

# Transformation and Upgrading Development Strategy of Ceramic Industry Cluster in Guangdong-Hong Kong-Macao Greater Bay Area Based on the Concept of Green Development

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**Abstract:** On February 18, 2019, the Central Committee of the Communist Party of China and the State Council issued the ‘Guangdong-Hong Kong-Macao Greater Bay Area Development Plan’ where the Greater Bay Area will undergo green and low-carbon development with four major innovations, and there is the core competitiveness of Guangdong, Hong Kong, and Macao to build a world-class bay area. In the past ten years, the ceramic industry, which belongs to the manufacturing industry, has formed an industrial cluster advantage in the Greater Bay Area. However, the continuous economic downturn in the international market, coupled with anti-dumping and other trade barriers, has impeded the export of ceramic industry products, and the domestic overcapacity and environmental. Additionally, the pressure of pollution has forced the government to issue various industrial policies and environmental protection policies to guide the upgrading and the transfer of the ceramic industry. The arising internal and external problems are restricting the improvement of the green innovation performance of the ceramic industry cluster in the Greater Bay Area under high-quality development. This paper analyzes the key factors which are restricting the improvement of green innovation performance of ceramic industry clusters in the Greater Bay Area. Further, a specific improvement path and policies for the high-quality development of the ceramic industry in the Greater Bay Area were proposed in this paper.

**Keywords:** Ceramic industry; Green economy; Technological innovation; Green development

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## 1. Introduction

On February 18, 2019, the Central Committee of the Communist Party of China and the State Council issued the ‘Guangdong-Hong Kong-Macao Greater Bay Area Development Plan.’ The Greater Bay Area will undergo green and low-carbon development with four major innovations <sup>[1]</sup>. The high-quality development of the manufacturing industry is the core competitiveness; therefore, it is important for Guangdong, Hong Kong, and Macao to build a world-class bay area <sup>[2]</sup>. In the past ten years, the ceramic industry, which belongs to the manufacturing industry has formed an industrial cluster advantage in the Greater Bay Area. The ceramic production and export have a heavy weight position in worldwide, including China, where these economic mosaics are not only contributing to the growth of the regional economy, but also dominate the country’s competitive advantage <sup>[3]</sup>. However, trade barriers such as anti-dumping and other trade barriers contributes to the continues economic downturn in the world, have impeded the export

of ceramic industry products, domestic overcapacity and environmental pollution pressure, thereby forcing the government to issue various industrial policies and environmental protection policies to guide the upgrading and the transfer of the ceramic industry [4]. These unfavorable factors restrict the improvement of the green innovation performance of the ceramic industry cluster in the Greater Bay Area [5,6].

This paper focuses on the background of high-quality development, and consider the characteristics of green innovation in the manufacturing industry. Path selection and policy recommendations for cluster green innovation performance improvement to guide high-quality development practices was also discussed in this paper.

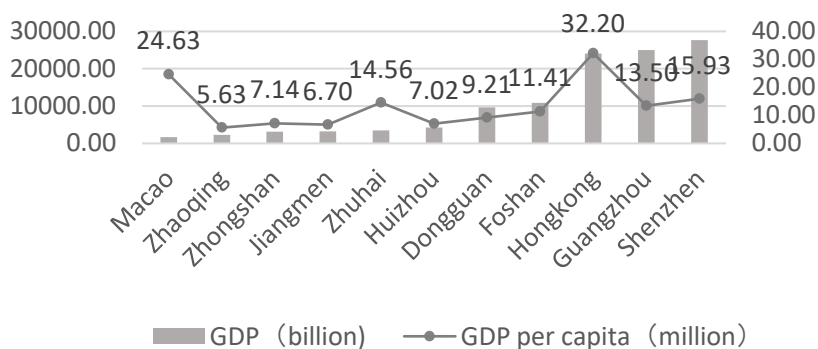
## 2. Literature review

The measures to promote the high-quality development of the manufacturing industry should not only reduce inefficient output, promote supply-side structural reform, but also should enhance technological innovation capabilities, encourage innovation and entrepreneurship [7], accelerate industrial integration, and promote the quality, efficiency, and power changes of manufacturing development [8]. The high-quality development of the manufacturing industry should have positive characteristics in term of quality, efficiency, power, coordination, greenness, openness, and sharing [9-11]. In the process of promoting the high-quality development of the manufacturing industry, elements such as innovation, capital, and human capital play an irreplaceable role. Among them, innovation is the first driving force for the manufacturing industry to move towards the high-quality development [12,13]. It is believed that the high-quality development of the manufacturing industry is a realistic choice to actively adapt to the new economic system, and solve the problems of unbalanced and insufficient development of the manufacturing industry [14]. The high-quality development of the manufacturing industry is focused on improving the quality of the supply system, and on the intelligent manufacturing, service-oriented manufacturing, green manufacturing, and high-quality manufacturing [15-17], and the initial point is promoting a high-quality development of the manufacturing industry [18]. At present, the innovation of China's ceramic industry is not at a high level, therefore the ceramic industry cluster has a significant effect on the improvement of innovation ability [19,20].

## 3. Constraining factors in the improvement of green innovation performance of ceramic industry clusters in Guangdong-Hong Kong-Macao Greater Bay Area under high-quality development

### 3.1. Regional economic development varies greatly

At the end of 2018, the Greater Bay Area created 11.71% of the national gross domestic product (GDP), however there are still some constraints on the economic development in the Bay Area. Therefore, the development level of green innovation in the ceramic industry cluster is closely related to the economic development level of a region. The economic development level of the Greater Bay Area is analyzed using the data of GDP, and per capita GDP as shown in **Figure 1**.

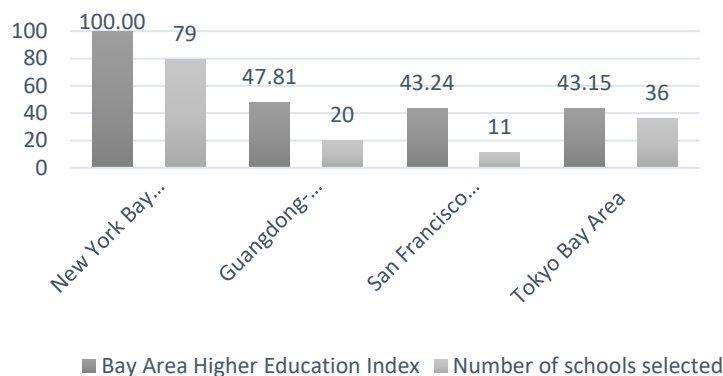


**Figure 1.** GDP and per capita GDP of cities in the Greater Bay Area in 2020

According to **Figure 1**, For Hong Kong, under the influence of adverse factors such as the decrease in exports and sluggish consumption under the impact of the new crown epidemic, the per capita GDP is still far ahead in the Greater Bay Area with a per capita GDP of 322,000 yuan. Although Macau's GDP is at a relatively low level compared to other cities in the Greater Bay Area, the per capita GDP level is on the second place after Hong Kong, reaching per capita GDP of 246,300 yuan. Compared to Pearl River Delta cities, Hong Kong, and Macao, the per capita GDP of Guangzhou, Shenzhen, Foshan, and Zhuhai is more than 100,000 yuan, and there is still a large gap between the per capita GDP levels between Hong Kong and Macao. In addition, Zhaoqing showed the lowest per capita GDP with only 56,300 yuan compared to other cities.

### 3.2. The technological innovation mechanism is not yet perfect

The technological innovation, product research and development, comprehensive utilization of production resources, and sustainable development of the ceramic industry in the Greater Bay Area are inseparable from the support of high-tech ceramic industry professionals. The World University Third-Party Index (TUI) is the fourth eye for third-party evaluation of universities, which can comprehensively measure the status of universities. The Greater Bay Area is compared with other three major bay areas in different country based on the evaluation ranking by TUI, and the number of selected universities is shown in **Figure 2**.



**Figure 2.** Evaluation rankings and the number of selected universities in the Big Four Bay Area World University Third-Party Index (TUI)

Hong Kong, Guangzhou, Foshan, and other core cities gather more ceramic innovation elements and resources, and have relatively rich experience in ceramic innovation. However, since the innovation resource cooperation mechanism has not been perfected, therefore the innovation resource cooperation relationship between cities needs to be strengthened. In addition, it is difficult for non-core cities such as Jiangmen and Zhaoqing to obtain the elements and resources which are required for ceramic innovation in timely, resulting in uneven distribution of ceramic innovation resources, thereby it is not conducive to continue the innovation and development of the ceramic industry in the non-core cities. Therefore, the Guangdong-Hong Kong-Macao Greater Bay Area still needs to improve the innovation resource cooperation mechanism, by taking the core cities as the radiating poles, activate the innovation power and potential of non-core cities, and encourage cities with a lower level of technological innovation.

#### **4. Improvement paths and policy recommendation for green innovation of ceramic industry clusters in Guangdong-Hong Kong-Macao Greater Bay Area under high-quality development**

##### **4.1. Improve the top-level design of the economic system, and promote high-quality economic development**

China, social and economic development is in a transition period from high-speed to high-quality development. However, affected by factors such as economic downturn, Sino-US trade friction, and the tightening of coal-to-gas environmental protection policies, the Greater Bay Area Ceramics Industrial development become slowed down. According to the Guangdong Ceramic Industry Data released by the Guangdong Ceramics Association from January to May 2020 the output of ceramic tiles by enterprises designated size in Guangdong Province was 615.379 million square meters, with a decrease of 20.2% yearly. Meanwhile the output of sanitary ceramics was 15.687 million pieces with a decrease of 22.1% yearly. Due to the development problems such as low entry barriers, high energy consumption, high pollution, and slow transformation, and upgrading of green innovation for ceramic enterprises in the Greater Bay Area, therefore the government should continuously improve and optimize the top-level design of the economic system to provide economic development in the Greater Bay Area with a solid guarantee.

##### **4.2. Give full play to the synergistic effect of green innovation, and enhance the level and intensity of green innovation**

Innovation and development should focus on solving the problem of development momentum, and green development, similarly solve the problem of harmony between man and nature. The government should increase the incentives for innovation funds for the ceramic industry in the Greater Bay Area, to encourage the ceramic enterprises to continuously improve their independent research and development capabilities, and master more key and advanced technologies. In addition, the government should encourage green innovation cooperation between small and medium-sized ceramic enterprises with large-scale ceramic enterprises, construct a systematic innovation cooperation platform, strengthen exchanges and cooperation between ceramic enterprises in the Greater Bay Area, and realize the sharing of technical information resources, thereby changing the concept of ‘I have no people to I have more people’, and believe in the concept of ‘I have more people, than I have competitive advantage’. A series of measures are conducive to promote the formation of the green innovation pattern of the ceramic industry in the Greater Bay Area, and to a certain extent, are conducive to the coordinated development of the economy, society and ecological environment of the Greater Bay Area.

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## Disclosure statement

The authors declare no conflict of interest.

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