

## Exploration of Patent Information Services in the Guangdong-Hong Kong-Macao Greater Bay Area by Libraries (Post-Print)

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### Abstract

[Purpose/Significance] Exploring library patent information services under the national strategy of the Guangdong-Hong Kong-Macao Greater Bay Area holds significant importance for promoting regional scientific and technological innovation and industrial development. [Methods/Process] Through field research, patent analysis, and literature review methods, this study summarizes the development trends of patent information in the Guangdong-Hong Kong-Macao Greater Bay Area; taking the Guangdong Provincial Science and Technology Library as a case study, it introduces the library's patent information service models and experiences. [Results/Conclusions] The study summarizes experiences from multiple aspects including intellectual property think tank construction, patent information platform development, patent information service models, and external collaboration, providing references for libraries to develop patent information services.

### Full Text

#### Preamble

**Title:** Exploration of Library Patent Information Services in the Guangdong-Hong Kong-Macao Greater Bay Area

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**Abstract:** [Purpose/Significance] Under the national strategy of the Guangdong-Hong Kong-Macao Greater Bay Area, exploring library patent information services holds significant meaning for promoting regional technological innovation and industrial development. [Method/Process] Through field investigation, patent analysis, and literature review, this paper summarizes the development trends of patent information in the Greater Bay Area, using Guangdong Science and Technology Library as a case study to introduce its service models and experiences. [Result/Conclusion] The paper summarizes experiences from multiple aspects including intellectual property think tank construction, patent information platform building, service models, and external cooperation, providing reference for libraries offering patent information services in the Greater Bay Area.

**Keywords:** Guangdong-Hong Kong-Macao Greater Bay Area; patent information service; professional library; platform construction; achievement transformation

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As an important coastal economic form, bay areas are crucial growth poles for global economic development and breeding grounds for new technologies, industries, models, and business forms. The Guangdong-Hong Kong-Macao Greater Bay Area has a total economic output of approximately 10 trillion RMB, with the combined economy of its 11 cities equivalent to the world's tenth largest economy [1], making it one of China's most open and economically dynamic regions with important strategic status in national development.

The national "13th Five-Year Plan" [2] formally proposed "supporting Hong Kong and Macao to play important roles in Pan-Pearl River Delta regional cooperation, and promoting the construction of the Guangdong-Hong Kong-Macao Greater Bay Area and major cross-provincial cooperation platforms." Subsequently, the State Council issued the "Guiding Opinions on Deepening Pan-Pearl River Delta Regional Cooperation" [3]. In July 2017, leaders from Guangdong, Hong Kong, and Macao signed the "Framework Agreement on Deepening Guangdong-Hong Kong-Macao Cooperation to Promote Greater Bay Area Construction." In August 2018, the Leading Group for Guangdong-Hong Kong-Macao Greater Bay Area Construction was established. On February 18, 2019, the Central Committee of the Communist Party of China and the State Council issued the "Guangdong-Hong Kong-Macao Greater Bay Area Development Plan Outline," followed by the "Opinions on Supporting Shenzhen in Building a Pilot Demonstration Area of Socialism with Chinese Characteristics" on August 18.

To support Greater Bay Area construction, libraries in the region have actively carried out collaborative library and information services. For example, South China University of Technology held the "Conference on Scientific and Technical Literature Cooperation of Greater Bay Area Libraries" [4], Shenzhen Library organized the "Guangdong-Hong Kong-Macao Library Cooperation" event [5]

and the “Half-Hour Shared Reading” activity in Macao [6], and Guangzhou Library hosted the “2019 Greater Bay Area Primary and Secondary School Students Story Conference” [7].

Domestic libraries have leveraged their rich data and human resources to develop patent intelligence analysis services. For instance, the National Science Library of the Chinese Academy of Sciences built an integrated knowledge infrastructure platform [8]; Shanghai Library established an industrial library providing one-stop full-chain information customization services for data collection, organization, and processing in industrial fields [9]; Guangdong Science and Technology Library (hereinafter referred to as “GDLIB”) has conducted regional technological innovation and industrial technology development trend analysis services based on patent analysis for governments and enterprises through an “information specialists + domain experts” model; and Hong Kong Trade Development Council Library adopts a tiered model, providing comprehensive business information services while establishing specialized libraries for different industries to offer professional competitive intelligence services for SMEs [10].

In summary, current library services for the Greater Bay Area mainly focus on cultural information exchange, joint reference services, union catalogs, coordinated reader promotion activities, local literature resource exchange, and librarian academic exchanges and visits, with relatively few studies on patent information services for the region. This paper analyzes patent information trends in the Greater Bay Area and introduces GDLIB’s research and service models in this field, providing reference for relevant libraries.

## 2. Patent Information Development in the Guangdong-Hong Kong-Macao Greater Bay Area

### 2.1 Innovation Environment Development Status

Through field investigation and literature review, we found that the Greater Bay Area enjoys a superior innovation environment, with intellectual property development ranking among the nation’s top and high attention to IP issues. The manufacturing output value of the nine Pearl River Delta cities accounts for about 1/8 of the national total and 5% of the world’s total. Under local government advocacy, these nine cities have a strong atmosphere of technological innovation, with patent holdings, effective invention patents, and PCT international patent applications consistently leading the nation [11]. Hong Kong’s scientific and technological innovation environment is first-class, attracting top global research talent with basic research levels ranking among the Asia-Pacific’s best. In the 2018 Global Innovation Index Report, Hong Kong ranked 14th, indicating strong public awareness of intellectual property protection [12]. Macao’s gambling industry dominates, with leading R&D in related systems and equipment [13]; its universities have strong and rapidly developing research capabilities with five state key laboratories, though public acceptance of IP protection remains relatively low and awareness of technological innovation needs

improvement [14].

## 2.2 Patent Creation Status

Over the past decade, patent applications in the Greater Bay Area have shown a growth trend, as shown in Figure 1 [Figure 1: see original paper], with total applications maintaining growth that accelerated from 2015. In terms of legal status, Macao has the highest patent validity rate, followed by Hong Kong, while the average patent validity in the nine Pearl River Delta cities shows a considerable gap with Hong Kong and Macao.

## 2.3 Patent Protection Status

The Greater Bay Area has continuously strengthened IP protection in recent years, with protection levels improving annually. First, legal institutions have been improved, with the establishment of the Guangzhou Intellectual Property Court [15], Shenzhen Intellectual Property Tribunal [16], and Guangzhou Internet Court [17], while the Guangdong Provincial Market Supervision Administration 统一管理全省商标、专利、原产地地理标志等知识产权工作 [18]. Hong Kong has established a leading IP arbitration center in the Asia-Pacific region [19], Macao has set up a Portuguese-language IP arbitration center [20], and both Hong Kong's Intellectual Property Department and Macao's Intellectual Property Office have optimized management and strengthened joint law enforcement with local customs [21]. Second, the region has promoted the construction of IP rapid rights protection centers for characteristic industries and IP protection centers for strategic emerging industries, with four national-level rapid rights protection centers for characteristic industries established in the Greater Bay Area to date [22].

## 2.4 Patent Utilization Status

**2.4.1 Multi-Pronged Operation and Transaction Measures** The Greater Bay Area has implemented multi-pronged measures for IP operation and transaction. By 2018, Guangdong had 29 various types of IP operation platform institutions and 28 transaction service agencies, establishing platforms such as the Public Service Hengqin Characteristic Pilot Platform, China (Southern) IP Operation Center, and Guangzhou IP Exchange Center [23]. The “Guangdong IP Transaction Expo” was successfully held for two consecutive years in 2017-2018, becoming an influential IP exchange platform nationwide [24]. Hong Kong Trade Development Council launched the free online platform “Asia IP Exchange” [25], and Macao has held multiple Portuguese-language IP seminars [26].

**2.4.2 Obvious Effects of IP Finance Innovation** The Greater Bay Area has achieved remarkable innovation in IP finance. Guangdong has vigorously promoted IP financial innovation through multi-party collaboration, with most

Pearl River Delta cities establishing “IP Pledge Financing Risk Compensation Funds” [27] and building risk guarantee mechanisms for IP pledge financing [28]. IP service agencies actively explore participation in IP pledge financing, with provincial IP departments implementing provincial IP finance innovation promotion plans to effectively lower financing thresholds for SMEs. Additionally, Shenzhen issued the “Shenzhen IP Pledge Loan Bad Debt Compensation Operation Procedures,” further improving the IP pledge financing guarantee mechanism [29].

### **3. Needs of Different Innovation Entities for Patent Information Services in the Greater Bay Area**

Through field investigation, we summarized the demand characteristics of different innovation entities for patent information services in the Greater Bay Area:

#### **3.1 Local Government**

As a strong IP province, Guangdong has strong demand for patent information decision-making consultation in promoting innovation-driven development and building an international science and technology innovation center in the Greater Bay Area: first, acquisition of patent big data, such as regional patent application/grant data, PCT patent holdings, patent transformation volumes, and patent litigation volumes; second, benchmarking against other developed countries/regions, such as providing comparisons and monitoring of patent development trends in bay areas like New York, San Francisco, and Tokyo; and third, IP policy recommendations adapted to the development of regional patent-intensive industries, such as strategies for IP protection in e-commerce.

#### **3.2 Universities and Research Institutes**

These entities’ patent information service needs mainly concentrate on patent creation and utilization: first, high-quality patent applications—universities and research institutes aim to produce high-quality research outcomes and need to address how to be competitive at the innovation source and avoid IP risks during R&D; second, patent transformation—universities and research institutes are strong patent suppliers but struggle to find demanders, leaving most patents “sleeping”; and third, collaborative patent information services among Greater Bay Area universities and research institutions—Hong Kong and Macao universities have quality patent resources and cutting-edge research teams, while Guangdong has strong patent agencies and information analysis institutions, making integration and resource sharing a future demand direction.

#### **3.3 Enterprises**

Enterprises primarily apply for patents to protect their technology and form core competitiveness, focusing on patent infringement, early warning, and nav-

igation services. Under China-US trade friction, some Guangdong enterprises choose to build factories and trade in countries along the “Maritime Silk Road” (especially South and Southeast Asian countries), creating strong demand for information on IP protection systems and import-export trade in these countries. Additionally, some high-tech enterprises actively expanding into overseas markets increasingly emphasize macro-analysis of patent information in relevant countries and acquisition of competitors’ patent intelligence when developing overseas layout strategies.

#### **4. Library Patent Information Services in the Greater Bay Area: A Case Study of Guangdong Science and Technology Library**

The Greater Bay Area’s strong scientific, technological, and economic development has boosted its patent information industry, whose diversified development requires more high-quality service providers. Guided by the Greater Bay Area’s patent information needs, GDLIB has strengthened resource organization and actively carried out service innovations for the region based on its existing IP services.

##### **4.1 Strengthening Intellectual Property Think Tank Construction**

To deeply support and serve the Greater Bay Area’s innovation-driven development, the Guangdong Academy of Sciences and the Institutes of Science and Development of the Chinese Academy of Sciences jointly established the Institute of Strategy Research for the Greater Bay Area in March 2019. This institute aims to gather domestic and international talent, build an open and cooperative strategic and policy research network, focus on directions including science and technology policy, regional development planning, innovation systems, industrial transformation, ecological civilization, and strategic intelligence, and provide scientific foresight and consultation for the Greater Bay Area’s innovative development [30].

As an integral part of this institute, GDLIB has developed an IP think tank using its rich scientific and technological information resources and professional IP service team, providing decision-making consultation services for local governments and research institutions at different levels, as shown in Figure 2 [Figure 2: see original paper].

**4.1.1 Local Government** GDLIB has formulated corresponding solutions for government needs: first, universal solutions that collect and analyze information based on common needs within a certain scope, such as compiling the “Global IP Dynamics” publication in cooperation with Guangdong IP Protection Center to track global IP development, policies, strategies, and systems for decision-making reference; and second, customized solutions that develop different research paths based on specific client needs, such as undertaking the

Guangdong Provincial Political Consultative Conference’s project on “Strengthening IP Protection and Utilization to Optimize the Greater Bay Area’s Innovation Environment,” which involved investigating the status quo and problems in IP protection and utilization across 11 Greater Bay Area cities and providing tailored suggestions.

**4.1.2 Research Institutions** Guangdong research institutions’ needs for IP decision-making consultation mainly involve IP review and evaluation, which comprehensively uses intelligence analysis methods to assess IP-related risks in economic and technological activities, evaluate IP asset quality and value, and provide countermeasures and suggestions [31]. In 2017, Guangdong issued the “Interim Measures for IP Review and Evaluation in Major Economic and Technological Activities,” incorporating IP review into major economic and technological activities [32]. In 2018, the Guangdong Science and Technology Department first proposed organizing third-party professional institutions to evaluate high-quality IP in major science and technology special projects [33]. In this context, research institutions increasingly value IP review and cooperate with service agencies. Most mainstream IP reviews focus on invention patents in specific fields, processing massive and scattered patent information into competitive strategic intelligence to reveal trends in technology, R&D, markets, policies, investment, and competition [34]. Building on previous patent analysis, GDLIB has actively developed IP review services, co-applying with the Wu Qingping Academician Team from Guangdong Institute of Microbiology for a Guangzhou patent special project on “IP Review Research for Rapid High-Throughput Detection Technology and Equipment for Foodborne Pathogenic Microorganisms Based on Omics,” embedding patent and standard analysis throughout the IP creation process to serve major R&D projects and high-value patent cultivation.

## 4.2 Building a Patent Information Analysis Platform for the Greater Bay Area

To better benchmark against international industrial technology frontiers and improve IP think tank service efficiency and quality, GDLIB has built a patent information analysis platform using big data and AI technologies to collect, analyze, and disseminate patent information. Relying on the Greater Bay Area Strategy Research Institute’s data center, the platform has collected international four-bay-area patent data resources accumulated by GDLIB’s IP think tank team, achieving patent storage, analysis, display, and push functions through technical capabilities.

The platform includes four functional layers: the Greater Bay Area Strategy Research Institute data center portal, data application support system, data resource support system, and data resource application system, as shown in Figure 3 [Figure 3: see original paper]. The international bay area patent information database is categorized according to Guangdong’s nine key industries: next-generation information technology, high-end equipment manufacturing, green

and low-carbon industries, biomedicine, digital economy, new materials, marine economy, modern seed industry and smart agriculture, and modern engineering technology, with data placed in sub-databases for subsequent mining and display. Currently, the platform's patent visualization data and intelligence products have been displayed on multiple portals and mobile clients, including Guangdong Biomedicine and Big Health Data Platform, New Materials Achievement Transformation Platform, Zhongshan Strategic Emerging Industry Information Service Platform, and "Guangdong Industry Development Think Tank" WeChat official account. Patent big data information is also promoted on the library's data screen, helping users quickly understand evolution patterns and industrial technology competition situations behind patent information to support strategic decision-making by research management.

### **4.3 Promoting One-Stop Patent Information Services for Research Institutes and Enterprises**

As a National Patent Information Dissemination and Utilization (Guangdong) Base and National Patent Document Service Outlet, GDLIB has been committed to promoting patent information services for research institutes and enterprises. In 2016, the library undertook the operation of the Guangdong Science and Technology Achievement Transformation Market Trading Platform—Southern Innovation and Entrepreneurship Hub—jointly built by Guangdong Academy of Sciences and Southern Media Group. Leveraging the Academy's strong scientific talent teams and high-end research platforms, GDLIB explored online and offline IP transformation services. With funding from Guangdong IP Office, GDLIB established the "Guangdong Academy of Sciences IP Transfer and Transformation Center" and "Guangdong Academy of Sciences Patent Utilization Platform," forming a full-chain patent information service system based on the entire IP chain, as shown in Figure 4 [Figure 4: see original paper].

**4.3.1 Patent Creation** Research institutes' needs in this 环节 mainly focus on the front end of the R&D process, such as determining R&D novelty, talent introduction risk assessment, and high-quality patent creation. Therefore, at the project selection stage, GDLIB provides literature intelligence services like patent novelty searches and SDI services to help researchers determine R&D direction novelty; during high-end talent recruitment, GDLIB selects appropriate indicators based on the institute's positioning to conduct IP risk prevention and control-based assessments of candidates, analyzing their comprehensive strength from multiple dimensions including academic ability, influence, and organizational capacity; in the high-quality patent creation stage, GDLIB customizes patent technology development trend analysis reports incorporating policy, economic, technological, and market factors to help researchers grasp global technology development trends, institutional competition, and market prospects, providing intelligence support for drafting high-quality patent claims and conducting patent layout.

For enterprise patent creation, R&D enterprises focus on global competitors' IP transfer and litigation trends. GDLIB incorporates IP information tracking into its global R&D enterprise dynamic monitoring system and provides relevant monitoring briefings. SMEs, limited by IP management investment, approach GDLIB when they need patent information but cannot afford databases. The library provides patent document delivery services through its "Virtual Reference and Document Delivery Platform," and offers patent navigation services for SMEs in specific industries to enhance their patent creation capabilities and promote independent innovation and transformation.

**4.3.2 Patent Protection** Currently, Guangdong research institutes have relatively weak patent protection awareness, and researchers lack in-depth understanding of patent legal knowledge when conducting achievement transformation. In response, GDLIB jointly organized training on "Legal Issues in Scientific Achievement Transfer and Transformation" with the Southern Innovation and Entrepreneurship Hub Platform, inviting renowned IP lawyers to explain effective patent protection for researchers and managers. This training, addressing a key pain point, was well-received, demonstrating strong demand for patent protection training in research institutes and providing space for libraries to develop related services.

As enterprises are closer to the market, they have stronger patent protection awareness and more diverse needs. For example, Dongguan Feipeng Pharmaceutical Company commissioned GDLIB to conduct patent searches related to a technology, particularly sorting and analyzing invalid patents, to assist in improving its patent litigation documents; Guangxin Group planned to invest in a new technology field and commissioned GDLIB to conduct due diligence on the field and related enterprises, receiving a due diligence report including IP. To serve enterprises' "going global" strategy, GDLIB also conducts patent early warning and IP risk analysis research for "Belt and Road" countries.

**4.3.3 Patent Achievement Transformation** GDLIB hopes to bridge the gap between research institutes and enterprises for achievement transformation through the Southern Innovation and Entrepreneurship Hub Platform. In the patent utilization 环节, GDLIB acts as an intermediary service agency, such as organizing the Academy's 22 institutes' patent achievements into a white paper categorized by research field for external promotion; hosting multiple offline matchmaking meetings in electronic information and environmental protection industries; organizing enterprise visits to Academy institutes to provide platforms for close exchanges among researchers, entrepreneurs, and financial institutions; conducting precise technology talent matchmaking services; and conducting patent value assessment research to provide technological innovation indicator systems for ICBC Guangzhou Branch's credit loan services for technology enterprises.

#### 4.4 Actively Expanding External S&T Cooperation Based on Patent Information Services

**4.4.1 Cooperation with Mainland Peers** To promote IP research in “Belt and Road” countries, GDLIB cooperated with the Chengdu Documentation and Information Center of the Chinese Academy of Sciences in 2017 to establish the “Maritime Silk Road IP Research Center” based on national “Belt and Road” requirements and Guangdong’s actual conditions. The center focuses on IP research and consultation, technology foresight and innovation services, and IP information resource sharing. Since its establishment, the center has jointly applied for and obtained approval for multiple projects, including the Guangdong IP Project “IP Risk Prevention and Control Country Guide for Belt and Road Countries—Singapore as an Example,” Guangdong Natural Science Foundation project “IP Management in Basic Research Scientific Data Dissemination,” and Guangdong Soft Science Project “Guangdong Biomedicine Industry Technology Development Strategy Based on Disruptive Technology Foresight,” producing a batch of IP think tank reports and cultivating young patent information analysis talents through research-driven approaches.

**4.4.2 Cooperation with University of Macau Library** Since the Greater Bay Area national strategy was introduced, GDLIB has actively sought cooperation with Hong Kong and Macao research institutions. In 2018, the library hosted the National Symposium on New Service Capacity Building of Libraries, inviting University of Macau Library (UML) Director Wu Jianzhong to deliver a keynote speech, which initiated cooperation. Subsequently, UML sent librarians to GDLIB for exchanges on patent information services, and both sides reached an intention to jointly apply for research projects. With the promulgation of the “Several Policy Measures for Further Promoting Scientific and Technological Innovation” (referred to as “12 Innovation Measures”), Guangdong science and technology plan projects opened to Hong Kong and Macao and established cross-border fiscal fund usage mechanisms [35]. Accordingly, GDLIB and UML explored cross-border research cooperation, jointly discussing feasibility plans for Guangdong Science and Technology Department soft science projects, which were eventually approved. Building on this successful cooperation, both sides proposed and implemented the concept of establishing a “Joint Patent Information Center” to provide patent information analysis and consultation, achievement transformation, and librarian exchange services for both regions, promoting patent information exchange and service implementation.

#### 4.5 Service Effectiveness

Through continuous exploration, GDLIB has gradually gained social recognition for its patent information service models, processes, and product systems in the Greater Bay Area. Its research report “Strengthening IP Protection and Utilization to Optimize the Greater Bay Area’s Innovation Environment” received instructions from Guangdong’s Party Secretary and Governor, with relevant re-

search results incorporated into provincial government policy documents. The Southern Innovation and Entrepreneurship Hub Platform's IP transformation innovation service won the "2018 Outstanding Science and Technology Intelligence Achievement Award" from Guangdong Science and Technology Intelligence Society and the "Third Guangdong Library and Information Innovation Service Award," gaining recognition from enterprises including CAS Holdings and ICBC Guangzhou Branch. The talent introduction assessment service based on IP risk prevention and control was affirmed by Guangdong Academy of Sciences, making GDLIB a recognized service provider for the Academy's high-level talent introduction assessment reports. Through these distinctive patent information services, GDLIB has achieved good social and economic benefits, gradually enhancing its think tank team's service and research capabilities and increasing its influence in the patent information service industry.

## 5. Conclusions and Recommendations

### 5.1 Taking National Strategy as the Driver to Actively Develop Library Patent Information Services

The Greater Bay Area development plan is a national strategy aiming to build a globally influential international science and technology innovation center. Technological innovation is the main theme, and a large number of high-quality patents are essential conditions. Therefore, library patent information services directly serve technological innovation, allowing librarians to feel the pulse of the era.

Libraries are service institutions that should not limit their service domains. Under China's innovation-driven development strategy, libraries can do anything that serves technological innovation. Only through good service can libraries make achievements and make librarians proud of their profession. GDLIB has contributed to the Greater Bay Area's technological innovation through diverse patent information services for governments, research institutions, and enterprises. Its cooperation with the Chengdu Documentation and Information Center to establish the "Maritime Silk Road IP Research Center" has enhanced high-quality patent service capacity, while its cooperation with UML to build a "Joint Patent Information Center" provides new ideas for cross-border joint services.

### 5.2 Highlighting Library Social Value by Supporting Regional Economic and Technological Development Through Patent Information Services

Through practice, GDLIB realized that libraries are changing and transforming. Librarians must dare to practice and influence readers, especially leaders, to change their perception of libraries. Most leaders' understanding of libraries remains at the level of their student experiences, so librarians must influence them through service innovation to recognize libraries' changes.

“Achievement creates position.” In recent years, interdisciplinary research has produced many technological innovation achievements, with increasingly broad boundaries between disciplines. Libraries—whether public, university, or specialized—should not limit themselves to traditional services but should proactively carry out work serving technological innovation, including in-depth patent information services. By completing high-quality tasks, especially those assigned by superiors, libraries can change leaders’ perceptions, gain their trust and dependence, avoid marginalization, and truly make achievements.

In conclusion, the only constant in library development is change. Patent information services for the Greater Bay Area are just one part of library services. Only through continuous service transformation can libraries survive and develop.

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## Author Contributions

Wei Dongyuan: Paper framework design

Zhu Lin: Organization of practical research sections

Chen Jiaqi: Content organization

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**Abstract:** [Purpose/significance] Providing patent information service under

the Guangdong-Hong Kong-Macao Greater Bay Area national development strategy has significant meaning to the regional technology improvement and industry development. [Method/process] The paper introduced the patent information service pattern and experience by summarizing the developing trend of the Great Bay Area through investigation, patent analysis and literature study as well as taking Guangdong Science and Technology Library as the example for case study. [Result/conclusion] Summarizing the experience from all aspects including building intellectual property think tank, constructing patent information platform, providing patent information service and external cooperation to provide future reference for libraries which are willing to offer patent information service in the Great Bay Area.

**Keywords:** the Guangdong-Hong Kong-Macao Greater Bay Area; patent information service; professional library; platform construction; achievement transformation

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

*Source: ChinaXiv — Machine translation. Verify with original.*