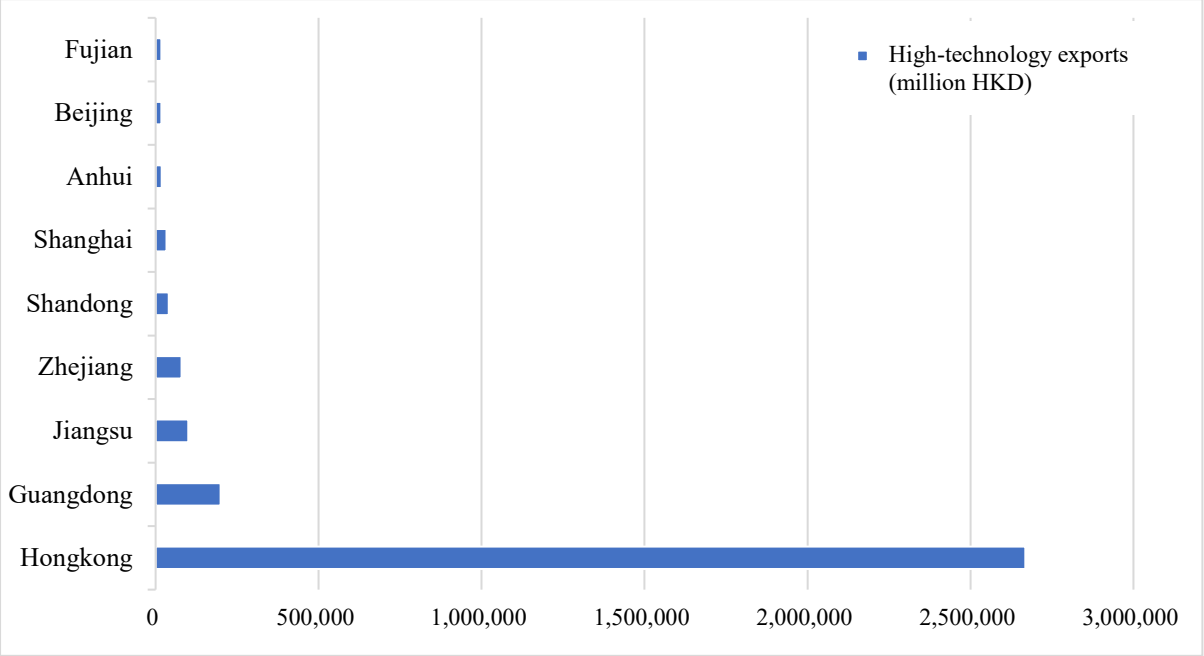


Figure 2: Top 10 High-tech Export Regions in Greater China

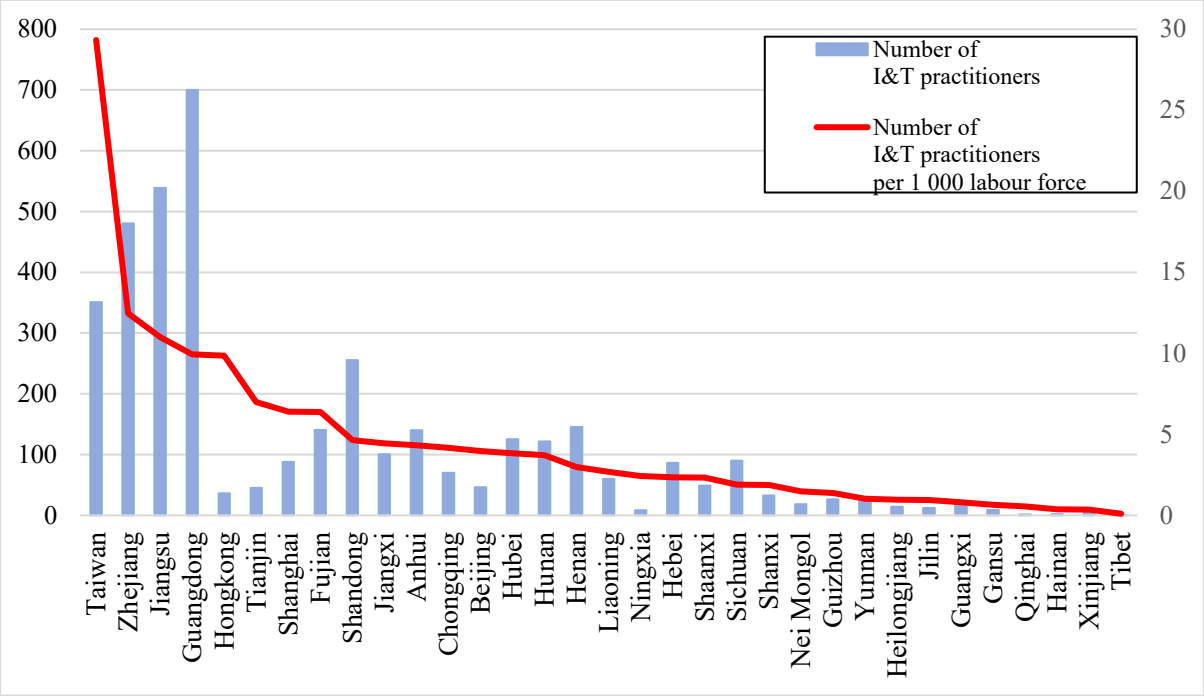


Figure 3: Number of I&T Practitioners and Practitioners per 1,000 Labour Force in Greater China[4]

[4] The data of Macao is missing.

Assuming the realisation of the ambitious targets outlined in the Hong Kong Innovation and Technology Development Blueprint, significant advancements are anticipated across various domains. In the realm of R&D (KPI 1), for instance, the GERD per capita (KPI 1.2A) is projected to reach HKD 5,000 and HKD 9,000 by the years 2027 and 2032, respectively. Moreover, the Number of I&T practitioners per 1000 labour force (KPI 3.2A) is expected to reach 16.54 and 28.05 respectively, reflecting a substantial growth in the talent pool.

By maintaining the 2020 levels of other regions, Hong Kong is predicted to attain the 6th and 3rd positions in 2027 and 2032 respectively, when compared to the other regions. These estimations signify the potential progress that Hong Kong can achieve in its I&T landscape, positioning itself as a prominent player within the broader context of I&T development.

Table 4 shows the evolution of Hong Kong's scores across three different periods. The findings reveal that even if the envisioned objectives are successfully attained by 2027, the progress in the I&T Index would be relatively modest, particularly within the Industry sector, where the increase would amount to a mere 0.01. Consequently, although Hong Kong's overall ranking would slightly increase, the disparity with the 6th ranked region (Shanghai, 3.89) would be only 0.01.

However, by 2032, Hong Kong is anticipated to ascend to the 3rd position in the I&T Index ranking. This notable advancement can be attributed primarily to the significant contributions of R&D and Talent, each accounting for approximately 0.55 points. Additionally, Start-ups and Industry are projected to contribute around 0.18 and 0.05 points respectively, to this progress. These forecasts underscore the pivotal role that R&D and Talent development play in shaping Hong Kong's future standing within the I&T realm.

Table 4: Projection of I&T Ranking of Hong Kong in 2027 and 2032

Rank	Year	Overall	R&D	Start-ups	Talent	Industry	Impact
7	2020	3.53	0.82	1.09	0.29	0.00	1.33
6	2027	3.90	0.96	1.11	0.46	0.01	1.33
3	2032	4.82	1.37	1.24	0.82	0.06	1.33

3.2 Comparison of the I&T Index between GBA and the Three Other Bay Areas

Among the four major Bay Areas worldwide, the GBA achieved a commendable score of 3.75, securing the 3rd position. Leading the pack, the San Francisco Bay Area claimed the top spot with a score of 6.99, followed by the Tokyo Bay Area in 2nd place with a score of 4.07. The New York Bay Area ranked 4th with a score of 3.14. This outcome highlights the competitive standing of the GBA within the global landscape of Bay Areas, signifying its substantial progress and potential for further advancement. These results are shown in Table 5.

Table 5: Four Bay Areas' I&T Ranking and Score

Rank	Bay Area	Overall	R&D	Start-ups	Talent	Industry	Impact
1	San Francisco	6.99	2.51	3.00	0.90	0.08	0.50
2	Tokyo	4.07	1.75	0.59	0.64	0.30	0.78
3	GBA	3.75	0.49	0.23	1.24	0.50	1.29
4	New York	3.14	0.97	1.01	0.75	0.00	0.41

Within the Tier 2 indicators, the GBA displayed comparatively lower scores in the Market value of high-tech manufacturing enterprises (KPI 2.3B) and GERD per capita (KPI 1.2B). These results suggest room for improvement in these specific areas to enhance the overall development of the region. Turning to the Tier 1 indicators, the GBA exhibited stronger performance in Talent (KPI 3), Industry (KPI 4), and Impact (KPI 5). However, it faced challenges in R&D (KPI 1) and Start-ups (KPI 2), particularly in the latter category where the Venture capital (KPI 2.4B) level fell behind that of New York and San Francisco, indicating potential areas that require targeted interventions and further support. Figure 4 illustrates this finding.

Despite efforts to improve Hong Kong's I&T ranking within the GBA by 2032, the overall impact on the GBA's standing will be limited. The GBA currently trails behind the top two Bay Areas. Thus, even if Hong Kong successfully achieves its targets, it will not significantly alter the GBA's relative ranking. Notably, in terms of Industry (KPI 4), the GBA already exhibits a robust industrial capacity surpassing the three other Bay Areas, owing to the contributions of the GBA cities. However, in the realm of R&D (KPI 1), the most significant disparity lies in the GERD per capita (KPI 1.2B). Even with Hong Kong's plan to increase its GERD per capita to HKD 9,000 by 2032, it will still fall short of the New York Bay Area, which currently holds the 3rd position in this aspect, as illustrated in Figure 5.

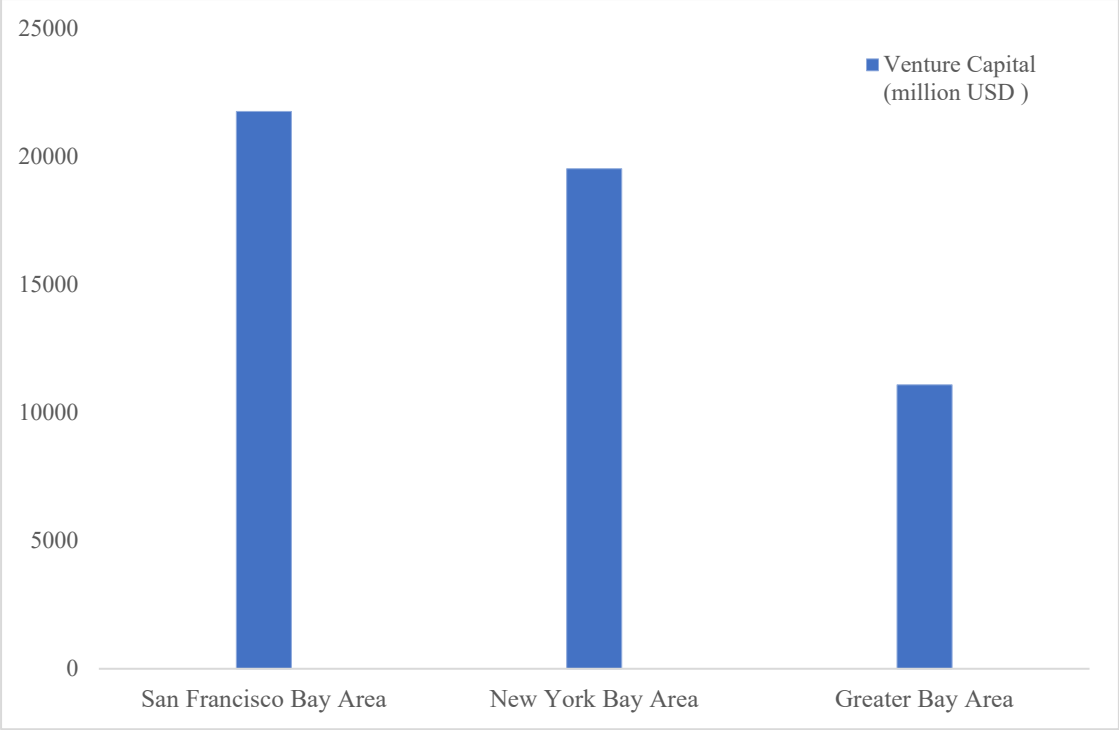


Figure 4: Venture Capital
Source: Global Innovation Hubs Index (2022)
Note: The data of the Tokyo Bay Area is not available

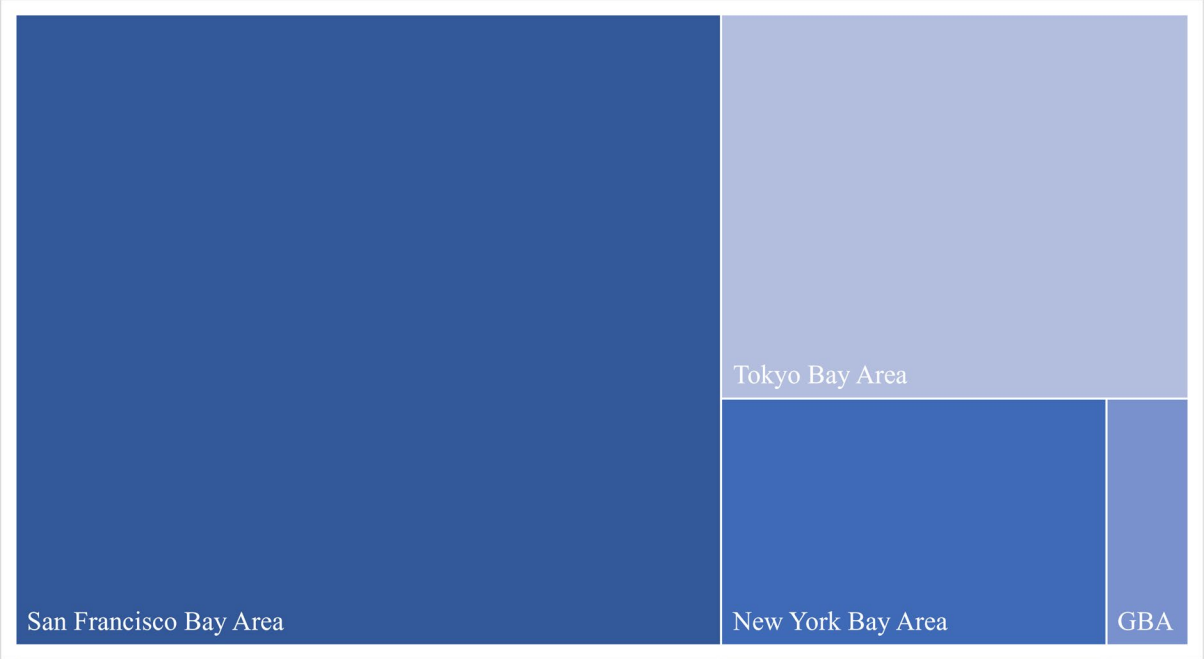


Figure 5: Projection of GERD per capital in 2032[5]

[5] Assuming that the data of the three other Bay Areas and other cities in the GBA remain unchanged. Only Hong Kong achieves its 2032 goals.

4. Interactive Map Dashboard

In order to improve the usability, accessibility and transparency of the proposed I&T index and to facilitate evidence-based decision-making for policymakers and stakeholders, we intend to develop an interactive map dashboard to present the findings. The sample layout depicted in Figure 6 shows the envisioned design. The interactive map dashboard will serve several key objectives, including:

4.1 Visual Presentation of Index Figures

The primary objective of the dashboard is to offer a concise and easily comprehensible visual depiction of the index figures, ensuring user-friendly access to policymakers and other stakeholders. By presenting the data in a clear and intuitive manner, the dashboard facilitates a rapid understanding of the overall performance of Hong Kong and the GBA in the I&T realm. Moreover, it enables the identification of specific areas that require enhancements. These features would thus empower decision-makers to swiftly grasp key insights and make informed judgments.

4.2 Geographical Comparison with other Regions in Greater China and Bay Areas

The secondary objective of the dashboard is to enable comprehensive comparisons between Hong Kong and other regions in Greater China and Bay Areas. Incorporating data from diverse regions within the dashboard allows for benchmarking Hong Kong's performance against other areas. This would thus facilitate the identification of best practices that can be adopted to enhance Hong Kong's I&T ecosystem. By providing a holistic view of the strengths and weaknesses of different regions, the dashboard empowers policymakers and stakeholders to leverage valuable insights from successful models and apply them strategically to augment Hong Kong's I&T landscape.

4.3 Updating and Monitoring the Index Figures

A pivotal objective of the dashboard is to facilitate real-time updating and monitoring of the index figures. This dynamic feature ensures that the data remains current and provides policymakers with access to the most recent information for making informed decisions. By frequently tracking progress over time, the dashboard allows for evaluation of the efficacy of policy interventions in driving I&T development. The ability to observe real-time updates and monitor key indicators fosters a proactive approach to decision-making and enables policymakers to promptly adapt strategies and interventions to maximise their impact on Hong Kong's I&T landscape.

The interactive dashboard is poised to serve as an invaluable tool for policymakers and key stakeholders within the I&T ecosystem of Hong Kong and the GBA. By leveraging data-driven insights, the dashboard empowers decision-makers to make informed and evidence-based choices that align with the objectives outlined in the Hong Kong Innovation and Technology Development Blueprint. This comprehensive platform allows for a systematic assessment of the current state of I&T development, identifies areas that require enhancement and facilitates the monitoring of progress towards the established goals. Through its user-friendly interface and comprehensive data visualisation, the dashboard empowers stakeholders to understand the I&T landscape holistically, thus fostering effective policymaking and strategic interventions that drive sustainable growth and development in the region. The interactive dashboard will be available soon.

5. Recommendations

5.1 Increase R&D Expenditure and Encourage Patent Licensing

Despite Hong Kong's incremental growth in GERD as a percentage of GDP, from 0.74% in 2016 to 0.99% in 2022 (Hong Kong Innovation and Technology Development Blueprint, 2022), it still falls behind other regions in Greater China. Notably, regions with robust I&T indices typically exhibit GERD-to-GDP ratios approaching 3%, with Beijing surpassing even 6%. Strengthening investment in R&D is of paramount importance towards establishing a solid foundation for the thriving I&T industry, which serves as a key driver for Hong Kong's overall development. Acknowledging this imperative, the 2023-24 Budget has allotted HKD 6 billion towards funding universities and research institutes to establish research facilities, along with an additional HKD 3 billion towards promoting fundamental research in cutting-edge technological domains, such as artificial intelligence and quantum technology. This concerted investment underscores the Government's commitment to bolstering Hong Kong's R&D landscape and fostering breakthroughs in transformative areas of knowledge.

Despite Hong Kong's prominent position as an internationalised and renowned free economy, its potential remains untapped due to the dominance of public expenditure in R&D, compared to private investment. In contrast, regions such as Zhejiang, Jiangsu and Guangdong have successfully fostered private capital involvement in local start-ups by implementing favourable investment policies. To change the dominance of public R&D expenditure over private, the Hong Kong Government could encourage the development of a joint incubator or accelerator with private enterprises to work on industry pain points and steer R&D to work on real-life problems. In recent times, Mainland China, particularly in the GBA, has witnessed the establishment of numerous venture capital funds with substantial investments. Hong Kong stands to gain significantly from the GBA's progress by facilitating a seamless flow of venture capital from Mainland China. Professor Christopher Chao, Vice President (Research and Innovation) of The Hong Kong Polytechnic University (PolyU), emphasised in a media interview the institution's plans to encourage collaborative partnerships between its faculty and institutions as well as enterprises in the GBA and other regions across Mainland China. By enhancing PolyU's reputation and attracting more investment, this strategic collaboration aims to further augment Hong Kong's innovation and technology ecosystem.

To further bolster Hong Kong's status as an innovative city, it is imperative for the city's R&D institutions, encompassing universities and enterprises, to actively engage in patent applications and standards establishment in collaboration with Mainland China, aligning with the objectives outlined in the 14th Five-Year Plan. Notably, the number of China patent applications originating from Hong Kong is comparatively low, with only 3,147 in 2020. In the same year, Guangdong applied for 967,204 patents. This may be attributed to Hong Kong

companies aiming at markets outside Mainland China. For Hong Kong to fully integrate into China's overall development plan, it is imperative that the domestic patent market is embraced and efforts are made to increase the number of domestic patents. Of course, the PCT number is also important to be concerned worldwide. The number of patents secured serves as a crucial metric for evaluating I&T prowess, emphasising the significance of safeguarding intellectual property rights. However, the substantial costs associated with maintaining intellectual property rights during the early stages of start-ups often hinder progress, leading to the abandonment of patent applications due to financial constraints. Consequently, it is advisable to consider raising the funding threshold for each enterprise or individual application, thereby fostering a supportive environment that incentivises innovation and facilitates intellectual property protection. For example, the Intellectual Property Department currently supports patent registration through the Patent Application Grant (PAG) scheme in Hong Kong, which could encourage more patent applications for our long-term benefits. GERD as a ratio to GDP of different regions in Greater China is shown in Figure 7.

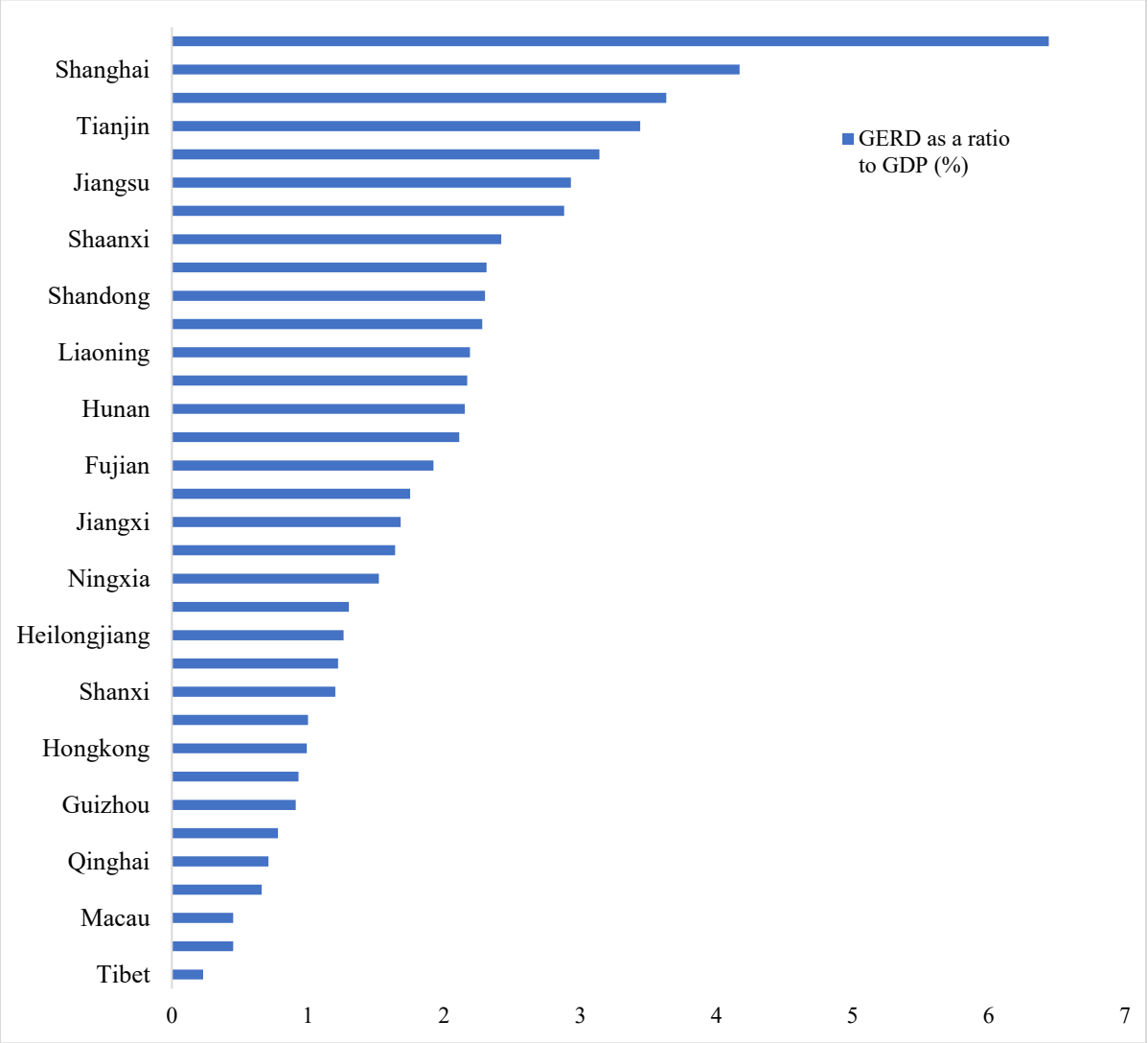


Figure 6: GERD as a ratio to GDP in Greater China

5.2 Support I&T Start-ups and Establish the I&T Ecosystem

In 2032, it is projected that the attainment of goals delineated in the Hong Kong Innovation and Technology Development Blueprint will yield limited influence in elevating Hong Kong's ranking in the I&T landscape. However, it is crucial to recognise the vital role of start-ups in generating economic value for Hong Kong. Start-up Genome, an organisation that has provided insights into the world's leading start-up ecosystems for 11 continuous years, recently published the Global Start-up Ecosystem Report 2023 (GSER). The Report shows that Hong Kong ranked second in the "Emerging Ecosystems Ranking". In addition, the number of unicorns in Hong Kong surged from 7 to 11. These findings demonstrate that Hong Kong has a start-up community that is at an early stage of growth, and has huge potential moving forward. However, there is still a significant gap between Hong Kong and leading start-up ecosystems, such as in Silicon Valley, New York City, and London, which are ranked in the top three globally.

More importantly, the university-supported research infrastructure is likely to emerge as a significant wellspring for I&T start-ups, as indicated by Spender et al. (2017), which underscores the pivotal role of the Higher Education System within the start-up I&T ecosystem. Especially, statistics reveal that nearly 60% of Pre-A round start-ups fail to secure funding, with less than 10% ultimately achieving success. Hence, it becomes imperative to provide start-ups with expanded opportunities, including specialised training that encompasses areas such as law, finance, management and general entrepreneurship. Such multifaceted training equips aspiring entrepreneurs with a comprehensive understanding of the start-up ecosystem and nurtures a business-oriented mindset, thus enabling start-ups to thrive in the market and secure necessary funding.

In addition, the start-up establishment process should be streamlined. This would enable teams to devote more attention to core product development, instead of being burdened by administrative procedures. Financial support assumes paramount importance, and the Hong Kong Government has demonstrated a steadfast commitment to bolstering the I&T ecosystem through initiatives such as the Science Park and Cyberport. Also, it has increased the Innovation and Technology Venture Fund to HKD 400 million in the 2023-24 Budget. One thing should be emphasised here: Early-stage investment is particularly challenging, given the macroeconomic environment and geopolitical situation. The previous efforts of the Government in grooming more start-ups in Hong Kong will be wasted if even high-potential ones cannot escape the valley of death due to funding shortage. Apart from strategic technology funds, there should be more funding to support the growth journey of start-ups. Elite programs could be a way to support the scale up of high growth start-ups. However, there should be objective criteria and metrics for screening elite start-ups, like the establishment of a list that

includes potential unicorn teams, alongside the involvement of experts from diverse domains to assess and provide technical support to potential unicorns. This arrangement would prove beneficial. Further improvements to the existing listing system, provision of land supply and adoption of financial subsidies can serve as incentives for unicorn enterprises to establish their operations or branches in Hong Kong, thus consolidating the city's position as an attractive destination for such enterprises.

5.3 Retain and Attract I&T Talents, and Improve the Public's Innovation Awareness

The vitality of any industry hinges upon the presence of skilled individuals and talents, and this holds particularly true for the I&T sector, which thrives on innovative capabilities. In today's global landscape, Greater China and other prominent Bay Areas are engaged in a fierce competition to attract I&T talents through, for example, providing financial subsidies, ample housing supply, quality education, healthcare facilities, and other amenities. Hong Kong, boasting five of the world's top 100 universities that attract talents from around the globe for study and research, encounters certain limitations pertaining to land supply, with housing emerging as a pivotal concern for many I&T talents. In order to entice and retain such talent, it is imperative for the Government to explore avenues for enhancing the living environment. Regrettably, the existing scenario often witnesses talented individuals departing from Hong Kong upon completion of their studies or research. This trend impedes their potential contributions to the development of the I&T industry in the city. The Government must proactively explore mechanisms to attract talents by offering an improved living environment, considering the broader perspective of the living circle.

Additionally, the cultivation of an I&T culture stands as a pivotal factor in determining the success of a region. The prevailing culture that prioritises short-term gains poses challenges for investors in supporting I&T, given that the process of commercialising research outcomes often entails a significant time investment. In order to foster a strong and widespread I&T culture within society, the Government must focus on I&T-focused advertisements and initiatives that actively encourage youth engagement. This approach instils awareness and appreciation for innovation from an early stage. For example, the Hong Kong Government could support entrepreneurship mindset training programmes in K-12 education, apart from STEM/STEAM programmes. Furthermore, it is crucial to promote a mindset among the general public that perceives failures in the I&T realm as valuable learning experiences, fostering an open-minded perspective towards setbacks and encouraging the continued pursuit of innovative endeavours.

Finally, achieving high-quality growth necessitates the presence of high-quality talent, including domestic and overseas talent. To attract top-notch students from renowned overseas universities, government-funded internship programs should also include non-Hong Kong

students. The cultivation and attraction of such talent are contingent upon the provision of superior housing, employment opportunities, income prospects, educational resources, access to healthcare facilities and a sustainable ecological environment. High-quality talent serves as a valuable asset to society and consequently imposes greater demands on the aforementioned aspects. It is imperative to refine job frameworks, salary structures and tax policies that align with and foster the development of the I&T industry. It is hoped that the Hong Kong Government can establish an I&T ecosystem that concentrates international technology companies, entrepreneurs and top-tier talent, thereby creating an environment that is conducive to a flourishing I&T sector.

5.4 Leverage Hong Kong's Strategic Positions to Accelerate New Industrialisation

The global impact of the Covid-19 pandemic has prompted a renewed recognition of manufacturing as a fundamental pillar for economic growth in numerous cities and countries. Although Hong Kong's manufacturing sector has witnessed a decline in its contribution to GDP, dropping to 1% in 2022, Hong Kong's renowned "Made in Hong Kong" brand has gained widespread recognition worldwide. Historically, the city's industrial development was primarily concentrated in the clothing, electronics and jewellery sectors. As market competition intensified, Hong Kong's manufacturing landscape gradually transitioned towards high-value-added and specialised industries, such as advanced precision machinery manufacturing and high-tech electronic products.

The adoption of automation technology holds immense potential for traditional enterprises to enhance operational efficiency, stimulate revenue growth and facilitate the development of local upstream, midstream and downstream industries. This is particularly relevant for industries that yield high-value-added returns, such as the semiconductor industry. Hong Kong's unique advantages, including its international network, strategic geographic location and favourable political and economic environment, present many opportunities for collaboration among multinational technology enterprises. Establishing long-term communication and learning mechanisms can further foster cooperation and innovation in the manufacturing sector.

Furthermore, the rule of law, intellectual property framework, international accounting system, diverse cultures and more are all advantages of Hong Kong as an international Innovation and Technology hub. These advantages can provide valuable professional support to ongoing industrial transformation efforts, serving as crucial enablers for the revitalisation of the manufacturing industry. By leveraging its strengths in professional services and embracing I&T advancements, Hong Kong can position itself as a competitive hub for manufacturing and facilitate sustainable industrial growth.

5.5 Harness the Green Economy and Enhance I&T Development

Hong Kong has established a long-term objective of attaining carbon neutrality by 2050, in line with China's commitment to achieve carbon neutrality by 2060, setting a record for the shortest time frame in global history to accomplish the twin carbon targets of "carbon peaking and carbon neutrality". Emphasising the significance of carbon neutrality and the development of an international carbon market, the 2022 Policy Address positions Hong Kong as the preferred financing platform for Mainland China, overseas governments and green enterprises. The Government is actively supporting the Hong Kong Stock Exchange (HKEX) in fostering collaborations with financial institutions in Guangzhou to advance the carbon market's development. The establishment of a carbon market can facilitate low-carbon progress across various sectors. However, green and low-carbon development also necessitates innovation and support for the commercialisation of renewable energy and carbon capture and storage technologies.

Currently, certain environmental technology start-ups and enterprises face challenges in terms of limited market awareness and capital availability to evolve into influential entities. To address this, it is recommended that the Government considers Science Park, Cyberport and tertiary institutions as entry points to support R&D in environmentally friendly technologies. This could involve, for example, offering a comprehensive range of training, publicity and promotion services. Encouraging all enterprises to adopt environmental technologies in their production processes to mitigate environmental impacts is also crucial. Moreover, policy alignment and up-to-date legislation play pivotal roles in fostering a successful green economy. For example, formulating policies on the utilisation of hydrogen vehicles in Hong Kong is essential to facilitate their market introduction.

By focusing on developing a carbon market, supporting R&D in environmentally friendly technologies, and ensuring policy alignment, Hong Kong can advance its green and low-carbon agenda. This would help the city contribute to global sustainability efforts and position itself as a leader in the transition to a greener economy.

5.6 Embrace the Digital Economy with the Innovation Evaluation Framework

The Hong Kong Digital Economy Summit, held on 13-14 April 2023, was dedicated to exploring the potential of smart city technologies in fostering the advancement of resilient digital societies and smart economies. A significant topic of discussion during the Summit revolved around the imperative of enhancing interconnectivity within the GBA. This entails integrating government services and governance across the Guangdong-Hong Kong-Macao region, as well as improving the efficiency of public services. These measures are essential for attracting and retaining top talent in the region. By prioritising these initiatives, Hong Kong

aims to establish a robust foundation for a thriving digital ecosystem, facilitating seamless connectivity, efficient governance and an environment that promotes the growth of digital industries.

Hong Kong, renowned as a global financial hub, is actively embracing financial innovation and encouraging explorations of the potential of distributed ledger technologies. The advancement of the digital economy also serves as a catalyst for new industrialisation and the adoption of Industry 4.0 principles. Furthermore, the advent of the Web 3.0 era is poised to revolutionise corporate asset allocation, presenting novel opportunities and business models. By adeptly seizing these opportunities, Hong Kong can attract more enterprises to establish and flourish within its borders, resulting in a surge of start-up ventures and increased venture capital investments in the region. This positive cycle will stimulate the growth of new businesses, generate employment opportunities and seamlessly integrate the traditional economy with the emerging economy, thereby propelling business transformations and facilitating the Government's objectives in achieving digitalised service delivery. These endeavours directly influence the outcomes of KPI 2 (Start-ups) and KPI 3 (Talent) within the current indicator system, underscoring the significance of embracing digital innovation and its transformative potential in Hong Kong.

The development of the digital economy yields several notable benefits. First, the emergence of new start-up ventures, leading to a substantial upsurge in the overall number of start-ups (KPI 2.1A). Second, unlike traditional economies, the digital economy demonstrates a greater propensity for nurturing unicorn companies, which are enterprises valued at over a billion dollars (KPI 2.2A). Thirdly, the rapid advancement of the digital economy brings about a transformation in the labour market, not only replacing existing jobs but also generating new employment opportunities.

According to Bukht and Heeks (2017), for each traditional job supplanted by digitalisation, three new positions are created, resulting in a notable increase in the number of professionals engaged in I&T (KPI 3.1A) and the number of I&T practitioners per 1,000 individuals in the labour force (KPI 3.2A). Given Hong Kong's relatively low employment figures, compared to other regions, the development of the digital economy will markedly enhance the I&T status of the city. In short, by developing the digital economy and harnessing its potential for economic growth, Hong Kong can make considerable progress.

As per the existing framework, while advancements in the digital economy can yield improvements in Hong Kong's KPIs, particularly those involving per capita data, they may not have a substantial impact on the overall ranking of the city, when compared to other regions.

Despite Hong Kong's noteworthy progress in areas such as start-up proliferation, the establishment of unicorn companies and the growth of I&T employment, these advancements may not necessarily translate into a significant rise in the overall ranking. However, there exists a potential solution to address this limitation.

Given the increasing significance of the digital economy, China introduced the "Classification of Digital Economy and Its Core Industries" in 2021. Some regions have already started to monitor and track this sector. Consequently, one approach to gauge the development levels in different regions is by using the proportion of the digital economy in the GDP as an indicator for KPI 5. For instance, Beijing's digital economy contributed 1,625.19 billion yuan in added value, accounting for 40.4% of its GDP in 2021. By adopting this indicator, we can compare the development levels across different regions and gain insights into the relative progress and integration of the digital economy within their respective economies.

According to the definition provided by Bukht and Heeks (2017), the digital economy encompasses economic activities that are primarily derived from digital technologies, with a business model centred around digital goods or services. Figure 8 illustrates the significance of digital services within the framework of the digital economy. Given that Hong Kong's economy is predominantly service-oriented, the city is strategically positioned to transition towards a digital economy. This transition holds greater potential for positively influencing Hong Kong's ranking in 2032, when compared to the contribution that reindustrialisation would offer, especially considering the limitations imposed by land availability and technological constraints.

5.7 Accelerate GBA Integration for Building a Leading International Innovation and Technology Hub

The four major Bay Areas have garnered global recognition for their thriving economies, remarkable technological advancements and overall socio-economic development. Notably, the success of these Bay Areas in surpassing Hong Kong can be attributed to their robust I&T sectors. Silicon Valley, situated in the San Francisco Bay Area, stands as a prime example, housing some of the world's most prominent technology companies. The Tokyo Bay Area has gained acclaim for its pioneering work in robotics and electronics, while the New York Bay Area serves as a prominent centre for finance and media.

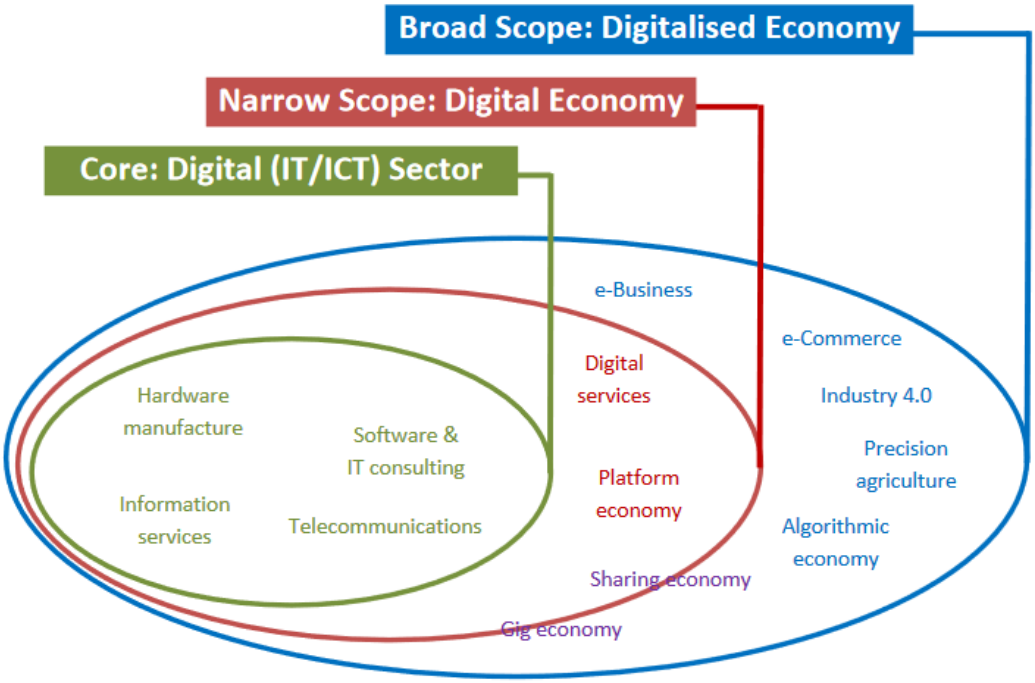


Figure 7: Scoping the digital economy

Based on the available dataset, the GBA exhibits certain shortcomings in R&D, particularly in terms of GERD per capita and the number of start-ups. However, the region excels in talent pool availability and industry development, which are considered its strong points when compared to the three other Bay Areas. It is worth noting that environmental sustainability is an area that requires attention as the GBA undergoes continuous expansion and development. Implementing sustainable practices becomes essential to mitigate adverse environmental impacts and ensure long-term viability.

In addition, the GBA stands to gain from placing greater emphasis on social innovation and inclusivity. This can be achieved by addressing income inequality and enhancing access to education and healthcare services. By prioritising these aspects, the GBA can differentiate itself from the other major Bay Areas and reinforce its position as a prominent global centre for economic and technological advancements.

Hong Kong has long been acknowledged for its strong financial and trading sectors, whereas the GBA boasts a rich talent pool and abundant entrepreneurial prospects. By fostering closer integration with the GBA and capitalising on the respective strengths of other cities within the region, Hong Kong has the potential to foster the growth of its I&T industries. Such efforts would contribute to bolstering the GBA's standing in the I&T sector, relative to the other major Bay Areas. Substantial advancements can be anticipated in the forthcoming decade, supported by strategic backing from the Nation as a whole.

6. Limitations

6.1 Evaluation Framework

The assessment framework utilised in this report predominantly draws upon the four pivotal development objectives, delineated in the Hong Kong Innovation and Technology Development Blueprint, to establish Tier 1 indicators. While supplementary Tier 2 indicators are incorporated, their comprehensiveness remains limited. In contrast to the Global Innovation and Entrepreneurship Index (GIHI), with its three-tier system that comprises 31 parameters, or the Global Innovation Index (GII), which employs a 5+2 Pillar Indicator System that encompasses 81 parameters, our existing indicator system offers only preliminary guidance for policy recommendations. By further refining and expanding the evaluation framework, more precise and detailed policy suggestions can be developed.

6.2 Data Sources

It should be noted that certain data presented in this report might not reflect the most recent information available. For instance, when comparing Hong Kong to other regions in Greater China in the Innovation and Technology Index, the data is based on 2020 figures due to limited access to more recent indicators. This limitation could potentially affect the accuracy of the policy recommendations provided. Furthermore, certain datasets, such as the market value of high-tech enterprises and venture capital investment, are proprietary and necessitate procurement from commercial statistical agencies. Efforts will be made to acquire these datasets to facilitate further analysis.

Additionally, it is important to acknowledge that using the profits of high-tech enterprises and average venture capital deal size as proxies for the strength of the local technology economy and market vitality may not provide a comprehensive representation. As these indicators capture specific aspects of the ecosystem, they may not fully capture its overall dynamics.

Moreover, the current evaluation framework relies on single-year data for each KPI. Future iterations of the framework will incorporate data from previous years to estimate growth rates and projections based on the latest policies and developments. This will provide a more comprehensive understanding of the trajectory and potential of the I&T landscape. As such, continuous efforts will be made to enhance the data quality, expand the range of indicators, and incorporate multi-year data to refine the evaluation framework and ensure robust policy recommendations.

7. Conclusion

The Hong Kong Innovation and Technology Development Blueprint outlines four visionary goals and eight key strategies established by the Hong Kong Government to advance the growth of the I&T industry. In order to gain deeper insights into Hong Kong's present standing and identify areas for enhancement, this study has introduced a novel evaluation system, namely the PolyU Hong Kong Innovation and Technology Index.

The study revealed several challenges faced by Hong Kong, including a comparatively lower number of I&T talents and start-ups, when compared to other regions in Greater China. Additionally, the I&T index of the GBA was assessed in relation to three other major Bay Areas worldwide. The findings indicated that the GBA ranks 3rd among these regions, with room for improvement in areas such as R&D and start-up initiatives, when compared to the leading San Francisco Bay Area (ranked first) and the Tokyo Bay Area (ranked second).

The report presents recommendations that address the identified challenges in Hong Kong and the GBA. Nevertheless, there remain areas that require further attention. The indicator system will undergo continuous refinement to establish a comprehensive and reliable tool for policymakers, offering guidance and quantifiable insights. It is believed that Hong Kong, leveraging its distinctive advantages, has the potential to emerge as a prominent I&T hub within Greater China and it can lead the GBA towards achieving recognition as an international innovation and technology hub, while operating under the "One Country, Two Systems" principle.

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About Policy Research Centre for Innovation and Technology (PReCIT)

The Policy Research Centre for Innovation and Technology (PReCIT) was founded in 2022 as a university-level interdisciplinary policy research centre. Led by Prof. Christopher CHAO, Vice President (Research and Innovation) of PolyU and Director of PReCIT, and Prof. Eric CHUI, Head of the Department of Applied Social Sciences and Co-Director of PReCIT of PolyU, the Centre aims to support Hong Kong's innovation and technology (I&T) development in the GBA via interdisciplinary collaborative research including but not limited to carbon-neutral cities, I&T development in the GBA, and the Belt and Road Initiative's development in Southeast Asia.

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Appendix: Indicator Values by Regions in Greater China

Rank	Region	KPI 1 R&D	KPI 2 Start-ups	KPI 3 Talent	KPI 4 Industry	KPI 5 Impact	Combined Index
1	Guangdong	2.03	2.08	1.00	0.46	1.20	6.77
2	Jiangsu	1.88	1.21	0.86	0.48	0.77	5.20
3	Beijing	2.22	1.68	0.15	0.14	0.52	4.72
4	Zhejiang	1.66	0.91	0.83	0.46	0.75	4.61
5	Taiwan	1.65	0.31	1.13	0.48	0.71	4.28
6	Shanghai	1.74	1.03	0.26	0.32	0.54	3.89
7	Hong Kong	0.82	1.09	0.29	0.00	1.33	3.53
8	Shandong	1.37	0.51	0.39	0.41	0.32	3.00
9	Fujian	1.22	0.30	0.31	0.47	0.60	2.90
10	Anhui	1.23	0.33	0.26	0.39	0.42	2.63
11	Hubei	1.20	0.34	0.23	0.43	0.42	2.62
12	Tianjin	1.44	0.26	0.23	0.39	0.20	2.52
13	Jiangxi	1.05	0.33	0.22	0.46	0.45	2.50
14	Hunan	1.16	0.37	0.22	0.39	0.36	2.49
15	Liaoning	1.07	0.44	0.13	0.41	0.29	2.35
16	Sichuan	1.03	0.46	0.14	0.36	0.34	2.34
17	Chongqing	1.13	0.22	0.18	0.36	0.42	2.32

	Region	KPI 1 R&D	KPI 2 Start-ups	KPI 3 Talent	KPI 4 Industry	KPI 5 Impact	Combined Index
18	Henan	1.11	0.25	0.23	0.42	0.19	2.21
19	Hebei	1.08	0.34	0.15	0.42	0.13	2.10
20	Shaanxi	1.02	0.27	0.11	0.44	0.17	2.01
21	Ningxia	0.92	0.23	0.07	0.43	0.31	1.95
22	Yunnan	0.85	0.16	0.05	0.29	0.49	1.85
23	Guizhou	0.82	0.11	0.06	0.33	0.50	1.83
24	Guangxi	0.82	0.13	0.04	0.30	0.48	1.79
25	Shanxi	0.92	0.08	0.08	0.50	0.10	1.68
26	Nei Mongol	0.88	0.02	0.05	0.42	0.28	1.64
27	Gansu	0.79	0.11	0.02	0.33	0.35	1.60
28	Jilin	0.79	0.11	0.03	0.37	0.25	1.56
29	Qinghai	0.72	0.13	0.01	0.34	0.32	1.52
30	Macao	0.03	0.83	0.00	0.00	0.65	1.51
31	Heilongjiang	0.78	0.17	0.04	0.30	0.17	1.46
32	Xinjiang	0.72	0.07	0.01	0.34	0.17	1.31
33	Hainan	0.49	0.02	0.01	0.12	0.62	1.26
34	Tibet	0.00	0.00	0.00	0.09	0.64	0.73

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