



# Analysis on Technology of Strategic Emerging Industries in Guangdong Province Based on Invention Patent Data from 2011 to 2020

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**Abstract.** With the accelerated economy and society and the transformation of the economic structure, the process of scientific and technological innovation has become faster and faster. The general objective of this study is to provide suggestions for the IUR (Industry-University-Research) in Guangdong Province Based on the analysis of multiple characteristic items of patent technical documents and the application data and cited data of invention patents, with a view to providing assistance for the scientific research institutions, scientific research technicians and technology enterprises in Guangdong Province to identify the technological development of basic research and applied research in a certain field or industry in the monitoring area and to find the scientific research cooperation and competition objects.

**Keywords:** strategic emerging industry · Patent analysis · Guangdong Province

## 1 Introduction

With the accelerated economic and social development and the transformation and transformation of economic structure, the process of scientific and technological innovation has become faster and faster. With the gradual progress of economic marketization, the level of social productivity in China has been significantly improved on the whole. With the continuous development of supply-side structural reform, the demand for basic R & D and applied technology is also gradually increasing [1] [2].

According to the opinions of the people's Government of Guangdong Province on cultivating and developing strategic pillar industrial clusters and strategic emerging industrial clusters, the world's industrial development practice shows that industrial clusters are the main form of industrial modernization development, the internal requirement for improving regional economic competitiveness, and the main content of modern industrial system construction [3]. At present, Guangdong has a certain foundation for the development of industrial clusters. The ten strategic pillar industrial clusters, including the new generation of electronic information, green petrochemical, smart home appliances, automobile industry, advanced materials, modern light industry and textile, software and information services, ultra-high definition video display, biomedicine

**Table 1.** Analysis index and calculation formula of invention patents (Self drawing)

Analysis index	Index name/Calculation formula
Annual distribution number of invention patents ( $PN_{\text{year}}$ ) And annual growth rate ( $PG_{\text{year}}$ )	$PG_{\text{year}} = (PN_{\text{year}} - PN_{\text{year-1}}) * 100\%$
Distribution quantity ( $IN_{\text{industry}}$ ) and proportion ( $IP_{\text{industry}}$ ) of invention patent industry	$IP_{\text{industry}} = (IN_{\text{industry}} / \sum IN) * 100\%$
Quantitative analysis of the patent applicant	PAN
Annual distribution of high cited patents	HCPN <sub>year</sub>
Distribution quantity ( $HCPIN_{\text{industry}}$ ) and proportion ( $HCPIN_{\text{industry}}$ ) of highly cited patent industries	$HCPIN_{\text{industry}} = (HCPIN_{\text{industry}} / \sum HCPIN) * 100\%$
Quantitative analysis of the applicant's highly cited invention patents	HCPAN

and health, modern agriculture and food, have a total operating income of 15 trillion yuan in 2019, with a solid development foundation and growth trend, It is an important foundation and support for Guangdong's economy.

## 2 Research Objectives and Research Methods

The general objective of this study is to provide suggestions for the IUR (Industry-University-Research) in Guangdong Province Based on the analysis of multiple characteristic items of patent technical documents and the application data and cited data of invention patents, intending to provide assistance for the scientific research institutions, scientific research technicians and technology enterprises in Guangdong Province to identify the technological development of basic research and applied research in a certain field or industry in the monitoring area and to find the scientific research cooperation and competition objects [4][5]. The analysis index and calculation formula are in Table 1.

## 3 Analysis of Patent Technology Distribution in Guangdong Province

### 3.1 Analysis of Invention Patents

We use the Incopat as Patent database and set the Retrieval type (AP-PROVINCE = Guangdong Province AND ADY = [2011 TO 2020]). From 2011 to 2020, all institutions in Guangdong Province applied for a total of 1340271 invention patents. The annual application trend of an invention patent is shown in Table 2. It can be seen that the number of invention patent applications in Guangdong Province increased rapidly from 2015 to 2018.

**Table 2.** Annual distribution number of invention patents ( $PN_{year}$ ) And annual growth rate ( $PG_{year}$ ) in Guangdong Province (Self drawing)

Patent application year	Number of invention patents ( $PN_{year}$ )	Annual growth rate ( $PG_{year}$ )
2011	46481	
2012	58780	26.46%
2013	66431	13.02%
2014	73288	10.32%
2015	97996	33.71%
2016	145895	48.88%
2017	196787	34.88%
2018	226008	14.85%
2019	207922	-8.00%
2020	220683	6.14%

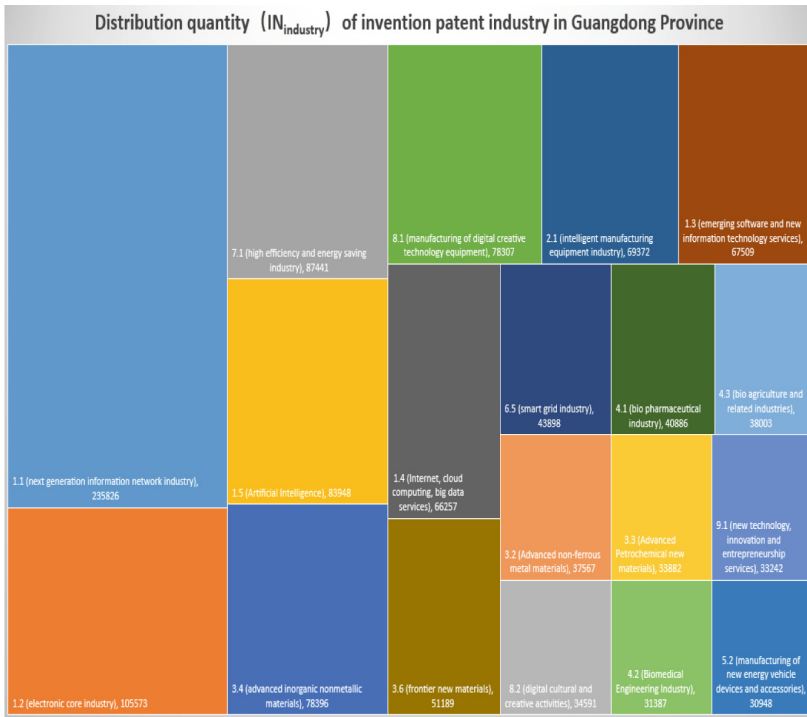
According to the classification of strategic emerging industries, it can be seen that the invention patent applications in Guangdong Province are mainly concentrated in the new generation information technology industry, new material industry, energy conservation and environmental protection industry, digital creative industry, biological industry, high-end equipment manufacturing industry, new energy industry, new energy automobile industry and other fields. From the perspective of categories, there are a large number of invention patent applications in the fields of 1.1 (next generation information network industry), 1.2 (electronic core industry), 7.1 (high efficiency and energy saving industry), 1.5 (Artificial Intelligence), and 3.4 (advanced inorganic non-metallic materials) (Fig. 1).

According to the standardized applicants, the top ten patent applicants in Guangdong Province are Huawei, Zhuhai Gree Group, OPPO mobile, ZTE, Tencent, Midea Group, South China University of Technology, VIVO mobile and Guangdong University of Technology. The top ten applicants are mainly enterprises (Fig. 2).

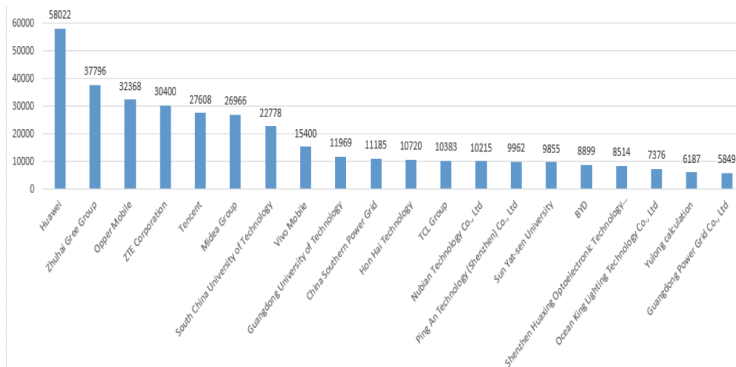
### 3.2 Analysis of High-Cited Patents

We use the Incopat as Patent database and set the Retrieval type ( $AP-PROVINCE = Guangdong Province AND ADY = [2011 TO 2020]$ ). We limit the retrieved invention patents to 21 citations or more. During the 10 years from 2011 to 2020, a total of 15328 invention patent applications were cited 21 times or more. Among them, the number of highly cited invention patents in 2012 was the largest, with a total of 2928 (Table 3).

According to the classification of strategic emerging industries, it can be seen that the highly cited invention patent applications in Guangdong Province are mainly concentrated in 1.1 (next generation information network industry), 8.1 (digital creative technology and equipment manufacturing), 1.5 (Artificial Intelligence), 1.2 (electronic



**Fig. 1.** Distribution quantity ( $IN_{industry}$ ) of invention patent industry in Guangdong Province (by strategic emerging industries) (Self drawing)



**Fig. 2.** Quantitative analysis of the patent applicant in Guangdong Province (PAN) (Self drawing)

core industry), 1.3 (emerging software and new information technology services), 1.4 (Internet and cloud computing, big data services), 3.4 (advanced inorganic non-metallic materials), 7.1 (high efficiency and energy saving industry) 8.2 (digital cultural and creative activities), 2.1 (intelligent manufacturing equipment industry) and other fields.

**Table 3.** Annual distribution of high cited patents (HCPN<sub>year</sub>) (Self drawing)

year	Annual distribution of high cited patents (HCPN <sub>year</sub> )
2011	2703
2012	2928
2013	2764
2014	2341
2015	1947
2016	1425
2017	948
2018	238
2019	30
2020	4
total	15328

According to the standardized applicant statistics of the applicants for highly cited invention patents in Guangdong Province, the top ten institutions are Huawei, ZTE, Tencent, OPPO, South China University of Technology, Midea Group, Yulong Computer, TCL group, Shenzhen China Star Optoelectronics Technology Co., Ltd and Zhuhai Gree Group. The top ten applicant organizations with a high number of cited invention patents are also mainly enterprises.

### 3.3 Analysis of Patent Citation

By analyzing the cited patents of invention patents in Guangdong Province, we can understand the situation of the patent technology industry and the key technology development fields. The patents that are limited to 21 times or more are highly cited, There were 15328 highly cited patents.

Table 4 and Table 5 show the patentees cited with high frequency and the patentees cited with high frequency among the highly cited patents in Guangdong Province.

It can be seen that the institutions in the high cited technology field, high-frequency cited technology field and main cited technology field of invention patents in Guangdong Province are highly concentrated in the new generation of the information technology industry, and there are relatively few other fields such as biomedicine, which indicates that the information technology industry is the most important pillar industry in the application of industrial patent technology in Guangdong Province and has generated more influence and attention.

**Table 4.** List of patentees cited with high frequency in Guangdong Province (Self drawing)

NO.	Name of the patentee cited by high frequency	Number of highly cited patents in Guangdong Province cited by the patentee
1	ZTE Communications Co., Ltd	1447
2	Huawei Technologies Co., Ltd	1278
3	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd	752
4	Samsung Electronics Co., Ltd	609
5	Guangdong Oppo Mobile Telecommunications Co., Ltd	571
6	Tencent Technology (Shenzhen) Co., Ltd	556
7	South China University of Technology	394
8	Lenovo (Beijing) Co., Ltd	390
9	Hon Hai Precision Industry Co., Ltd.	362
10	Huawei Terminal Co., Ltd	358

**Table 5.** List of patentees cited with high frequency among the highly cited patents in Guangdong Province (Self drawing)

No.	Name of the patentee cited	Number of cited patents for high cited patents in Guangdong Province
1	Huawei Technologies Co., Ltd. (Chinese patent)	3454
2	HUAWEI TECHNOLOGIES CO LTD	3167
3	Guangdong Oppo Mobile Telecommunications Co., Ltd. (Chinese patent)	2714
4	Tencent Technology (Shenzhen) Co., Ltd. (Chinese patent)	2509
5	ZTE Communications Co., Ltd. (Chinese patent)	2352
6	Guangdong Oppo Mobile Telecommunications Co., Ltd. (Chinese patent)	2161
7	ZTE Corporation	2147
8	Vivo Mobile Communication Co., Ltd. (Chinese patent)	2131
9	Nubian Technology Co., Ltd. (Chinese patent)	1930
10	Beijing Xiaomi Mobile Software Co., Ltd. (Chinese patent)	1867

## 4 Conclusion

Based on the technology release of invention patent applications in Guangdong Province from 2011 to 2020, The institutions in the high cited technology field, high-frequency cited technology field and main cited technology field of invention patents in Guangdong Province are highly concentrated in the new generation of the information technology industry, and there are relatively few other fields such as biomedicine, which indicates that the information technology industry is the most important pillar industry in the application of industrial patent technology in Guangdong Province and has generated more influence and attention.

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