Tertiary education and innovation in the Greater Bay Area

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Abstract

Purpose – The purpose of this paper is to discuss the necessity of tertiary education in promoting innovations of the Guangdong-Hong Kong-Macau Greater Bay Area by using cases from other well-developed bay areas.

Design/methodology/approach – The paper used cases from bay areas of the USA and Japan to discover approaches that have been used to strengthen collaborations between tertiary education and industries by innovations.

Findings – This paper found that bay areas in the USA and Japan have adopted or developed various approaches to enhancing collaborations between tertiary education and industries. In the San Francisco Bay Area, the well-established knowledge transfer offices in universities help scholars to discover the commercial value of academic findings and help business in reverse. In New York Bay Area, big corporations built research institutes for universities with considerable findings. In Tokyo Bay Area, corporations and universities have developed various internship programs for different levels of students and also provide funds for universities to conduct research works.

Originality/value – This paper analysed approaches that using by other well-developed bay areas through real cases, and suggested that the Guangdong-Hong Kong-Macau Greater Bay Area should adopt these experiences in order to strengthen collaborations between tertiary education and industries to promote innovations.

Keywords Innovation, Tertiary education, The Greater Bay Area development

Paper type Viewpoint

In 2015, the Chinese Government started to actualise its initiative of building "The Belt and Road Initiative (BRI)" and mentioned the possibility of establishing the "Guangdong-Hong Kong-Macau Greater Bay Area" (GBA) as an extension of BRI (National Development and Reform Commission, 2015). In 2017, in his reports on the government's future developmental strategy, Prime Minister Li Keqiang introduced the national policy of establishing the GBA which covers nine cities in Guangdong Province (Guangzhou, Shenzhen, Zhuhai, Foshan, Dongguan, Zhongshan, Jiangmen, Huizhou and Zhaoqing), Hong Kong and Macau (Xinhua News Agency, 2017).

To promote innovation in industries to increase competitiveness in the global market, local governments of Hong Kong, Macau and Guangdong signed the Outline Development Plan for the Guangdong-Hong Kong-Macau Cooperation in the Development of the Bay Area in early 2019 (Constitutional and Mainland Affairs Bureau, 2019). The outline development plan emphasised seven key cooperation areas: infrastructure connectivity, market integration, technological innovation, modern system of industries, quality living circle, international cooperation and establishment of cooperation platforms (Constitutional and Mainland Affairs Bureau, 2019). Within these areas the GBA aspires to achieve, one of its most urgent and significant goals is to innovate industries.

Apart from well-established infrastructure, what is the most important single factor for Hong Kong's or the GBA's rapid development? The quality of the labour force is vital. To promote industries through innovation, the abundant tertiary education resources in the GBA could be used as an engine that drives industrial innovation. After introducing key features of the GBA, this paper first analyses current tertiary education and the development of manufacturing industries in the GBA by using various cases from other well-known bay areas. This paper suggests that industries and academia should be more cooperative in transferring

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knowledge and technology from universities or research institutes to the real economy, the part of the economy that produces real goods and services, rather than selling and buying invisible capital in financial markets.

1. Features of the GBA

The geography of the GBA is favourable for the development of innovative and technological industries. The GBA consists of nine cities in Guangdong Province, Hong Kong and Macau, located on the Southeastern Coast of China. In the GBA, approximately 67m people live in 56,500 square of kilometres of land, which is double the population of the Tokyo Bay Area, and the land is three times larger than San Francisco Bay Area (Deloitte, 2018). The population and rich land resources provide more possibilities for land use accumulating human capital. However, the talent pool in the GBA is relatively weak. The proportion of the population with a university degree in the San Francisco Bay Area is as high as 46 per cent, while in the GBA, the proportion of the population with higher education is only 17.47 per cent. The highest proportion of the GBA is Hong Kong, but it accounts for only 26.18 per cent (CCG, 2018).

In terms of transportation, mainland cities are connected through the train system and traditional highways with bridges. Besides established bridges, subways and ferries between mainland China, Hong Kong and Macau, the newly built Hong Kong-Zhuhai-Macau Bridge and high-speed railway from Hong Kong to the mainland have further reduced commuting time when people travel in the GBA. Chow (2017a) suggested that the new high-speed train can be an opportunity for Hong Kong to develop more opportunities in Guangdong and other inland cities since the railway is connected with the mainland's high-speed rail network.

In regard to the economy, the GBA's Gross Domestic Product reached $1.38 trillion in 2016, with annual growth of about 7.9 per cent, mainly reliant on industries in technology, finance and manufacturing (Research Office of Legislative Council Secretariat, 2018). The GDP of this area was listed as the eleventh-largest economy in the world, surpassing countries like Russia and South Korea (Research Office of Legislative Council Secretariat, 2018).

In summary, the GBA is equipped with favourable resources among all bay areas, including abundant human resources, land resources, decent infrastructure and policy support. Thus, the critical challenge for developing the GBA is the integration of resources from different stakeholders and the input of energy into innovation.

2. Manufacturing industry in the GBA

When economic reform commenced in the late 1970s, Shenzhen and eight other cities near the Pearl River Delta (PRD) began their economic transformation by developing labour-intensive industries such as food, toys and clothes (Hong Kong Trade and Development Council Research, 2018). After a few years of development, light industries in Hong Kong, Taiwan and Macau gradually relocated to the PRD as a result of its low labour costs (Liao and Chan, 2011). According to Enright, Scott and Dodwell (1997), 80 per cent of investments in the PRD were from Hong Kong. This wave of manufacturing relocation was named the PRD model, which involved overseas Chinese investment in the PRD, especially capital from Hong Kong (Liao and Chan, 2011). From the 1990s to the present, besides low-end, labour-insensitive industries gradually moving to inland provinces, the PRD developed industries in high-tech electronics, machinery, chemicals and automobiles (Hong Kong Trade and Development Council Research, 2018). In 2005, the Guangdong government proposed a "dual track transformation," which required transformations in both the economy and society to get rid of "lock-ins" which limit the PRD to a "world factory" in the global market (Yang, 2012). In economy, the resource-based economy should transform into an innovation-based economy.

2.1 Transformation

In 2008, the global financial crisis caused the needs of foreign markets to decline, which led to economic problems for export-oriented enterprises in the PRD (Federation of Hong Kong Industries, 2015). According to the Information Services Department of the Government of HK SAR (2007), more than 60 per cent of foreign direct investment in Guangdong (including Hong Kong, Macau and Taiwan) in 2006 and 2007 was capital from Hong Kong. The majority of Hong Kong investments in Guangdong were in export-oriented enterprises, which were later hit by the financial crisis of 2008. Thus, enterprises in Guangdong focussed on the domestic market instead of the decreasing foreign markets, which were initially the main focus of the local government in 2005 (Song and Wang, 2016).

In addition, the mainland government chose to balance foreign and domestic investments to stabilise the market when it was under pressure from the global economy (Song and Wang, 2016). With the continued decline in economic growth, in 2014, President Xi Jinping admitted that the economy was slow-growing, and identified it as the "new normal condition" (Song and Wang, 2016). The rapid growth of the economy based on the demographic dividend was no longer an advantage for China. A possible solution to help improve the future economy is to promote the competitiveness of innovative products.

In the post-financial crisis era, the PRD encountered numerous challenges. First, industries in the PRD lack sufficient labour resources, which includes general labourers, skilled workers and talent. According to Li *et al.* (2014), the labour shortage was approximately 180,000 in early 2018 (Wang, 2018). The shortage of labour is not only a cause of concern for labour-intensive industries, it also increases the cost of labour, which intensifies the burden for enterprises. Due to competition for migrant labour between economic regions in China, the cost of labour increased, causing the average wage to increase several times since 2000. According to Yang (2012), who studied the average wage in Shenzhen, the average minimum wage almost doubled from 2002 to 2010. The Federation of Hong Kong Industries found that 30 per cent of corporations with capital from Hong Kong suggested their labour costs increased from 21 to 40 per cent since 2008 (Federation of Hong Kong Industries, 2015). The low price of products caused by the low cost of labour was no longer an advantage for enterprises in the PRD. In addition, the New Labour Contract Law, which was implemented in 2008, further weakened the previous advantage China's enterprises had through using cheap labour that minimised employees' welfare (Wang, 2012).

The second and most critical challenge is the lack of competitiveness of products due to a shortage of technological innovation. As a result of losing the advantage of cheap labour cost, firms in the PRD began to press for transformation and upgrade. There are two major strategies to transform and upgrade industries in the PRD. First, in the early 2000s, the Guangdong government gradually required enterprises in the PRD (mostly invested by Hong Kong capital) to make an institutional change from the form of the "three-plus-one" trading-mix (*sanlaiyibu*) to the form of the three types of foreign-funded enterprises (*sanzi*) (Yang, 2012). *Sanlaiyibu* refers to foreign-invested enterprises with equipment, technology and marketing channels cooperating with Chinese local governments regarding land, factory buildings and labour forces (Industrial Association of Macau, 2011). *Sanzi* refers to three types of enterprises with foreign investors in China: Sino-Foreign Equity Joint Ventures, Sino-Foreign Cooperative Joint Ventures and Wholly Foreign-Owned Enterprises (Industrial Association of Macau, 2011).

This institutional transformation was the result of numerous export-oriented enterprises relying heavily on subsidies and tax returns from local governments rather than increasing the competitiveness of their products and making profits from foreign markets. Furthermore, local governments gradually lost control of foreign-invested enterprises and lost opportunities to learn advanced management skills for local enterprises, which violated the original intention of introducing foreign investors into mainland China. Therefore, it was

necessary to make institutional changes in foreign-invested enterprises, especially after China joined the World Trade Union, which emphasises institutionalisation and normalisation of the economy. Second, the idea of "dual relocation" suggested that labour-intensive enterprises and low-end industries should relocate to mountainous terrains with relatively less-developed economies in Guangdong and relocate high-quality labour and talents to the PRD for innovation (Liao and Chan, 2011). As mentioned, the overall wage of Guangdong has increased significantly since the beginning of the twenty-first century, which pushed labour-intensive industries to escape Guangdong and relocate to inland provinces such as Jiangxi and Henan rather than other places in Guangdong, even Southeast Asian countries (Yang, 2012). The relocation of labour-intensive industries within Guangdong Province to maintain labour-intensive and high-tech industries has become a pseudo-proposition, and innovation is becoming the only way to maintain economic growth of the PRD and its stakeholders like Hong Kong and Macau.

In 2015, the Hong Kong Government adopted a new strategy, "Industry 4.0", first proposed by the German Government in 2013 (Hong Kong Productivity Council, 2018b). Industry 4.0 suggests that a combination of sensors, internet, big data and other advanced technologies should be used to create a smart and automatic production line for manufacturing industries (Hong Kong Productivity Council, 2018b). With the influence of Industry 4.0, the mainland government implemented its "Made in China 2025" plan, and the Hong Kong Government announced its "Reindustrialisation" plan to promote the competitiveness of products through technological innovation and integration. In the Made in China 2025 plan, the Chinese Government believes that innovation-driven development is the primary strategy, followed by quality, eco-friendly, structure and human capital (State Council of the People's Republic of China, 2015).

Similarly, Hong Kong's Reindustrialisation plan emphasised promoting innovation through the accumulation of human capital from academic institutions. For instance, the Hong Kong Government has established a two billion Hong Kong dollars fund programme, "Midstream Research Programme for Universities", to encourage local universities to conduct research on robotic technologies, smart city and so on (Hong Kong Productivity Council, 2018a). According to Chow (2017b), if reindustrialisation can successfully implement collaboration amongst different stakeholders in Hong Kong, then Hong Kong will regain its advantages in manufacturing industries by using the brand effect of "Made in Hong Kong". In addition, the gain of Hong Kong's advantages in industries can speed up the process of Made in China 2025, which will involve advanced technological products commercialised in the mainland with the help of Hong Kong (Chow, 2017c).

With respect to the discussions above, there is no doubt that the best way to maintain economic growth and create a win-win situation for stakeholders in the GBA is through the development of technological and innovative industries. According to Martin and Sunley (2006), the key determining factor for the GBA to get rid of the name "world factory" is to strengthen research institutions and accumulate human capital. Therefore, tertiary education should be the vanguard and source of power for development of the GBA, because research institutions and human capital are a good base for innovation.

3. Tertiary education in the GBA

As a result of reducing pressure and increasing the potential for development in the GBA, tertiary education is a priority sector that needs attention. According to Szücs (2018), who used data from the European Union, economic projects that involve academic institutions usually have higher knowledge spillover. Also, patents produced by academic institutions is a crucial factor for business projects that design new products (Szücs, 2018). Knowledge production, such as patents created by academic institutions, can improve the quality of business projects and help economic development be more innovative. Moreover, the Bay Area Council in California

believes high-quality education will attract more businesses to invest since local educational institutions are their talent pipeline, which helps sustain development of the Bay Area (Bay Area Council, 2018). Thus, there is no doubt that tertiary education is a key component that can influence the future of innovative and technological industries in the GBA.

According to data from Times Higher Education (THE) and Quacquarelli Symonds (QS), universities in Hong Kong are highly competitive in the world. Three universities – the University of Hong Kong (HKU), Hong Kong University of Science and Technology (HKUST), and the Chinese University of Hong Kong (CUHK) – are listed in the top 60 universities in the world, according to Times Higher Education (2019). Also, QS World University Rankings indicates that four Hong Kong local universities are listed in the top 60: City University of Hong Kong and the three universities mentioned earlier (Quacquarelli Symonds, 2019). Besides these rankings for universities, more than 40 Hong Kong scholars are members of the Chinese Academy of Science, and seven scholars are members of the Chinese Academy of Engineering, two of the most authoritative and representative academic organisations in China (Beijing-Hong Kong Academic Exchange Centre, 2017). Meanwhile, Hong Kong's universities have 16 National Key Laboratories. This suggests that Hong Kong has a high capability in developing high technologies.

In Guangdong, Sun Yat-Sen University and South China University of Technology in Guangzhou are listed in the Double Top University Plan of 36 Chinese universities, which indicates they have strong potential to become first-class universities in the world with first-class subjects (Ministry of Education of the People's Republic of China, 2017). Also, Guangdong has 11 National Key Laboratories operated by local universities and the Chinese Academy of Sciences, and this number surpasses most provinces in China. Compared with Hong Kong and Guangdong, Macau has limited human and land resources, but it still has four National Key Laboratories in subjects of innovative technologies (University of Macau, 2018). Besides these well-established academic institutions, the government of Shenzhen in Guangdong has developed strategies for building cross-regional cooperative universities, which encouraged the establishment of CUHK (Shenzhen), Sun Yat-Sen University (Shenzhen), Harbin Institute of Technology (Shenzhen) and Shenzhen MSU (Moscow State University) – BIT (Beijing Institute of Technology) University (Chow, 2017b).

Thus, if cooperation can be built between universities with strong innovative abilities and corporations or governments with financial and administrative power, tertiary education resources can help further the development of the GBA, especially in innovative and technological industries.

4. Tertiary education and industry

As a result of the urgent need for innovation in the GBA, tertiary education, which mainly refers to universities with research institutions, is indispensable to stakeholders in its development. According to the London School of Economics and Political Science (2014), in the chain of innovation, tertiary education is responsible for providing education and promoting research. In tertiary education in the GBA, HKUST received about 50 per cent (800m Hong Kong dollars) of total governmental funding for technological innovation from 2016 to 2019. The HKU and CUHK received the other half of public funding (Innovation and Technology Commission, 2019). Meanwhile, Sun Yat-Sen University received more than 3bn Chinese Yuan in the 2017–2918 academic year, more than tenfold that of HKUST (428m Hong Kong dollars) the same year. Thus, the huge investment in tertiary education in the GBA is able to secure the education and research work of universities.

In addition to the above two responsivities of higher education, the London School of Economics and Political Science (2014) suggests that building networks and collaborations with society is essential for stimulating innovation. Using Sun Yat-Sen University's academic year

2017–2018 as an example, only 17 per cent of research funds originated from non-governmental sources (Sun Yat-Sen University, 2018). Similarly, less than 8 per cent of research funds of HKU and CUHK were contributed by non-governmental sources (The University of Hong Kong (HKU), 2018; The Chinese University of Hong Kong (CUHK), 2018). Moreover, Times Higher Education (2018) shows that top universities in the GBA have relatively lower scores in the industry income (also known as knowledge transfer) category than do universities in other well-known bay areas. According to Madgett *et al.* (2005), interactions between tertiary education and the private sector, such as investments in academic research and commercialising research outputs, can help regional innovation. However, research funding received from society and knowledge transfer to society are not satisfactory in the GBA.

There is a lack of societal stakeholders in tertiary education. Madgett *et al.* (2005) believe that interactions between universities and private sectors are not only through donations but also investments that allow companies to participate in research with their practical ideas, experience and expertise that return benefits to academic research from their products. As a newly built bay area, the GBA must strengthen collaborations between tertiary education and industries. The following sections study cases of academia-industry partnerships in promoting innovation.

4.1 Case studies

According to Etzkowitz (1998), partnership between academia and industry is a process of transforming knowledge to capital. University–industry partnerships or academic-industry partnerships have been built and practiced in other famous bay areas for a long time. This section will introduce different models of cooperation in other bay areas through relevant cases.

4.1.1 San Francisco Bay Area. The San Francisco Bay Area, which contains approximately 8m residents, is on the west coast of the USA. The most famous location where high-tech companies gather is Silicon Valley. Silicon Valley has created a lot of well-known technological corporations, like Google and Apple, and is located in the south of the bay area. There are 34 public and 49 private universities or colleges in the San Francisco Bay Area. Within this area, Stanford University is one of the top three universities in the world, according to both QS and THE (Times Higher Education, 2018; Quacquarelli Symonds, 2018).

Also, the University of California (UC), Berkeley, is listed in the top 30 in both rankings. In the late twentieth century, academia, industry and the US Government started cooperation in accordance with the theory of public–private partnership with the coordination of the US Office of Scientific Research and Development. In 1980, the Bayh-Dole Act led to many universities in the USA establishing offices for technology transfer or technology licensing to help experts and scholars in academic research apply for patents and collaborate with non-academic institutions (Mowery and Bhaven, 2004). The main approaches of the office of the technology transfer or licensing are "push" and "pull" (Lee, 2009).

The push approach indicates that the technology transfer office is actively seeking opportunities from industries, which can be translated as selling research outputs to businesses (Lee, 2009). The pull approach refers to the technology transfer office passively waiting for a call from industries that would like to marketize any research results to the general public (Lee, 2009). By using these two strategies, research outputs contributed by academics can collaborate with industries to develop more profound value for their outputs.

4.1.1.1 The case of a cancer drug (Taylor, 2018). In the 1990s, immunologist Professor James Allison from the UC, Berkeley was working on a natural experiment to understand the role of T-cells in the human immune system. Coincidently, he discovered a protein receptor, CTLA-4, which could enhance the activity of T-cells and have an influence on

tumour cells. In other words, the CTLA-4 found by Professor Allison could have positive effects on people with malignant tumours, also known as cancer. Thus, Professor Allison and his colleagues at UC Berkeley published their findings in the journal Science and applied for a patent. Allison and his research team believed everybody would be attracted to their findings, especially pharmaceutical companies. However, for more than two years, no company was willing to collaborate with them to develop the commercial value of their findings.

In the late 1990s, Professor Allison and a company called NeXstar worked together to develop a cancer drug based on their findings, but failed after years of experiments. Fortunately, with the help of a friend, the pharmaceutical company Medarex finally agreed to continue the project and work with Professor Allison and his team. In 2011, after years of clinical trials, the US Food and Drug Administration approved the drug developed by Professor Allison and Medarex, 15 years after the research results were published.

According to Springer Nature Limited (2017), most labs do not have the resources to continue their research after they find valuable results and continue to commercialise their findings to the general public. Compared to academic institutions, industries have more funding, personnel and experience to actualise theories and merchandize academic findings. In this case, Allison luckily found a reliable partner and finally brought benefits to researchers, industries and the general public. Several problems need to be solved between academic researchers and industries due to institutional differences. For academic institutions and researchers, their primary mission is to discover new things and publish them once the findings are confirmed, even if the process takes years (Taylor, 2018).

However, industries wish to profit from academic findings immediately and may terminate projects that are difficult to profit from or have slow profitable abilities (Taylor, 2018). In addition, industries are usually unwilling to publish their findings to the public since they are worried about competition from rival industries (Taylor, 2018). Therefore, mutual understanding and trust, which can be helped through long-term cooperation from the beginning of projects and clear feasibility reports provided by the academic partner, between people who work in academia and industry are necessary.

4.1.2 New York Bay Area. The New York Bay Area, also known as the New York Metropolitan Area, is on the northeast coast of the USA, with a population of more than 20m. The economy of the New York Bay Area was listed as the number one of all US states in 2015, and its development is supported by industries (Statista, 2018). Many high-ranked universities are located in the New York Bay Area. According to Quacquarelli Symonds (2018) and Times Higher Education (2018), Columbia University, Princeton University and Yale University are listed in the top 20 of the world university rankings.

4.1.2.1 The case of International Business Machines Corporation (IBM) (New York Academy of Sciences, 2009). Besides the financial industry, such as the well-known Wall Street and fashion industry events such as New York Fashion Week, information technology industry also makes a significant contribution to development of the New York Bay Area. The most famous information technology corporation in New York is IBM, which is headquartered in Armonk, New York. As a New York-based corporation, IBM has built numerous collaboration programs with nearby universities. The Computational Center for Nanotechnology Innovations (CCNI) and Albany NanoTech are two major programs supported by IBM. CCNI is a $100m collaboration between IBM, New York's Rensselaer Polytechnic Institute and the government of New York State. Within this collaboration, IBM provides large-scale partnerships such as fellowships and internships, faculty and research awards, student competitions, mentoring programs and executive programs.

Another major nanotech programme is based at the College of Nanoscale Science and Engineering at State University of New York (SUNY Albany), Albany with funds from IBM. This programme has become part of IBM's research centre for microelectronics. By using these two major university–industry partnership programs, IBM believes that its collaboration with universities has become a key factor in its success and is essential to building relations with more partners, including government and industries, to organise more resources.

In addition to corporation-led partnerships in the New York Bay Area, local government has been leading collaborations between academic institutions and industry. The government of New York City has several programs to help people develop their careers, and some of these programs focus on university–industry partnerships. For instance, the Tech Talent Pipeline is designed to grow tech industries in the city through collaborations between City University of New York and the city's Departments of Education and Small Business Services (NYC Career Pathways, 2014). This programme is also supported by several philanthropic partners such as JP Morgan Chase, a well-known financial services corporation.

4.1.3 Tokyo Bay Area. Besides the San Francisco and New York Bay Areas, the other pioneer of regional collaboration is the Tokyo Bay Area, known as the Greater Tokyo Area or Capital Region. The Tokyo Bay Area has a population of 38m, and it is the second-largest bay area, behind only New York Bay Area before the GBA was established. In the Tokyo Bay Area, the University of Tokyo is listed in the top 30 of world university rankings, and the Tokyo Institute of Technology is listed in the top 60 (Quacquarelli Symonds, 2018).

4.1.3.1 The case of multiple internships. In establishing university–industry partnerships to promote innovation, Japan and cities in the Tokyo Bay Area developed three main strategies in the late 1990s. In 1997, the Japanese Government implemented the policy, Process of Educational Reform and Transformation of Economic Structure and Action Plan of Innovation, which emphasised a new model of developing practical talents through internship programs built by universities and industries (Yoshimoto, 2006). According to the two significant policies, Japanese universities developed two types of internships to develop talents. First, experiential internship suggests that the corporation provides winter or summer break internship opportunities and recruits students with the help of universities.

With experiential internships, the principal objective is to help college students understand the operation of corporations to provide ideas when students start their job search after graduation. In addition, the internship can help the corporation improve its reputation and fulfil its social responsibilities (Kong, 2017). Second, cooperative education, also known as Co-Op programs, also strengthen university–industry cooperation in innovation. Compared to experiential internship, cooperative education is dominated by universities rather than corporations, which indicates the university helps students find corporations that match their majors for long-term, paid internships (Kong, 2017). For instance, the famous Japanese corporations Fujisoft and Asahi Glass have collaborated with the University of Tokyo to build laboratories for technological innovation and provide practice opportunities for students (University of Tokyo, 2017).

In addition to attracting talent for innovation through internships, Japanese universities set up colleges of professional graduate studies to provide talent with practical and professional skills to society. For example, Kanagawa University often hires practicing lawyers to be instructors for students (Kong, 2017). Since the late 1990s, to promote development of Tokyo Bay Area and the overall economy of Japan, Japanese governments and universities have developed various types of collaboration with industries to help innovation and economic growth.

In summary, in the development of bay areas, San Francisco, New York and Tokyo have built areas with distinct features. In the San Francisco Bay Area, the Office of Technology Transfer helps academic researchers apply for patents and collaborates with industries to develop the commercial value of research outputs. In the New York Bay Area, leading local corporations invest significantly to build full-scale support for talented students. In the Tokyo Bay Area, various internship programs and professional training ensure the close relationship between universities and industries in transferring talent to encourage innovation.

5. Conclusion

In recent years, governments of mainland China, Hong Kong and Macau have concurred that industries in the GBA need innovation. Without constant innovation, the GBA's advantage will no longer remain strong compared to other economies in the world. Fortunately, compared to other bay areas in the world, the GBA has not only richer land resources and labour forces but also excellent academic institutions. In other words, the resources of tertiary education can be transferred to industries to help them innovate. Thus, it is necessary to coordinate governments, industries, research institutes and academia in promoting innovation, as Nicholas W. Yang, secretary of Hong Kong's Innovation and Technology Bureau, said in 2015 (News.gov.hk, 2015).

In practice, there are still many obstacles in cooperation between stakeholders within the GBA, such as the imperfect legal system and restricted entry-exit regulations, which may not be resolved in the next few years. However, as the knowledge source for innovation, academic intuitions like universities and laboratories can collaborate with each other and local or non-local industries. As other bay areas have demonstrated, universities should establish offices of technology transfer or knowledge transfer to develop more values of academic research outputs, as some universities in Hong Kong have done. Besides, local corporations in the GBA should actively build cooperation with universities by using their advantages in fundraising and commercialising their experiences to develop talents for innovation. Various internship programs are not only able to ensure the close relationship between students and society but also to ensure the academic outputs are relatively tied to current needs.

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