

# New Stage of Cooperative Development of the Semiconductor Industry Between Guangdong and Taiwan

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## ABSTRACT

This paper analyzes characteristics of the semiconductor industry of Guangdong and Taiwan, respectively, and the degree of cooperation between the two sides since China's adoption of the reform and opening-up policy. Following that, this paper points out that the semiconductor industry of Guangdong and Taiwan has been ushered in a new stage of complementary cooperative development under the background that Guangdong is vigorously promoting the structural upgrade of its semiconductor industry, promulgating new preferential policies for Taiwan, and accelerating the semiconductor industrial promotion among enterprises of the two sides to improve the position of the industry in the new pattern of "international and domestic dual cycle". Additionally, challenges facing the Taiwan and Guangdong for their embarking on a new stage of the semiconductor industrial cooperation are examined, and countermeasures on how to cope with these challenges are proposed to better seize opportunities of cooperation.

**Keywords:** Guangdong and Taiwan, semiconductor industry, complementary cooperative development, new stage.

## 1. INTRODUCTION

First, since China's adoption of the reform and opening-up policy, Guangdong and Taiwan have fostered a solid basis of cooperation in the field of electronic information manufacturing. Currently, Guangdong's semiconductor industry is crying for a structural upgrade. Second, integrated new policies have been promulgated by the Guangdong Provincial Government, which are different from the previous fragmented preferential policies for Taiwan. Third, under the new development pattern of "domestic and international dual cycle", semiconductor enterprises of Guangdong and Macau should not only deepen their cooperation on core technologies to further tap the potential of China's market, but also gradually involve them into the regional trade integration to develop the overseas market. These three points constitute three primary backgrounds for the new stage of cooperation between Taiwan and Guangdong on the semiconductor industry.

### 1.1. Solid Cooperation Basis and Demand for Structural Upgrade of the Semiconductor Industry

Thanks to the active interaction of the manufacturing industry between Guangdong and Taiwan over the past four decades, a solid basis for industrial cooperation has been cultivated. Take the semiconductor industry of the two sides for example. Driven by the global industrial chain transfer of the 1990s, Taiwanese enterprises located core R&D of semiconductor products and new product experiments in Taiwan but outsourced their mature products to plants in the Pearl River Delta, where the cost of production elements was lower, for mass production. After that, finished products were directly exported to the international market. Benefiting from the development of triangular trade of the kind, Taiwan's semiconductor industry successfully transformed themselves into industrial clusters with innovation and R&D as their main activities. This could also explain why Taiwan's semiconductor industry plays an influential role in today's international market. On the other hand, investments of Taiwanese enterprises in Guangdong Province have contributed partially to Guangdong's economic development,

turning it into the province with the largest electronic information industry in Mainland China. At present, Guangdong's semiconductors and integrated circuits have found wide applications in fields, such as consumer electronics, 5G communications, artificial intelligence, etc. However, factors, such as the lack of innovation and core technology R&D, Sino-American trade frictions, and international blockade on technologies, have made it an imperative for Guangdong's semiconductor industry and integrated circuit industry to address weak links in the industrial chain [1]. Therefore, the "14th Five-Year Plan" of the Guangdong Provincial Government proposes accelerating the development of key technological fields, such as integrated circuit, to make up weak links of core technologies, and promoting major tasks, particularly "Guangdong's Core Strengthening Action", to realize autonomous and controllable development of major products and key technologies at an earlier date [2]. As Guangdong's traditional manufacturing industry is heading towards the capital-intensive and technology-intensive high-end manufacturing industry, Taiwanese semiconductor enterprises will in the foreseeable future feel the pressure from the industrial structural upgrade of Guangdong's local enterprises.

### ***1.2. Guangdong's Promulgation of Recent Preferential Policies for Taiwanese Enterprises***

In spite of a variety of preferential policies drawn up by the Guangdong Provincial Government for Taiwanese enterprises in the past, these voluminous policies were too fragmented, thus making Taiwanese enterprises confused about how to apply for the incentives and what documents were required for the application. The highlight of policies at the new stage focuses on strengthening the implementation of the policies, that is, to build a steady and shortcut policy map for Taiwanese enterprises so that qualified enterprises can more conveniently apply for relevant subsidies. The implementation of preferential policies for Taiwanese enterprises can effectively provide fiscal support for Taiwanese enterprises, avoiding too many intermediate links and reducing rent-seeking and trading costs.

For example, the Guangdong Provincial Government announced the "Service Guidelines", which integrated previous preferential policies, such as "Several Measures for Promoting Economic and Cultural Exchange and Cooperation between Taiwan and Guangdong" and "11 Rules on Boosting Development of Taiwanese Enterprises". In the future, Taiwanese enterprises only have to turn to the "Service Guidelines" to learn organizations responsible for implementing all policies targeted at emerging industries, qualifications and requirements of application, and detailed application procedures. In December

2020, Shenzhen published the 3.0 Version of the "Compilation of Shenzhen's Preferential Policies for Taiwan", which draws up and combs relevant policy documents and application guidelines, and integrates the currently most important industrial policies, such as the "Action Plan for the Development of Shenzhen's Integrated Circuit Industry during the 14<sup>th</sup> Five-year Plan". This enables Taiwanese enterprises to retrieve policies and regulations on fiscal support that are relevant to their needs. Considering the profound basis of industrial cooperation between Taiwan and Guangdong, and driven by the implementation of policies benefiting Taiwan, an increasing number of Taiwanese enterprises will lay out their business in Guangdong.

### ***1.3. New Stage of Cooperative Development of Semiconductor Industry between Guangdong and Taiwan under the New Development Pattern of "International and Domestic Dual Cycle"***

At present, the Chinese government has been vigorously propelling "new-type infrastructure construction" that is oriented towards intelligentization and digitalization. Under the background, emerging industries of strategic importance represented by 5G, Internet of Things, and artificial intelligence have been prospering with a growing demand for the semiconductor industry. Hence, a majority of Taiwanese semiconductor enterprises have already embarked on the path of deeply digging the potential of the semiconductor market in Mainland China. For instance, Taiwanese merchants from the semiconductor design industry have been planning the development of wearable devices and other intelligent chip, while Taiwanese merchants from the semiconductor sealing test industry has a plan to expand their production lines to the automotive electronics [3]. As mentioned above, Guangdong is the largest consumer of China's electronic information industry, and the local semiconductor enterprises have been pursuing the upgrade of its industrial structure to meet China's domestic market needs. It is apt to say that the huge market potential has created favorable conditions for the entry of the semiconductor industrial cooperation between Taiwan and Guangdong into a new stage.

From the perspective of overseas market expansion, 15 countries, including China, formally signed the Regional Comprehensive Economic Partnership (RCEP), a symbol that one third of the global economies would be integrated into a large market covering Asia and Oceania. Of special note is that a majority of RCEP members are major economic and trade partners of Taiwan's "Neo-Southwards Policies", but Taiwan, in addition to signing the "preferential protocol" with Mainland China, Singa-

pore and New Zealand, has not yet signed the “preferential protocol” with other countries of its “Neo-Southwards Policies”. The signing of the RCEP has improved the liberation and facilitation of members’ trade and investment activities in Asia. Taiwan that is excluded from the RCEP will be faced with the dilemma of marginalization. The mutual exemption of tariffs among members of the RCEP will deal a heavy blow to Taiwan’s export-oriented economy [4]50.

Regarding the trade relations between Guangdong and members of the ASEAN (Association of Southeast Asian Nations), the two sides are geographically separated by the sea. Apart from benefiting from the official dialogue mechanisms, such as the “China (Guangdong) Strategic Cooperation Forum”, the two sides can also make use of opportunities brought by the expanding scale of Guangdong enterprises. According to statistics of the China Customs Guangdong Branch, the ASEAN became the biggest trading partner of Guangdong the first time in history [5]. It is predicted that, following the commencement of the RCEP, the intensity of cooperation between the two sides will be further enhanced.

Currently, China’s domestic semiconductor application market demand has been strengthening. Meanwhile, under the support of the RCEP, Guangdong enterprises have kept on tapping the market potential of ASEAN countries. Besides, intelligentization and digitalization are becoming mainstreams of the industrial upgrade. All this has created unprecedented opportunities for Taiwanese enterprises as Guangdong has been laying out its semiconductor industry for a long time and Taiwan is confronted by the crisis of trade marginalization. With the preferential policy support, the semiconductor industry of the two sides will make a breakthrough of the previously triangular trade partnership to enter a new stage of grasping core technologies for autonomous and controllable development to its own benefit, and capitalizing on the regional trade integration and “One Belt & One Road” Initiative to jointly develop the domestic and international market.

## **2. STATUS ANALYSIS OF SEMICONDUCTOR INDUSTRY OF GUANGDONG AND TAIWAN**

### ***2.1. Status Analysis of Guangdong’s Semiconductor Industry***

Design, manufacturing, and sealing test constitute three most important links of the semiconductor industrial chain. Currently, Guangdong’s semiconductor industry is dominated by the Pearl River Delta, which has Shenzhen at its core and the semiconductor design as its pillar industry. From 2016 to 2019, Shenzhen’s semiconductor design industry maintained a growth rate of above

25%, which suggested a robust development momentum. In 2019 alone, the industrial scale of Shenzhen’s semiconductor design even exceeded 100 billion yuan. It is apt to say that Shenzhen is a leader of China’s semiconductor design industry in terms of both the growth rate and the overall scale [6]. The annual report on intellectual property rights of China’s integrated circuit industry in 2019 showed that applications for patent rights of around 1,196 pieces of integrated circuit layout design were approved throughout Guangdong, accounting for around 23.9% of the national total, which ranked No. 1 in China [7]. This suffices to demonstrate remarkable achievements of Guangdong in the field of semiconductor design.

To sum up, Guangdong’s semiconductor industry, while excelling in design, still has a long way to do in the field of semiconductor manufacturing and sealing test. However, statistics show that the sales volume of Guangdong’s semiconductor industry in 2019 experienced a year-on-year increase of 63.9%, the growth rate far beyond that of the national average [8]. Considering the overall output of Guangdong’s electronic information manufacturing industry, the figure had surpassed 4 trillion yuan by the year 2019, which remained in the first place among Chinese competitors for 29 years in a row. All this can provide solid evidence for the well-established development basis and potential of Guangdong’s semiconductor industry.

### ***2.2. Status Analysis of Taiwan’s Semiconductor Industry***

Data reported by the Semiconductor Equipment and Materials International (SEMI) showed that Taiwan’s global semiconductor output had been more than 102.73 billion USD by the year 2020, ranking No. 2, behind the United States [9]. Taiwan’s market share in the field of semiconductor manufacturing and semiconductor sealing test was as high as 60% and 30%, respectively, both ranking No. 1 in the world. Take Taiwan Semiconductor Manufacturing Company Limited (TSMC) for example. The advanced manufacturing processes constitutes one of the most important competitive advantages of TSMC. Particularly under the background that all major economies in the world are actively developing emerging industries, such as 5G, artificial intelligence, and Internet of Things, cores with a steady efficacy and excellent performance are in need. TSMC was the first of its industry to realize the large-scale mass production of 7-nanometer and 5-nanometer cores. It is expected that TSMC’s 3-nanometer cores would realize mass production in 2022. This has turned TSMC into a major cooperator which major technology manufacturers strive to work with. In addition to the competitive advantages in the advanced manufacturing processes for semiconductors, TSMC is also highly competitive in semiconductor design and sealing test.

This has shaped TSMC's strong cluster effect in the whole semiconductor industrial chain. Besides, TSMC has been developing a semiconductor industrial chain with the most striking competitive advantages in response to the rapidly-growing emerging markets, such as 5G, smartphones, Internet of Things, and wearable devices, as well as to specific needs of downstream customer. While shortening the time of core design, TSMC has also been accelerating the launch of products on the market to enhance the partnership with clients [10]. According to the smiling curve, Taiwan's semiconductor industry is still on two ends of the value chain with a high added value. It possesses obvious advantages to lead the semiconductor market and R&D.

Of special note is that out of 60% of semiconductor products worth around 122.5 billion USD were exported from Taiwan to Mainland China and Hong Kong Special Administration Zone [11]. This suggests that, without the vigorous market demand from Mainland China, it is hard for Taiwan's semiconductor enterprises to gain high profits for reinvestment in innovation and R&D so as to maintain a benign industrial cycle.

As to Taiwan itself, it lacks resources (land supply, water supply, electricity supply, talent supply and workforce supply) and market potential for further development. Though Taiwan's authorities have already upheld the slogans such as "5+2 Industrial Innovation", it is hard for Taiwan's government to promulgate specific fiscal plans to support the development of the new-generation technological industries, particularly under the influence of the global economic recession. On the contrary, Mainland China has emphasized on vigorous fiscal support for the development of the semiconductor industry in addition to the promulgation of planning documents. The highest policy highlight is that the Chinese government established the "National Integrated Circuit Development Industrial Investment Fund" in September 2014. In recent years, the fund pool has increased its investment to 138.7 billion RMB. The investment projects have covered almost the whole semiconductor industrial chain, including semiconductor design, manufacturing, etc[12].

### ***2.3. Entry of Semiconductor Industry of Guangdong and Taiwan into a New Stage of Complementary Development***

The above status analysis of the semiconductor industry in Guangdong and Taiwan shows a strong complementarity of the semiconductor industry between the two sides. Guangdong Province plays a leading role in China's semiconductor design, and is enjoying a sound development momentum in the field. Of course Guangdong's shortages in semiconductor manufacturing and sealing test cannot be ignored. However, Taiwan's semiconductor industry possesses technological advantages in

these two links which the Guangdong counterpart are weak in. This makes the complementary development between the two sides in the semiconductor industry possible.

As stated above, Guangdong is faced with the structural upgrade of its semiconductor industry under three backgrounds of the new development stage. The shortages of Guangdong's semiconductor industry are the strengths of Taiwanese semiconductor enterprises. This lays a solid foundation for the close bilateral technological cooperation on manufacturing and sealing test. The close partnership between the two sides can not only help Guangdong's semiconductor enterprises overcome technological barriers, but also fuel up the demand under the support of Guangdong's preferential policies for Taiwan and the integration of China's semiconductor application market and regional trade. On the other hand, Taiwanese enterprises are faced with marginalization in the regional trade integration process, because of the small local market, insufficiency of the production elements, and lack of the fiscal support. Under the condition, there is an urgent need for the promotion of the bilateral cooperation between Guangdong and Taiwan on the semiconductor industry to jointly lift their position in the global value chain.

## **3. CHALLENGES FACING GUANGDONG-TAIWAN COOPERATION ON SEMICONDUCTOR INDUSTRY AT THE NEW STAGE**

The semiconductor industrial chain of Guangdong and Taiwan is highly complementary. So there is big room for the two sides to cooperate with each other. Nevertheless, as Chinese provinces and cities contend to bring in new policies to support the development of their semiconductor industry, the Sino-U.S. economic and trade frictions keep on escalating under an international environment, and Taiwan's authorities are making use of the Sino-U.S. economic and trade frictions to suppress the development of Mainland China's semiconductor industry and purposely create barriers for the cross-Straits industrial cooperation. Guangdong and Taiwan cooperation on the semiconductor industry has embarked on a new stage with a bundle of new challenges to cope with.

### ***3.1. Obvious Regional Differences of Cross-Straits Semiconductor Industrial Cooperation Intensity***

From Table 1, one can observe the top 5 provinces and cities with the highest cumulative investment amount from Taiwanese businesses in Mainland China from 1991 to 2020. It shows that Taiwanese businesses are mainly interested in investing Jiangsu and Guangdong. Mean-

while, the types of investments attracted by the two provinces from Taiwan are varied. In terms of the amount of investment attracted from Taiwanese businesses, Jiangsu ranks No. 1, which is followed by Guangdong. The former takes up 30.79% of the total, which is obviously higher than that of Jiangsu, being 17.65%. If Shanghai is

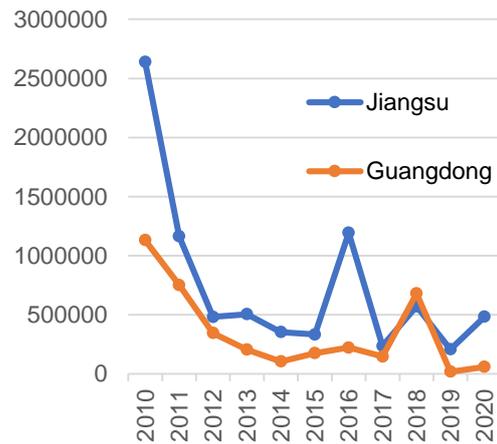
also considered, it can be seen that investments of Taiwanese businesses are mainly concentrated in the Yangtze River Delta, which take up around 45% of the total. Regarding the cumulative number of projects invested by Taiwanese businesses in Mainland China, 30.8% of projects are invested by Taiwanese businesses in Guangdong Province, which far overtakes 16.9% of Jiangsu Province.

**Table 1.** Regional differences of cumulative investments by Taiwanese businesses in Mainland China from 1991 to 2020

Province/City	Amount of investment by Taiwanese businesses (Unit: 1 million USD)	Percentage of the investment amount (%)	Number of investment projects by Taiwanese businesses	Percentage of investments (%)
Guangdong	33963	17.65	13400	30.18
Jiangsu	59245	30.79	7502	16.90
Shanghai	27964	14.53	6422	14.46
Fujian	16925	8.80	5891	13.27
Zhejiang	12712	6.61	2410	11.82

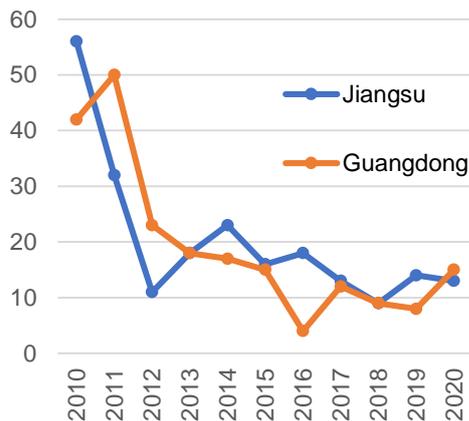
Data source: Taiwan Mainland China Committee

Fig. 1 and Fig. 2 shows investments of Taiwanese businesses in the electronic parts manufacturing industry in Jiangsu and Guangdong over the recent ten years. (Taiwan classifies the semiconductor industry as part of its electronic parts manufacturing industry instead of separately providing statistics for the semiconductor industry. However, Taiwan businesses' investments in Mainland China's electronic parts are concentrated in the semiconductor industrial chain. Therefore, these statistics can also cast light on characteristics of Jiangsu and Guangdong Province to attract Taiwanese enterprises to invest in their local semiconductor industry.) One can notice from Fig. 1 that the investment amount of Taiwanese businesses in Jiangsu's semiconductor industry is most of the time higher than that in the Guangdong counterpart. Nevertheless, Fig. 2 suggests that the number of semiconductor projects invested by Guangdong and Jiangsu by Taiwanese businesses is generally the same. Combining the information of the above table, one can observe advantages of Jiangsu Province in attracting Taiwanese businesses in terms of both the total investment amount and the semiconductor industrial investment amount, while Guangdong Province has an edge over Jiangsu Province in attracting Taiwanese investment projects.



**Figure 1** Amount (Unit: 1,000 USD) invested by Taiwanese businesses in the electronic parts manufacturing industry of Guangdong and Jiangsu from 2010 to 2020

Data source: Economic and Trade Network of Taiwanese in Mainland China



**Figure 2** Number of investment projects of Taiwanese businesses in the electronic parts manufacturing industry of Jiangsu and Guangdong

Data source: Economic and Trade Network of Taiwanese in Mainland China

As to the reason behind the above phenomenon, the author thinks that the cluster advantage of the semiconductor industry in the Yangtze River Delta is more obvious than that in Guangdong, so the former can more easily attract large-scale semiconductor enterprises from Taiwan to invest there. According to the survey carried out by the Research Institute of the China Investment Corporation, the sales scale of the semiconductor industry in the Yangtze River Delta enjoys a market share of around 50% in China, and its output in terms of semiconductor manufacturing and sealing test both take up more than 50% of the national total. In addition, the economic development degree of various cities and counties in Jiangsu Province is more balanced than that in Guangdong Province. Besides, Guangdong's economic development has the Pearl River Delta as its center, and the development in Northern Guangdong, Western Guangdong and Eastern Guangdong is relatively background. Thereby, Taiwanese businesses have more options of investment destinations with a favorable economic basis in Jiangsu Province than in Guangdong Province. So, the existing cluster advantages of Jiangsu Province's semiconductor industry can more easily attract investments from large-scale Taiwanese semiconductor plants. For example, TSMC spent around 3 billion USD in building a new semiconductor manufacturing plant in Nanjing in 2016.

Therefore, Guangdong Province should highlight its advantage in attracting the large number of investment projects from Taiwanese businesses, accelerate the construction of its semiconductor industrial clusters, establish the semiconductor enterprise group in Taiwan's Hsinchu Industrial Park, improve its industry-university-research cooperation, and so on to create favorable conditions to attract large-scale semiconductor plants in the foreseeable future.

### 3.2. Limitations Set by Taiwan's Authorities on Investments in Mainland China's Semiconductor Industry

The other obstacle for Guangdong-Taiwan cooperation on the semiconductor industry to enter a new stage is the strict rules set by Taiwan's authorities on the investments of Taiwanese investments in Mainland China's semiconductor industry. Different kinds of administrative approaches have been adopted to limit the entry of Taiwanese semiconductor enterprises to Mainland China for new development opportunities. At the same time, those investing in Mainland China are required to maintain a technological gap between the semiconductor industrial development in Mainland China and Taiwan. For example, the plant set up by TSMC is devoted to producing 12-nanometer and 16-nanometer semiconductors, while enterprises in Taiwan have already realized mass production of semiconductors of the 7-nanometer or even 5-nanometer standard. Therefore, even if Guangdong Province vigorously attracts Taiwanese semiconductor enterprises to invest locally, the bilateral cooperation on core technologies might still be impossible. Meanwhile, Taiwan's authorities have strict restrictions on the entry of capitals from Mainland China to take a stake in Taiwan's semiconductor industry, requiring the Mainland China to not control its investments in Taiwanese semiconductor enterprises. In 2015, Tsinghua Unigroup from Mainland China had a plan to purchase Taiwanese semiconductor enterprises such as Powertech Technology Inc., but the plan failed because political obstructions posed by Taiwan's authorities [13].

In response to this problem, Guangdong Province can resort to more flexible policies to promote cooperation between the two sides at a new stage in terms of the semiconductor industrial standards, talent exchange, etc. The countermeasures are elaborated in the following part.

## 4. CONCLUSIONS

Currently, Guangdong Province has vigorously made breakthroughs of core technologies, and promulgated new preferential policies for Taiwan to effectively provide fiscal support for Taiwanese businesses to participate in the development of the provincial semiconductor industry. Meanwhile, Guangdong is entering a new development pattern of "international and domestic dual cycle" and the RCEP regional trade integration process. All this has created new historical opportunities and policy support for the complementary cooperation between Guangdong and Taiwan on the semiconductor industry. Concerning how to grasp these opportunities, the author thinks that channels can be further expanded for the Guangdong-Taiwan cooperation on the semiconductor

industry through the following three modes of cooperation.

#### ***4.1. Strengthening Guangdong and Taiwan's Semiconductor Industrial Standards on Cooperation***

Due to administrative limitations imposed by Taiwan's authorities, the cooperation mode in which semiconductor enterprises in Mainland China purchases Taiwanese semiconductor enterprises might have difficulty to move forward. However, in fields with a stronger flexibility, Guangdong-Taiwan semiconductor industry can keep on deepening the bilateral cooperation.

Xi Jinping pointed out on the 40<sup>th</sup> anniversary following the publication of A Message to the Compatriots in Taiwan that the cross-Straits should actively promote the integration of their respective industrial standards[14]. Take the "Cross-Straits Information Industry and Technological Standard Forum" held for 16 years after 2019 for example, It has cumulatively reached a consensus on more than 450 industrial consensuses and 65 shared industrial standards [15].

So Taiwan and Guangdong should speed up the cross-Straits cooperation on semiconductor industrial standards. Guangdong Province can continuously and frequently work with nonofficial self-discipline organizations from Taiwan's semiconductor industry to hold cooperation forums on the formulation of semiconductor industrial standards. Meanwhile, relying on the huge development potential of the electronic information market in China and other emerging markets, the industrial standards drawn up by semiconductor associations from Guangdong and Taiwan can form a set of industrial standards with regional characteristics and competitive advantages, which can then be upgraded into national standards. This can help the semiconductor industry of the two sides to dominate the formulation direction of international standards in this industry.

#### ***4.2. Strengthening Guangdong's Provincial Semiconductor Industrial Cluster Construction and Improving Guangdong-Taiwan Semiconductor Industrial Talent Exchange System***

At present, the biggest bottleneck facing China's semiconductor industrial development is the lack of talents. According to statistics released by the "White Paper on Talents for China's Integrated Circuit Industry (2019 - 2020)", China's semiconductor industry will have a demand of 744,500 talents by the year 2022. By the end of 2019, the number of personnel directly engaging in China's integrated circuit industry maintained at around 511,900. In light of the current annual growth rate of around 10%, the expected talent demand of 2022 cannot

be satisfied. At the same time, China's semiconductor industry is generally experiencing an important and difficult period of developing core technologies, which is crying for leading talents. Nevertheless, leading talents of the industry are hard to bring up. So top-notch talents from the overseas semiconductor industry can be vigorously attracted. To attract international talents and teams from foreign countries is a quick and efficient means to promote industrial upgrade. In recent years, though China's semiconductor industry has been constantly strengthening its introduction of leading talents from foreign countries, the effects are not pronounced. A main reason is that China's policies to attract and retain talents are not competitive enough. The talent report posted by the International Institute for Management Development, China is far behind the United States, Japan, Taiwan and other countries or regions with the mature semiconductor industrial development[16].

Though Guangdong Province does not lack subsidy policies to attract talents. For example, the "Several Measures for Promoting Economic and Cultural Exchange and Cooperation between Taiwan and Guangdong" and "11 Rules on Boosting Development of Taiwanese Enterprises" can support Taiwanese talents working in Guangdong to apply for "One Thousand Talent Plan", "Pearl River Talent Plan", etc. However, as the cross-Straits industrial cooperation on the semiconductor industry is entering a new stage, it is more important to strengthen and implement policies on how to attract talents than on how to retain talents.

Guangdong Province can learn from Taiwan's experience in the period of developing the Hsinchu Technological Park. In the late 1970s, Taiwan started setting up the Hsinchu Technological Park with the high-tech industry at its core. So far, Hsinchu Technology Park has become a major town for the global semiconductor OEM, which has attracted nearly 400 electronic information technological enterprises. Among them, there are some renowned semiconductor enterprises, including TSMC and United Microelectronics Corporation (UMC). From the very beginning, the authorities provided vigorous policy and fund support for these enterprises. Therefore, the Hsinchu Technological Park has attracted a large number of innovation talents either in or out of Taiwan. Besides, the Hsinchu Technological Park is located where the best research universities of Taiwan are here, such as National Tsing Hua University and National Yang Ming Chiao Tung University. The favorable industry-university-research integration has ensured adequate innovation talents for Taiwan's semiconductor industry. It takes Taiwan around three to four decades to achieve today's leadership in the global semiconductor industrial chain via its R&D of high-end core technologies, such as semiconductors.

Moreover, Taiwan and Guangdong share many similarities in language and culture, and Taiwanese businesses have laid out their electronic information industry for a long time in Guangdong Province. This has established a solid basis for the bilateral cooperation. In addition, semiconductor talents in Taiwan, affected by the stereotyped salary system, have actively sought development opportunities in Mainland China. All these are opportunities for Guangdong's semiconductor industry. Thereby, Guangdong Province should speed up its construction of technological universities and semiconductor industrial clusters, and set up specialized area for semiconductor talents from Taiwan to live. This can not only improve the industrial clustering degree of Guangdong's semiconductor enterprises and deepen the industry-university-research integration and attraction for talents, but also retain talents and help them settle down in Guangdong.

### ***4.3. Sharing Dividends of Industrial Cooperation of the New Stage Based on Guangdong's Platform Carriers***

Taiwanese enterprises invested in Guangdong's semiconductor industry should actively join the new development pattern of "international and domestic dual cycle", "One Road & One Belt" Initiative, and other open platforms established in Mainland China so as to share the dividends brought by the new round of reform and opening-up of Mainland China's economy. In recent years, Taiwan's authorities have tried to weaken their reliance of foreign trade development on Mainland China by promulgating the "Neo-Southwards Policy" in 2016. According to this policy, Taiwan will focus on 18 countries, all of which are members of RCEP. However, this policy has backfired, with the percentage of Taiwan's export to the 18 countries declining from 21.3% in 2017 to 17.7% in 2020. On the contrary, the export of Taiwan to Mainland China and Hong Kong increased from 41.2% to 43.9% from 2017 to 2020, which set a record high in history. In addition, export of Taiwan towards 18 countries of its "Neo-Southwards Policy" and to Mainland China was driven by its semiconductor products. Of special note is that RCEP follows the rule of origin, which stipulates that, if products of members of RCEP are adopted, products processed and produced not using materials of the origin will be cumulatively added to finished products. This has strengthened the connection of the industrial chain among RCEP members, which can deal a heavy blow to the industrial chain value of Taiwan that is excluded from the protocol [4]53.

The outbreak of COVID-19 in 2020 resulted in a slump of the world trade. Nevertheless, the trade and economic exchange between Guangdong and the ASEAN countries was unexpectedly strengthened. In 2020, the

ASEAN became the largest trading partner of Taiwan, the first time in history. The bilateral cooperation will be further strengthened following the implementation of the RCEP. Taiwanese semiconductor enterprises should make use of the platform, Guangdong, the province of Mainland China with the closest trading partnership with the ASEAN, and the new preferential policies introduced by Guangdong to support Taiwanese enterprises to march into Guangdong's semiconductor market. Meanwhile, they should realize the bilateral development of the new stage is reciprocal and market-oriented, which is unlikely to be changed subjectively. Taiwan's advantage in the semiconductor industry still remains, so it should accelerate the deepening of its industrial cooperation with Mainland China in the field. The policy of Mainland China on promoting development of semiconductor core technologies serves as a golden opportunity for Taiwan's semiconductor industry. Relying on the regional trade integration and the implementation of the "One Belt & One Road" initiative, Guangdong and Taiwan can jointly develop the global market.

### **AUTHOR'S CONTRIBUTIONS**

Z.Z. designed research, performed research, analyzed data, and wrote the paper.

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