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Value Chain Analysis: A Study on the Guangdong-Hong Kong-Macao Greater Bay Area Urban Agglomeration

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Abstract:
The emergence of urban agglomeration is a new major form of driving force to urbanisation in this era. With the rapid growth of cities, an analysis on the functional division is vital to optimise the coordination among cities within its geographic cluster in order to accelerate further development. Value chain is initially derived from the theory of competitive advantage, with the evolvement and enhancement in the understanding of markets,this concept may be applied as a contemporary approach to analyse the functional specialisation of cities based on selective urban functions, namely, production, research and development, marketing, and management. This paper examines the specialisation of cities in the Guangdong-Hong Kong-Macao Greater Bay Area using the empirical data from 2008-2018.The results indicate that, core cities have a higher specialisation index in functions that possess high knowledge intensive characteristics, while peripheral cities have comparative advantage in labour intensive industries in the value chain.

Keywords: *Value chain, urban function, specialization index, Guangdong-Hong Kong-Macao Greater Bay Area*

1. Introduction

Since China's opening up, industrialisation and urbanisation has grown rapidly. The process of globalisation has impacted significantly on the economic performance and deepening of regional integration. The establishment of the Guangdong-Hong Kong-Macao Greater Bay Area was first raised in 2016 as part of China's 13th Five Year Plan. This was followed by the signing of the Framework Agreement on Deepening Guangdong-Hong Kong-Macao Cooperation in 2017. The Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area (hereafter, the Plan)was issued in 2019 to recognise the new wave of China's reform and opening up of the 9+2 cities.Strategically, GBA has ports as foundations which enables cross border economic cooperation in trade, market and investment. Politically, it has a special 'one, two, three, four' characteristic, representing 'one country, two systems, three custom zones, four core cities'. Geographically, the GBA possesses a natural advantage, situated on the southern coastal front, provides an expansive foundation in promoting the One Belt One Road initiative. Socially, the tourism industry in Guangdong, Hong Kong and Macao each has unique characteristics with a combination of Chinese and Western cultures, not only is it a complementary advantage, but also generates cultural synergy.

With the economic reform, the changing orientation of cities within the Pearl River Delta (PRD) region and the neighbourhood, Hong Kong and Macao have led to the continuous shaping of the urban structure. One of the direct motives of regional integration is to break through the bottleneck of economic development confronted by each region. In the PRD, the main problems are identified by the rising cost of production and the urgency of industrial homogeneity. For Hong Kong, the major drawback is the limited geographical area resulting in increasing prices, forcing the manufacturing industry to hollow out. For Macao, the economy is overly reliant on the gaming business as its only pillar industry, which leads to a series of undesirable social effects. The industrial structure does not only define the distribution of industries in the urban agglomeration, but also suggests the correlation of industries within the city and how coordination with other cities will play an important role in the performance of its neighbouring cities.

It is of great practical significance to explore the industrial chain division in the different targeted levels of cities in the GBA. Urban agglomeration is a spatial carrierfor value chain, while value chain is a functional channel for urban network between cities. Hence, the urban agglomeration not only reflects the geographical proximity, but also the functional relevance. An appropriate division of labour among the cities within the urban agglomeration will enable each city to benefit from the economies of scale and form mutual advantages and complementarity within the region.Value chain stems from a vertical division system that disaggregates strategically relevant industries into different value segments in order to focus on the sources competitive advantage. Core cities are likely to specialise in high value-added segments, while peripheral cities will focus on industrial divisions.This study attempts to analyse the specialisation of cities in the Guangdong-Hong Kong-Macao Greater Bay Area using the empirical data from 2008-2018.

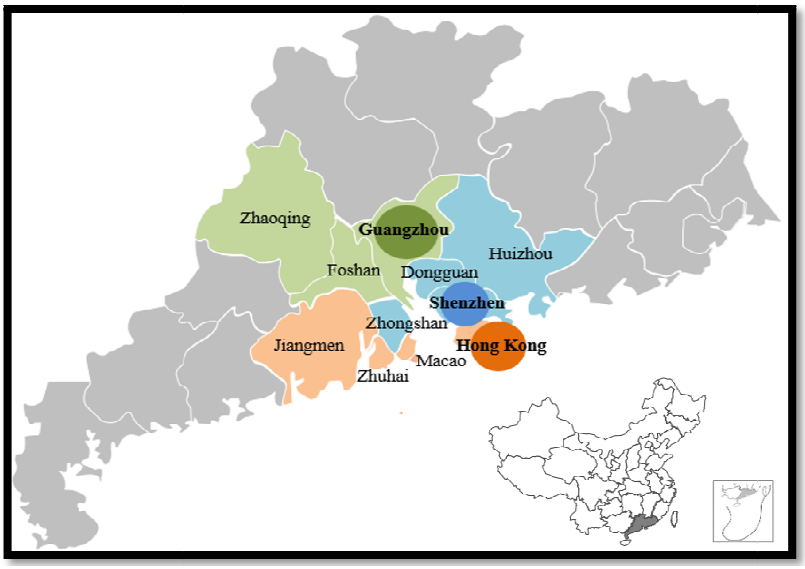

Figure 1: Cluster Groups in the GBA

2. Related Literature

The concept of value chain was first familiarised by Porter (1985) as a framework for strategically assessing how the division of activities within a firm will impact the business structure.Normally value is understood in its competitive terms, which is the price at which consumers are willing to pay for the firm's production units. In conceptual terms, value is the accumulation of overlapping activities without distinct differentiation. The term, chain, invokes that it should be of lineal order, however oxymoronically, value, implies that activities may be accrued layers of attributes interrelating one another without a distinct boundary or clear cut. Value producing measures may essentially reflect a cobweb-like or spatial network, particularly evident in an urban agglomeration study, rather than a simple chain (Ensign 2001). Porter (1985) particularly introduced the construction of value chain from a firm level perspective to refine the focus, as an industry-wide value chain may be overly multifaceted. Similar studies provide related perspective; see e.g. Bolton and Whinston (1993); Grossman and Helpman (2001).

Value does not occur alone, in a competitive environment, the industrial structure will determine the competitive advantage of that city, and the strategy it utilises in conjunction to its neighbouring cities. In simple terms, the competitive advantage stems from the production, research and development, marketing, and management functions of a firm or industry, and value chain analyses the effect these functions in order to determine the value it has created for the firm or industry. O'Sullivan and Geringer (1993) further distinguished that a natural value chain is what a firm has to do with its resources to realise its competitive strategy, while the contrived value chain is the subsequent step to how the natural value chain is executed. In a naturally endowed geographic region, competitive advantage may be in the form of integrating industries and coordination of cities. To optimise the value chain, the interrelationship created between cities are based on the vertical integration of functional industries. Earlier studies explore the function of competition and agglomeration where diverse activities in the value chain are performed in the same place (Baum and Haveman 1997). While later research considered strategic value location choices to have various impacts on different value chain activities due its geographical dispersiveness (Alcácer 2006).

Value chain related research is not only limited to a company level, but also a method integrated to urban functional structure. On a city-wide level, centralised and decentralised cities depend on its proximity to the central business district, which is employed to determine where to appropriately allocate urban functions based on value added factor of the value chain in order to minimise costs, see e.g. Anas, Arnott and Small (1998); Glaeser and Kahn (2006). With regional integration, scholars have conducted empirical studies on the evolution of urban network with the synergies and complementarities of polycentric cities, and found that spatial and functional integration, and economic complementarity are important basis for the development of urban network, see Meigers (2005); Meigers and Burger (2010).

There are relatively minimal urban functional studies from a value chain approach. Most of the earlier studies on the urban function are either static or comparative between time periods see e.g. He and Liu (2016); Lao et al. (2017), while very little provide a complete picture of the evolving changes present in an urban agglomeration. Shi, Zhu and Huang (2017) attempt to use value chain as the basis to divide the urban function, however, the primary sector, which is not an urban function was included in the study. From the above research on urban functional division, while scholars have chosen different methods in their studies, it is limited to measuring a comprehensive urban function specialisation index (Su& Zhao, 2011). This does not directly reflect the value segments of the urban functional specialisationcatergorised by production, research and development, marketing, and management functions. In addition, it is of great significance for cities to divide their work based on the current development of an urban agglomeration, however, existing research on urban functional specialisation explores all industries individually, furthermore including the primary sector, neglecting the current planning of cities and industrial focus from a value chain prospect.

3. Sample, Data and Methodology

3.1. Sample and Data

This paper explores the urban functional specialization transformation of 11 metropolitans of the GBA, which comprise of the PRD in the Guangdong Province, viz., Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing, and the two special administrative regions, Hong Kong and Macao. This research examines a 11-year period between 2008-2018, in which was a challenging time for many economies during the global financial crisis, followed by the debt crisis in 2012.

The most practical and reliable sources to obtain employment data for the cities are the 2009 to 2018 China Statistical City Yearbook, Hong Kong Annual Digest of Statistics and the Macao Yearbook of Statistics. With reference to the 2017 Industrial Classification for National Economic Activities of China (GB/T 4754-2017), the employment sector comprises of 19 categories, however, as the main function of services performed by the urban agglomeration are based on the secondary and tertiary industries, the primary industry (agriculture, forestry, animal husbandry and fisheries) is omitted from the study. Of the remaining eighteen categories, 6 kinds are selected and merged into 4 functional specialisations based on Duranton and Puga (2001); Bade, Laaser and Soltwedel (2004); Duranton and Puga's (2005) classification, which are production, research and development (R&D), marketing, and management functions (see Table 1). The industry classification for Hong Kong and Macao differ to that of the mainland, thus accordingly, categorisation is based on the above standards as shown in Table 1.

The employment data for scientific research, technical service and geological prospecting is unavailable for Macao due to the nature of its economic and industrial development, hence, there is no specialisation index result for the research and development function.

Function	Industry Classification	Sector
Production	Mining	Secondary
	Manufacturing	
	Production and Distribution of Electricity, Heat, Gas and Water	
Research and Development	Scientific Research, Technical Service and Geological Prospecting	Tertiary
Marketing	Wholesale and Retail Trade	
Management	Leasing and Business Services	

Table 1: Value Chain Categorisation
Source: All Cities Are Based on the 2017 Industrial Classification for National Economic Activities of China (Gb/T 4754-2017)

3.2. Method

In previous studies of urban functional classification, methods such as the Nelson's classification has been used extensively to measure the functional intensity of industries. The proportion of the labour force of a city engaged in carrying out a function is perhaps one of the best approaches for measuring the spread of the function, but it cannot accurately determine the intensity level as it does not take into account the effect of different sized cities when applied for comparison between inter-cities. Likewise, principal component analysis and cluster analysis are widely used to categorize the function of each city but cannot quantitatively determine the specialization level of a certain function for a specific city.

Location quotient, however, can measure the level of the functional specialization of a city and determine whether a specific city has a comparative advantage within the urban agglomeration, or if a certain urban agglomeration exhibits particular specialization characteristics. The location quotient (LQ_{ij}) method to calculate the four urban functions is shown below:

$$LQ_{ij} = \frac{e_{ij}/e_i}{E_j/E} \ (i = 1,2,3 \dots n)$$

Where LQ_{ij} is the specialisation index for one of the four urban functions of city i, e_{ij} is the number of employed people in urban function j in city i; e_i is the number of employed people in city i; E_j is the total number of employed people in function j within the urban agglomeration; and E is the total number of employed people in the urban agglomeration.

LQ takes a value between $(0, +\infty)$, normally when the value of LQ_{ij} is greater than 1, $LQ_{ij} > 1$, the proportion of a function in a certain city in comparison to the other cities within its urban agglomeration is above the average, which indicates that this function industry is dominant within its region. When the value of LQ_{ij} is below 1,$LQ_{ij} < 1$, it implies that this function industry is relatively weak within its region. When the value of LQ_{ij} is equal to 1, it indicates that this function industry is relatively neutral within its region.

4. Results

Graphs1a.-1d. illustrates the results for the specialisation index of the 11 cities in the production, research and development, marketing, and management functions. There are obvious differences in the specialisation levels between the core cities and the peripheral cities, and their coordination of urban functions. Amongst the knowledge intensive

functions, specifically, marketing, management and R&D, the four core cities are ranked in the top 4 within its urban agglomeration (see Table 2).

Hong Kong and Guangzhou concentrate on knowledge intensive functions in the urban agglomeration, which mainly are R&D, marketing and management functions, and other high performing value-added segments of the value chain. Shenzhen is also strongly capable of performing R&D, and suitable for carrying high-end production for its strong ability to convert R&D outcomes, given the significant advantage of advanced and high-tech companies and its seaport and close ties with peripheral cities. Macao is strong in the management function due to its advantage in leasing and business services. The regional cities coordinate to focus on the different types of manufacturing and may receive geographical support from its neighbouring core city. As Zhuhai, Foshan, Dongguan and Zhongshanneighbour the core cities, it works as small centres in the urban cluster by taking advantage of the convenient transportation networks for its supply chain in advanced and high-tech manufacturing productions and logistics. Given the relatively weak knowledge-based functions in Huizhou, Jiangmen and Zhaoqing, it undertakes more traditional manufacturing production and assembly line.

In order to optimise the significance of the value chain, cities will need to enhance the division of labour to achieve a better outcome for the entire urban agglomeration. The core cities have the ideal resources to strengthen the knowledge-intensive functions while the regional cities have a strong competitive industrial system that show potential in the production function. The benefit of an urban agglomeration is the institutional openness between the cities, which helps to eliminate market barriers and reduce the uncertainty of transactions

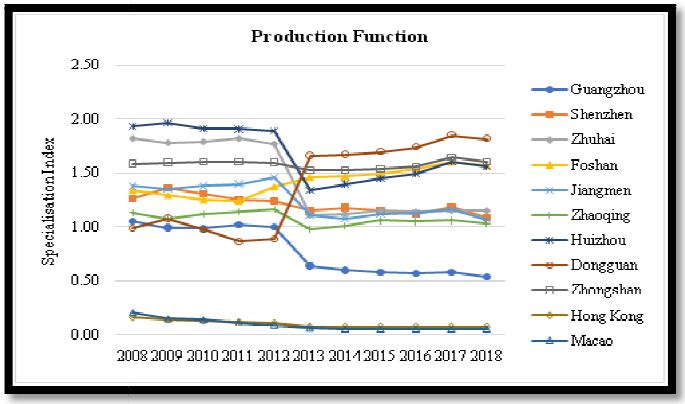

Figure 2: Production Function Specialisation Level 2008-2018

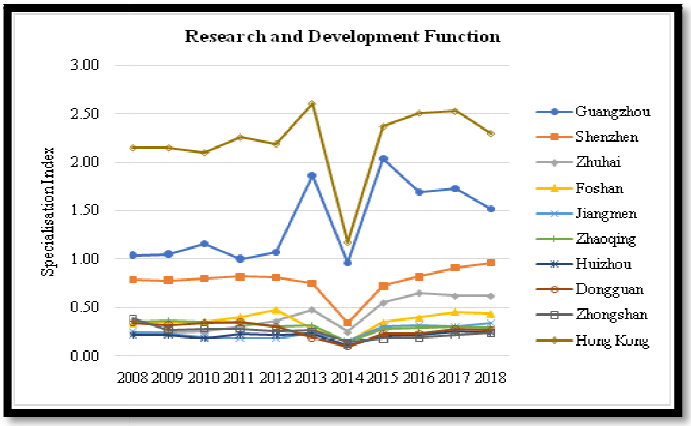

Figure 3: Research and Development Function Specialisation Level 2008-2018

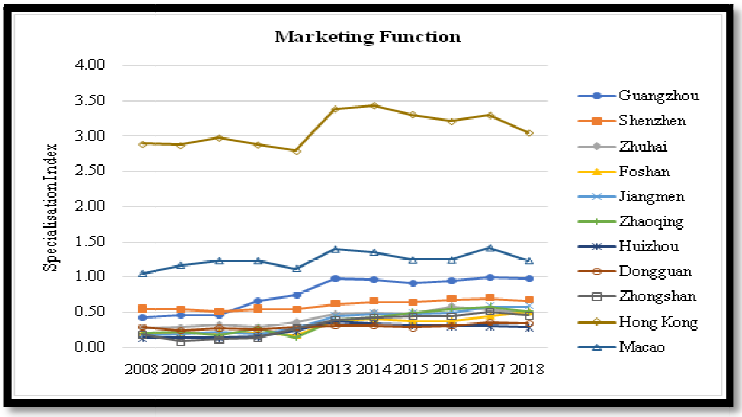

Figure 4: Marketing Function Specialisation Level 2008-2018

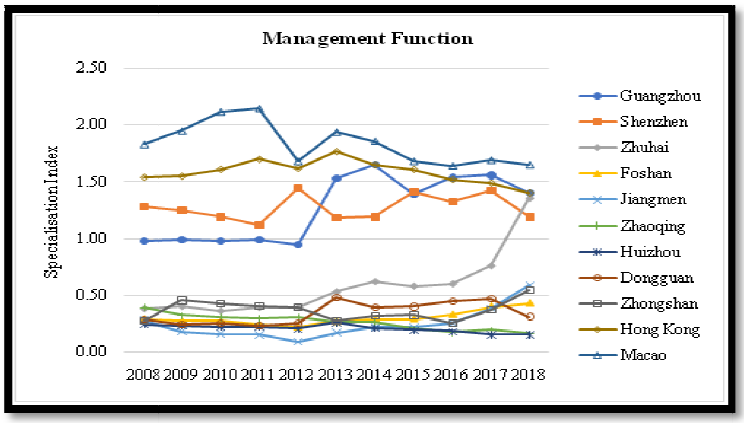

Figure 5: Management Function Specialisation Level 2008-2018

4.1. Production Function

This function is comprised of the three industries (mining, manufacturing, and production and distribution of electricity, heat, gas and water) from the secondary sector. Mining of natural resources is finite, and accordingly, the number of people employed has fallen from year to year, and in some cities, there are no employment data recorded for this category. Each city maintains a certain level of electricity, heat, gas and water in order to facilitate vital functioning of the city. The top four cities ranked in this function are Dongguan, Zhongshan, Foshan and Huizhou, all of which have objectives to target high-tech, electronics and information, and advanced manufacturing as specified in the Plan. From 2008-2012, the specialisation index is relatively stable for the eleven cities. Through 2012, both the European and American debt crisis persisted, and the China's economic reform has impacted China's financial system, and the effect on the real economy has mainly a decrease in foreign trade, namely manufactured products. While in Dongguan, there was an exceptional surge (see graph 1a) since the municipal government implemented a strategic aim to 'accelerate transformation and modernisation'. By 2018, all cities show a fall in the number of people employed in the manufacturing industry. The specialisation index for Hong Kong and Macao almost mirrored each other and are ranked 10th and 11th respectively.

4.2. Research and Development Function

Due to the unique industrial structure of Macao, even in the last ten years or so, Macao still lacks development in the science and research field, thus it does not have recorded statistics of the number of people employed in the scientific research, technical service and geological prospecting industry. But in recent years, given the urban size to population ratio, Macao has developed four top national key laboratories, which is an unprecedented innovation, hence the size of science and research field should see growth. The three core cities, Hong Kong, Guangzhou and Shenzhen are ranked top three in the specialisation index for this function, which meets the expectations of the urban orientation proposed in the Plan. Only Hong Kong and Guangzhou have a specialisation index above 1.00, which shows the dominancy in this function. The LQ result is a measure of the relative R&D functional index, which indicates that the fairly stable R&D functional specialisation trend does not imply that the R&D level of each city has not improved, such results show that whole agglomeration has a rather steady developmental pattern throughout the period, except for unexpected events (see graph 1c). The significant V-shaped plunge in 2014 is likely related to the nation's active implementation of supply-side structural reform and a period of recovery from the market. With the ongoing adjustment and greater focus of the industry, the R&D specialisation index in the following years gradually recovered to the previous level. It is still to mention that the scientific research, technical service and geological prospecting industry is still reasonably weak in most peripheral cities.

4.3. Marketing Function

There is a marginal growth for most of the cities in this function. Wholesale and retail trade is a major activity in Hong Kong and makes up a large employment proportion. It possesses a considerably strong specialisation index that surpassed the second ranked city, Macao, with an LQ of 3.05 in 2018. The remaining two core cities, Guangzhou and Shenzhen are ranked 3rd and 4th respectively. Only the top three ranked cities have a specialisation index above 1 in 2017, and the remaining eight cities have an average location quotient of 0.50, which is substantially weak. While regional cities have a dominant role in the secondary sector, it will gradually strengthen in the marketing function as the wholesale and retail trade industry will take a stronger position in the tertiary sector when cities in the urban agglomeration move in one direction towards a more developed cluster. With the continuous development of internet and logistics, the promotion of major network marketing activities has become indispensable.

4.4. Management Function

The results illustrated (see Figure 5) for this function do not follow a particular trend. The problem shown in the leasing and business services industry is the relatively slow growth. As the GBA becomes more developed, cities have a more comprehensive social division of labour with greater leasing and business services. Zhuhai experienced are great leap in the specialisation index in 2018, ranked 4th behind Hong Kong, Guangzhou and Macao, but first time before

Shenzhen. The opening of the Hong Kong-Zhuhai-Macao Bridge has resulted easier and faster connection between the mainland and the special economic zones than ever before, which has resulted in increased investment in mainly leasing and business by over 280% in 2018, with real estate development contributed primarily by Hong Kong. Business service providers have a high degree of interaction between companies and customers that are generally knowledge centric. Much of the GBA is manufacturing dominant, with the rapid development of the manufacturing industry, the proportion of the services sector is still relatively small. As a rising activity, financial leasing has always played a major role in the leasing and business services industry. The competitiveness of Guangdong's financial leasing industry ranks first in China, since the second half of 2018, the liquidity of the market capital was quite abundant, and the coverage of financial leasing business continues to expand. While core cities are noticeably dominant, the GBA has constructed pilot free trade zones in peripheral cities such as Dongguan and Foshan to minimise the gap between cities within the urban agglomeration and taking geographic advantage to increase the penetration rate of the financial leasing market in the agglomeration and further, to the region.

City	Year	Production Function		Research and Development Function		Marketing Function		Management Function	
		LQ	Rank	LQ	Rank	LQ	Rank	LQ	Rank
Guangzhou	2008	1.04	8	1.04	2	0.42	4	0.98	4
	2013	0.64	9	1.87	2	0.99	3	1.53	3
	2018	0.54	9	1.52	2	0.99	3	1.40	2
Shenzhen	2008	1.26	6	0.79	3	0.55	3	1.28	3
	2013	1.15	5	1.15	3	0.62	4	1.18	4
	2018	1.09	6	1.09	3	0.67	4	1.19	5
Zhuhai	2008	1.82	2	0.24	9	0.27	6	0.38	6
	2013	1.11	6	0.48	4	0.47	5	0.53	5
	2018	1.15	5	0.62	4	0.49	8	1.36	4
Foshan	2008	1.34	5	0.34	6	0.21	7	0.29	7
	2013	1.46	3	0.28	6	0.37	9	0.27	7
	2018	1.57	2	0.44	5	0.51	6	0.43	8
Jiangmen	2008	1.38	4	0.25	8	0.17	10	0.28	8
	2013	1.11	6	0.24	6	0.45	6	0.17	11
	2018	1.07	7	0.34	5	0.58	5	0.59	6
Zhaoqing	2008	1.13	7	0.36	5	0.20	8	0.39	5
	2013	0.98	8	0.32	5	0.40	7	0.26	9
	2018	1.03	8	0.30	7	0.51	6	0.16	10
Huizhou	2008	1.94	1	0.22	10	0.13	11	0.24	11
	2013	1.34	4	0.23	9	0.37	9	0.26	9
	2018	1.56	4	0.25	9	0.28	11	0.15	11
Dongguan	2008	0.99	9	0.34	6	0.29	5	0.28	8
	2013	1.66	1	0.19	10	0.30	11	0.48	6
	2018	1.82	1	0.27	8	0.34	10	0.31	9
Zhongshan	2008	1.59	3	0.39	4	0.18	9	0.27	10
	2013	1.53	2	0.26	7	0.38	8	0.27	7
	2018	1.61	2	0.24	10	0.45	9	0.54	7
Hong Kong	2008	0.16	11	2.15	1	2.89	1	1.54	2
	2013	0.08	10	2.61	1	3.39	1	1.77	2
	2018	0.08	10	2.30	1	3.05	1	1.40	2
Macao	2008	0.21	10	-	-	1.05	2	1.83	1
	2013	0.06	11	-	-	1.39	2	1.94	1
	2018	0.05	11	-	-	1.23	2	1.65	1

Table 2: Specialisation Index and Ranking of the Four Urban Functions

The calculated indexes reflected that core cities possess similar qualities of a large economy of scale, a high degree of industrial population concentration, and a consistently leading level of economic and technological development over other cities.

5. Trends and Functional Orientation Analysis

The spatial network of the GBA is structured to promote an appropriate division of labour and functional complementarity among core and peripheral cities. Due to economic disparity between cities, it is beneficial to create a diversified internal structure through fostering city clusters within the urban agglomeration to form a stronger strategic positioning for the future. The strengthening of city clusters is a result of the urban agglomeration effect of cities, which facilitates on the concentration of resources and allocating it more efficiently to enhance productivity. The advantage of city clusters not only retain the existing proposal offered in the Plan but can also emphasise on the distinct characteristics of each city. From a value chain viewpoint, based on economic development and geographic endowment measures, the appropriate clusters are formed based on the upstream and downstream industries of the chain. Each cluster contains at least a core city to support related transforming and upgrading cities, and the transport network are chains for the

coordination to ensue. The three clusters can be divided into Guangzhou-Foshan-Zhaoqing, Shenzhen-Huizhou-Dongguan-Huizhou and Hong Kong-Macao-Zhongshan-Jiangmen (see figure 1).

The concept of value chain provides a suitable vertical integration system that can promote the industrial development precisely for the GBA. Every city ought to have comparative advantage in more than one industry to prevent excessive dependence on a single industry, which is certainly conducive to industrial transformation and advancement. Thus, this study enables a detailed examination of the changing functional orientation of each city over the eleven-year research period. Data from 2008, 2013 and 2018 (see graphs2a.-2k.) are selected as study points to analyse the gradual shaping from an employment ratio perspective.

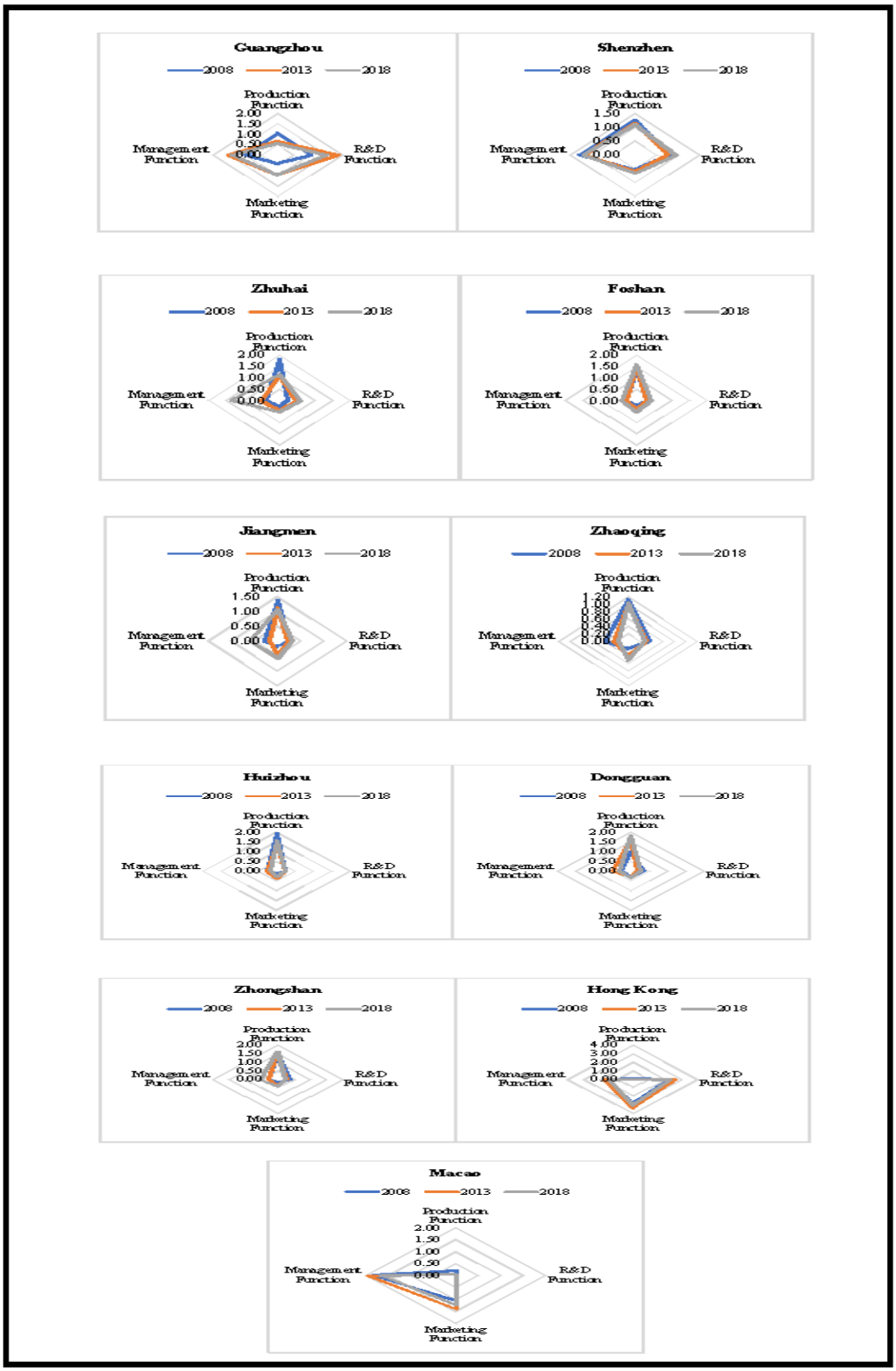

Figure 6: Functional Orientation in 2008, 2013 and 2018

5.1. Guangzhou-Foshan-Zhaoqing

Prior to the formation of the GBA, The Guangzhou-Foshan-Zhaoqing Economic Circle Development Plan (2010-2020) outlined the intention to promote regional economic integration in the PRD and has demonstrated closer cooperation ever since. As the capital of Guangdong Province and core city, Guangzhou plays a vital role in fostering an integrative zone through developing an international business and trade centre, transportation hub and enhancing knowledge intensive industries. Foshan is the pilot city for manufacturing transformation and upgrade, and along with Guangzhou is known as the 'GuangFo Integrative City'. Shortly after the release of the Plan, Guangzhou and Foshan signed the memorandum of cooperation on the joint establishment of the GuangFo high quality development and integrative pilot zone to break barriers to urban integration and achieve efficiency through complementarities. Zhaoqing has an advantage in natural resources and maintains traditional industrial production. While these three cities are geographically and historically linked via its similar customs, culture and trade practices, each city performs its urban functional comparative advantage.

Originally, the manufacturing industry in Guangzhou has been mainly distributed in the inner districts, but since the implementation of the 'Back Two Forward Three' policy in the earlier 2000s and the roll out of the Guangzhou City Plan (2010-2020), inner districts have been promoted for commercial activities, as a result, manufacturing has gradually shifted to suburban districts, and eventually to peripheral cities such as Foshan. The dispersal of the manufacturing industry to the regional suburbs and cities is due to the lower land costs and greater employment support for higher concentration of labour-intensive functions, which is seen in the fall in the production function from 1.04 in 2008 to 0.54 in 2018. Guangzhou still retains its major automotive production base, combining it with knowledge-intensive components such as new energy vehicles.

Foshan has had a remarkable development based on the labour-intensive and capital-intensive manufacturing enterprises on the west bank of Pearl River. The LQ for the production function showed a steady rise from 1.34 in 2008 to 1.54 in 2018. The city is the country's household appliance and machinery manufacturing centre. It aims to upgrade traditional manufacturing into high-tech industries such as intelligent automobile and intelligent manufacturing and robotics as a breakthrough. It has a manufacturing cluster totalled to more than 20 billion yuan, covering automobile manufacturing and machinery equipment industries. Under the joint cooperation of GuangFo, both cities promoted to construct a four trillion-yuan industrial cluster base for advanced equipment manufacturing, automobile, new generation of information technology and biopharmaceutical.

Zhaoqing primarily focused on agriculture and metal smelting as its two pillar industries, recent years show that the wholesale and retail trade industry is the only knowledge intensive based function that exhibited evidence of strengthening in the specialisation level, in which the LQ result has rose by more than double between 2008 and 2018. A large part of the wholesale and retail trade is credited to agricultural produces (grain, oil and food products), which showed an increase in total retail sales of consumer goods by over 38 percent. Zhaoqing has the potential to further strengthen its tertiary sector, particularly in the marketing function, given its balanced trend in employed personnel over the course of 11 years to develop its vertical integration in the value chain.The integrative zone assists Zhaoqing to strengthen its development in the region. Zhaoqing will become an important gateway for the Guangzhou-Foshan-Zhaoqing Expressway to connect to the southwest of Guangdong. Zhaoqing determined its functional orientation based on the core city's positioning and the core industrial chain of the cluster. While maintaining its traditional production, Zhaoqing New Town District will focus to build a high-end electronic information industry, given leading businesses such as Aoshikang Technology Company on printed circuit boards. At present, the District aims to concentrate on the downstream value chain, by finding investment for automotive electronics, consumer electronics. Zhaoqing is expected to put effort into education and research, by 2024, there will be 4 colleges and universities to accommodate for its population growth.

5.2. Shenzhen-Dongguan-Zhongshan-Huizhou

As per the Plan, alongside Shenzhen, Dongguan is targeted to build a high-end manufacturing industry centre on the east bank of the Pearl River. Since the economic reform, Shenzhen was appointed as one of the first special economic zones along with Zhuhai in 1980. Shenzhen engages to become one of the main economic and technology centres in the country and a national figure for research and innovation. Dongguan will work on fostering high-end manufacturing headquarters jointly to expand on strategic emerging industries. Given the complete and convenient network consisting of seaport, railway, highway and airport, Huizhou has developed strong mutual economic ties within the metropolis cluster, and being geographically adjacent to Shenzhen, it demonstrates similar industrial structure and pillar industries. Zhongshan has focused on traditional industries but is in the process of upgrading. Once the Shenzhen-Zhongshan Bridge is completed, Zhongshan will play an even greater role in connecting the east and west together.

The close tie between Dongguan and Shenzhen in the metropolis district is further reinforced by its coordination in manufacturing. Due to the land constraint and balancing of the number of personnel in Shenzhen, high-tech industries, namely Huawei, has moved its production plant to Dongguan's Songshan Lake national high-tech industrial development zone while keeping its headquarters and R&D team. In the coordination between the R&D centre in Shenzhen and manufacturing centre in Dongguan, it has formed a multi-locational input-output structure that enabled technology to support efficient production and sales network. In 2017, there were 2049 new national high-tech enterprises added to the city, with a total of 4077, ranking first in the province. This has allowed the number of professional personnel in the scientific and research industry to shift to core cities with greater developed R&D facilities such as Shenzhen and Guangzhou.

In 2008, the share of Zhongshan's manufacturing industry to the number of people employed in the urban industries accounted for 56.88 percent, and by 2018, this figure has increased to 67.42 percent. This data indicates that Zhongshan has gradually established its position in manufacturing, and the increasing added value in high-tech industries show the dominance in the manufacturing industry. In 2018, the LQ result for the production function is 1.61, ranked second behind Dongguan. There has generally been minimal movement in both the R&D function and marketing function between 2013 and 2018, but there is obvious expansion in the marketing function showing that coordination between industries is more beneficial for the economy than relying on a single function, such as Huizhou.

Huizhou is geographically adjacent to Shenzhen, which undoubtedly has greater advantages in the spill over effects of Shenzhen's high-end industries and innovative resources. In 2008, the city continued to undergo industrial restructuring by promoting institutional innovation including scientific and technological advancement and to encourage enterprises to increase their investment in research and development. The city strives to increase the contribution of added value for high-tech products to account for more than 40 percent of its industrial sector. The investment input for the three knowledge intensive functions are still relatively low as it is for the number of employed in the relevant function. Overall, there are little signs of movement (see graph2g), which shows thatthe manufacturing industry remains as its dominating industry, however excessive reliance on a single industry, when there are no signs of improvement in the knowledge-intensive functions, is not conducive to its economic stability and a development of the urban agglomeration.

5.3. Hong Kong-Macao-Zhuhai-Jiangmen

Hong Kong is known for its international finance centre such as the offshore Renminbi. It possesses strong upstream industries of the value chain including scientific research and wholesale and retail trades, that can diffuse to neighbouring cities. While Macao is a core city, due to geographical and historical facets, it has a different industrial structure to the remaining cities of the GBA. As such, if analysing the city as part of a metropolis district or using a value chain approach, it will take a supportive role within the cluster. Zhuhai is the only city from the Mainland to connect directly to Hong Kong and Macao by land via Hong Kong-Zhuhai-Macao Bridge. The geography has bestowed the city with advantage in the construction of ports and marine equipment, harbour machinery and electronic information manufacturing. Jiangmen has developed a relatively strong industrial foundation in the traditional production of food and beverage, textiles and agriculture. Jiangmen is a major hometown of overseas Chinese with more than 4 million overseas Chinese around the world. According to the 1998 survey of overseas Chinese in Jiangmen, there are one fifth of Hong and one third of Macao's population accounting for Jiangmen descent. Macao has a Fellow Townsmen Macao-Jiangmen Association, providing abundant overseas Chinese resources, such as encouraging Macanese youth to develop entrepreneurship and innovation in Jiangmen to promote integration in the GBA.

R&D is the key driver to economic growth; it is an indicator of innovation, and a crucial impetus for technological advancement. In 2008, the gross domestic expenditure on R&D of Hong Kong [i.e. total expenditure on in-house R&D activities performed locally in the business, higher education and government sectors (including public technology support organisations)] calculated to 10.66 billion yuan representing a modest decrease of 1 percent when compared to 2007. The GDP edged down from 0.77 percent in 2007 to 0.73 percent in 2008.Expenditure on R&D (including R&D labour cost and other related operating expenditure) in the business sector dropped by 13 percent, from 5.90 billion yuan to 4.70 billion yuan. The most significant decrease in expenditure on in-house R&D was recorded in the manufacturing sector. Much of the business sector was adversely affected amidst the global financial crisis in the course of 2008.

The global financial crisis and the ensuing economic recession had relentlessly hurt various sectors. Wholesale trades decreased by 2.6 percent in 2009, as for the retail trade, the values of total retail sales receipts saw a declining trend in the early half of the year. The previous occurrence of similar observations dated back to 2003 following the SARS epidemic. With the sustained growth of the local economy in the latter part of 2009 and the implementation of various facilitation measures by the Mainland authority which improved Hong Kong's inbound tourism, exhibited signs of recovery in the following periods. The value of total retail sales increased notably by 19.4 percent in the fourth quarter of 2010. Wholesale and retail trade make up the largest working population, the proportion of people employed as a ratio to the remaining urban industries is 33.66 percent in 2008 and 28.11 percent in 2018, while the LQ results showed that it increased from 2.89 in 2008 to 3.05 in 2018. The industrial structure shows that cities such as Dongguan and Zhongshan have shifted to fill in the manufacturing industry and Hong Kong has shifted to strengthen the services sector.

Due to the cumulative effect of geographical and historical factors, Macao has developed into an export-oriented economy dominated by the tertiary industry. Macao has been heavily reliant on the gaming industry as its dominant business, and highly dependent on tourism. In order to reduce the negative impact of the unique industrial structure of the gaming industry on the sustainable development of the economy, such as in 2008, with the support of the central government, Macao has implemented a rather diversified economic policy committed to developing non-gaming industries. In order to achieve the coordinated growth of various factors of production and resources, a virtuous circle of mutual promotion between the gambling industry and upstream and downstream industries should be formed. Macao can implement a vertical integration strategy by cultivating traditional industries to support the gaming industry and to build a complete tourism and leisure industrial chain.

In 2018, Zhuhai has invested 10.96 billion yuan to improve economic functional zone infrastructure to facilitate its position with working on international projects with Hong Kong and Macao. In line with the Plan, according to the Industrial Layout Planning of Zhuhai Industrial Park (2016-2025), Zhuhai is steadfast to becoming the regional industrial service centre. In the same year, Zhuhai experienced impetus in real economy development with industry (i.e., manufacturing, equipment primarily) contributing 76% to its economic growth. In the intermediate to long term, manufacturing will still be the focus of development and complementarity for Hong Kong and Macao until a period of

revitalisation. The proportion of the secondary sector to tertiary was 49.2 percent and 49.1 percent respectively, while those sectors in Guangdong province were 41.8 percent and 54.2 percent respectively. The proportion of the tertiary sector in Zhuhai was slightly lower than those of other relatively developed coastal cities. Its high proportion in the secondary industry is designated as the industrial belt for advanced equipment manufacturing, with its peer, Foshan in the west bank of PRD.

In Jiangmen, the secondary sector contributed to 57.6 percent of the total GDP in 2008, and has reduced to 48.5 percent of the total GDP in 2018, concurrently the LQ results have also shown a decrease from 1.38 to 1.07. While there is a noticeable decrease in the number of people employed in the production function industries, the investment in fixed assets in 2018 for industry increased by 8.2 percent and manufacturing increased by 8.0 percent. Investment in the tertiary sector continues to vary based on funding, in the midterm, advanced manufacturing continues to be the focus.

6. Conclusion and Discussion

6.1. Conclusion

Value chain has become an increasingly researched topic from firm level to industry wide focus in recent years. This paper analysed the changes of the functional structure of the Guangdong-Hong Kong-Macao Greater Bay Area urban agglomeration between 2008-2018. The main findings include:

In the 11-year study period, the ability of employment absorption in the urban agglomeration has increased significantly. The manufacturing industry, specifically high-tech manufacturing and advanced manufacturing has become the pillar industry of the modern industry in the urban agglomeration, while the traditional manufacturing industry has decreased. As a world-class urban area, the tertiary industry including the scientific research, technical service and geological prospecting, wholesale and retail trade, and leasing and business services industries have been growing. Manufacturing in core cities have gradually hollowed out, and peripheral cities have taken over different segments of manufacturing.

Secondly, the specialisation division pattern of GBA urban agglomeration is strengthening, which shows that the functional intensity is consistent with the orientation of urban positioning. During 2013-2018, the functional division of GBA changed greatly. By 2018, Dongguan and Zhongshan had the largest growth in the manufacturing industry since 2008, cooperating with five other peripheral cities in different manufacturing sectors. Based on the orientation, the GBA is positioned on the upper stream of the value chain.

6.2. Discussion

Under the context of economic globalisation, China's rapid industrialisation and urbanisation has led to the tendency of industrial homogenisation in neighbouring cities, with fierce competition for resources, markets, and talent. This ultimately leads to problems such as low efficiency in resource allocation within the urban agglomeration. Thus, in what approaches can GBA be stimulated to achieve a healthier regional coordination, requires further discussion. In view of the current urban functional division, the following aspects should be taken into consideration for future synergetic development:

It is necessary for cities to merge industrial division with functional division together to form an efficient value chain. Cities should not aimlessly pursue for merely a large and comprehensive development model, instead, should emphasise on activities with existing industrial foundation that will correspond to their resource endowments and level of comparative advantage in the relevant value chain segment. Peripheral cities have originally focused on the traditional secondary sector, while recently transitioning and upgrading to advanced manufacturing, strategic emerging industries, and modern services. The Outline of the 13th Five-Year Plan for cities such as Foshan, Dongguan, Zhuhai and Zhongshan have proposed to expand on high-end equipment manufacturing, new generation of information technology, new material, new energy and biotechnology. With the rapidly growing environment, when cities become involved in a range of industries, it is challenging to focus and specialise on a segment of a function, which is contrary to the concept of comparative advantage. Industrial and functional overlap reduces the degree of cooperation within the urban agglomeration; hence it is crucial to promote coordination in policy, planning, resource development and ecological protection.

Minimise the gap between core cities and peripheral cities by creating opportunities. In terms of economic scale, the cities are divided into three levels based on GDP, the core cities (excluding Macao) are ranked in the first tier, Foshan and Dongguan in the second, and the remaining cities fall into the third tier. In 2019, the GDP level of the three core cities are nearly four times as much as the six cities combined in the third tier. While there is a large gap difference, this creates opportunities for development from a different point of angle. Macau's GDP is ranked in the third tier, however its GDP per capita is the largest amounting to over five thousand yuan, which is ten times the amount of Zhaoqing. Based on the GDP per capita factor, Macao and Hong Kong's development are equivalent to the standards of a developed country, while all cities except Jiangmen and Zhaoqing are below national average. A large gap difference within the same strategic agglomeration may hinder equitable performance, thus Hong Kong and Macao, with comparative advantage in foreign direct investment, are able to shift surplus investment service for neighbouring cities to benefit from regional growth.

Improve transportation infrastructure and reduce the cost of mobility and communication. It is essential to create an urban structure that provides an appropriate industrial balance between cities and promote interconnectedness of intellectual capital. There are major transportation facilities such as Guangzhou-Shenzhen-Hong Kong express rail link, and the Shenzhen-Zhongshan Bridge that are under construction, are platforms to promote cooperation development

between the east and west banks of the Pearl River, but has the mobility increased as a result of these infrastructure constructions need further analysis.

Zhuhai has a unique geographical position connected alongside with Macao in the south and across the sea in the east. Since the opening of the Hong Kong-Zhuhai-Macao Bridge, Zhuhai is the only city in the mainland to connect directly with the two special administrative regions by land, which further emphasises its strategic infrastructure implementations. In terms of population growth, Zhuhai's permanent population is the second smallest to Macao in GBA but has the fastest growth rate of 7 percent year on year in 2019 for the second consecutive year. Meanwhile, the permanent population of the other cities is also increasing gradually, and the GBA's population adsorption capacity is relatively strong, moreover, Zhuhai has the highest intercity travel capacity. With the given social unrest in Hong Kong and the coronavirus pandemic, the tangible developments have been slower than expected in the last year and likely over this year.

On average, the residents in core cities have higher wage levels thus greater consumption capacity, while increasing labour costs for enterprises. More developed cities are less affected by high-cost labour, however, have continually upgraded from labour-intensive to intellectual-intensive businesses, and from production to services industries. Tertiary industries occupy a higher proportion of the core cities, creating industrial transfer and spill-over effects to the adjacent areas, driving the development of neighbouring cities. For example, Dongguan located between Shenzhen and Guangzhou, has received numerous industry industrial transfers from these two core cities in recent years due to its cost advantages and policy guidance. The question of how to improve the level of economic development, while maintaining the investment and living cost of cities within a particular range, is a challenge that many cities are exploring.

7. References

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