Research on Dynamic Mechanism and Path Selection of Digital Economy Enabling the Industrial Upgrading in Guangdong-Hong Kong-Macao Greater Bay Area

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Abstract: This article analyzes the status and characteristics of industrial development at present in Guangdong-Hong Kong-Macao Greater Bay Area (GBA), and calculate the synthetic evaluation indicators of digital economy using entropy method based on the relevant panel data of GBA from 2016 to 2022. It explores the influence mechanism of digital economy enabling the optimization and upgrading of industrial structure in GBA, analyzes the dynamic mechanism of digital economy enabling industrial upgrading in GBA and finally makes a path selection.

Keywords: digital economy; GBA; industrial upgrading; dynamic mechanism; path selection

1 Presentation of the Problem

GBA is located in the south of China, with superior geographical location, strong economic vitality, prominent innovation capabilities, and many leading enterprises. Our country emphasized that the real economy is the focus of economic development, and proposed to accelerate the construction of a digital China. The mainstream economic form that emerged at the historic moment - the digital economy - is the main engine of economic growth. It will promote profound changes in people's lifestyles, production methods, and economic and social governance methods, and will drive the improvement of total factor productivity and the transformation and upgrading of traditional industries. At the same time, it will reshape the global economic structure and change the global competition landscape. there are still issues such as unbalanced and inadequate industrial development within GBA, low quality of economic growth, and serious industrial isomorphism among cities. Traditional industries or some emerging industries do not adapt to the requirements of high-quality economic development in the new era. Therefore, how to leverage the development of the digital economy to empower industrial upgrading in GBA is the most urgent practical issue to be addressed in the industrial development of GBA.

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2 Basis of Digital Economy Enabling the Industrial Upgrading of GBA

2.1 The Connotation of the Digital Economy

The G20 Digital Economy Development and Cooperation Initiative (2016) issued at the G20 Hangzhou Summit put forward the concept of digital economy. From this concept, we can see that the digital economy must meet three conditions. The first condition is that there must be a new general-purpose technology, which can also be called digital technology, as an important driving force, such as the Internet, big data, cloud computing, and artificial intelligence that represent information technology. The second essential condition is new factors of production, and the key factors of production in the digital economy are digitized knowledge and information. The third condition is the new infrastructure, namely, the modern information networks that serve as the carrier of the digital economy. These three pillars are indispensable. The digital economy constructed through these three pillars exhibits two prominent effects. Firstly, the effect of economies of scale is prominent. In the operation of the digital economy, personnel, resources, information, and other elements can be precisely matched, reducing mismatches and losses, enhancing resource allocation efficiency, and lowering production costs. Digitization enables precise identification of consumer demand, reducing inventory costs and management costs. The e-commerce transaction model accelerates the transaction process, reduces transaction costs, and highlights the scale economy effect of the digital economy. And then, the effect of open economy is formed. The digital economy, using modern information networks as its carrier, breaks through the temporal and spatial barriers of industries, accelerates the infiltration and integration capabilities among industries, and gives rise to new ecosystems, platforms, and business forms, leading to the formation of an innovative, open, and inclusive situation [1].

2.2 Analysis of the Development Status of GBA

GBA as a global manufacturing center is gradually strengthening, the innovation economy is accelerating, and the trade economy continues to grow. The current development trend is becoming increasingly positive, mainly manifesting in the following aspects:

Firstly, the industrial model has undergone a thorough transformation in GBA. The industrial model of GBA has undergone a complete transformation. With the continuous and rapid integration of the economies and societies of Hong Kong, Macao, and the Pearl River Delta, the utilization efficiency of various collaborative innovation factors has been greatly improved, and the innovation capability has also rapidly escalated. Previous industrial models such as "three-in-one compensation" and "front shop, back factory" have been completely transformed.

Secondly, the standard of social and economic development of GBA is the highest. The Pearl River Delta region in Guangdong, which already possessed a strong manufacturing foundation, has now become more mature and powerful, playing an important role in the global manufacturing industry chain. It has become a global advanced manufacturing center with transformation and upgrading capabilities. The complementary elements of Hong Kong as a global financial center are an important strategic support for China's high-quality development and the formation of a new "dual circulation" development pattern. Macau, an international free port with a high population density and developed tourism and leisure industry, will

achieve more achievements under the appropriate diversified economic development.

Thirdly, the standard of scientific research in GBA is high. More than 170 internationally and domestically renowned universities and over 800 research institutions are gathered in the bay area, attracting global high-end scientific and technological talents. The platforms and talents of the bay area have advantages in both quantity and quality, ranking among the world's best in many fields such as computer science, mathematics, and electronic engineering.

Despite the numerous advantages of GBA, some disadvantages have gradually emerged during its rapid development. Firstly, there is an imbalance in the development of cities within the Area, particularly in the distribution of innovation factors. Hong Kong significantly outperforms the Pearl River Delta region, and the integration of technological innovation among cities urgently needs to be improved, as the cost of coordinated development among them is relatively high. Secondly, the efficiency of the flow of capital, talent, and other production factors among cities in the Greater Bay Area is relatively low, and a coordinated development mechanism has not yet been formed. [2].

2.3 The practical advantages of digital economy empowering the industrial upgrading of GBA

2.3.1 GBA has a superior geographical location. It is located in the southern coastal area of China and is an important gateway connecting inland areas with Southeast Asia. This unique geographical advantage is conducive to fully utilizing domestic and foreign market resources, integrating industrial markets, and promoting industrial upgrading through digital economy empowerment.

2.3.2 GBA has strong technical support. The Guangdong Hong Kong Macao Greater Bay Area has gathered numerous high-end talent groups and innovative resources, such as higher education institutions, research institutes, and some data platforms. Digital techn [3] ology continues to develop, and digital industrialization continues to break through, providing strong technical support for industrial upgrading. the added value of digital economy in Guangdong reached 6.4 trillion yuan in 2022, accounting for 49.7% of GDP and 12.8% of the national digital economy added value. The total amount has been ranked first in the country for six consecutive years. The digital industries in Hong Kong and Macao are also booming. Hong Kong has established a Digital Economy Development Committee, with 5G coverage exceeding 90% in Wan Chai, Central and Western District, Causeway Bay, and other areas, and a digital economy scale exceeding 100 billion Hong Kong dollars. Macao has achieved digital transformation in public services, and the "Qin-Ao Tong" innovation platform has been launched. The most active urban agglomeration for the domestic digital economy will be GBA.

2.3.3 GBA has a solid industrial foundation. A large number of advanced manufacturing, modern service, and high-tech industries are gathering in the Guangdong Hong Kong Macao Greater Bay Area. These industries provide broad application scenarios and market demand for the digital economy.

2.3.4 GBA has a good policy environment. The Guangdong Hong Kong Macao Greater Bay Area has a favorable policy environment. In order to promote the rapid development of the digital economy in the Guangdong Hong Kong Macao Greater Bay Area, the government has

introduced a series of supportive policies and enjoys the advantage of being a pioneer. These policy environments provide a good business environment and legal protection for the development of the digital economy, which helps to stimulate market vitality and enterprise innovation momentum.

2.3.5 GBA has potential for upgrading its demand. The cities in the Guangdong Hong Kong Macao Greater Bay Area have different traditional manufacturing industries with huge scales. Faced with market changes and competition pressure, these manufacturing industries release the demand for upgrading, especially the digital and intelligent upgrading. Therefore, the digital economy a broad market space for industrial digitalization.

2.3.6 GBA has an appropriate development pattern. Based on different dimensions such as digital infrastructure construction, digital innovation activity, digital industry chain, and digital industry scale, GBA can be divided into different tiers of cities, forming a complementary development pattern that is conducive to the coordinated and differentiated development of the digital economy among different cities within the Bay Area.

In summary, GBA has an urgent need for industrial upgrading, and the digital economy has significant advantages in promoting industrial upgrading. Therefore, the digital economy will be a powerful support for industrial upgrading in GBA.

3. Analysis of the Level of Industrial Upgrading Enabled by the Digital Economy in GBA

Based on existing research findings, this article selects 10 evaluation indicators from digital technology innovation, digital infrastructure, and digital output level to comprehensively measure the development level of the digital economy in GBA (see Table 1 for the specific indicator system).

3.1 Measurement of the Comprehensive Standard of the Digital Economy in GBA Based on Entropy Method

3.1.1 Standardization of Original Data

GBA includes 11 cities, all of which are used as samples. Ten evaluation indicators are designed and represented by X_{ij}, the i represents the i-th city and the j represents the original value of the j-th evaluation indicator (i = 1, 2, 3, ..., 11; j = 1, 2, 3, ..., 10). The range standardization method is used to standardize the evaluation indicator data, and the formula is as follows:

$$\overline{X} = (X_{ij} - \min X_{ij}) / (\max X_{ij} - \min X_{ij}) \tag{1}$$

In the formula, X_{ij} represents the original data value of the j-th indicator for the i-th city, $\min X_{ij}$ represents the minimum value, $\max X_{ij}$ represents the maximum value, and $\overline{X}$ represents the indicator value after standardization.

3.1.2 Calculate proportion of indicator

$$P_{ij} = \frac{\overline{X}_{ij}}{\sum_{i=1}^{11} X_{ij}} \tag{2}$$

3.1.3 Calculation of the entropy value

$$e_j = -\frac{1}{Inn}\sum_{i=1}^{11} P_{ij} In(P_{ij}) \qquad 0 \le e_j \le 1 \tag{3}$$

3.1.4 Calculation of the coefficient of variation

$$g_j = 1 - e_j \tag{4}$$

3.1.5 Determination of the Weights of Evaluation Indicators

$$W_j = \frac{g_j}{\sum_{j=1}^{10} g_j} \tag{5}$$

Based on the standardized evaluation indicators of digital economy for the 11 cities in GBA from 2016 to 2022, the weights of each evaluation indicator are calculated using the entropy method. (Specific indicator weights are shown in Table 1, and the final indicator weights based on the average of the indicators are shown in Table 2).

Table 1: Weights of Evaluation Indicators for Digital Economy in GBA from 2016 to 2022

Indicators	2016	2017	2018	2019	2020	2021	2022
Digital Product Development Projects	12.58	13.76	13.82	14.91	15.78	16.32	16.74
Investment in Digital Technology Research and Development	9.89	10.22	10.24	10.54	11.02	11.03	11.12
Full-Time Equivalent of Digital Technology Research and Development Personnel	10.01	10.17	10.27	9.29	10.54	10.75	11.05
Number of Patents Related to Digital Technology	11.11	11.23	11.32	11.38	11.47	11.56	11.61
Mobile Phone Penetration Rate	2.24	2.21	2.17	1.98	0.84	0.34	0.32
Industrial Internet Usage Rate	9.08	9.11	9.78	10.01	11.27	12.04	12.62
Number of Artificial Intelligence Enterprises	10.23	10.33	10.57	10.34	10.87	8.74	9.78
Number of Domain Names and Websites	16.64	13.95	11.93	10.58	5.91	3.64	3.13
Total Output Value of Digital Economy	11.01	11.78	11.89	12.43	13.29	15.32	15.83
Total Output Value of Software Industry	7.21	7.24	8.01	8.54	9.01	10.26	10.79

Table 2: Weights of Evaluation Indicators for Digital Economy in GBA

Evaluation Targets	Primary Indicator	Secondary Indicator	Weight	Indicator Attribute
Level of Digital Economy	Digital Technology	Digital Product Development Projects	14.84	Positive Indicators
		Investment in Digital Technology	10.58	Positive Indicators

Development	Innovation (47.10%)	Research and Development Full-Time Equivalent of Digital Technology Research and Development Personnel	10.30	Positive Indicators
		Number of Patents Related to Digital Technology	11.38	Positive Indicators
	Digital Infrastructure (31.30%)	Mobile Phone Penetration Rate	1.44	Positive Indicators
		Industrial Internet Usage Rate	10.56	Positive Indicators
		Number of Artificial Intelligence Enterprises	10.12	Positive Indicators
		Number of Domain Names and Websites	9.40	Positive Indicators
	Output of Digital Economy (21.60%)	Total Output Value of Digital Economy	13.08	Positive Indicators
		Total Output Value of Software Industry	8.72	Positive Indicators

3.1.6 Calculating the Comprehensive Standard of Digital Economy for Ach City

Using the formula of multiplying the indicator weight W_j by the ratio P_{ij} of the i-th evaluated object on the j-th evaluation indicator, we can calculate the comprehensive development standard of digital economy (DEI) in GBA from 2016 to 2022. The formula is as follows:

$$Z = \sum_{j=1}^{10} W_j \times P_{ij} \tag{6}$$

3.2 Measurement of Industrial Upgrade Indicators

Drawing from the measurement indicators of industrial structure upgrading designed by Xu Deyun [4], this paper uses the gradual increase in the proportion of the tertiary industry and the decreasing proportion of the primary industry as a sign of industrial upgrading. The specific indicators for industrial structure upgrading are as follows:

$$S = Y_1 * 1 + Y_2 * 2 + Y_3 * 3 (1 \le S \le 3) \tag{7}$$

In the formula, Y_1, Y_2, and Y_3 represent the contribution rates of the three industries to GDP, respectively, and S measures the degree of industrial structure upgrading. The result of s analysis, the lower the industrial structure, then S is smaller, the higher the industrial structure, then S is larger.

3.3 Empirical Analysis and Results

3.3.1. Variable Selection and Data Description

Empirical research is conducted using panel data of GBA from 2016 to 2022.

(1) The optimization and upgrading of industrial structure (UIS) is set as the explained variable. The measurement indicators are designed based on Xu Deyun's method for industrial structure upgrading. Using the ratios of the three industries to GDP in GBA from 2016 to 2022, the level of industrial structure optimization and upgrading in corresponding cities is assigned.

(2) DEI is set as the core explanatory variable. Based on the evaluation index system designed earlier, the entropy method is used to assign weights to the indicators and calculate the digital

economy development index for corresponding cities in GBA from 2016 to 2022.

(3) Control variables. Based on literature review, economic development level, degree of opening up, government participation, and technological innovation capability are selected as control variables. They are denoted as LnPGDP, OD, GI, and TI, respectively. Descriptive statistics for each variable are presented in Table 3.

Table 3: Statistical Description of Variables

Variable	N	Mean	Std.Dev.	Min	Max
Industrial Structure Optimization and Upgrading (UIS)	150	3.473162	0.5728373	3.0135746	3.9872371
Digital Economy Development Level (DEI)	150	0.147263	0.098284	0.002326	0.753465
Economy Development Level (LnPGDP)	150	12.65426	1.9287367	11.247364	13.975425
Degree of Opening to the Outside World (OD)	150	2.201549	0.523763	1.214342	2.983458
Government Participation Level (GI)	150	1.239821	0.4732552	0.724618	1.432662
Technological Innovation Capability (TI)	150	0.985741	0.092738	0.635488	1.024356

3.3.2 Construction of Panel Data Model

Based on the research needs, F-test and LM-test were conducted on the data. Housman test with a P-value of 0.0010 rejected the null hypothesis, leading to the use of the fixed-effects model as follows:

$$UIS_{it} = \beta_0 + \beta_1 DEI_{it} + \beta_2 GDP_{it} + \beta_3 OD_{it} + \beta_4 GI_{it} + \beta_5 TI_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (8)$$

In this formula, UIS represents the explained variable of industrial structure optimization and upgrading, while DEI represents the level of digital economic development. μ_i and ν_t represent individual and time effects, respectively, and ε_{it} is the random disturbance term.GDPit, ODit, GIit, and TI_{it} are the control variables. β0 represents the intercept term, while β_1, β_2, β_3, β_4, and β_5 represent the coefficients of the explanatory variables. A dynamic panel model is established as follows:

$$UIS_{it-1} = \beta_0 + \alpha DEI_{it} + \beta_1 DEI_{it} + \beta_2 InPGDP_{it} + \beta_3 OD_{it} + \beta_4 GI_{it} + \beta_5 TI_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (9)$$

In this formula, UIS_{it-1} represents the lagged value of UIS from the previous period, and α is its regression coefficient. It can be seen from the simple regression fit line that the development of digital economy is positively correlated with industrial upgrading.

3.3.3 Testing Panel Data

This paper uses Stata software for quantitative analysis of panel data.

(1) Testing for Heterosexuality Among Groups

As shown in Table 4, P=0, rejecting the null hypothesis of homosexuality among groups, indicating the existence of heterosexuality among groups.

Table 4: Results of Heterosexuality Test Among Groups

HO:sigma(i)^2=sigma^2 for all i
Chi2(11)=1.3e+0.5
prob>chi2=0.000

(2) Test for Auto correlation Within Groups. In Table 5, P=0, strongly rejecting the null hypothesis of no first-order auto correlation within groups. Therefore, there exists first-order auto correlation within groups in industrial upgrading.

Table 5: Test Results for Auto correlation Within Groups

HO:no first order auto-correlation
F(1,10)=46.317
prob>F=0.000

(3) Cross-sectional Dependence Among Groups. Based on Table 6, the P-value is less than 0.01, rejecting the null hypothesis of no cross-sectional dependence among groups. Therefore, it is believed that there exists cross-sectional dependence among groups.

Table 6: Test Results for Cross-sectional Dependence Among Groups

HO:Cov (ε_{it}, ε_{jt})=0(i≠j)
Pesaran's test of cross sectional independence=4.325
pr=0.0006

3.3.4 Analysis of Regression Results

(1) Estimated Values for Static Panel Model

Based on the above tests, a regression comparison was conducted using the two-way fixed effects model and the comprehensive FGLS, yielding specific regression results as shown in Table 7. The control variables selected in this study have a positive impact on the industrial upgrading at a significant level, and the level of digital economic development has a significant promotional effect on the industrial upgrading.

Table 7: Empirical Results of Two-way Fixed Effects and Comprehensive FGLS

	(1)	(2)
	FE	FGLS
DEI	0.427**	0.759***
	(2.109)	(2.923)
LnPGDP	-0.236***	0.208***
	(-6.89)	(3.94)
OD	1.957***	6.037***
	(3.76)	(4.24)
GI	0.216	0.537***
	(1.14)	(3.82)
TI	-0.376	2.063*
	(-1.479)	(1.73)
_cons	4.298***	-14.574
	(13.47)	(-1.24)

N	150	150
Individual Effect	Control	Control
Time Effect	Control	Control

Note: *variable significant standard=10%, **variable significant standard=5%, and *** variable significant standard=1%

(2) Estimated Values of Dynamic Panel Model

The dynamic panel data model employs Difference-GMM (Generalized Method of Moments with Differences) and System-GMM (Generalized Method of Moments with Systems) for estimation. Table 8 is regression results.

Table 8: Empirical Results of the Dynamic Panel Model

	(1)	(2)
	FDGMM	SYSGMM
L.UIS	0.714***	1.112***
	(18.04)	(48.72)
DEI	1.117***	0.443**
	(5.86)	(2.64)
LnPGDP	-0.107***	-0.024***
	(-5.39)	(-8.97)
OD	1.495***	-0.086
	(2.98)	(-0.24)
GI	-0.016	-0.107**
	(-0.43)	(-3.02)
TI	0.876*	-2.984
	(2.09)	(-0.74)
_cons	2.205***	1.106***
	(8.44)	(9.21)
N	120	150
AR (2)	0.9143	0.8246
Sargan	Effective	Effective

According to Table 8, the coefficients of the core explanatory variables estimated using System-GMM are positive and significant at the 5% in the dynamic panel model. This indicates that the digital economy has a positive impact on industrial upgrading in GBA. Specifically, a 1% increase in the digital economy leads to 0.443% increase in the industrial upgrading. The lagged term of industrial upgrading in the GBA (L.UIS) is significantly positive at the 1%, suggesting that industrial upgrading is a chained dynamic evolutionary process.

3.3.5 Testing the Robustness of the Model

To test the robustness of the model, the Theiler Index (TL) is used as an alternative measure for industrial upgrading. The model is specified as follows:

$$TL = \sum_{i=1}^{3} (\frac{Y_i}{Y}) In(\frac{Y_i / L_i}{Y / L}) \tag{10}$$

In the above equation, i represents the type of industry, Y_i denotes the total output of the i-th industry, Y represents the total output of all three industries, Li represents the employment in the i-th industry, and L represents the total employment in all three industries. The regression results using System-GMM are presented in Table 9.

Table 9: Empirical Results with Alternative Measures

	L.TL	DEI	LnPGDP	OD	GI	TI	_cons	N
TL	0.714***	-0.772**	0.091***	-0.501*	-0.236*	-3.143***	8.723***	120
	(14.31)	(-3.36)	(5.13)	(-2.31)	(-1.98)	(-6.37)	(4.32)	

The model passes the Sargan over-identification test and the AR serial correlation test, indicating that the digital economy is significantly negative at the 5%. Since the alternative measure used for the explained variable is inverse, this suggests that the empirical conclusions of the model established in this study are reliable and robust.

4 The Driving Mechanism of Digital Economy Enabling Industrial Upgrading in GBA

4.1 The Digital Economy Enables GBA to Optimize Industrial Layout and Weaken Industrial Homogeneity

The homogeneity of manufacturing industries among in the Pearl River Delta is prominent, with innovation elements concentrated in the core area around the Pearl River Estuary. The digital economy significantly reduces spatial and temporal obstacles within the region through network technology, weakening the external constraints of geographical and temporal heterogeneity. This helps to overcome the "big city disease" caused by excessive industrial concentration, such as high prices for land, talent, and other resource elements in large cities. The digital economy drives balanced development of elements within the region, enabling population and industries in small and medium-sized cities to remain local, and narrowing the development gap within the region. Through big data, the digital economy brings together different producers and consumers within the bay area, alleviating the phenomenon of homogeneous development of industries within the region.

4.2 The Digital Economy Enables Free Flow of Innovation Elements and Promotes Collaborative Innovation in GBA

First, the digital economy can effectively enable the three regions to facilitate customs clearance, personal income tax legal application, currency exchange, reduce the cost of production factors, and weaken administrative barriers. Second, the digital economy drives innovative talents in the three regions to break through the constraints of time and space and drive collaborative "cloud innovation", promoting the deep integration of scientific and technological innovation talents in GBA. Third, the digital economy reconstructs the integration of GBA into the global innovation chain, gathers high-end innovative talents from both inside and outside the region, and promotes the formation of an international science and

technology innovation center [5].

4.3 The Digital Economy Enables GBA to Accelerate Industrial Upgrading by Forming an Integrated Large Market

The digital economy enables GBA to break through industrial and market boundaries, building an integrated industrial and market system in the region. It actively links with other regions internationally and domestically, forming an ultra-large industrial and market body. First, the digital economy significantly weakens the industrial, urban-rural, and regional boundaries in GBA, jointly constructing the overall effect of a larger-scale industrial cluster with regional collaboration and cross-boundary integration. Second, the digital economy drives the consumption potential of GBA, building an integrated ultra-large market group both inside and outside the region. Third, the digital economy significantly reduces the barriers to entry for innovation and entrepreneurship caused by administrative monopolies and regional segmentation in GBA, stimulating the synergistic effect of balanced development both inside and outside the region. Fourth, the digital economy enables GBA to deeply participate in and integrate into the reconstruction of global industry chains, value chains, supply chains, and data chains, driving accelerated upgrading of traditional industries, markets, and elements in terms of digitalization, intelligence, and internationalization [6].

5 Path selection for digital economy to drive industrial upgrading in GBA

5.1 Strengthen and make overall plans for the construction of new digital infrastructure

Firstly, comprehensively plan the layout of new digital infrastructure such as cloud computing, Internet of Things, and artificial intelligence to promote industrial digitization, networking, and intelligent transformation and upgrading. Secondly, enhance the digital level and capabilities in specific scenarios such as "Internet +" production, government affairs, healthcare, education, and environmental governance, and improve the intelligence level of public facilities. Thirdly, make overall plans for the construction of digital infrastructure in GBA and underdeveloped regions in China, to stimulate effective investment in upstream and downstream industries in GBA and the central and western regions, and effectively enhance the radiation capabilities of GBA.

5.2 Standardize and improve relevant systems for the development of digital economy

Fully leverage policy advantages, standardize and improve relevant policies and measures for the development of digital economy in GBA, and create a good political and business environment for the optimization and upgrading of industrial structure. Further optimize the inter-governmental coordination among the administrative divisions in GBA, promote the construction of an integrated innovation system for digital economy and industrial upgrading in the region, and provide development space for industrial structure upgrading. Strengthen the supervision of large digital economy platforms, combat digital economy monopolies in accordance with the law, break the bottlenecks in the supervision of digital economy platforms in GBA, and build a scientific, legal, dynamic, and efficient market supervision system for digital economy platforms, and improve and perfect the fair competition mechanism for digital

economy in GBA.

5.3 Continue to build a high ground for opening up to the outside world

Research shows that high-level opening up is an important driving force for digital economy to drive industrial optimization and upgrading in GBA. Therefore, further consolidate the high-quality opening-up pattern of GBA. Continuously improve the level of using foreign capital, import and export, and digital economy integration capabilities in GBA, create a new high ground for leading the country's opening up to the outside world, and improve the international competitiveness of China's industrial optimization and upgrading and the overall quality of economic and social development.

5.4 Increase the training and introduction of international innovative talents

Digital technology innovation is the driving force for the development of digital economy. Therefore, it is crucial to increase the training and introduction of scientific and technological innovation talents in GBA. On the one hand, it is necessary to strengthen the training of scientific and technological innovation talents in GBA and build a new high ground for innovative talent training; on the other hand, it is necessary to increase the introduction of international innovative talents in GBA, build an international digital science and technology innovation platform, attract talents, focus on breaking through international technological bottlenecks in digital frontier technologies and core technology fields, and lead the frontier development of digital technology, so that the digital economy becomes an important engine for industrial upgrading in GBA.

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