Survey and Research on the Development of Technology Contracts in Dongguan

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Abstract: Under the strategic opportunity of deepening regional innovation and coordinated development of Guangdong-Hong Kong-Macao Greater Bay Area, Dongguan's technology market presents the distinctive feature of "late start and fast growth", and the turnover of its technology contracts has realized over 30 times leapfrog growth in the past ten years. However, the structural contradiction of the technology market is becoming more and more obvious: the proportion of technology development contracts has been over 75% for a long time, the concentration of technology transactions in the field of electronics and information is as high as 64%, and the contribution rate of major technology contracts is over 90%, forming a pattern of "unipolar dominance"; at the same time, there is a serious imbalance between the scale of technology absorption and output, which exposes the shortcomings of the local technology supply capacity. At the same time, the serious imbalance between the scale of technology absorption and output exposes the shortness of local technology supply capacity. Through data analysis, this study systematically reveals the deep-rooted contradictions in the ecology of technology transactions, and provides data support for reconstructing the diversified technology transaction system, promoting the synergy of the "R&D-transformation" chain, and optimizing the allocation of regional innovation resources.

Keywords: Regional Innovation; Technology Market; Technology Contract; Dongguan

1. Introduction

Against the background of intensified global competition in science and technology innovation and the in-depth implementation of the national strategy of the Guangdong-Hong Kong-Macao Greater Bay Area, the technology market, as a core hub for the transformation of scientific and technological achievements, has become an important driving force for the transformation and upgrading of the regional economy. As a manufacturing town in Guangdong Province, the development of Dongguan's technology market is not only related to the migration of local industries from "manufacturing" to "smart manufacturing", but also a key link in the construction of an international science and technology innovation center in the Greater Bay Area. In recent years, Dongguan's technology market has shown rapid growth, but compared with advanced cities such as Guangzhou and Shenzhen, there is still a structural imbalance and institutional shortcomings, and a systematic study is urgently needed to clarify the development path.

Data show that from 2012-2023, Dongguan's technology contract turnover climbed from 145 million yuan to 9.24 billion yuan, and the transformation efficiency of technology transactions on R&D investment was significantly improved. However, the structural imbalance within the market is prominent: technology development contracts are dominant, while technology consulting and service contracts have been marginalized for a long time; the scale of technology absorption far exceeds that of output, and the local technology supply capacity is weak; technology transactions in the field of electronics and information are highly concentrated, and a diversified innovation ecology has yet to be formed. In addition, despite the outstanding contribution of major technology contracts, the realization of the goals of the 14th Five-Year Plan still faces serious challenges.

2. The Basic Situation of Dongguan's Technology Contract

Dongguan's technology market in general is characterized by a late start and rapid development, and the turnover of technology contracts has shown strong growth over the past decade or so, steadily climbing to 1.832 billion yuan in 2018 since 145 million yuan in 2012. It is noteworthy that a leaping growth was realized in 2019, jumping to a historical high of 22.207 billion yuan in one fell swoop, followed by a sharp retracement to 6.953 billion yuan, but it has risen stepwise to 9.24 billion yuan by 2023, showing an overall growth trend.

In terms of contract volume, apart from the unusual peak in 2019, the pace of growth has remained steady in all the other years. In particular, in 2023, the number of registered contracts reached 414, almost equal to the historical peak of 417 in 2019, a figure that strongly proves the robustness and continuity of Dongguan's technology market.

Observing further, the turnover of an average single contract has grown from 955,000 yuan in 2012 to 22,319,000 yuan in 2023, a significant increase that not only highlights the increasing proportion of high-value contracts in Dongguan's technology market, but also reflects the continued improvement in the quality and economic benefits of technology transactions.

The share of Dongguan's technology contract turnover in gross domestic product (GDP) has steadily increased from 0.2% in 2018 to 0.8% in 2023. Excluding abnormal fluctuations in 2019 due to the surge in technology contract registrations, the share has stabilized in the range of 0.6% to 0.9% in recent years, a trend that highlights the increasingly close association and virtuous cycle of mutual promotion between Dongguan's technology market and economic development.

At the same time, the proportion of technology contract turnover in research and development (R&D) expenditure has also grown significantly from 7.8% at the beginning to 19.7% in 2023. This jump in data deeply reflects that Dongguan's investment in R&D is being effectively transformed into actual technology transactions and considerable economic benefits, and that Dongguan's efficiency and results in technological innovation and transformation have been significantly improved.

3. Dongguan Technology Contract Composition

A technology contract consists of four parts: a technology development contract, a technology consulting contract, a technology service contract and a technology transfer contract.

3.1 Technology Development Contracts

Between 2018 and 2022, both the number and volume of technology development contracts show an upward trend amidst fluctuations. Specifically, the volume of contracts exceeded the 200-item mark for the first time in 2017, then reached a peak of 384 items in 2019, and despite experiencing a rapid decline in the following year, it steadily rebounded in the following years to reach 297 items in 2022. In terms of volume, it similarly hit an all-time high of $19.196 billion in 2019, and then, despite subsequent fluctuations, has rebounded to $7.746 billion by 2022.

It is worth noting that the situation of the share of technology development contracts in the overall technology contracts shows some changes. In terms of the share of contract volume, its dominant position is remarkable, but the share is decreasing year by year, from the highest 92% in 2018 to 75% in 2022. As for the share of turnover, except for 2020, when it was slightly below 80%, it stabilized at a higher level of 80% to 90% in the rest of the years, although it also showed a declining trend overall.

Comprehensively, the ratio of turnover and turnover can make it clear that technology development contracts occupy a core position in Dongguan's technology contract system. Over the past five years, the average value of the number of technology development contracts has been as high as 85%, and the average value of the turnover has reached 75%, which is a strong proof of the mainstay role of technology development contracts in Dongguan's technology transactions.

3.2 Technical Consultancy Contracts

Among the multiple components of technology contracts in Dongguan, technology consulting contracts are at the lowest level in terms of the share of both contract volume and turnover, and both indicators have been near zero for many years, highlighting their marginal position in the overall structure. However, looking at the observation cycle from 2018 to 2022, technology consulting contracts exhibit some dynamics.

Specifically, after experiencing two consecutive years of zero contract volume in

2018 and 2019, technical consulting contracts witnessed significant growth in 2020, reaching a historic peak of 13, but then gradually declined in the following years, falling to only 2 in 2022, and its share correspondingly slipped from the peak of 5% to 1%, with the average share over the five-year period remaining at a low of about 1.2%.

The trend of change in the turnover of technology consulting contracts is closely related to the contract volume, which also reaches a peak in 2020, but is only $0.09 billion, showing its relatively small transaction size. In other years, the turnover of technology consulting contracts is even as low as 0, further confirming its marginalized status in Dongguan's technology transaction market.

3.3 Technology Transfer Contracts

In terms of the number of items of technology transfer contracts, it was relatively stable from 2018 to 2020, remaining at a low level of between 10 and 15 items. However, this figure shows significant growth momentum into 2021 and reaches a high of 46 items in the following year 2022, indicating a gradual warming up of technology transfer activities in Dongguan.

In terms of contract volume share, the performance of technology transfer contracts is equally remarkable. Its share reaches its lowest point in 2019 at just 3%, while it rises steadily in the following years and climbs to a new high of 12% by 2022. On average, the number of technology transfer contracts accounts for about 6.7% of the total technology contract volume, which is a low starting point but with a clear growth trend.

In terms of turnover, technology transfer contracts show more significant fluctuation characteristics. Specifically, its turnover, which was only 170 million yuan in 2020, reached a peak of 4.397 billion yuan in 2020, showing an unprecedented boom in technology transfer activities in that year. However, this growth momentum did not last, and the turnover declined in the following years, falling to 1.857 billion yuan in 2022, showing an overall trend of change that first rises and then falls.

At the same time, the proportion of technology transfer contract turnover in the total technology contract turnover showed similar fluctuations, reaching a historical high of 63% in 2020, indicating that technology transfer played a pivotal role in the overall technology transaction market in that year. However, in line with the fluctuations in turnover, the share then declined significantly over the next few years, to a low level of 19% in 2022. On average, the share of technology transfer contract turnover is about 25%, but this value hides a high degree of volatility, reflecting the uncertainty and complexity of the technology transfer market.

3.4 Technical Service Contracts

The volume and turnover of technical service contracts showed a fluctuating upward trend, with the volume of technical service contracts accounting for between 3% and 13% of the total volume of technical contracts, with an average value of 7.3%. The proportion of turnover is relatively low, ranging from 0.1% to 0.5%, with an average value of 0.3%.

Technical services are usually performed to solve specific technical problems or provide technical support, and are often regarded as auxiliary services compared to more innovative and core-competitive activities such as technology development and technology transfer. The execution of technical service contracts may involve more complex coordination and communication efforts and may be relatively less attractive.

4. Technology Export and Absorption in Dongguan

Dongguan is a typical outward-oriented city in terms of technology demand, unable to meet the balance between technology demand and supply, with technology supply lagging far behind technology demand. Statistics show that in 2021, the number of exported technology contracts in Dongguan was only 301, and the number of absorbed technology contracts was as high as 5,163, which is 17 times the number of exported technology contracts, and far exceeds the average level of Guangdong Province by 3.8 times, emphasizing Dongguan's strong dependence on and thirst for external technology resources.

In terms of transaction value, the turnover of exported technology contracts amounted to RMB 1.31 billion, while the turnover of absorbed technology amounted to RMB 50.22 billion, with the latter being 38 times that of the former, and also far ahead of the overall average of Guangdong Province, which is 1.3

times higher than that of Guangdong Province as a whole. In terms of the Guangdong-Hong Kong-Macao Greater Bay Area, Dongguan's ratio of technology absorption to output turnover is even more significant, surpassing not only Shenzhen's 1.5 times, Foshan's 7.8 times, and Guangzhou's 0.6 times, and is the highest among Guangdong-Hong Kong-Macao Greater Bay Area cities. The significant increase in the number of technologies absorbed in Dongguan is a result of the strong demand for external technologies from Dongguan City's enterprises and research institutions. This may be due to the need to introduce more advanced technologies to support industrial upgrading, restructuring or the development of new industries in Dongguan City.

Between 2019 and 2021, the multiplier difference between Dongguan in terms of absorbing and exporting technologies shows a significant and rapid widening trend, jumping from 7 times (in terms of volume) and 2 times (in terms of turnover) in 2019 to 17 times and 38 times in 2021, reflecting the trend of increasing imbalance between the demand and supply of technologies. It is worth noting that although the volume of exported technology contracts and turnover in Dongguan in 2019 are higher than the corresponding values in 2021, on the contrary, in terms of technology absorption, the number of contracts and turnover in 2021 significantly exceed the level of 2019, indicating that Dongguan's desire for and ability to absorb external technology has significantly increased in these two years.

5. Geographical Composition of Technology Contracts in Dongguan

According to the authoritative data of the 2022 Annual Report on National Technology Market Statistics, Dongguan City showed strong strength in the field of technology absorption in FY2021, with the total turnover of its technology trading contracts amounting to RMB 50.22 billion, covering a total number of 5,163 projects, with an average turnover of a single contract of about RMB 9.727 million, an achievement that not only highlights the activity of Dongguan's technology market, but also surpasses the This achievement not only highlights the activity of Dongguan's technology market, but also exceeds the average level of Guangdong Province as a whole (7.687 million yuan).

Further analyzing the geographical distribution of technology absorption, the number of technology transaction contracts absorbed by Dongguan from within Guangdong Province in that year was 1,632, occupying 32% of the total number of contracts absorbed in that year, reflecting the closeness of technological cooperation within the province, and the transformation of regional innovation achievements. At the same time, Dongguan actively expanded international cooperation and exchanges, absorbing 20 technology transaction contracts from Hong Kong, Macao and Taiwan, making it the provincial city that absorbed the most technology from Hong Kong, Macao and Taiwan.

Particularly noteworthy is that Dongguan absorbed a large number of technological resources from other regions in mainland China besides Hong Kong, Macao and Taiwan and Guangdong Province, with the number of contracts reaching as high as 3,426, which accounted for 66% of the total turnover of absorbed technologies in that year, a ratio that fully demonstrates Dongguan's national influence as a highland of technology absorption. In addition, Dongguan also actively embraced global technology resources, absorbing 85 technology transaction contracts from outside China, accounting for 2% of the total technology turnover absorbed that year, injecting international elements and vitality into Dongguan's science and technology innovation.

6. Characteristics of Dongguan Technology Contracts

Electronic information manufacturing and electrical machinery and equipment manufacturing are Dongguan's pillar industries. In 2021, the operating revenues of the electronic information manufacturing industry and electrical machinery and equipment manufacturing industry (on a regular basis) accounted for 53% and 22.6% of the city's (on a regular basis), respectively, which were significantly ahead of other industries, highlighting their core position in Dongguan's economic map. Against this backdrop, Dongguan's electronic information technology sector was particularly active in the registration of technology contracts, with a total of 176 contracts registered that year, with

a turnover of up to 4.348 billion yuan, a year-on-year growth rate of up to 131.23%, accounting for 64.14% of the city's turnover in technology contracts, which ranked first in all industries, and its turnover was almost twice as much as that of the second-ranked advanced manufacturing sector (with the latter accounting for 2.197 billion yuan, or 32% of the city's turnover). 2.197 billion yuan, accounting for 32.40%). The combined turnover of these two sectors accounted for 96% of the city's technology contract turnover, while the rest of the technology sectors accounted for only 4%. Electronic information technology is not only an important support for Dongguan's economy, but also plays a leading role in technological innovation and achievement transformation. This highly concentrated technology turnover also reflects Dongguan's market attractiveness and industrial agglomeration effect in the field of electronic information technology.

7. Status of major Technology Contracts

In 2020, the total value of major technology contracts worth more than RMB10 million in Dongguan reached RMB6.574 billion, an amount that accounted for 94.55% of the total value of technology contracts for the year, highlighting the core position of major technology contracts in Dongguan's technology trading market. 2021, Dongguan continued to deepen its cooperation in technology trading, with the number of major technology contracts worth more than RMB10 million increasing to 62, achieving an annual increase of 67.57%. The number grew to 62 items, realizing an annual growth of 67.57%. At the same time, the turnover of these major technology contracts also reached RMB 6.261 billion. Although the proportion of the total turnover of the city's technology contracts dropped slightly to 92.35%, it still maintained a very high contribution rate, fully demonstrating the high value orientation and strong vitality of Dongguan's technology transactions.

8. Summary of Data on Technology Contracts in Dongguan

To summarize, Dongguan's data on technology contracts are mainly characterized by the following features：

8.1 Rapid Development but Huge Gap with Advanced Cities

The turnover of technology contracts in Dongguan ranks 3rd in Guangdong Province after Guangzhou and Shenzhen, with the average turnover of a single contract growing rapidly from 955,000 yuan in 2012 to 22,319,000 yuan in 2023, and the share of the turnover of technology contracts in the Gross Domestic Product (GDP) increasing steadily from 0.2% in 2018 to 0.8% in 2023. The share of technology contract turnover in research and development (R&D) expenditure also grew significantly from 7.8% at the initial stage to 19.7% in 2023.

In 2023, Guangzhou registered 20,555 technology contracts with a turnover of 255.082 billion yuan, and Shenzhen registered 17,256 with a turnover of 158.025 billion yuan, with the combined turnover of the two cities accounting for 76.25% of Guangdong Province, and the turnover of Guangdong Province accounting for 93.08%. Dongguan accounted for only 0.83% of Guangdong Province in terms of volume and 2.08% in terms of turnover. Guangzhou and Shenzhen have an absolute leading position in technology transactions, and these two cities are at the center of science and technology innovation activities in Guangdong Province and even the whole country. Although Dongguan's technology market has made great progress, it is still lagging behind, and there is still much room for improvement in terms of scientific and technological innovation and transformation of achievements.

8.2 Uneven Types of Technology Transactions

In the past five years, the number of technology development contracts in the Dongguan technology market accounted for 85% of the total number of technology contracts, which is the absolute core force in technology transactions; the number of technology consulting contracts was 0 for many years, accounting for 1.2% of the total number of technology consulting contracts; the number of technology transfer contracts accounted for 6.7% of the total number of technology service contracts, and the total number of technology service contracts accounted for 7.3% of the total number of technology consulting contracts. In terms of the number of contracts, the number of technology development contracts is far ahead, the number of technology transfer contracts and technical service contracts is basically

equal, and the number of technical consulting contracts is the least.

In terms of the proportion of turnover, the turnover of technology development contracts still maintains absolute dominance, with the average value accounting for about 3/4, the turnover of technology transfer contracts accounting for 1/4, and the turnover of technology service contracts and technology consulting contracts accounting for about zero.

The imbalance in the structure of technology transactions is remarkable. The proportion of technical consulting contracts in the number of contracts and turnover is extremely low, and even the value is 0 for many years, which indicates that the demand for technical consulting in Dongguan is relatively small, or the related services have not been fully developed. Nevertheless, as an important link in the process of technological innovation, the lack of technological consulting may limit the breadth and depth of technological innovation in the Dongguan region to a certain extent. The sharp fluctuation in the turnover share of technology transfer contracts indicates that its position in technology contracts is not stable enough, and policy support and market guidance need to be further strengthened. Technical services play a more obvious supplementary role in technology transactions in the Dongguan region, but have not yet become a dominant force. The low turnover share of technical service contracts may be related to the nature of their services, i.e., most technical services may be traded in non-monetary forms or at lower prices.

On the whole, the composition of technology contracts in the Dongguan region is characterized by a predominance of technology development contracts, supplemented by other types of contracts. This reflects Dongguan's strengths and potential in technological innovation, but also reveals its shortcomings and room for improvement in the areas of technological consulting, technology transfer and technological services.

8.3 Uneven Turnover of Individual Contracts in Technology Transactions

Dongguan technology contract single turnover showed an uneven state, in which the average single turnover of technology contracts was 27.61 million yuan, the average value of technology development contracts was 25.22 million yuan, which was basically the same as the average of the total amount, and the average value of technology transfer contracts was 91.05 million yuan, which was 3.3 times of the average value of the total amount of the contracts. The transfer of technological achievements has a high market value and potential for commercialization, and some core competitiveness of the technologies or patents that can attract high transfer fees. The average value of the single contract turnover of technology consulting contracts and technology development contracts is basically equal, at 710,000 yuan and 850,000 yuan respectively, only about 3% of the average value of the total number of contracts. Technology consulting and services are regarded as more basic or auxiliary activities, with relatively low commercial value, or these services have not yet been fully recognized and priced by the market. The turnover of individual contracts is extremely uneven, as evidenced by the basic nature of technology development contracts, the high-value nature of technology transfer contracts, and the high-growth nature of technology consulting and technology development contracts. In the technology innovation ecosystem, the commercialization of high-end technological achievements has been more successful, but the development of complementary links such as technology consulting and services has lagged behind.

8.4 Demand for Technology Far Exceeds the Strength of Technology Supply

Dongguan's technology acceptance features are obvious, and technology absorption is significantly higher than technology output, indicating that Dongguan's technology demand is strong, the number of technology absorption contracts is high, and Dongguan's enterprises have a strong demand for technological innovation and industrial upgrading, and need to introduce external technologies to meet their development needs.

In contrast, the number of technology output contracts is relatively small, and the supply of technology is relatively insufficient, indicating that in terms of technological innovation and R&D, Dongguan colleges and universities, scientific research institutes, and enterprises are mainly on the technology supply side of the technological reserve and innovation

capacity is relatively weak, making it difficult to form an effective technology output.

8.5 High Concentration of Technology-Demanding Industries

Market demand in the electronics and information sector is much higher than in other industries, and innovative technology research and development and intellectual property trading activities around this sector are active. This centralization may help to form a more professional and efficient technology trading network, and promote technological innovation and industrial upgrading in related industries.

8.6 Large Gap between Technology Contracts and Set Targets

The “14th Five-Year Plan for Science and Technology Innovation in Dongguan” clearly sets the ambitious goal that by 2025, the turnover of technology contracts in Dongguan will reach RMB 26 billion. However, in 2023, the city's technology contract turnover was only RMB 9.24 billion, a significant gap between this value and the target, reflecting a large deviation between the current progress and the expected goal.

Further reviewing the growth trend between 2020 and 2023, it is not difficult to find that, despite the growth, the overall growth rate is not satisfactory, showing that there are still many challenges in promoting the transformation of scientific and technological innovation results and promoting technology transactions. The next two years will be a daunting task and difficult to implement in order to achieve the technology contract turnover targets set in the 14th Five-Year Plan.

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