

Deciphering of the development process of innovation network in Shenzhen, China

Zhe Huang

School of Geography and Planning, Sun Yat-sen University, Guangzhou Guangdong, 510275

Abstract: under the background of intensified international trade conflicts, continuous scientific and technological blockade and rapid reconstruction of the global production network, innovation has become an important strategy for China to meet the challenges of global development. The city is the machine to stimulate innovation activities, and the innovation network is the organizational system structure formed by the main body of urban innovation for creation, communication and exchange. As an important subject of the innovation network, China's central and local governments at all levels actively govern through the innovation network to achieve the goal of stimulating regional innovation, driving urban economic development and responding to global development challenges. This paper takes Shenzhen, a newly emerging innovative city in China, as a case study, analyzes the development and evolution of its innovation network, and reveals the governance strategies of China's central local governments at different development stages and global local development trends.

Keyword: innovation network; Shenzhen; development process; governance strategies

1. introduction

Since the global financial crisis in 2008, the economic globalization with the clue of the governance of the global production and R & D network of transnational corporations has suffered a huge blow, and the world has set off a wave of anti globalization. As one of the biggest beneficiaries of globalization, China is facing great challenges in the reconstruction of global production network and global value chain trade. The global governance layout of multinational enterprises' production networks has always been the most important force leading economic globalization, and the regional embeddedness of multinational enterprises' global production networks significantly promotes the change of the organizational structure of regional industrial innovation system. Under the background of international trade conflicts and technological blockades, multinational enterprises' governance and reconstruction of global production networks have shifted from efficiency priority to toughness, political economy, geography, security and other factors. Thus, the local innovation network is rapidly reconstructed. On the other hand, different from the growth machine of Western Neo liberalism, the key to the rise of the "China model" is to form a response to internal and external development crises through the governance of the "state market" relationship. As the core actor of the "China model", the government (state) took the lead in proposing to meet the challenges of globalization with innovation, and gradually became the governance consensus of the central and local governments at all levels. How the innovation policy of the Chinese government affects the development of its innovation network has attracted much attention.

The concept of "innovation network" was first proposed by Freeman. It refers to an institutional arrangement for systematic innovation based on the innovation cooperation relationship between enterprises. Innovation network is a network like organizational structure and spatial structure formed by multiple actors (enterprises, R & D institutions, colleges and universities, local governments, intermediaries and individuals) in the region for Innovation Association. It is the sum of the stable, innovative, formal or informal relationships established between various actors in the process of interaction and collaborative innovation. In the 21st century, economic globalization has profoundly reshaped the regional innovation network and has become the most important force to promote global economic development and local industrial upgrading. In the existing research, there are many researches on how to form and develop the innovation network of the leading developed countries in science and technology, and there is still a lack of systematic research on how to form and develop the innovation network of developing countries in the process of economic globalization. This paper aims to reveal how China's central local governments at all levels promote the development and evolution of their innovation networks through innovation governance policies in the process of responding to global local development challenges by taking Shenzhen, a newly emerging innovative city in China, as the research object.

2 study area and research methodology

2.1 Study area

Shenzhen, the research object of this paper, is a vice provincial city of Guangdong Province and a city specifically designated in the national plan. It is one of the first four special economic zones in China to open to the outside world. Shenzhen was set up in 1979. In 1980, four special economic zones were set up in Luohu, Futian, Nanshan and Yantian; In 2010, the central government approved the expansion of Shenzhen Special Economic Zone to the whole region. At the beginning of its establishment in 1980, Shenzhen's GDP was only 270 Million yuan. By 2019, its GDP will reach 2692.7 billion yuan, with a permanent population of 17.56 million and a total area of 1997.47 km². Shenzhen is one of the cities with the highest level of regional innovation and development in the country. In 2019, the whole society's

R & D investment accounted for 4.93% of the regional GDP, which has exceeded the level of developed countries. The number of PCT international patent applications ranked first in the country for 17 consecutive years.

This paper argues that “innovative development” is the main strategy for Chinese cities to cope with the challenges of global competition. From the perspective of the development process of Shenzhen, the global challenges it faces are caused by two key events: China’s accession to the World Trade Organization (WTO) in 2001 and the global financial crisis of 2008. Therefore, the development process of Shenzhen can be divided into three stages: the “initial stage of reform and opening up” from 1978 to 2000, the “post WTO period” from 2001 to 2008, and the “post financial crisis period” since 2009. The following will study the development process and government governance strategies of Shenzhen innovation network in three stages.



Figure 1 location of Shenzhen in Guangdong Province, China

2.2 Data sources

The main research data of this paper is the invention patent data published by the State Intellectual Property Office (SIPO). As the data widely used in innovation research and analysis, patent data is divided into three types: invention, appearance and utility model patents. Invention patents are more representative because they can better reflect innovative technology and contain innovative development. In this study, the data of invention patents issued by the State Intellectual Property Office (SIPO) were selected to characterize the innovation activities and links. This paper collected a total of 645000 invention patents in Shenzhen from 1985 to 2020.

2.3 Methodology

In this paper, the geographical location of the innovation subject is represented by the application address of the invention patent applicant, and the cooperation relationship of the innovation network is represented by the joint application of the invention patent applicant. The network characteristics are analyzed and visualized by ArcGIS and Gephi software. This study uses social network analysis (SNA) method to analyze the evolution and development of innovation space network. The description method of social network analysis for individual, cluster and network characteristics can more accurately express the relationship between innovation individuals and innovation spatial units. Pairing patent data to establish a co-occurrence matrix. Expression (1) measures the degree of centrality of points in the innovation network, S_i indicates the proportion of the nodes (the number i) directly connected to innovation entities in the number of all nodes. The value of L_{ij} is counted as 1 when i and j connected directly, otherwise it is 0. The higher the degree of centrality, the more important the role of innovation subject in the organizational structure of innovation network.

$$S_i = \sum_{j=1}^n \frac{L_{ij}}{n} \#(1)$$

3 Shenzhen innovation network development and government governance policies at various

development stages

3.1 Early stage of reform and opening up (1978-2000)

From 1978 to 2000, Shenzhen completed the initial accumulation stage of innovation by using the technology introduction of “three to one compensation” (collectively referred to as “processing with supplied materials”, “assembly with supplied parts”, “processing with supplied samples” and “compensation trade”). Because the original industrial base is relatively weak, enterprises mainly innovate through the technology introduction of “three to one compensation” processing trade, “learning by doing” and “imitation absorption improvement”, so the total number of invention patents is small. From 1978 to 2000, the total number of patents in Shenzhen was only 1419, most of which were distributed in the special economic zones. At this stage, there are only 50 times of cooperation among innovation subjects within the city, and the cooperation is mainly point-to-point linear connection, without forming a localized innovation network (see Figure 2).

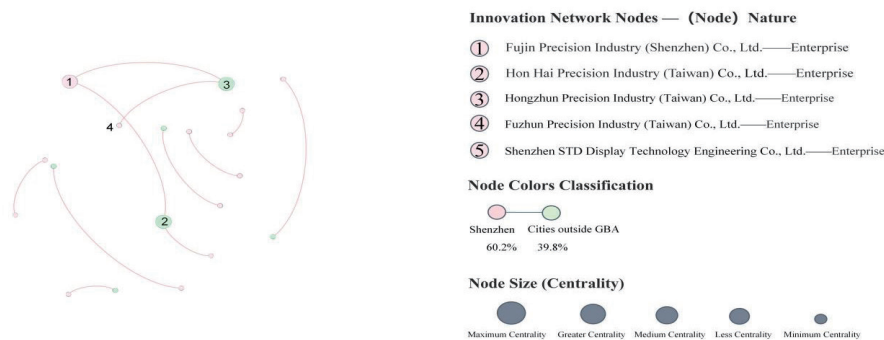


Figure 2 Innovation network of the joint invention patents in Shenzhen (1990-2000)

At this stage, Shenzhen’s innovation activities are mainly due to the establishment of special economic zones. Through the institutional arrangement of the special economic zone, Shenzhen has become a “policy highland” and “cost depression” for the mainland to undertake national industrial transfer. In 1980, the regulations of Guangdong Province on special economic zones were promulgated, officially establishing the Shenzhen Special Economic Zone with a total area of 327.5 square kilometers; Through the institutional arrangement of “special policies and flexible measures” authorized by the central government to the local government, Shenzhen Special Economic Zone has become the most favorable area for industrial policies and the richest area of regional assets in mainland China. Shenzhen Special Economic Zone became the most favorable open area for mainland China to attract foreign investment and the most clear policy environment at that time. It attracted a large number of overseas investment, enterprise equipment and technical talents from Hong Kong, Macao and Taiwan as the main body to gather in Shenzhen Special Economic Zone, forming a division of labor and cooperation with Hong Kong; On the other hand, Shenzhen Special Economic Zone was the most flexible domestic operation system and the most abundant innovation opportunities at that time. It attracted central enterprises and state-owned enterprises with relatively strong technical force from all over the country to set up branches in Shenzhen and even directly relocate to Shenzhen - the combination of the two forces formed the unique “external and internal” industrial development mode of Shenzhen Special Economic Zone at that time. However, due to the weakness of the original industrial base and the low technological level of enterprises in Shenzhen, the spillover of global innovation knowledge can only be achieved through the introduction of technology in processing trade, “learn by doing” and “imitation absorption improvement”, and there is no obvious knowledge innovation marked by a large number of invention patents.

By the end of the 20th century, overseas investment and multinational enterprises had accelerated their flow into Shenzhen. IBM, Compaq, DuPont, Sanyo, Ricoh, Panasonic, Sony, Toshiba, Siemens, etc. have put the production of products with higher technical content in Shenzhen, and high-tech products have gradually replaced light industrial consumer goods as the main export products in Shenzhen. Local enterprises have gradually formed the innovation base of high-tech industries by either obtaining technology transfer through cooperation or forming technology accumulation through imitation, absorption and improvement. By joining the global production network, Shenzhen has completed the accumulation of the original foundation of regional innovation and significantly improved the regional innovation ability. In 2000, the total output value of industries above the designated size in Shenzhen was 258.6 billion yuan, of which foreign-invested enterprises accounted for 33.1% and enterprises with investment from Hong Kong, Macao and Taiwan accounted for 36.7%. The proportion of high-tech industries in Shenzhen’s industrial structure has gradually increased. The output value of high-tech products in the city increased from 22.58 billion yuan in 1995 to 106.45 billion yuan in 2000, an average annual increase of 36.4%. The proportion of the output value of high-tech products in the total industrial output value increased from 20.5% in 1995 to 42.28% in 2000. There are more than 490 private science and technology enterprises recognized by Shenzhen Science and Technology Bureau. At the same time, due to the prevalence of the global

flexible and specialized production mode, the core production departments of multinational enterprises have been transferred to Shenzhen, forming wheel and axle local industrial clusters (such as Foxconn), thus forming a global channel for technology spillovers.

3.2 post WTO period (2001-2008)

After China's accession to the WTO in 2001, the inflow of overseas FDI accelerated in an all-round way, and multinational enterprises accelerated the transfer of manufacturing capacity to China. The central government has fulfilled its commitment to join the World Trade Organization and increased its opening-up efforts. Cities in the Pearl River Delta have set off a construction boom of "development zones" and "new towns and new districts", attracting overseas investment with lower land costs. This is not conducive to the Shenzhen Special Economic Zone, which does not have a vast land area. On the one hand, after China's accession to the WTO, Shenzhen's "one step ahead" policy dividend gradually disappeared; On the other hand, the special economic zones are facing "four unsustainable problems" in land space, population, resources and environmental carrying capacity, and the comprehensive cost of industry has no advantage.

Therefore, since 1996, Shenzhen has put forward the development goal of developing high-tech industry, and started to guide the low-end manufacturing industry in the special zone to move out in an orderly manner with policies, making room for high-tech industry. 2001-2008 is the development stage of Shenzhen's transformation to high-tech industry and the formation of a regional innovation system with local innovation ability. Then, outside the special economic zone, the municipal government led the construction of municipal industrial platforms such as "Shenzhen high tech industrial belt" and "four new towns" to guide the transformation of Shenzhen into high-tech industry. In 2006, Shenzhen put forward the development goal of "national innovative city" in the form of No. 1 document of the municipal government, and issued a series of policies to support the development of the regional innovation system, such as the decision on improving the regional innovation system and promoting the sustainable development of high-tech enterprises (shenfa [2004] No. 1). The government's institutional arrangements have received positive responses from market participants: from 2001 to 2008, the total number of invention patents in Shenzhen reached 73177, nearly 52 times that of 1978-2000; Among them, the number of patents with joint applicants (innovation cooperation) is 12641, accounting for 17.27%. Among them, the innovation network is mainly connected with Taiwan, China. The number of innovation cooperation in Shenzhen's internal innovation network only accounts for 13.80% of the total number of innovation cooperation. Among them, Hon Hai Technology Group (Foxconn) is the innovation subject with the highest centrality in the global innovation network in Shenzhen, and Huawei Technology Co., Ltd. is the innovation subject with the highest centrality in the local innovation network.

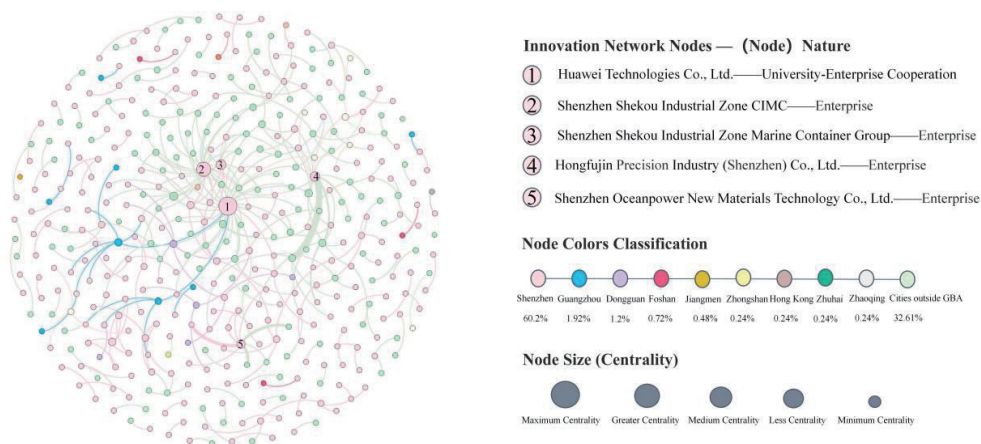


Figure 3 Innovation network of the joint invention patents in Shenzhen (2001-2008)

The government's policy guidance has received positive response from the market. The original traditional industrial clusters such as underwear, watches, clothing, molds, furniture, bicycles and so on have been gradually replaced by high-tech enterprise clusters. The manufacturing industry in the special zone has gradually transformed into a producer service industry cluster, while the manufacturing industry outside the special zone has gradually upgraded to a high-tech industry manufacturing cluster

Inspired by the innovation policies of the local government to encourage the development of high-tech industries, local enterprises in Shenzhen started with original equipment assembly (OEA), original equipment manufacturing (OEM), and original design manufacturing (ODM), and eventually developed into original brand manufacturing (OBM). It has formed a regional innovation system with enterprises as the main body and four 90% characteristics: more than 90% of R & D personnel are concentrated in enterprises, more than 90% of R & D funds come from enterprises, more than 90% of R & D institutions are set up in enterprises, and more than 90% of service invention patents come from enterprises. Multinational companies not only take Shenzhen as a low-cost manufacturing base, but also gradually move into their core production and R & D departments, strategic partners and core suppliers; Global technology giants apple, Microsoft, Oracle,

Qualcomm, Intel, Samsung and other multinational companies have set up global R & D centers in Shenzhen. Huawei, ZTE, BYD and other local technology flagship enterprises also rose rapidly during this period by embedding in the global production network.

3.3 Post financial crisis period (2009 present)

The period from 2009 to 2020 is the development stage for Shenzhen to form a regional innovation system with endogenous innovation ability with the goal of “national innovative city”. After the global financial crisis in 2008, Shenzhen faced development challenges such as the slowdown of transnational investment, the continuous disputes over trade and technology, and the reconstruction of the global production network. At home, it faced development difficulties such as the exhaustion of land resources in the city, the rapid rise of comprehensive industrial costs, and the continuous transfer and relocation of enterprises. On the one hand, the Shenzhen municipal government has implemented a series of institutional arrangements, such as the expansion of special economic zones, the adjustment of administrative divisions, and the “strengthening of regions and delegating power”, to promote the innovation, development and transformation of the whole region with the equalization of institutional thickness; On the other hand, a large number of universities, research institutes, new R & D institutions and high-level overseas talent teams have been introduced to improve the innovation value chain from “incubation” to “mass production” by using state-owned capital, and strengthen the endogenous innovation ability of the regional innovation system. From 2009 to 2020, Shenzhen’s regional innovation ability was significantly improved, and the total number of invention patents in Shenzhen reached 570820, 7.8 times that of the previous stage; Among them, the number of patents with joint applicants (innovation cooperation) is 54502, accounting for 9.55% of the total number of patents, and the number of innovation cooperation of Shenzhen’s internal innovation network accounts for 38.40% of the total number of innovation cooperation. Among them, the top innovators in the centrality of Shenzhen innovation network are China Nuclear Power Corporation and its subsidiaries, Shenzhen Institute of advanced technology, Shenzhen University, Harbin Institute of Technology (Shenzhen Campus) and Tsinghua University (Shenzhen Campus).

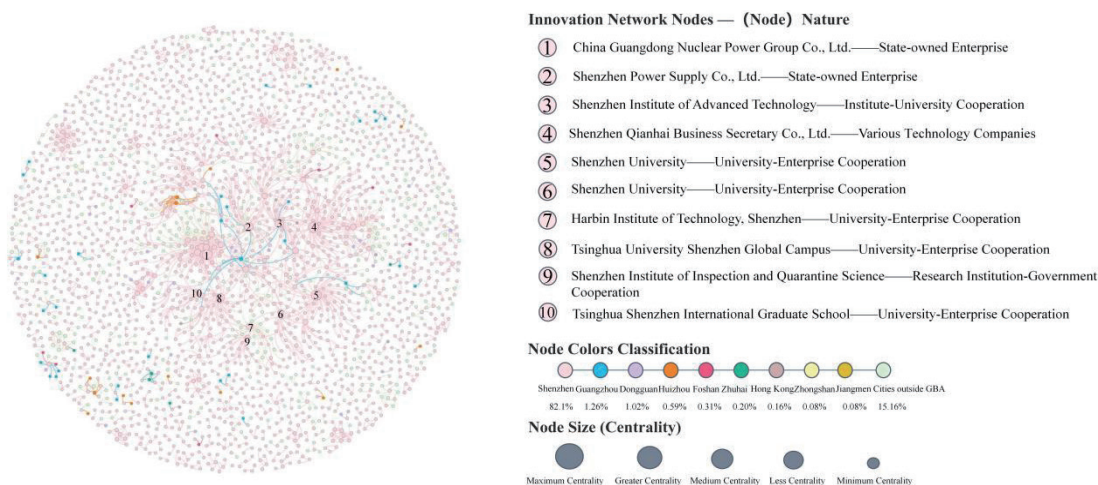


Figure 4 Innovation network of the joint invention patents in Shenzhen (2009-2020)

Since 2009, Shenzhen is coping with the development challenge of rapid restructuring of the global production network by improving its endogenous innovation ability and its influence on the global production network. The Shenzhen municipal government has successively issued policy documents such as the decision on implementing the independent innovation strategy to build a national innovative city and the notice on printing and distributing the master plan of Shenzhen national innovative city (2008-2015), to support the improvement of independent innovation ability from the aspects of financial support, university construction, infrastructure, policy optimization, system guarantee and so on. In 2014, the State Council of China officially announced that Shenzhen has become China’s first national independent innovation demonstration zone based on cities. Subsequently, Shenzhen released the 13th five year plan for the development of strategic emerging industries in Shenzhen, and invested in the construction of basic scientific research institutions such as the national gene bank, the National Supercomputing Shenzhen Center, Pengcheng laboratory, and Daya Bay neutrino laboratory. In 2019, the Ministry of science and technology and the Shenzhen Municipal Government jointly issued the action plan for scientific and technological innovation in the leading demonstration area of socialism with Chinese characteristics, which clearly stated the development goal of building a “city of innovation, entrepreneurship and creativity with global influence” by 2035.

In order to make up for Shenzhen’s weakness in the allocation of scientific research infrastructure, Shenzhen has invested in the construction of a series of large-scale scientific research infrastructure in the past decade. For example, in order to meet the demand of local technology enterprises for high-performance computing capacity, Shenzhen invested in the construction of China’s first sub Supercomputing Center with a total investment of 1.23 billion yuan in 2009. At present, there are 20000 user organizations and more than 12million

individual users per time; In 2020, the second phase will be built in Shenzhen bright science city. After completion, the pre computing power will be 1000 times that of the current one, reaching the global leading level, and providing support for the strategic emerging industries requiring huge computing power, such as artificial intelligence, life sciences, marine science and technology in Shenzhen and even the bay area. Other important large-scale infrastructures include the National Gene Bank approved by the national development and Reform Commission, the Ministry of finance, the Ministry of industry and information technology and the Ministry of health in 2011 and entrusted to Shenzhen Huada Institute of life sciences for management; In 2022, Guangming District of Shenzhen signed a special financial cooperation agreement of 10billion yuan with Shenzhen Branch of China Development Bank to invest in the large scientific device cluster project of Guangming Science City in combination with the financial allocation of Shenzhen, and the total investment is expected to reach 13.12 billion yuan.

In order to improve the ability of innovation strategy, Shenzhen further increases the introduction and support of universities, scientific research institutions, innovation carriers and high-level talents. Shenzhen has successively introduced new R & D institutions such as the Institute of advanced technology of the Chinese Academy of Sciences to form a combination of “basic scientific research + industrial transformation”. The new R & D institution in Shenzhen originated from the Research Institute of Tsinghua University in Shenzhen, which was jointly established by Tsinghua University and Shenzhen Municipal People’s Government in 1996. Different from ordinary universities and research institutes, new R & D institutions adopt the operation of “quasi enterprise”, and generally adopt a more flexible internal management system and profit distribution mechanism of “no fixed staffing, no fixed funds and no administrative level”. They tend to have projects with clear industrialization prospects, and have stronger motivation to unite with enterprises or industrialize research results, In terms of industrial transformation of innovative achievements, it often has a more efficient performance than traditional scientific research institutions (zhangguangyu et al., 2021, P106). At present, there are 44 provincial-level new research institutions in Shenzhen. Their research fields are mainly concentrated in the fields of artificial intelligence, robots, new materials, biomedicine and so on, which are related to the existing industrial base in Shenzhen. 25% of the new R & D institutions are directly set up in enterprises, further opening up the direct contact channel between “basic scientific research” and “industrial transformation”. The number of national innovation carriers has increased from 41 in 2010 to 116 in 2019, and the number of colleges and universities has increased from 8 in 2010 to 15 in 2022, making Shenzhen an important source of innovation in the world. On the other hand, Shenzhen has attracted talent teams from all over the country and even the world to carry original innovation achievements to Shenzhen for industrial transformation with its superior innovation ecology. Since 2011, Shenzhen has introduced overseas high-level talents and teams in a large-scale and systematic way through the “peacock plan” and “peacock team”. By the end of 2019, Shenzhen has introduced 64 “peacock teams” in total, Incubate scientific and technological Unicorn enterprises such as Yuntian lifeI and Huake Chuangzhi.

Shenzhen has gradually become a world-famous innovation city. In 2019, Shenzhen’s GDP reached 2692.709 billion yuan, continuing to rank third among mainland cities. In 2021, the whole society’s R & D investment accounted for 5.46% of the GDP of the region, surpassing the level of developed countries. PCT’s international patent applications ranked first in cities across the country for 17 consecutive years, and the number of patents authorized ranked first in cities across the country. The number of necessary patents for 5g standard accounted for 1/4 of the world; The added value of strategic emerging industries accounted for 37.1% of the regional GDP, and 18600 national high-tech enterprises, with a five-year increase of 237%.

Table 1 innovation cooperation at various stages of invention patents in Shenzhen

	Phase I(1978-2000)	Phase II(2001-2008)	Phase III(2009-2020)
Total number of invention patents authorized (PCs.)	1419	73177	570820
Number of patents with joint applicants (innovation cooperation) (PCs.)	50	12641	54502
Proportion of joint application in total invention patents	3.52%	17.27%	9.55%
Number of patents jointly applied in Shenzhen (PCs.)	4	1749	20914
Proportion of joint application in Shenzhen	8%	13.80%	38.40%
Proportion of joint application in Shenzhen in total invention patents	0.28%	2.39%	3.66%

4 Conclusion

The innovation strategy source of Shenzhen innovation network has changed significantly in different stages of global value chain and global production network reconstruction. In the early stage of reform and opening up, Shenzhen did not have the basic conditions for innovation, such as technology, talent, capital, equipment, etc. it could only build an innovation development path of “introduction, digestion, absorption and innovation” by integrating into the global production network, and by means of “three supplies and one subsidy” and “learning by doing”, so as to form transnational spillover of innovation knowledge and accumulation of local knowledge through attracting foreign

capital, And gradually started the innovation process of self owned brands and independent intellectual property rights. In the post WTO stage, the Shenzhen government has formulated a series of policies to encourage innovation with the development goal of high-tech industry. Shenzhen's local industries have gradually formed three types of innovation networks: the first is the satellite platform regional innovation network based on the core production departments, branches, strategic partners and suppliers of multinational enterprises. Multinational companies generally adopt the internal vertical integration innovation mode, Even in order to consolidate its intellectual property advantages and even form a strong patent technical barrier to the outside world, for example, Hon Hai Group (Foxconn) is the main builder of Shenzhen regional innovation overseas knowledge channel at this stage. However, most of its innovation is completed internally and has not formed a localized innovation cooperation network; The second type is the new Marshall innovation network composed of small and medium-sized enterprises with certain independent innovation ability and flexible professional division of labor; The third type is the hub and spoke innovation network with local large private technology enterprises (such as Huawei and BYD) and large state-owned enterprises (such as ZTE) as the core to form a close collaboration network with local private SMEs. After 2009, with the goal of "independent innovation" and "innovative city", the Shenzhen municipal government has supported more front-end, earlier and more cutting-edge scientific and technological innovation and R & D through the introduction of high-level university scientific research institutions, the construction of innovation carriers by state-owned enterprises, and the strategy of state-owned assets to guide venture capitalState anchored innovation network with research institutes as the core. The research shows that the "industry university research" innovation network cooperation among universities, enterprises and institutions, as well as the involvement of government state-owned capital in innovation venture capital, significantly improve the endogenous innovation ability of cities. By creating a long-term and stable policy environment to stimulate enterprises to carry out long-term innovation and R & D, the Shenzhen government's innovation policy has received a positive response from market players, thus promoting the sustainable development of regional innovation.

References

- [1] Ernst D. global production networks and the changing geography of innovation systemsImplications for developing countries[J]Economics of innovation and new technology, 2002, 11 (6): 497-523
- [2] Dicken P. global shift: mapping the changing boundaries of the world economy[m]Sage Publications Ltd, 2007
- [3] Coe n m, Yeung h W. global production networks: mapping recent conceptual developments[J]Journal of economic geography, 2019, 19 (4): 775-801
- [4] Yeung h W. retreating mechanism and process in the geographical analysis of uneven development[J]Dialogues in human geography, 2019, 9 (3): 226-255
- [5] Yeung h W. regional worlds: from related variety in regional diversification to strategic coupling in global production networks[J]Regional studies, 2021, 55 (6): 989-1010
- [6] Broekel T, boschma R. knowledge networks in the Dutch aviation industry: the proximity paradox[J]Journal of economic geography, 2012, 12 (2): 409-433
- [7] GL ü ckler J, dorean P. social network analysis and economic geography - positive, evolutionary and multi-level approvals[J]Journal of economic geography, 2016, 16 (6): 1123-1134
- [8] Wu F. planning centrality, market instruments: governing Chinese urban transformation under state entrepreneurship[J]Urban studies, 2018, 55 (7): 1383-1399
- [9] Freeman C. networks of innovators: a synthesis of research issues[J]Research policy, 1991, 20 (5): 499-514
- [10] Nonaka I, Takeuchi h. The knowledge creating company: how Japanese companies create the dynamics of innovation[J]New York, NY, 1995
- [11] Ernst D. a new geography of knowledge in the electronics industry?Asia's role in global innovation networks[J]Asia's role in global innovation networks (March 6, 2009)East West center policy studies series, 2009, 54
- [12] Ter wal a L J, boschma R. co evolution of firms, industries and networks in space[J]Regional studies, 2011, 45 (7): 919-933
- [13] Duandezhong, dudebin, Yang Fan, et alIndustrial technological change and spatial evolution of global technological innovation system [J]Geoscience, 2019, 39 (9): 1378-1387
- [14] Zhang F, Wu F. rethinking the city and innovation: a political economic view from china's biotechnology[J]Cities, 2019, 85:150-155
- [15] Zhu s, he C. what can evolutionary economic geography learn from global value chain and global production network research on developing and emerging economies?[J] Area development and policy, 2022, 7 (2): 162-176
- [16] Chang Y C, Chen p h, Teng m J. how do institutional changes facilitate University centric networks in Taiwan?The triple helix model of innovation view[J]Science and public policy, 2021, 48 (3): 309-324
- [17] Pan F, Zhang F, Wu F. state led financing in china: the case of the government guided investment fund[J]The China quarterly, 2021, 247: 749-772