

Research on the Current Development Status of Dongguan's Mobile Phone Industry from a Patent Perspective: Postprint

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Date: 2023-10-08T00:00:00+00:00

Abstract

[Purpose / Significance] Through patent analysis of Dongguan's mobile phone industry, to provide intelligence reference for the development of Dongguan's mobile phone industry. [Method / Process] First, it introduces the basic overview of China's mobile phone industry, then selects patents of Dongguan's mobile phone industry as the research object, analyzes the overall development trends of Dongguan's mobile phone industry patents, the comprehensive status and trends of applicants and inventors, the general overview and trends of IPC classification technologies, the composition of IPC classification applicants, and the correlation of IPC classification technologies, and finally identifies the problems existing in the patent development of Dongguan's mobile phone industry and proposes specific response strategies. [Result / Conclusion] Based on the analysis of patents in Dongguan's mobile phone industry, the following five recommendations are proposed for the development of Dongguan's mobile phone industry: First, strengthen patent trend analysis in the mobile phone industry; Second, establish a specialized database for the mobile phone industry; Third, enhance enterprises' technological R&D capabilities; Fourth, support key enterprises; Fifth, improve the mobile phone industry chain.

Full Text

Preamble

Research on Dongguan Mobile Phone Industry Development Status from the Patent Perspective

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Abstract

[Purpose/Significance] This study analyzes patents in Dongguan's mobile phone industry to provide intelligence references for its development. **[Method/Process]** The paper first introduces the basic overview of China's mobile phone industry, then selects patents from Dongguan's mobile phone industry as the research object. It analyzes the overall development trends of Dongguan's mobile phone patents, the comprehensive status and trends of applicants and inventors, the general situation and trends of IPC classification technologies, the composition of IPC classification applicants, and the correlation of IPC classification technologies. Finally, it identifies existing problems in Dongguan's mobile phone industry patent development and proposes specific countermeasures. **[Result/Conclusion]** Based on the patent analysis of Dongguan's mobile phone industry, this paper offers five recommendations: (1) strengthen patent situation analysis of the mobile phone industry; (2) establish a thematic database for the mobile phone industry; (3) enhance enterprise technology R&D capabilities; (4) support key enterprises; and (5) improve the mobile phone industry chain.

Keywords: mobile phone industry; Dongguan; patent; intelligence analysis

Classification Number: G353.1

Citation Format: Qiu Yu. Research on Dongguan Mobile Phone Industry Development Status from the Patent Perspective [J/OL]. Knowledge Management Forum, 2017, 2(2): 97-109 [citation date]. <http://www.kmf.ac.cn/p/1/109/>.

1 Introduction

Mobile phones, also known as cellular phones or wireless phones, are portable telephone terminals that can be used over a wide area. In 1987, the official launch of cellular mobile communication services in Guangdong Province marked China's entry into the mobile communication era. With the rapid development of mobile communication networks, mobile phones have entered a fully intelligent era. The smartphone market has experienced rapid growth, presenting excellent development opportunities for China's smartphone industry.

Currently, third-generation (3G) mobile phones are the most widely used globally. First-generation (1G) phones were analog mobile phones that only supported voice communication, had unstable reception, insufficient confidentiality, and underutilized wireless bandwidth. Second-generation (2G) phones are the most common digital phones, offering stable call quality and appropriate standby time. Third-generation (3G) phones represent a new generation of mobile communication systems that integrate wireless communication with the Internet and multimedia, capable of processing various media formats such as images, music, and video streams, while providing services including web browsing, teleconferencing, and e-commerce. Fourth-generation (4G) phones can transmit high-quality video images comparable to high-definition television, and the en-

mobile phone industry is transitioning toward 4G. The year 2014 marked the first year of official 4G commercialization and an important year for China's mobile phone industry transition to 4G.

2.1 Development Status of China's Mobile Phone Industry

China's mobile phone manufacturing began in 1999. After more than a decade of development, it has grown from nothing to a considerable scale, from backwardness to a certain level of strength. China's mobile phone production now exceeds half of global output and has expanded rapidly, becoming an important force driving economic growth. Mobile phones are divided into smartphones and non-smartphones. Smartphones feature higher main frequencies, faster operating speeds, quicker program response, and better performance, while non-smartphones are the opposite but offer better stability.

With the rapid development of electronic information technology and mobile Internet, as well as continuous improvements in mobile chip technology and mobile terminal technology innovation, China's mobile phone industry has transformed and upgraded from traditional non-smartphones to smartphones, with both production and sales volume ranking first globally. According to statistics from IC Insights, a well-known American semiconductor market research institution, on global mobile phone manufacturer shipments in the first quarter of 2016, the top 12 brands by global shipment volume were Samsung, Apple, Huawei, OPPO, Xiaomi, Vivo, LG, ZTE, Lenovo, TCL, Meizu, and Micromax. Chinese manufacturers accounted for 8 of these positions, a historic first. From 2006 to 2015, China's mobile phone production increased more than threefold, maintaining steady development as shown in Figure 1 [Figure 1: see original paper].

2.2 Development Status of Dongguan's Mobile Phone Industry

Dongguan is an important mobile phone R&D and manufacturing base in China, with nearly complete industry chain coverage. In April 2013, Dongguan became a provincial-municipal collaborative strategic emerging industry base—the Dongguan Smartphone Industry Base—covering the entire city and focusing on the high-end new electronic information industry with smartphones as the development direction. Currently, the smartphone and mobile terminal industry is one of Dongguan's most pervasive, innovative, and influential strategic emerging industries.

According to data from the Dongguan Economic and Information Technology Bureau's "Report on the Development of Dongguan's Electronic Information Industry in 2015" [1], Dongguan's mobile phone production reached 236 million units in 2015, a year-on-year increase of 24.5%, accounting for 13% of national production (1.819 billion units). Among these, smartphone production was 190 million units, up 40.9% year-on-year.

Dongguan currently has over 4,000 communication electronic component manufacturers. Key electronic component industries such as copper-clad plates, PCBs, chip capacitors, crystal oscillators, magnetic components, and motors, as well as emerging industries like mobile phone batteries and screens, lead both provincially and nationally in technology and production capacity. The city hosts leading brand manufacturers including Huawei Terminal (Dongguan) Co., Ltd. (hereinafter “Huawei”), Vivo Communication Technology Co., Ltd. (hereinafter “Vivo”), Guangdong OPPO Mobile Communications Co., Ltd. (hereinafter “OPPO”), Dongguan Yulong Communication Technology Co., Ltd. (hereinafter “Yulong”), and Gionee Group (hereinafter “Gionee”). It also has large OEMs such as Dongguan Huaqin Electronics Technology Co., Ltd. (hereinafter “Huaqin Electronics”) and Dongguan Aerospace Electronics Co., Ltd. (hereinafter “Aerospace Electronics”), as well as upstream supporting enterprises like Samsung Display Dongguan Co., Ltd. (hereinafter “Samsung Display”), Dongguan Maike Technology Co., Ltd. (hereinafter “Maike”), and Dongguan Jinsheng Precision Components Co., Ltd. (hereinafter “Jinsheng”) [2].

Dongguan is now striving to build a national smartphone innovation and R&D base, forming a “1+3” industrial development pattern focused on complete machine manufacturing with three major supporting sectors: components and modules, batteries, and peripheral accessories. In 2013, the manufacturing segment accounted for 99.5% of Dongguan’s total mobile phone industry output value, with complete machine enterprises contributing 49.1%, and peripheral accessories, electronic components/modules, and mobile phone batteries contributing approximately 23.7%, 21.9%, and 4.7% respectively [3]. Table 1 lists Dongguan’s mobile phone manufacturers with proprietary brands.

3 Overview of Mobile Phone Industry from Patent Perspective

Patents are a crucial metric for measuring enterprise innovation competitiveness. As a primary component of intellectual property rights, patents serve as an important means and resource for converting knowledge into wealth. They represent a key indicator of comprehensive strength for nations, regions, and enterprises, objectively reflecting mastery of core technologies and demonstrating scientific innovation capabilities and international competitiveness [4].

3.1 Main Technical Analysis of Mobile Phone Industry

As a comprehensive product, modern smartphones involve approximately 100,000 related patents covering communication technology, display technology, semiconductor chip technology, human-computer interaction technology, application software, and numerous other aspects. The China National Intellectual Property Administration’s Patent Examination Cooperation Beijing Center published the “Smartphone Industry Patent Situation Analysis” report

in 2012, which classified smartphone technologies into several main categories: human-computer interaction, applications and services, low power consumption, antennas, operating systems, and processors. Among these, human-computer interaction, applications and services, and low power consumption are the fastest-growing and most popular technologies.

Human-computer interaction technology includes: touch technology (structural design [screen structure, circuit structure], gesture recognition [tapping, trajectory, handwriting]), voice recognition, and sensor technology (magnetic induction, light sensing, acceleration sensing, distance sensing, gyroscope sensing). Applications and services technology includes: location-based services (navigation, information provision, location presentation, nearby search, scenario settings, location reporting), video calls, mobile TV, NFC-based applications (authentication, payment, structural design, data sharing), and PUSH-based applications. Low power consumption technology includes: structural design, operation modes, communication processes, system processes, and application scenarios.

3.2 Patent Perspective on Mobile Phone Industry Overview

Patent application volume reflects an enterprise's technical strength. From 2006 to 2015, China's mobile phone patent quantity grew steadily each year, reaching a peak in 2015 at ten times the 2006 level, with approximately 50,000 total patents over the decade. Design patents and utility models are the main types, with design patents accounting for roughly half of the total, primarily filed by individuals, and geographically concentrated in Shenzhen and Shanghai.

From a technical perspective, core mobile phone technologies were initially dominated by foreign enterprises, so invention patents were primarily filed by foreign companies. As domestic enterprises gradually began emphasizing mobile phone technology development, domestic invention patent applications increased gradually, with applications concentrated among ZTE, Huawei, and Yulong Technology—all headquartered in Shenzhen. Currently, human-computer interaction and application services have become technological hotspots and are increasingly maturing. In human-computer interaction, touch technology dominates, while voice recognition technology is also gaining significant attention. Foreign applications show more balanced distribution in structural design and gesture recognition, while domestic applications focus on gesture recognition, particularly tapping and trajectory recognition. Apple, Samsung, and LG are the main owners of touch patents. Applications and services include mobile security management, qualification certification, video/voice entertainment, and data information management, with location-based services being the R&D hotspot, while low power consumption remains a challenge in mobile phone development.

4.1 Research Object

According to Dongguan Municipal Bureau of Statistics, Dongguan has approximately 26 mobile phone complete machine manufacturers (excluding component manufacturers). Preliminary patent searches of these 26 enterprises revealed that patents are concentrated in only a few companies. Due to the large number of mobile phone design patents, searching only by complete machine manufacturers cannot guarantee comprehensive and accurate results and would miss many component manufacturers. Conversely, searching solely by mobile phone keywords would miss many core technology patents. Therefore, based on analysis of mobile phone technical characteristics and after multiple search attempts, IPC classifications in Section H (Electricity) including H04M (Telephonic communication), H04L (Transmission of digital information), H04Q (Selecting), H04W (Wireless communication networks), and Section G (Physics) including G06F (Electric digital data processing) were selected as search classification fields to improve recall and precision.

4.2 Data Sources

The patent data for this study were obtained from the Guangdong Intellectual Property Public Information Comprehensive Service Platform's online patent search and analysis database [5], with a search date of June 30, 2016. The search period covered 2006-2015 (10 years), with Dongguan as the address. The final search formula was: Publication (Announcement) Date = [20060101 to 20151231] AND Address = Dongguan AND Classification Number = (G06F3/041 OR G06F3/042 OR G06F3/043 OR G06F3/044 OR G06F3/045 OR G06F3/046 OR G06F3/047 OR G06F3/048 OR H04M1/% OR H04L12% OR H04W% OR H04Q7/32).

After content analysis of search results, irrelevant patents and duplicate documents were removed, yielding 5,556 relevant patent documents for Dongguan's mobile phone industry, including 4,009 invention patents and 1,547 utility model patents. Patent types (design patents were excluded due to different classification systems), applicant institutions, and legal status are shown in Table 2 and Table 3. These patent documents serve as the primary analysis objects for Dongguan's mobile phone industry patent intelligence analysis.

4.3 Patent Analysis

4.3.1 Overall Development Trends

From annual application and publication volumes (Figure 2 [Figure 2: see original paper]), patent quantities have remained relatively stable with steady growth. Applications peaked in 2012 at 1,476, declined slightly in 2013-2014, then increased to 1,197 in 2015. Publications peaked in 2013 at 1,910, declined in 2014, then rose to 1,728 in 2015.

All technologies and products have life cycles with four stages: introduction,

growth, maturity, and decline. With the continuous development of Internet and product intelligence, mobile phone technology continues to innovate and improve. Currently, Dongguan's mobile phone industry technology remains in the growth stage (Figure 3 [Figure 3: see original paper]), with technology growth rates showing a slow upward trend, reaching the lowest point in 2014 (correlating with the patent decline that year) but beginning to rise again in 2015. The technology maturity coefficient has maintained a steady upward trend, indicating broad future development prospects.

4.3.2 Applicant Composition and Trends

The data identified 692 applicants. The top 10 applicants and their patent counts are shown in Table 4. Guangdong OPPO Mobile Communications Co., Ltd. ranked first with 2,956 patents (53.2% of the total), followed by Dongguan Yulong Communication Technology Co., Ltd. with 662 patents (11.92%). Others include Sheng Hua Group (122 patents, 2.2%), BBK (112 patents, 2.02%), and Guangdong Xiaotiancai Technology Co., Ltd. (102 patents, 1.84%). The remaining six applicants each had fewer than 50 patents, representing less than 1% each. Guangdong OPPO Mobile Communications Co., Ltd. demonstrates strong R&D capabilities with numerous inventors and high-value patents, holding an absolute advantage in Dongguan's mobile phone industry.

Overall, except for Foxlink (Cheng Uei Precision Industry Co., Ltd.), major enterprises had virtually no mobile phone patents during 2006-2009. Patent quantities began climbing annually from 2010, peaking in 2013, declining in 2014, then surging in 2015. As the top patent applicant, Guangdong OPPO Mobile Communications Co., Ltd. continues to lead in annual applications, with its 2013 patent count (1,163) exceeding the 10-year total of other units. Foxlink has generated patents annually, albeit in smaller quantities (Figure 4 [Figure 4: see original paper]).

4.3.3 Inventor Composition and Trends

The survey identified 2,994 inventors. The top 10 inventors are listed in Table 5. Zeng Yuanqing ranked first with 622 patents (11.2% of the total), exceeding the combined total of the next nine inventors. Zhang Qiang ranked second with 133 patents (2.39%), and Li Jianlin third with 78 patents (1.4%). Among the top 10 inventors, eight are from Guangdong OPPO Mobile Communications Co., Ltd., with only Ji Tongkai (5th place) from Guoyun Technology Co., Ltd. (44 patents, 0.79%) and Zhan Zhanhai (8th place) from Guangdong Xiaotiancai Technology Co., Ltd. (39 patents, 0.7%) representing other companies.

As shown in Figure 5 [Figure 5: see original paper], inventors had virtually zero patents during 2006-2010. Zeng Yuanqing had 7 patents in 2011, 198 in 2012, 208 in 2013, 7 in 2014, and 202 in 2015. Zhang Qiang had 5 patents in 2012, 55 in 2013, 29 in 2014, and 44 in 2015. The 3rd, 6th, and 7th ranked inventors only had patents in 2015, with none in the previous nine years. Other inventors

also generated only small numbers of patents in recent years.

4.3.4 Overall Status and Trends of IPC Classification

The International Patent Classification (IPC) is the internationally recognized patent document classification and retrieval tool, primarily used for invention and utility model patents. The IPC classification covers all knowledge areas related to invention patents, divided into 8 sections (the highest level), which are further subdivided into classes, subclasses, groups, and subgroups.

As shown in Table 6, Dongguan's mobile phone industry patents are primarily distributed in Section H (Electricity) and Section G (Physics), with H04 (Electric communication technique) and G06 (Computing; Calculating; Counting) accounting for the largest numbers. The four technical directions with the most patents are H04M (Telephonic communication), G06F (Electric digital data processing), H04W (Wireless communication networks), and H04L (Transmission of digital information), representing over 87% of total patents.

Table 7 shows the top 10 IPC subgroups for Dongguan's mobile phone industry patents. Structural design patents rank first, accounting for over 30% of total patents, followed by touch technology, human-computer interaction technology, chip technology, and gesture recognition. The combined patent count of these technologies exceeds 55% of the total, indicating that Dongguan's mobile phone industry is developing toward these fields—the current hot spots in smartphone technology.

As shown in Figure 6 [Figure 6: see original paper], Dongguan's mobile phone industry patent technology experienced a low period in the first five years. Human-computer interaction and gesture recognition technologies only emerged in 2013, while touch technology began developing in 2011. All categories saw rapid development from 2013 onward. However, chip technology remains a weak link in Dongguan's mobile phone industry, with the fewest patents relative to other technologies.

4.3.6 IPC Classification Technology Correlation

Technology correlation refers to the degree of association in product technology portfolios. Through technical cross-analysis, relationships between key technologies and technology integration status can be revealed. Analyzing the top 50 IPC subgroup classification numbers among the 5,556 retrieved patents reveals the technology correlation in Dongguan's mobile phone industry (Figure 7 [Figure 7: see original paper]).

The highest correlation is H04M1/725 (Cordless telephones) with 324 composite technology patents and 25 associated technologies. Next is H04M1/02 (Structural features of telephone sets) with 135 composite patents and 24 associated technologies. Third is G06F3/041 (Digital converters characterized by conversion method, e.g., touch screens) with 78 composite patents and 13 associated

technologies. This shows that mobile phone structural design technology has relatively close collaborative connections, followed by touch technology. Although other technologies show less correlation, each key technology has its associated technologies, forming a stable interdependent relationship conducive to overall industry technology improvement and higher-level development.

Table 8 shows the IPC classification applicant composition. Except for Dongguan Pingbo Electronics Co., Ltd. and Xingke Electronics (Dongguan) Co., Ltd. replacing Guoyun Technology Co., Ltd., Dongguan Huaqin Electronics Technology Co., Ltd., and Foxlink, the rest are the top 10 enterprises from Table 5. Guangdong OPPO Mobile Communications Co., Ltd. continues to lead across all technologies with patent numbers far exceeding other enterprises. In chip technology, only Guangdong OPPO Mobile Communications Co., Ltd. and Dongguan Yulong Communication Technology Co., Ltd. have invention patents (61 and 19 respectively), while other enterprises have zero patents in this area. Sheng Hua Group, Jinlong Electromechanical (Dongguan) Co., Ltd., and Dongguan Pingbo Electronics Co., Ltd. focus on touch technology, while BBK Electronics and Xingke Electronics (Dongguan) Co., Ltd. concentrate on structural design.

5 Problems in Dongguan Mobile Phone Industry Patent Development

5.1 Significant Gaps Between Enterprises

The patent analysis reveals that Dongguan's mobile phone industry patents are overwhelmingly concentrated in Guangdong OPPO Mobile Communications Co., Ltd., which holds over half of all patents and has the largest number of inventors, with R&D capabilities far exceeding other enterprises. Although Dongguan Yulong Communication Technology Co., Ltd. ranks second, its patent count is only one-fifth of OPPO's. Other enterprises have even fewer patents. The preliminary survey showed that Dongguan has many complete machine manufacturers, but aside from OPPO, Yulong, and Huaqin, other enterprises have zero patents. The gap between enterprises is enormous, with large companies holding overwhelming competitive advantages.

5.2 Uneven Technical Levels

Most of Dongguan's mobile phone industry technology concentrates on low-tech processing and manufacturing fields such as peripheral accessories, phone casings, and brackets. Development capabilities are insufficient in key technologies like mobile phone-specific chips, high-end displays, human-computer interaction, applications and services, and intelligent terminals, with high dependence on imports. Only a few enterprises possess R&D support capabilities from solution design to functional design, while many remain in OEM and ODM processing stages. Patent data shows (Figure 4) that major Dongguan mobile phone enterprises had virtually zero patents before 2009. Using the same database with

identical classification numbers for 2006-2009, national mobile phone patents totaled 55,663 invention patents and 7,100 utility models, indicating a large gap between Dongguan and national levels. Although development has been rapid since 2012, mobile phone technology remains in the growth stage with considerable room for future improvement.

5.3 Lagging Industrial Chain Innovation

Except for Huawei, OPPO, Yulong, and BBK Electronics, which have proprietary brands, most Dongguan mobile phone enterprises still focus on OEM and low-end products. Mobile phone innovation design is relatively monotonous, mechanically following market trends without focusing on consumer needs or substantive content, remaining at the basic “mobile Internet” level. Product positioning is not precise enough, with insufficient emphasis on extending the industrial value chain and inadequate content service innovation capabilities, limiting high-end development. Personalized customization services need strengthening.

6 Recommendations

6.1 Strengthen Mobile Phone Industry Patent Situation Analysis and Establish Patent Barriers

Analyzing industry patent situations provides dynamic information on industrial development trends and plays an irreplaceable role in industry early warning and planning. By analyzing the current patent status and existing problems in Dongguan’s mobile phone industry and comparing with other major domestic mobile phone enterprises, this study points out development directions and provides intelligence references to enhance industrial levels and competitiveness. Enterprises must further strengthen and standardize patent management systems, incorporating patent management into every stage from project initiation and R&D to product launch to effectively protect their technologies and convert patents into economic benefits, thereby improving the success rate of technological innovation and international competitiveness.

Local governments should improve patent-related laws and regulations, increase patent promotion, raise patent protection awareness, strengthen patent mapping tracking and research, and conduct patent early warnings. Particularly, they should perform quantitative and qualitative analysis of published patents, construct patent pools and layouts to promote secondary development and innovation. They should also encourage technology development and patent applications, emphasize patent deployment, build patent early warning mechanisms, and establish patent barriers to protect the healthy development of local enterprises.

6.2 Establish a Thematic Database for Mobile Phone Industry to Achieve Resource Sharing

Currently, most enterprises use free online patent information databases such as the CNIPA patent search system or Baiten patent search system. However, these databases lack specificity for particular enterprises and cannot meet specific industry retrieval needs. Searching massive data is cumbersome, and balancing comprehensiveness and accuracy is difficult. Therefore, Dongguan needs to establish a thematic database for the mobile phone industry.

Using such a thematic database for patent tracking and data analysis can help us easily understand: the current domestic and international development status of a specific technology theme; how competitors are developing in the same technology theme; what technological gaps exist; how our R&D capabilities compare with others; which technology fields or themes offer survival space; and the life cycle of specific technology themes. This addresses complex patent strategy issues that can significantly improve R&D investment efficiency, helps us fully understand the competitive environment, learn from existing technologies, avoid patent disputes, and promote secondary development and innovation.

6.3 Enhance Enterprise Technology R&D Capabilities and Strengthen Patent Protection

Dongguan's mobile phone enterprises generally lack sufficient R&D capabilities. They should fully utilize local advantages, adjust R&D strategies and directions according to their capabilities, select appropriate R&D routes, and improve technical R&D levels from multiple angles. This will promote development in high-end smartphone segments such as chip R&D and design, complete machine and module solutions, system development, hardware and software design, and business model innovation. To achieve the transformation from "OEM processing" to "independent innovation," a government-industry-academia-research collaboration model can be adopted to build a mobile phone industry R&D and production service system. Enterprises should improve technological innovation platforms, advance planning, promote technological innovation, and enhance market competitiveness. Increased R&D investment in various technologies and funding for mobile phone industry science and technology innovation projects will facilitate the transition to advanced manufacturing.

6.4 Support Key Enterprises and Promote Industrial Collaboration

Dongguan has a group of leading enterprises with significant influence and radiation effects, including Huawei, OPPO, Yulong, and BBK Electronics. In display screens, mobile phone batteries, components, and peripheral accessories, it also has high-quality advanced enterprises with independent design and development capabilities, such as Samsung Display, Maiké, Jinsheng, Guangdong Shengyi Technology Co., Ltd. (hereinafter "Shengyi Technology"), Dongguan Huake Electronics Co., Ltd. (hereinafter "Huake Electronics"), and Dongguan

Yumingxin Precision Technology Co., Ltd. (hereinafter “Yumingxin”). Policy support for these key enterprises should be provided to establish Dongguan mobile phone design and R&D centers, cultivating a group of highly competitive mobile phone enterprises to lead and drive industry development. Building a Dongguan mobile phone industry technology cooperation alliance should be the goal to enhance inter-enterprise communication and collaboration, strengthen guidance for industrial alliances, technology alliances, and common technology platforms. Enhanced communication and coordination with relevant departments will effectively integrate and allocate science and technology resources, promoting inter-departmental collaboration and establishing cooperative mechanisms.

6.5 Improve the Mobile Phone Industry Chain and Build a Sound Ecosystem

Dongguan should strengthen independent brand smartphone R&D and manufacturing, promote transformation and upgrading of processing trade segments, optimize supporting capabilities in key components and high-end components, expand application and content services, improve mobile phone product structure, and promote industrial resource integration and optimization through scientific and rational layout. Comprehensive support policies should be formulated in patents, intellectual property rights, tax subsidies, and talent introduction to further extend and broaden the industry chain, comprehensively promoting the healthy and rapid development of Dongguan’s mobile phone industry and building a sound ecosystem of “hardware + software + applications + services.”

Songshan Lake has been designated by the Ministry of Industry and Information Technology as a National New Industrialization Industry Demonstration Base (Mobile Intelligent Terminals). Leveraging Songshan Lake National High-tech Industrial Development Zone’s advantages in infrastructure and public service support, Dongguan should strive to build Songshan Lake into a core platform for Dongguan’s smartphone industry to participate in international competition, with R&D and design at its core, key supporting segments as the focus, and smartphone public service platforms as the support. Dongguan should vigorously promote the construction of new smartphone industry agglomeration carriers, encouraging qualified areas to plan and construct professional smartphone parks to promote industrial element aggregation and build a complete smartphone industry ecosystem with comprehensive supporting services, enhancing Dongguan’s smartphone industry agglomeration and carrying capacity.

7 Conclusion

This study investigated and analyzed the current patent development status of Dongguan’s mobile phone industry. Due to different search strategy constructions, data retrieval results may vary. The final search formula may have omissions or insufficient precision. Additionally, although Huawei’s entire mobile phone production chain has relocated to Dongguan’s Songshan Lake area,

its patents are still applied for through its Shenzhen company, so few Huawei patents appear in the retrieval results, affecting the accuracy of Dongguan's mobile phone patent data. While this analysis cannot completely and precisely represent the entire Dongguan mobile phone industry, the results remain representative. Since design patents use a different classification system, they were not included in the retrieval results, which focused only on invention and utility model patents regarding core mobile phone technologies. Overall, this analysis can reflect the patent status and some urgent problems in Dongguan's mobile phone industry to a certain extent, hoping to stimulate reflection and provide intelligence references for the industry's development.

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Note: Figure translations are in progress. See original paper for figures.

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