

Structuring and Operating Patent Intermediary as Platform Ecosystem: Case Studies of Patent Operation Platforms (POPs) in China

KAITONG LIANG, LEI MA, ZHENG LIU and TAO LI¹

Alongside Patent Super Aggregators represented by Intellectual Ventures in US, there is a trend to construct patent intermediary in the context of platform ecosystem. Accordingly, patent operation platforms (POPs) have emerged recently in China, yet few studies focus on uncovering their structure and operating mechanism. This paper aims to explore them based on two in-depth case studies with the application of a four-dimensional service innovation framework. Findings pinpoint that POP consists of 'Patent Plus' database, patent service platform and two-sided patent platform, as a closed loop. In this structure, ICT plays a prominent role, connected with new service concepts, service delivery system and client interface, to operate the platform. Our paper also shows implications to POP related theory and practice.

Keywords: patent intermediary, platform ecosystem, patent operation platform, China

Introduction

PATENT INTERMEDIARY is an organization which not only matches the supply and demand of technology by providing patent transaction service, but also supports firms that pursue technological innovation through various approaches (Benassi & Di Minin, 2009; Caviggioli & Ughetto, 2013; Agrawal et al., 2016). Patent intermediary has grown rapidly in the European and USA patent markets since the 2000s (Gredel et al., 2012; Benassi & Di Minin, 2009). Patent super aggregators represented by Intellectual Ventures have taken the central role in globalization of innovation process (Patra & Krishna, 2015). These aggregators provide patents to their clients by buying,

Kaitong Liang, School of Intellectual Property & Centre for Innovation and Development, Nanjing University of Science and Technology, Nanjing, P R China.

Lei Ma (corresponding author), School of Public Affairs & Centre for Innovation and Development, Nanjing University of Science and Technology, Nanjing, P R China.

E-mail: maryma208@sina.com

Zheng Liu, Cardiff School of Management, Cardiff Metropolitan University, Wales, UK; Centre for Innovation and Development, Nanjing University of Science and Technology, Nanjing, P R China.

Tao Li, School of Intellectual Property & Centre for Innovation and Development, Nanjing University of Science and Technology, Nanjing, P R China.

selling or licensing. Moreover, with numerous patent portfolio, litigations can be initiated to Apple, Lenovo, Microsoft and other well-known multinational enterprises (MNEs) as their core business (Hagiü & Yoffie, 2013). Such impressive market power has enabled a platform ecosystem (Caviggioli & Ughetto, 2013), constructed by platform, complementor, interface, architecture and customer (Jacobides et al., 2018). Patent intermediaries in the context of platform ecosystem are popular in the European and USA patent markets, such as Sisvel and Questel (Fischer & Henkel, 2011).

Since the Chinese government released ‘The Outline of the National Intellectual Property Strategy’ in 2008, patent intermediaries such as Sixlens and Baiten have emerged to realize commercial value. Known as ‘patent operation platforms’ (POPs), their business models are different from Non-Practicing Entity (NPE) which rely on selling or licensing patents and initiate patent litigations (Damien et.al,2012). Instead, based on the Internet, POPs play an important role in constructing innovation networks by providing patent services without owing patents, to satisfy innovation needs and gather resources (Ma et al., 2021).

While Europe and USA demonstrate matured patent markets with the coordination from leading companies, the emergence of POP in China is mainly based on the direction of policies. Their structure and operating mechanism remain unclear. Extant studies have covered gaming consoles (Ozalp et al., 2018), smartphone (Kapoor & Agarwal, 2017) and other manufacturing service platforms. However, less attention is paid to specialized service platforms such as consultancy, legal services, financial services and social media, except from the works of Letaifa et al. (2016) and Inoue et al. (2019). Studies on patent intermediary mainly discuss the causes of occurrence, market role, geographical distribution built on theories of structural hole, transaction cost economics and crowdsourcing (Benassi & Di Minin, 2009; Reiffenstein, 2009; Agrawal, 2016).

Currently literature shows limited understanding on the structure and operating mechanism of POP, especially those based in emerging countries where the patent markets are still evolving. The feature of platform ecosystem enabled by the patent intermediaries in form of POP is very unique as a new phenomenon underexplored. Thus, to fill the research gaps, our paper aims to uncover the ‘black box’ of POP by addressing the key research question – ‘as a type of patent intermediary in the context of platform ecosystem, how is POP structured and operated?’ To answer this question of ‘how’, two in-depth case studies from China are conducted with the elaboration and application of a theoretical framework generated from literature review. Findings contribute to the limited literature that examines the structure and operating mechanism of POP with empirical evidences from ongoing business processes and events.

Literature Review and Theoretical Framework

Features and Structure of Platform Ecosystem

Platform ecosystem is regarded as ‘semi-regulated marketplaces’ that foster

entrepreneurial action, or as ‘multisided markets’ enabling transactions between distinct groups of users (Jacobides et.al., 2018). Highly open to the external environment, it involves complementors, customers and multiple innovators with diverse identities to integrate (Eckhardt et al., 2018). Platform ecosystem absorbs the advantages of product platform and two-sided platform (Thomas et al., 2014; Gawer, 2014). Product platform refers to a set of design, components, knowledge and personnel shared among different products when product innovation is within the firm (Utterback & Meyer, 1993; Robertson & Ulrich, 1998). When two or more customers interact through an intermediary that provides products or services with the strategy influenced by network effect, there is a two-sided platform (Rochet & Tirole, 2003; Armstrong, 2006).

Accordingly, platform ecosystem structure mainly consists of product platform and two-sided platform (Gawer & Cusumano, 2014; Facin et al., 2016). Although product platform for innovations in product family is internal, the modularity concept provides a foundation for the structure of platform ecosystem (Sanderson & Uzumeri, 1995). Two-sided platform needs to be external, because external environment can enhance its impact. Thus, network effect concept deeply influences platform ecosystem structure (Sun & Tse, 2009). Platform ecosystem possesses the openness and network effect of two-sided platform along with the modularity of product platform.

Dimensions of Operating Patent Intermediary

The emergence of patent intermediary is linked to firms’ establishment and perfection of patent system and implementation of patent monetization strategy (Reiffenstein, 2009; Monk, 2009; Petrusson et al., 2010), initiating patent applications that create chances for the emergence of patent intermediary (Reiffenstein, 2009; Monk, 2009). Once firms have implemented patent monetization strategy, patents are no longer treated as exclusive rights only, but as tradable assets. By adopting patent monetization strategy, firms can enhance innovativeness and gain profit from it, which is considered as a crux for enlarging the scale of patent intermediaries (Hagiu & Yoffie, 2013). Nevertheless, this strategy has brought challenges to the patent market, resulting in several market demands identified by patent intermediary (Gredel et al., 2012; Caviggioli & Ughetto, 2013). Patent intermediary not only makes up for the information asymmetry between parties in a transaction, but also offers customers with a feasible solution (Feller et al., 2012; Fisher, 2013).

Patent intermediary providing feasible solutions to challenges in the patent market has several natures from different theoretical perspectives. Benassi and Di Minin (2009) discuss the topic from transaction cost economics (TCE) and structural holes perspectives. Based on TCE, patent intermediary is a mixed governance of ‘standardization and marketization’ that strengthens the institutional settings to enable transactions, while enhancing trust between buyer and seller and helping them to execute high-risk transactions and reducing the information asymmetry during bargain. From structural holes aspect, patent intermediary is essentially a ‘relationship bridge’ among unlinked groups of participants previously in the patent market. Feller et al. (2012) discuss the nature of patent intermediary as a virtual innovation community

(VIC) from crowdsourcing. Through crowdsourcing, patent intermediary aggregates the need for knowledge and uses decentralized knowledge and skills to motivate innovation for themselves and their customers. Apart from the above studies, the nature of knowledge intensive business service (KIBS) has not been discussed adequately. KIBS is a term for services aimed at promoting knowledge accumulation, creation and dissemination, as well as strengthening innovativeness in industrial sectors to meet customer needs (Hertog, 2000; Muller & Zenker, 2001). Due to specialized knowledge loaded by patents, the creation, accumulation and dissemination of them require strong knowledge-decoding capability. Without knowledge network accumulated by intermediary in the patent market, the searching cost is relatively high if firms seek for appropriate deals individually (Agrawal et al., 2016). Patent intermediary not only realizes the flow of knowledge through interaction with customers, but also absorbs and transforms customers' knowledge to promote innovativeness.

Providing patent-based KIBS is an important essence of patent intermediary, and the dimensions of KIBS innovation are significant for operating them (Izaskun et.al.,2020). The four-dimensional model of service innovation proposed by Hertog (2000) is widely used. The first dimension is information and communications technology (ICT), an indispensable way to enhance the capability of decoding and disseminating knowledge (Palvalin et.al,2013; Park et.al, 2019). Countries embarked on the development of ICT sector will become globally competitive, as the same for KIBS (Singh & Krishna, 2015). The second dimension is client interface, the design of interface between service provider and its clients (Bettiol et al., 2012). While the adoption of ICT becomes the consensus of various KIBS firms, the competitiveness among them mainly relies on the optimization of client interface. It is the reason why ICT can theoretically reduce regional differences among KIBS firms, yet regional differences among them become more obvious (Carrillo et al., 2006). The third dimension is new service concepts. Although KIBS firms generally do not have the same specialized R&D sector as manufacturing firms, they still need to develop new services to gain competitive advantages (Kim & Yoon,2014). The 'new' here is compared to different regions, industries and countries (Rodriguez et al., 2017). The fourth dimension is service delivery system, consisting of talented teams and organization divisions (Hertog, 2000). KIBS firms can change their organization divisions and form professional talented teams to accommodate with the development of ICT or changes in other dimensions (Cabigiosu et al., 2015). Taking front-line employees in KIBS firms for example, seasoned front-line employees not only accumulate valuable knowledge during the interaction with customers, but also create values through interaction since service innovation is sometimes a disruptive process (Santos et al., 2013). These four dimensions need to be linked, which is significant to operate patent intermediary.

Research Gap Identification and Theoretical Framework

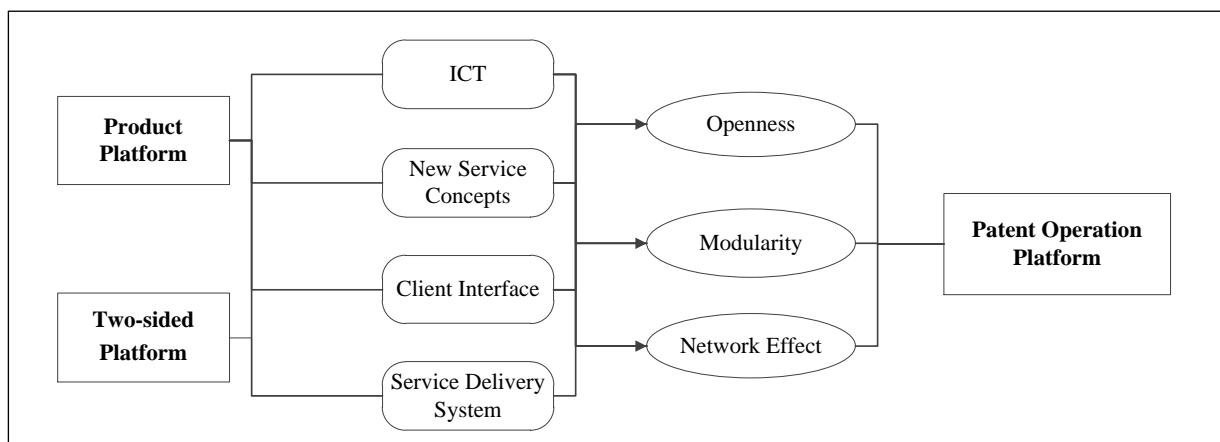
The structure-based view applied to product platform and two-sided platform has made platform ecosystem a huge impact on regional and global economy with its business and social values (Yun et al., 2017). However, such conclusions are mainly drawn upon

studies on manufacturing service platforms, such as videogames (Ozalp et al., 2018) or smartphone (Kapoor & Agarwal, 2017). Whether the structure of POP providing specialized service is based on product platform and two-sided platform is still unknown.

In terms of patent intermediary and KIBS literature, ICT, new service concepts, service delivery system and client interface can be generated as four dimensions of operating patent intermediary. However, the influence of their connection to POP is still underexplored. Current studies on patent platform are mainly limited to its appearance, mission and functions, and less attention is paid to their operating mechanism (Petrusson et al., 2010; Hagi & Yoffie, 2013).

To fill in the research gaps, this paper will focus on the POP structure and operating mechanism. Specifically, the connection among ICT, new service concepts, service delivery system and client interface in POP will be analyzed. From literature review, a theoretical framework is generated (Figure 1) based on a four-dimensional framework of service innovation (Hertog, 2000). It identifies product platform and two-sided platform as the basic structure of POP. ICT, new service concepts, client interface and service delivery system are considered as four dimensions operating POP synthetically, by influencing its openness, modularity and network effect. This theoretical framework will be further developed and elaborated in the following case analysis session.

FIGURE 1
Theoretical Framework of Structuring and Operating POP



Source: Created by the authors.

Research Methodology

The key research question is “as a type of patent intermediary in the context of platform ecosystem, how is POP structured and operated?”. This is a question of ‘how’ which is seldomly studied in the field of patent intermediary and platform ecosystem. To answer this type of question, exploratory case study approach is adopted for theory building and deepening the comprehension of subject matters (Yin, 2013; Eisenhardt, 1989). Meanwhile, the large and standardized public data are scarce for patent intermediaries in USA, Europe or China, resulting in the fragmented data collection for POP (Benassi

& Di Minin, 2009; Gredel et al., 2012). Hence, by using qualitative data from case studies, the research can reveal more details in the structure and operating mechanism of POP.

Case Selection

Four criteria are used in selecting cases in China. First, the selected POPs should have the capability of providing services including patent agency, patent information and patent transaction. Second, POPs should have experience of serving different clients such as firms, governments and universities. Third, POPs should be awarded as ‘National Intellectual Property Service Brand Organization’ by China National Intellectual Property Administration (CNIPA) demonstrating their popularity and impact in China. Fourth, the selected cases should have abundant qualitative data to form the evidential chain.

Accordingly, two cases-Sixlens and Baiten-are selected, and their overviews are presented as Table 1.

TABLE 1
Overview of the Two Chinese POPs

<i>Cases</i>	<i>Founder</i>	<i>Established year</i>	<i>Overview</i>
Sixlens	Hangzhou Six Prism Intellectual Property Technology Co., Ltd.	2018	Sixlens combines industries, enterprises, talents, investments, finances and other data to support the integration of technology and capital factors such as enterprises, universities, investors, governments and financial institutions. At present, the platform has 130 million patent information, 40 million industrial and commercial information and other massive data. It has been awarded as ‘National Intellectual Property Service Brand Organization’ in 2020.
Baiten	Jiangsu Baiten Technology Co., Ltd.	2013	Baiten provides patent agency, patent information retrieval, patent management, technology transfer and other services for domestic and foreign users. Daily visits for the website have reached more than 80,000 times, serving more than 120,000 enterprises. It has been awarded as ‘National Intellectual Property Service Brand Organization’ in 2018.

Sources: The case companies’ documents and websites of Sixlens ([https://www. linkinip.com/](https://www.linkinip.com/)) and Baiten (<https://www.baiten.cn/>).

Data Collection and Analysis

Data collection process has two stages from June 2020 to June 2021. First, documents and archives about Sixlens and Baiten were reviewed to shape an initial impression on their structure and operating mechanism. Second, semi-structured interviews were conducted to 3 managers in Sixlens and 3 managers in Baiten, each lasting around 1 hour to capture primary data about their structure and operating mechanism, especially ideas and events about how ICT, client interface, service delivery system and new service

concepts connect together to operate POP, based on the structure of product platform and two-sided platform. A database for the two cases was built as the final purpose after the process.

Data analysis was carried out as two stages under the theoretical framework of structuring and operating POP generated from literature review. In the initial stage, the collected data were coded into two structural component, product platform and two-sided platform (Ke et.al,2015). Subsequently, in each component, the data mentioned above were sub-coded into the following four dimensions: ICT, client surface, service delivery system and new service concepts (Kapoor et.al, 2021). To find out how the four dimensions are related to each other, the research team used discussions to develop a mutual understanding of the relations. In the second stage, based on a narrative strategy and the categorized data above, this paper analyzed each case separately in a logic of literal replication (Yin, 2013). Findings concluded from the case analysis are based on various data sources and reached an evidential triangulation (Tian et.al,2015).

Case Analysis

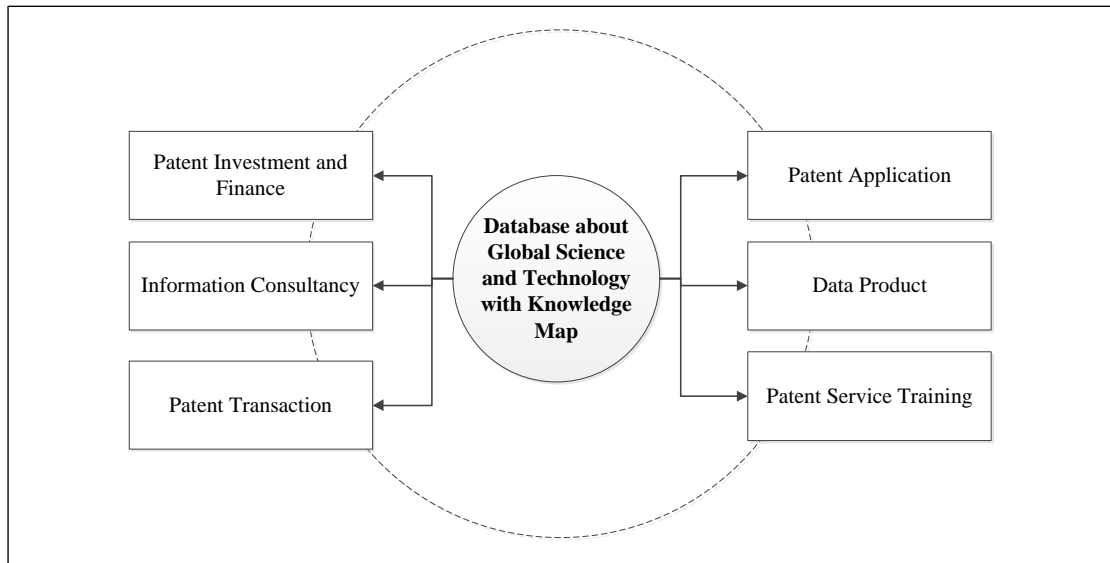
To answer the research question in accordance to the theoretical framework (Figure 1), this section will analyze each case separately through exploring the structure first. Then based on the product platform and two-sided platform, the linkage of ICT, client interface, service delivery system and new service concepts is made as the operating mechanism.

Case One - Sixlens

The Structure of Sixlens

Sixlens is structured by the database about global science and technology with knowledge map and several service modules including patent application, consultancy, transaction and so on (Figure 2). The database is self-developed by Sixlens through aggregating multi-dimensional data involved global patents, investment, mergers and acquisitions, technical standards etc. It has contained 200TB local data resources, more than 400 types of data in more than 1000 specific fields of science, technology and industry¹. Relying on such a database, as a product platform, patent application service can be provided by exerting ICT on satisfying clients demands such as online patent application. Patent consultancy service for government, firms and universities based on the database can also be provided, such as patent supply chain management and industrial patent analysis. Moreover, as a two-sided platform, patent transaction services can be provided by giving place for sellers with patents and for buyers who need them. These services can be bundled as several service packages if clients register as members in the platform.

FIGURE 2
The Structure of Sixlens



Source: Created by the authors.

The Mechanism for Operating Sixlens in Product Platform

A combination of ICT and new service concepts has extended patent agency and information service modules to meet various needs from clients. Owing to the appearance of AI or big data, Sixlens has exploited an intelligent service for patent application. On one hand, patent applications from clients can be intelligently pre-examined by the patent database. On the other hand, a list of high-quality patent agencies can be screened with the aim of supporting clients to find appropriate and credible agencies. The embedding of ICT increases the value of knowledge added to services provided by Sixlens, and inspires the emergence of new service concepts.

Based on ICT, the connection of client interface and service delivery system has influenced Sixlens' openness and network effect. A division called 'operation of patent big data' has been set up aiming for adapting the rapid speed of ICT innovation and providing services to governments, firms, universities and other institutions throughout China, covering high-tech industries such as the Internet of Things (IoT), biomedicine, new materials. A 20-person talented team with compound knowledge and working experiences is currently running this division. Members have qualifications as lawyers and certified public accountants (CPA), whose majors covering electronics, chemistry, statistics, intelligence and economics. By means of exerting ICT expertly, Sixlens serve clients based on their extensive knowledge and form a wide range of client interface containing final report, bulletin and data visualization to sustain clients with different requirements.

'...effective communication strengthens the mutual understanding and trust of the team, and each member's talents and characteristics can be handled to achieve the best cooperation of work.' – a manager from Sixlens

The business in ‘operation of patent big data’ has branched out in Beijing, Shanghai, Shenzhen, Hangzhou, Wuhan, Nanjing and other cities in China, resulting in the enhancement of Sixlens’ service reputation¹.

The Mechanism for Operating Sixlens in Two-sided Platform

Patent transaction service mainly relies on the interaction with clients, and thus new service concepts predominate its operation. The connection of new service concepts and ICT can support Sixlens to give feasible solutions to their clients, the modularity of patent transaction service has been expanded consequently.

‘...clients often complain that commercial banks are often reluctant to accept their financing demands by patent pledge because high costs are required to evaluate the value of patents. The low efficiency of evaluation is due to the deficient knowledge of evaluating patents by commercial banks, resulting in a decreasing enthusiasm for them to carry out related business.’ – a manager from Sixlens

Sixlens has seized this opportunity and exploited a service called ‘Patent Value Stream’, a new idea different from traditional patent evaluation. It is a service that assesses the value of patents before, during and after their pledge dynamically via using the patent database and ICT. It has shifted the traditional concept of evaluating patents based on price to continuously monitoring. Currently, ‘Patent Value Stream’ has supported more than 150 SMEs to finance by pledging patents successfully and the total amount of financing has reached more than 700 million RMB¹.

Patent transaction service is a client-based service and thus the connection of client interface and service delivery system can be catalyzed by ICT to influence the openness and network effect of Sixlens. Sixlens has set up a consulting division to provide high value-added patent transaction service. In this division, a talented team from a various background of accounting, law, and management is of prominence to fulfill the goal of providing superior patent transaction service. Moreover, clients can not only interact with staffs, but also with experts invited by Sixlens as professional consultants. During the second half of 2020, this team served bonding companies by identifying the risk of pledging patents more than 270 times¹.

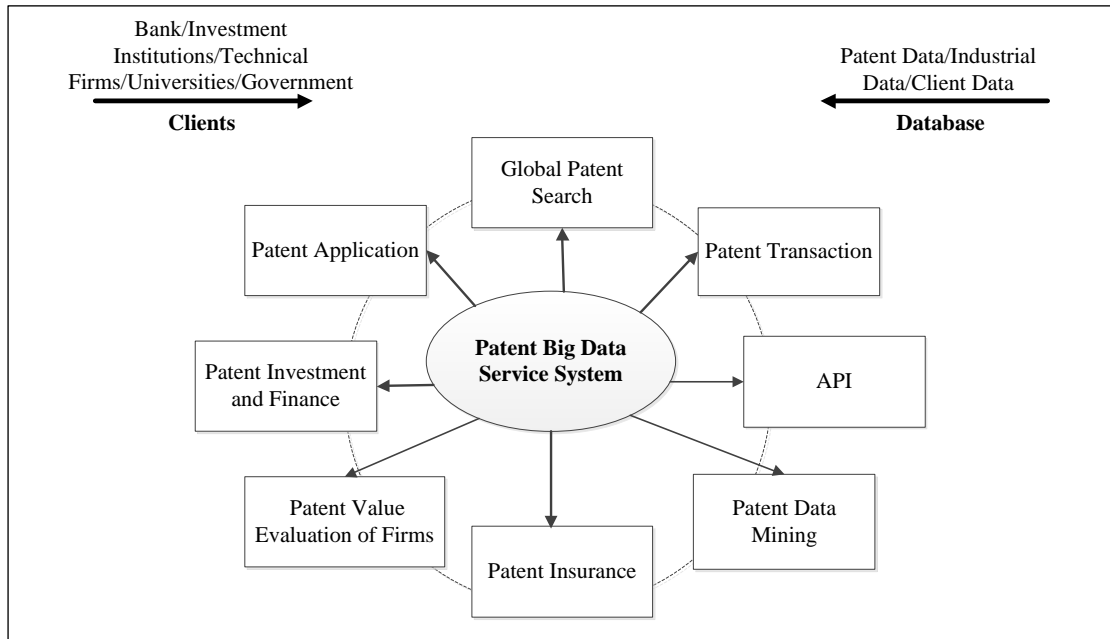
Case Two - Baiten

The Structure of Baiten

Baiten is structured by the database called ‘Patent Big Data Service System’ and several service modules included patent application, retrieval, data mining, investment and finance, transaction, Application Program Interface (API) and so on (Figure 3). ‘Patent Big Data Service System’ contains more than 130 million pieces of data from 103 countries and organizations, including United States, Japan, Germany, France, UK, the World Intellectual Property Organization (WIPO) and the European Patent Office

(EPO)². The system has adopted the ‘Shujia’ big data platform developed by Alibaba Cloud Computing Co. Ltd., as a way to improve the capabilities of machine learning and data analysis to cope with the rapid changes in the patent market. Based on this powerful database, Baiten can provide several services related to patents, such as patent application, patent transaction, API and patent investment and finance etc. Similar to Sixlens, these services can be bundled as several service packages if clients register as members in the platform.

FIGURE 3
The Structure of Baiten



Source: Created by the authors.

The Mechanism for Operating Baiten in Product Platform

The connection of ICT and new service concepts expand Baiten's service modules to satisfy various needs from clients. For example, as firms intend to fill in patent information as part of evidential materials to pass the identification of National High and New Technology Enterprises organized by Ministry of Science and Technology of the People's Republic of China (MOST), they will face many problems, such as the invalid or non-owned patents have been filled in. Baiten has identified these problems and exploited an API service related to the identification of National High and New Technology Enterprises. The API service has set the rules of identifying National High and New Technology Enterprises as a series of code, and patent information can be filled in by firms accurately and effectively. This service has successfully supported thousands of firms to fill in the patent information accurately and pass the identification of National High and New Technology Enterprises.

Baiten's client interface and service delivery system has been optimized by adopting ICT, providing it a competitive advantage in the patent market. Relying on the

professional capability of a complementor called ‘Changzhou Baiye Tengfei patent agency’, a patent agency served more than 40,000 domestic and foreign demands for patent applications with more than 50 full-time employees, Baiten has opened the online patent application service in 2015.

‘Traditional offline patent application mostly relies on local patent service agencies. The process of patent application is invisible and intangible to clients, and the opinions from CNIPA mostly stay at the agencies. Moreover, factors such as personnel changes in such agencies will delay the application from time to time.’ – a manager from Baiten

The online patent application service has broken the time and space limits for patent application, enabling the systematic management of patent application more efficiently.

‘... We have received request for patent application from a university in Xinjiang Uygur Autonomous Region soon after the online patent application service was established. Through the communication with the university, we discover that patent agencies in Xinjiang Uygur Autonomous Region are rare. The online patent application service can solve such a kind of problem.’ – a manager from Baiten

To maintain the quality of online patent application service, a skilled and talented team and their positive interaction with clients are indispensable. Currently, Baiten has more than 150 employees graduated with degrees in law, mechanics, electronics, chemistry, biomedicine and software².

The Mechanism for Operating Baiten in Two-sided Platform

New service concepts have expanded Baiten’s patent transaction service modules by exerting ICT. For example, due to the frequent counterfeit at the market, the benefits for innovators have been infringed vastly in China. Contrastingly, such obstacle has triggered market demands for preventing it. Hence, together with China Intellectual Property Research Association (CIPRA), Baiten has developed a new service called ‘Collection for Patent Product’.

‘It mainly uses QR code and big data in the Internet of Things to create patent marks printed on certified products. Such patent marks are issued by CIPRA with functions of distinguishing counterfeit and certified products, playing a positive role in promoting and publicizing patented products.’ – a manager from Baiten

This new service is of great significance to crack down on Chinese counterfeits. ‘Collection for Patent Product’ has accumulatively served for more than 3000 firms with nearly 14000 products and verified nearly 30000 valid patents².

The optimization of client interface can be ensured by service delivery system and ICT, making huge impact on Baiten’s patent transaction service. At first, customers as buyers can search the website for patent they intend to buy. If they discover patents tradable in the searching result, patents will be highlighted with the words ‘on sale’. Moreover, customers as sellers can register at the platform and release patents they want

to sell. Once buyers have locked the targeted patents, they can check the details, transaction process and contact information of sellers. Buyers have several selections to accomplish the deals. They can consult with sellers online or offline directly, or delegate Baiten's talented team as agency, or send their demands for well-known patent intermediaries through Baiten to complete the transactions with the assistance of those intermediaries. The optimization of client interface can improve the efficiency of patent transaction service.

The operating mechanism of Sixlens and Baiten are summarized as Table 2.

TABLE 2
Mechanism for Operating Sixlens and Baiten

<i>Structural Component</i>	<i>Connection Dimensions</i>	<i>Influences on the Features of Platform Ecosystem</i>	<i>Evidence from Sixlens</i>	<i>Evidence from Baiten</i>
Product Platform	ICT+ New Service Concepts	Modularity: More services have been developed due to the opportunities from new technologies.	<ul style="list-style-type: none"> ■ Sixlens has developed patent quality supervision and pre-examination services to help clients to find high quality patent agencies, based on AI, cloud computing, etc. 	<ul style="list-style-type: none"> ■ According to problems arising when firms fill in the patent information needed as materials to the identification of National High-tech Enterprises on the internet, the API service has been exploited.
	ICT+ Client interface+ Service Delivery System	<p>Openness: More clients in different regions are involved due to the accumulated reputation of POP.</p> <p>Network Effect: Reputation for patent agency and information services are widely speared among governments, firms and universities.</p>	<ul style="list-style-type: none"> ■ Sixlens has established a division called ‘operation of patent big data’ with a 20-person composite talent team, providing services in Beijing, Shanghai, Shenzhen and other cities. 	<ul style="list-style-type: none"> ■ Baiten provides online patent application service for clients in Xinjiang Uygur Autonomous Region. It has more than 150 employees graduated with degrees in law, mechanics, biomedicine, software and so on.
Two-sided Platform	New Service Concepts+ ICT	Modularity: More service modules have been developed due to the new demands from patent market.	<ul style="list-style-type: none"> ■ Sixlens has developed a patent value assessment service with the concept of “Patent Value Stream”, which is based on the big data of patents and idea about evaluating the value of patents dynamically. 	<ul style="list-style-type: none"> ■ Baiten and CIPRA jointly developed a new service which mainly uses the QR code, and prints the QR code of patents on certified products, effectively identifying patented and non-patented products.
	Client interface+ Service Delivery System+ ICT	<p>Openness: More clients in a complex process of patent transaction service are involved.</p> <p>Network Effect: Reputation for high quality of patent transaction service has been widely speared among governments, firms and universities.</p>	<ul style="list-style-type: none"> ■ Sixlens has established a consulting business division with composite talent team and invite experts in different technological fields to meet various needs of patent transaction from number of clients. 	<ul style="list-style-type: none"> ■ Baiten provides well-designed and personalized client interface. They can also entrust patent agencies to assist clients in completing the whole process of patent transactions.

Source: Created by the authors.

Discussion

From the above data analysis, insights about the structure and mechanism for operating POP have been gathered. Specifically, the structure of POP mainly consists of product platform and two-sided platform (Gawer, 2014; McIntyre & Srinivasan, 2017). However, 'Patent Plus' database is another component that should not be ignored. Furthermore, the connection of four dimensions in service innovation has been identified to explore the mechanism for operating POP. This session is the further discussion on the structure and operating mechanism of POP. Three propositions are generated based on the discussion.

The Structure of POP

The structure of POP can be separated into three components: 'Patent Plus' database, patent service platform and two-sided patent platform. These components form a closed loop efficiently to sustain a stable structure of POP (Figure 4).

'Patent Plus' database takes a prominent role in providing data for supporting all patent services in POP. This database is different from the database providing public patent data founded by United States Patent and Trademark Office (USPTO), European Patent Office (EPO) or CNIPA. It not only contains patent data from these institutions above, but also includes data from industries, financial institutions and cities (Wang, 2010). Value of patent information can be increased after the integration with data across industries, cities and so on. It is the 'Patent Plus' database that POP act as a station to offer more valuable information (Benassi & Di Minin, 2009). Thus, the POP can collocate more resources on upgrading the value of knowledge added to patent agency, information and transaction services, and clients' demands can provide feedback to 'Patent Plus' database for its next optimization.

Referring to a set of knowledge sharing among different patent services, the second component can be called 'Patent Service Platform', which provides patent agency and information services. Patent agency services are related to the confirmation and protection of patents, such as patent application (Chesbrough, 2006; Reiffenstein, 2009). It is a traditional service with almost standardized process in many countries. Compared to traditional patent agencies, the competitive advantage of POP is mainly lied in the data supported by 'Patent Plus' database and can be online and online simultaneously. Patent information services are services that can fulfill clients demands for R&D, commercial projects and so on (Hagiu & Yoffie, 2013). It can be considered as the most competitive business for POP because it relies highly on ICT. Patent information services given by POP are more competitive on its multi-dimensional data sources released by 'Patent Plus' database. To sum up, providing patent agency and information services is the main function of patent service platform as a prominent structural component of POP.

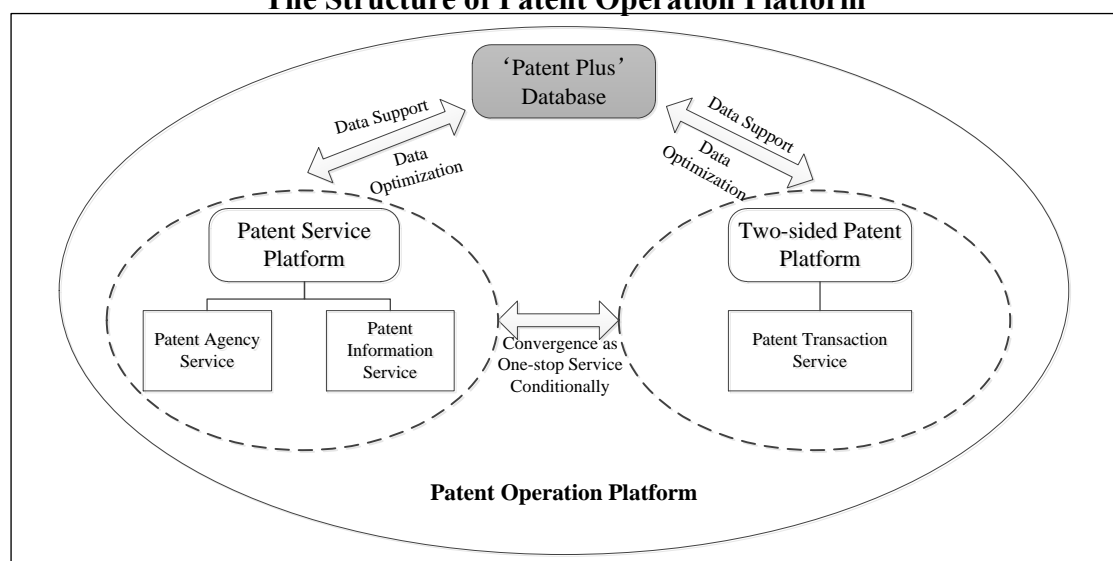
The third component is 'Two-sided Patent Platform', providing space, price and

strategies to buyers and sellers who need patent licensing, transfer, financing and so on (Monk, 2009; Benassi & Di Minin, 2009). No matter in China or USA, Europe, patent market still has many restrainers, such as the lack of standardized metrics for evaluating the value of patents, the desire on part of buyers to maintain anonymity, the misaligned expectations of sellers and buyers (Monk, 2009). The patent transaction services given by POP not only sets a stage for sellers and buyers, but also provides both parties with important information to accomplish the deal. Meanwhile, the identity of buyers and sellers can be protected, and the information asymmetries in patent market can be reduced (Benassi & Di Minin, 2009; Melchioris, 2017).

Client demands are becoming more diverse and integrated. Accordingly, patent service platform and two-sided patent platform can be united to provide a one-stop service. This demonstrates that POP can be considered as a unique intermediary which merges the functions of patent broker, patent trading platform and other types of patent intermediaries together (Ma et al., 2021; Agrawal, 2016; Hagi & Yoffie, 2013; Petrusson, 2010). For example, if a client requires patent application, patent service platform can provide agency services to support client’s technical solution to be granted by patent law. Afterwards, if the client wants to sell his patents, the two-sided patent platform can provide transaction services. POP can assemble different service modules from patent service platform and two-sided patent platform to meet the rapid changes in the patent market. The proposition on the structure of POP is as follows:

Proposition 1: Patent operation platform is structured by ‘Patent Plus’ database, patent service platform and two-sided patent platform as a closed loop. ‘Patent Plus’ database provides data for supporting services in both platforms. The data in ‘Patent Plus’ database can be optimized by services in both platforms through clients’ feedback or use of ICT. One-stop service can be provided as the integrated demands advanced by clients through assembling different service modules from both platforms.

FIGURE 4
The Structure of Patent Operation Platform



Source: Created by the authors.

The Mechanism for Operating POP

Taking insights from the case analysis of Sixlens and Baiten, the four dimensions of service innovation have made prominent impact on POP, accompanied with data, information, knowledge and their translations (Krishna, 2020). Thus, the original theoretical framework (Figure 1) can be extended considering the operating mechanism of POP, as presented in Figure 5.

The mechanism for operating POP is inseparable from the adoption of ICT, which is an important manifestation of transforming the innovation model from closed innovation to open innovation (Baldwin & von Hippel, 2011). The Internet provides a virtual space for POP. Blockchain and artificial intelligence (AI) work in decoding, indexing, categorizing and analyzing data. Nonetheless, the adoption of ICT alone is deficient to operate POP. It needs to be combined with client interface, new service concepts and service delivery system to make a real difference. As such, two relationships in the four dimensions of service innovation to operate POP are identified.

In order to gain competitive advantages in the patent market, patent agency and information services should rely more on the adoption of ICT. Hence, taking ICT as a leading role, the combination of ICT with service delivery system and client interface can enlarge the network effect and enhance openness of POP. Specifically, the talented teams in POP can skillfully handle big data, AI and have a positive interaction with clients (Feller et al., 2012). As a result, the reputation of POP can be overflowed. More clients and cities are involved in the platform, and its network effect has enhanced rapidly (Gredel et al., 2012). Patent transaction service is mainly originated from market demands, particularly under the circumstance of information asymmetries (Caviggioli & Ughetto, 2013). Therefore, client interface is more often taken as a leading role, and its connection to service delivery system and ICT that enhance the openness and network effect of the platform. Thus, the proposition is as follows:

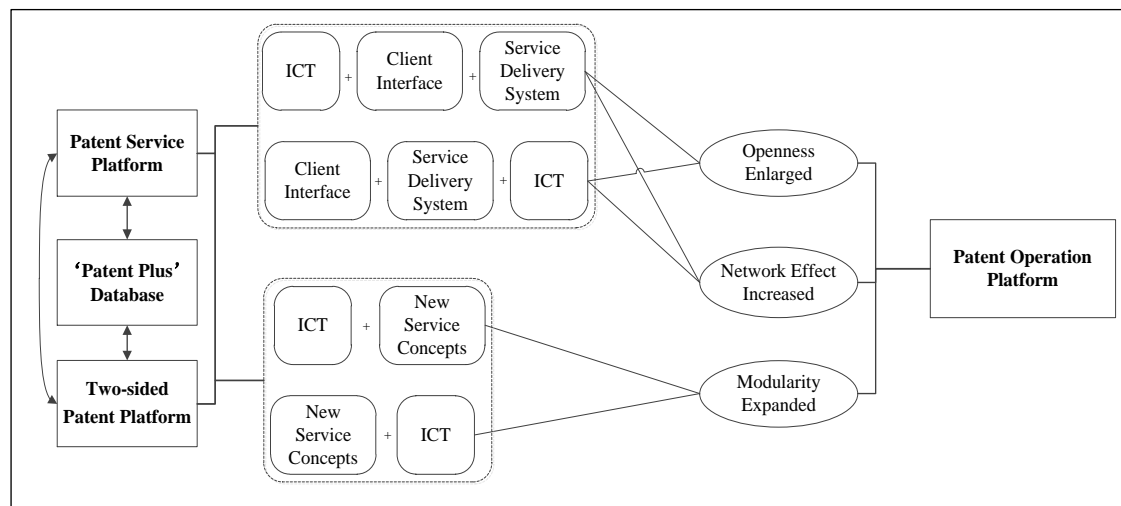
Proposition 2a: Taking ICT as a leading or auxiliary role, the talented teams in POP can extend the business of patent services to different industrial sectors and regions, and then cultivate an overflowing reputation effect, by skillfully exerting ICT and positively interacting with clients. As a result, the openness and network effect of POP are enhanced.

For developing new service concepts based on exerting ICT, the modules of patent agency and information services will be rapidly and effectively expanded. New service concepts exploited by ICT can provide clients with meritorious information, and support the decision-making of new market demand. Meanwhile, followed by the rapid speed of ICT innovation, the development of new service concepts will also accelerate. It indicates that the demand for patent agency and information services has been shifted from market to technologies (Cabigiosu et al., 2015). For developing new service concepts based on identifying market demands, the modules of patent transaction service will be rapidly and effectively expanded as well. User innovation is more common in patent transaction service, due to many general problems related to clients existing at the current patent market (Caviggioli & Ughetto, 2013). Customer management based on big data drives a continuous and direct shift in customer

relationship management (Kim & Kim, 2020). Under the initial stage of patent market, POP has more opportunities to identify demands and exploit new service concepts. As a result, more valuable modules have been expanded. Therefore, we provide the following proposition:

Proposition 2b: New service concepts developed by ICT or market demands can accelerate the speed of expanding service modules in POP, and increase the value of newly expanded modules remarkably.

FIGURE 5
The Mechanism for Operating Patent Operation Platform



Source: Created by the authors.

As for the propositions proposed in this study, some empirical examinations can be applied to for theory testing and validation in the future. For example, ICT, new service concepts, service delivery system and client interface can be used as independent variables, while the operating efficiency of POP can be seen as a dependent variable to explore the net effect of connecting ICT, new service concepts, service delivery system and client interface on operating POP.

Conclusions

To answer the research question, by elaborating and applying a theoretical framework, this paper builds on the theories of platform ecosystem, patent intermediary and KIBS to examine how the two cases of POP, Sixlens and Baiten, are structured and operated as platform ecosystem in China. Our study has made several theoretical and practical implications.

Theoretical Implications

Thomas et al. (2014) consider that platform ecosystem draws inspiration from product platform and two-sided platform. Through the case studies, we find that POP has important structural components represented by these two platforms as well.

Furthermore, the maintenance of POP relies more on data support and optimization from 'Patent Plus' database. Both patent service platform and two-sided patent platform need to be supported by the data from 'Patent Plus' database developed by POP. This cultivates a competitive advantage in the patent market different from traditional patent intermediaries such as patent broker or patent attorney (Monk,2009). Moreover, Inoue (2017) and Kapoor (2017) have addressed the structure of platform ecosystems in video games industry and smartphone operation systems where the manufacturing service platform requires more complementors, due to the complexity on product development and production. Nevertheless, in specialized service platforms, because the R&D of services often take place during the process of interacting with clients or identifying the advanced ICTs, the number of complementors required by specialized service platform may less than manufacturing service platform (Alaimo et al., 2020). As a specialized service platform, POP often develops services through the interaction between staffs and clients, or the exertion of new ICT without complementors. However, the participation of complementors is significant sometimes, such as the 'Collection for Patent Product' service jointly developed by Baiten and CIPRA.

Based on the case findings, our study has also identified the operating mechanism of POP is guided by ICT (Inkinen et.al., 2019). Firstly, ICT shapes the 'Patent Plus' database that provides data for supporting services, and optimizes the data after receiving clients' feedbacks. Secondly, ICT can be combined with new service concepts to extend service modules, and create opportunities for providing more high-value-added patent services. Thirdly, ICT can be combined with client interface and service delivery system to expand the openness and network effect of the platform. These functions of ICT prove that it is no longer ICT only an optional dimension in the model proposed by Hertog (2000), but an indispensable one.

Practical and Policy Implications

This study has important enlightenments on how practitioners can further develop their POP. Firstly, practitioners can set patent service platform, two-sided patent platform and the 'Patent Plus' database as their structural basis. Secondly, a deep understanding in the role of ICT on the mechanism for operating POP is required. Companies can pay attention to the role of different ICTs in various patent services and exert them well with other dimensions to smoothly operate the platform. Thirdly, a compound talented team is needed, which is the key to an integration between client interface and service delivery system, and the core for the implementation of new service concepts.

Findings also have implications for policymakers. First, policy instruments can promote the innovation capabilities of POPs in response to the emerging patent market. Already in China, CNIPA has issued 'develop a market-oriented way to promote intellectual property operation services' in 2014. Inspired by this policy, more than 20 POPs have been established in China³. More such policies can inspire POPs to promote service, ICT and business model innovation, as seen in the case companies. Second, financial support is needed for POPs at early stage. A public-private partnership (PPP) mode can be selected to screen POPs with fruitful market potential. Financial subsidies

or tax reductions can be used as a tool for supporting platforms with great performance. Third, as found in the case companies, teams play essential role in the success of POP, and thus policies are needed to cultivate talents through training programs in universities. Studies indicate that universities can be of significance in specific regions and sectors (Krishna, 2019). For example, government can help to create patent management and platform innovation related courses in business or law schools.

Limitation and Future Research

This paper explores the structure and operating mechanism of POP in the context of platform ecosystem. Our research has some limitations. It can be further enriched through quantitative data analysis, despite that current quantitative analysis method of patent intermediary is lack of structured data and difficult to regression or cluster multiple samples (Benassi and Di Minin, 2009; Caviggioli and Ughetto, 2013). The fact that the two case companies in this paper are currently preparing for listing also make the operational and financial data difficult to collect. As for future research, more patent intermediaries in USA, EU and other countries can be involved as multiple cases for comparative studies.

DECLARATION OF CONFLICTING INTERESTS

The authors declare no conflict of interests.

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NOTES

- 1.Source: Data from the interview and [http://www. linkinip.com/](http://www.linkinip.com/)
- 2.Source: Data from the interview and <http://www.baiten.com/>
- 3.Source: Retrieved from http://www.gov.cn/zhengce/zhengceku/2020-05/07/content_5509474.html

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