

An institutional view on the leverage of external patent law expertise and patenting performance: Insights from China



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ABSTRACT

Drawing on the institutional setting in China, this study examines how firms seek legal resources and their effects on patenting performance in a weak and transitional intellectual property regime. We illustrate that due to weak protection of intellectual property rights in China, firms rely on external legal resources, which are found to be positively related to patenting performance in terms of the capability of external patent law expertise, but negatively related in terms of knowledge diversity. The marginal effect of the level of external patent law expertise on patenting performance is positive when research and development (R&D) investment is low and negative when it is high, illustrating the negative interaction between R&D investment and the level of external patent law expertise. Furthermore, institutional pressure and support moderate the effect of the level of external patent law expertise on patenting performance. This study advances the understanding of the impact of patent institutions on patent strategies in transition economies and provides novel implications for policy and patent management.

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Introduction

As an economy becomes increasingly knowledge-based, intellectual property rights (IPR), particularly patent rights for inventions, confer competitive advantages on firms by deterring their competitors and building legitimacy (Cohen, Nelson & Walsh, 2000; Blind, Edler, Frietsch & Schmoch, 2006; Clarkson & Toh, 2010; Conti, Thursby & Thursby, 2013). Patenting outcomes have been found to positively influence firm performance because of the strategic value of patents' sustainable competitive advantages (Pakes, 1985; Markman, Espina & Phan, 2004; Reitzig, 2004; Ceccagnoli, 2009; Andries & Faems, 2013). To reveal how the organization of patenting activities affects patenting outcomes, research has emphasized the role of patent law expertise, which is responsible for conducting prior art searches, drafting patent applications, and prosecuting these applications at the patent office in the process of generating patents (e.g., Somaya, Williamson & Zhang, 2007; Choudhury & Haas, 2018; Huo, Motohashi & Gong, 2019).

Scholars have found the importance of patent law expertise in generating patents and its positive relationship with patenting outcomes in

developed economies (Somaya et al., 2007; Mayer, Somaya & Williamson, 2012). Intra-organizational, inter-organizational, and industry-level contextual factors influence how firms organize patent law expertise and its effects on patenting outcomes (e.g., Somaya et al., 2007; Mayer et al., 2012). However, the impact of an intellectual property regime and particularly patent institutions on the roles played by patent law expertise and related performance implications has received little attention (Somaya, 2012), even though the leverage of legal resources never develops in a vacuum (Somaya, 2012; Peng, Ahlstrom, Carraher & Shi, 2017). Patent institutions and agency interactions shape a firm's patenting behaviors and subsequent patenting outcomes by affecting value creation and value capture in a competitive landscape (Hu & Jefferson, 2009; Huang, Geng & Wang, 2017; Trigeorgis, Baldi & Makadok, 2022). The context of transition economies provides a great opportunity to examine how institutional factors impact the leverage of patent law expertise and its effects on patenting outcomes (Tan & Tan, 2005), and we can observe the influences of institutional transition and path-dependence characteristics in the experimental background (Barros, 2015; Huang, 2016; Paik & Zhu, 2016; Huang et al., 2017; Rudy & Black, 2018). For a particular transition economy, like China, this study aims to examine how institutions affect the leverage of patent law expertise and its effects on patenting performance in a weak and transitional IPR regime.

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Based on the institutional setting, firms rely heavily on external patent law expertise in China (Li, Wang & Zhou, 2007). Therefore, this study focuses on the impact of external patent law expertise on patenting performance in the Chinese institutional context. Furthermore, we develop a contingency framework of institutional constraints and facilitators to extend the theoretical boundaries of the role of external patent law expertise in patenting performance (Hu & Jefferson, 2009; Ahuja & Yayavaram, 2011; Li, 2012). Specifically, using a dataset of Chinese listed companies in 2010, we analyze the effect of external patent law expertise on firms' patenting performance by considering how the level, capability, and knowledge diversity of external patent law attorneys influence the granting of patents (Hoetker, 2005). We also examine the moderating roles of research and development (R&D), litigation pressure, and local patent incentives, which influence the outcomes of external patent law expertise.

We make four key contributions to this area of research. First, in line with Somaya (2012), we enrich the institution-based view of patent strategy by providing a more fine-grained conceptual analysis of the relationship between institutional frameworks and patent acquisition strategy. Our primary observation suggests that firms rely on external legal resources in weak and transitional institutional regimes. The leverage of external legal resources is contingent on institutional pressure and support (Mayer et al., 2012). Second, using data on Chinese listed firms, we contribute to the innovation literature by providing evidence that the level, capability, and knowledge diversity of external patent law expertise influence firms' patenting performance in a transition economy, and describe how their influence works (Somaya et al., 2007). Third, this study offers insights into how outsourcing patent law expertise can be managed in practice (Gilley & Rasheed, 2000; Hätönen & Eriksson, 2009). The characteristics of external patent law expertise can be analyzed to fit firms' patenting demands, thereby providing practical implications for knowledge-based supplier management (Hoetker, 2005). Fourth, this study extends the understanding of policymakers on how to initiate patent institution reform in China and other transition economies (Huang et al., 2017). Understanding how firms react to and shape patent institutions at the micro level could lead to more effective and efficient patent institutions from a macro perspective.

Research context: China's IPR institutions and IPR reforms

China passed its first patent law in 1984. It was similar to the basic patent laws of Europe and Japan, in that it offered three types of patents: invention, utility model, and design patents. Only invention-related patent applications were examined for utility, novelty, and non-obviousness prior to being granted. Since then, China has strengthened the protection of IPR by amending patent law in 1992, 2000, 2008, and again in 2020. To adjudicate patent-related disputes and enforce patent laws, China has established a litigation system comprising people's courts and special intellectual property courts. Along with these pro-patent legal changes in China, punishment for patent infringement has become more severe. The growing number of patents and more severe enforcement of patent rights led to more litigation, which subsequently resulted in more patent applications (Peng et al., 2017). As a result, after these legal changes and institutional developments, there are better patent institutions on patent applications, regulations, and enforcement in China. However, compared with developed economies that have efficient and strong legal protection, Chinese institutions meant for the protection of IPR are still weak and inefficient (Hu & Jefferson, 2009; Huang et al., 2017; Peng et al., 2017).

To mitigate this weakness, stimulate innovation, and adapt to the global economy, the Chinese government has been attempting to build a more developed patent system (Peng et al., 2017). Various policies have been initiated using patent subsidies and patent agents

to facilitate patent applications. The government launched its first patent subsidy policy in Shanghai in 1999 to encourage domestic and foreign patent applications by local inventors. It started providing subsidies for patents in the process of patent applications, substantial examinations, and maintenance. Other local governments gradually began to launch similar initiatives to subsidize patent filings for inventors in their jurisdictions. By 2010, 30 of 31 provincial-level administrative regions (excluding Hong Kong and Macau) in mainland China had launched patent subsidy programs (Li, 2012). Subsidy standards differed across provinces and changed over time (Chang & Wu, 2014). Some cities even prepared their own subsidy standards rather than following those of their provinces. Subsidy amounts varied for different application phases and jurisdictions. Overall, patent subsidies have greatly stimulated patent applications in China (Li, 2012).

In addition to subsidies, the Chinese government and State Intellectual Property Office (SIPO) of the People's Republic of China (PRC) have promoted the establishment and development of patent agent institutions to meet the demands for legal aid in the patent application process. In China, patent attorneys (external patent law experts) must work for patent agencies (i.e., law firms) and be regulated for their work in this capacity. After the implementation of the first patent law in 1985, several administrative policies were implemented to regulate patent agents and patent agencies (i.e., law firms), including the Provisional Regulations on Patent Agency in 1985, Regulations on Patent Agency in 1991, and Administration of Patent Agency in 2003 (Li et al., 2007). Administrators built a basic system for patent agents and agencies to include regulations for qualification, organization regulation, and punishment. Initially, only state-owned patent agencies were allowed in the market. In 2000, to meet the requirements of World Trade Organization (WTO) membership and development of a market economy, patent agency regulation was reformed toward market-oriented institutions (Zhou, Delios & Yang, 2002; Wang, Wang, Jiang, Yang & Cui, 2016). However, patent institutions in China remained inefficient, and domestic firms submitted patent applications mainly through external patent law expertise to gain legitimacy from stakeholders (Kshetri, 2009). For example, from 2001 to 2010, 68.1 percent of invention patent applications were submitted by domestic inventors via patent agencies, a much higher figure than in the United States and Europe (Reitzig & Wagner, 2010). This reflects the lack of human capital in the newly established IPR system and shows why the government has given impetus for patent agencies.

Theory and hypotheses

Institutions provide more than just background setting for organizations. According to Ingram and Silverman (2002, p. 20), they "directly determine what arrows a firm has in its quiver as it struggles to formulate and implement strategies." By defining the rules of the game, institutions shape organizational strategies according to rational choices, isomorphic pressure, and organizational inertia (Ahuja & Yayavarma, 2011; Marquis & Raynard, 2015). However, organizations are capable of shifting institutions by actively pursuing institutional rent. That is, institutions both constrain and facilitate organizational behavior (Ahuja & Yayavarma, 2011). In an environment with specific institutions, organizations converge around taken-for-granted behaviors as a result of either institutional pressures or the proactive leveraging of institutional opportunities (DiMaggio & Powell, 1983; Tan & Tan, 2005; Greenwood & Suddaby, 2006; Ahuja & Yayavarma, 2011). In terms of firms' legal resource acquisition strategies for patents, the leverage of patent law expertise and outcomes are also influenced by institutional environments (Huang et al., 2017). However, to date, patent strategy researchers have taken resource-based and knowledge-based views, paying little attention to how institutional factors influence patent strategies (Gupta, Tesluk & Taylor, 2007; Somaya, 2012). Accordingly, drawing

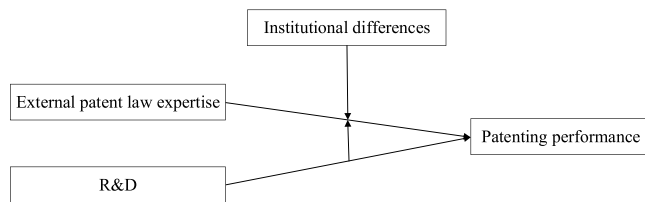


Fig. 1. Conceptual model.

on the context in transition economies (in our case, China), in which both the enforcement of patent rights and promotion by government motivate firms to patent (Hu & Jefferson, 2009), we illustrate how firms leverage patent law expertise and its effects on patenting performance, as well as the moderating role of R&D and institutional differences. Fig. 1 presents the conceptual model used to guide the theoretical framework of this study.

External patent law expertise and patenting performance

An important part of patent acquisition is the management of legal resources for patent applications. The process of obtaining a patent includes conducting prior art searches and drafting patent applications, as well as making applications following the generation of inventions from R&D (Somaya et al., 2007; Reitzig & Wagner, 2010). Applicants can access patent law expertise either inside or outside a firm. Internal patent law experts are valuable because they have firm-specific knowledge (Teece, 1986; Lippman & Rumelt, 2003; Mayer et al., 2012). Thus, they are more likely to understand a firm's technologies, research programs, and strategies. They also tend to establish better relationships with R&D researchers (Fox, 1998; Stasik, 2003; Somaya et al., 2007); therefore, they are more likely to share cultures, languages, and a sense of identity with a firm than external experts (Mayer et al., 2012; Wang et al., 2016). External patent law experts may offer extended resources, knowledge, and competencies that help firms survive changing environments; they are able to enlarge their patenting scope, facilitate patenting speed, and overcome the limitations of local search (Reitzig & Wagner, 2009; Ayerbe, Lazaric, Callois & Mitkova, 2014; Wagner, Hoisl & Thoma, 2014; Süzeroglu-Melchior, Gassmann & Palmie, 2017). Furthermore, external patent law experts may have more industry-specific knowledge than internal experts because of their contacts with diverse clientele in a specific industry (Mayer et al., 2012). For these reasons, external patent law expertise plays an important role in patent applications, even though outsourcing of legal resources may harm downstream activities such as patent enforcement (Reitzig & Wagner, 2010).

Only a few studies have been conducted on patent legal resource acquisition strategies in transition economies, even though firms in such economies face different patent institutions that affect how they obtain legal resources (Huang et al., 2017). In China, firms rely more on external patent law expertise for patent applications. There is a historical reason for this. Firms in China have relied on external patent law expertise for a long time ever since patent institutions started getting established. They are not likely to change their usual practices in this regard due to organizational inertia, if there is no external intervention (Kelly & Amburgey, 1991). Many other reasons make firms choose external legal expertise; for example, IPR protection is weak and inefficient in China because of its undeveloped institutions (Peng et al., 2017). Instead of being used only as proprietary strategies for competition, patents are also valued for their ability to attain legitimacy from consumers, potential cooperators, investors, and especially governments (Kshetri, 2009). Thus, using external legal resources for patents, which cost less and provide efficient service, is an economically rational choice for firms.

An equally important factor for using external patent law expertise is that patent agents are a taken-for-granted norm, supported by the SIPO and local governments. Provincial governments encourage the development of local patent agents to increase legal resources in the market and enhance political performance. External patent law experts benefit from their informal relationships with patent examiners and officials in SIPO and local governments. They interact with examiners and officials at conferences and during the application process. These personal connections provide patent agents with access to knowledge about how to get things done by state agencies in the Chinese context (Xin & Pearce, 1996; Huang et al., 2017). Patent agents understand patent examiners and their actions, share goals and interests, and are able to increase trust with bureaucrats in the SIPO, which confers great advantages for firms seeking external patent law expertise in a weak and inefficient institutional environment (Yang, 2004). Therefore, external patent law expertise not only offers lower costs, but also possesses capabilities, knowledge, and social capital that can improve patenting performance for a focal firm. Based on this, we hypothesize the following:

Hypothesis 1. All else being equal, a positive relationship exists between a firm's level of external patent law expertise and its patenting performance.

That is, all else being equal, external patent law expertise should increase a firm's patenting performance by providing professional services, knowledge repositories, and social capital. We further suggest that the effectiveness of external patent law expertise in generating patents is contingent on the level of R&D expenditures. Firms may be more likely to generate patents from less complex inventions in an inefficient but developing IPR context with low R&D investments. External patent law experts do not need deep immersions to understand these inventions. Professional services, knowledge, and social capital provided by external patent law experts may increase the probability of success when firms apply for patents for less complex inventions. In contrast, when firms invest more in R&D, they may generate explorative complex technical inventions, and the interdependent relationships between different inventions could be complex (Swift, 2016). Firms can convert complex inventions into patents. However, to move forward with patents from complex inventions, firms need patent law expertise with firm-specific knowledge to understand these invention portfolios and convert them into patents. In such cases, a common language, internal relationships, and a sense of identification with specific firms are crucial (Kogut & Zander, 1996; Mayer et al., 2012). Furthermore, drafting patents with well-developed claims from explorative inventions requires external patent law experts to invest significant time and make strong commitments (Wang et al., 2016). Consequently, for firms with high levels of R&D expenditure, the cost-effectiveness of external patent law expertise in generating patenting performance may be lower as patent complexity and exploration increases. Accordingly, we hypothesize as follows:

Hypothesis 2. The level of a firm's R&D expenditure negatively moderates the relationship between external patent law expertise and patenting performance.

Furthermore, we propose that the heterogeneity of patent law expertise and patent law firms impacts patenting performance (i.e., granting success) (Mayer et al., 2012). We believe that the capabilities that external patent law experts develop in their work experience benefit clients with qualified patent applications by increasing their probability of being granted patent rights (Hatch & Dyer, 2004). In China, external patent law experts work in a wide range of technical areas, which enhances their knowledge diversity and helps generate more novel outputs (in this case, patents), especially in cross-domain

applications (Taylor & Greve, 2006). However, most patents focus on specific technological areas, which makes specialization more competitive in patenting services (Mayer et al., 2012). This knowledge diversity may impede patenting performance. Moreover, patent law agencies control knowledge repositories, social networks, and capabilities that contribute to successful patent performance. Patent law agencies accumulate these resources and retain them as internal benefits; then, patent law experts trained in these agencies use these resources to serve their clients. Accordingly, we hypothesize as follows:

Hypothesis 3a. *Ceteris paribus*, a positive relationship exists between the capabilities of external patent law expertise and patenting performance.

Hypothesis 3b. *Ceteris paribus*, a negative relationship exists between the knowledge diversity of external patent law expertise providers and patenting performance.

Hypothesis 4. *Ceteris paribus*, a positive relationship exists between the capabilities of patent law agencies and patenting performance.

Variation in effectiveness of external patent law expertise due to institutional differences

Patent institutions not only influence how firms seek legal resources, but also moderate the effects of legal resources on patenting performance (Oliver, 1997; Ahuja & Yayavaram, 2011). For legal resources to effectively generate patents, firms must develop consistent strategies to establish matched organizational structures and routines (Moran & Ghoshal, 1999; Liu, Yang & Augustine, 2018). Patent institutions affect firms' internal arrangements through institutional constraints and facilitators (Bourgeois, 1980; Oliver, 1997; Ahuja & Yayavaram, 2011; Shu, Wang, Gao & Liu, 2015), so the effectiveness of legal resources on patenting performance may be contingent on patent institutions. Accordingly, we argue that patent institutional pressure and support moderate the effect of external patent law expertise on patenting performance.

Litigation pressure

Patent institutions give firms the right to protect their technologies by granting and enforcing patent rights. Enforcement refers to the use or threatened use of patent litigation to prevent infringers from using patented inventions (Agarwal, Ganco & Ziedonis, 2009; Polidoro & Toh, 2011; Somaya, 2012; Ganco, Ziedonis & Agarwal, 2015). If sued by a patent-holder, a patent-infringing firm risks losing money, reputation, and legitimacy (Somaya, 2003; Bessen & Meurer, 2008; Tan, 2015). Therefore, patent institutions and the interactions of firms in a particular jurisdiction generate institutional pressure on firms in that jurisdiction (Gray, Purdy & Ansari, 2015). If the threat of patent litigation is real and significant in a jurisdiction, firms may be more likely to build patent portfolios to avoid the economic damage and legitimacy loss associated with being found guilty of infringement (Somaya et al., 2007). For example, firms from Beijing, Shanghai, and Guangzhou, where the market economy is more developed and judicial protection for IPR is stronger, may face higher pressure to build significant patent portfolios to avoid being sued and then blocked by rivals. Thus, as legal protection for IPR becomes stronger and regional development of patent enforcement institutions is uneven in China (Chang & Wu, 2014), firms in jurisdictions with high institutional pressure for patent litigation may develop more efficient routines and processes to support patenting activities. Therefore, we hypothesize as follows:

Hypothesis 5. The impact of external patent law expertise on a firm's patenting performance is stronger for firms in jurisdictions that experience greater litigation pressures.

Institutional support

Patent institutions not only create constraints and pressures for organizations and individuals, but also provide economic incentives and opportunities for action (North, 1990; Peng & Heath, 1996; Ahuja & Yayavaram, 2011). Thus, in addition to the "iron cage" argument, there is also an "institutional support" argument that expands the prevailing focus on change-as-isomorphism to include change-as-incorporation (Washington & Ventresca, 2004). As a transition economy, China is shifting its IPR institutions to a more efficient system. To encourage patent applications, regulatory agencies and local governments are enacting subsidy policies to address their political goals of increasing local patent applications (Li, 2012). These policies provide institutional settings in which there are opportunities for institutional rent (Washington & Ventresca, 2004; Ahuja & Yayavaram, 2011). As these subsidies increase, firm managers may be more willing to support patenting activities by initiating corresponding routines (Dang & Motohashi, 2015). Therefore, we hypothesize as follows:

Hypothesis 6. The impact of external patent law expertise on patenting performance is stronger for firms in regions with more institutional incentives.

Methods

Sample

We tested our hypotheses using a cross-sectional dataset of Chinese listed companies in 2010. This study used cross-sectional data for two reasons. First, the data were available only in 2010, when we tried to match the data pertaining to aspects such as financial, patent, litigation, and patent subsidy. We cannot observe the variations in all these important variables before and after 2010 because of the problem of ensuring the exact time window of our dataset. Second, cross-sectional data could support the tests of our theoretical hypotheses to examine the effects of external patent law expertise on patenting performance and moderating effects across individual firms. We collected our data primarily by matching three datasets: the China Stock Market and Accounting Research (CSMAR) database, the Peking University (PKU) Law Database, and the SIPO's Database of the People's Republic of China. The CSMAR database contains data pertaining to the Chinese stock market and finances of Chinese listed firms. The SIPO database provides information on patents. From the PKU Law Database, we collected the information on patent litigations and patent subsidies.

We developed our theory based on the assumption that firms are involved in technological innovation and patent applications related to their inventions. Therefore, we included only firms from industries that fit this profile. Our sampling frame consisted of all Chinese A-share listed firms in 2010 from the following five broad industries: chemical (75 firms), electronics (128 firms), electrical equipment and machinery (66 firms), automobiles (37 firms), and scientific instruments (10 firms). Of these 316 firms, we excluded 87 because of missing data. Thus, we conducted tests to validate our hypotheses using data on 229 firms. In our sample, external patent law experts submitted 91.93 percent of the patents.

Dependent variable

Firm patenting performance. Patenting performance was measured as the number of all successfully granted Chinese invention patents filed by a firm. For each firm, we compiled data pertaining to the entire corporate family (including subsidiaries, divisions, and affiliates) by searching the annual reports. We used the SIPO database

to match patents to each firm by searching for the names of listed firms in the database.

Independent variables

R&D. We measured R&D using the natural logarithm of the total R&D financial expenditure for each firm. We used same-period R&D to measure the impact of research activities on a firm's patenting (Hall, Griliches & Hausman, 1984; Hall & Ziedonis, 2001; Somaya et al., 2007). We gathered firm R&D data using the CSMAR economic and financial databases.

External patent law expertise

We measured a firm's external patent law expertise as the total number of Chinese patent agents (i.e., external patent attorneys in China) who worked for a firm's corporate family in a year. The names of external patent agents and patent agencies (i.e., patent law firms in China) are available from patent files submitted by patent agents. If an internal patent law expert submitted a patent application, the name of the expert was not available in the patent files. Thus, we assumed that a patent application with no listed patent agent was an application by an internal patent law expert. We used the SIPO database to search for specific details about patent agents and agencies, which we used to measure the following three variables:

Capability of external patent law expertise

We determined the capability of a patent agent based on the number of granted invention patents that had been received in the previous year. As our study's unit of analysis was an individual firm, we averaged the capability value of all patent agents employed by a firm. Then, we took the natural logarithm of the averaged capability plus one as the variable in our model, given the non-normality of the distribution of the averaged agents' capability.

Knowledge diversity of external patent law expertise

We measured the knowledge diversity of a patent agent as the number of technological fields (i.e., patent industrial classes) of granted invention patents filed by a patent agent in the previous year. We, then, averaged the values of all patent agents employed by a firm.

Capability of patent law agencies

In China, patent agencies are equivalent to patent law firms that qualify to provide legal services for patent applications. Under Chinese law, a patent agent must be an employee of a patent agency. We calculated a patent agency's capability by counting the number of granted invention patents filed by it in the previous year. We, then, averaged the capabilities of patent agencies that provided legal services for a focal firm. Then, we took the natural logarithm of the averaged capabilities plus one as the variable in our model, given the non-normality of the distribution of the averaged agencies' capabilities.

Litigation pressure

We measured jurisdictional litigation pressure by counting the number of invention-patent infringement litigations in each province from 2008 to 2010. To focus on the new institutional environment, we included data from 2008 because the third amendment to Chinese patent law occurred that year. We collected litigation data from the PKU Law Database. We identified provinces in which litigation occurred by searching for courts where an infringed patent holder initiated a lawsuit.

Local incentive

We measured local incentives according to the 2010 economic subsidies for granted invention patents in the city in which a firm

was located. As subsidies were provided at different phases of patent applications, we calculated our variable as the highest subsidy given to a domestic granted invention patent. Then, we took the natural logarithm of the local incentive as the variable in our model, given the non-normality of the distribution of local incentives. We collected data from the PKU Law Database and local intellectual property office websites.

Control variables

We included several control variables in the analyses. Consistent with prior research on patenting performance, we controlled for firm size (Ahuja & Katila, 2001; Somaya et al., 2007). We used the natural logarithm of the total number of employees as a measure of firm size. We also controlled for the number of invention patent applications and industry dummy variables. Further, we included the number of research team members of a firm in patent applications. In addition, we controlled for the outsourced-to-total-patents ratio, computed by dividing patents applied for by external patent law experts by the total number of patents, to account for the impact of internal patent law expertise.

Empirical model

Firm patenting performance is count data, so Poisson or negative binomial models are the appropriate models for this study (Ahuja & Katila, 2001; Hall & Ziedonis, 2001; Somaya et al., 2007). While the Poisson model assumes that the mean and variance are equal, the negative binomial model seems to be an appropriate analytical tool. We tested for the overdispersion of the dependent variable, as suggested by Cameron and Trivedi (2013), and found an overdispersion problem. Thus, we used a negative binomial model with the number of granted invention patents as the dependent variable.

Results

Main results

The summary statistics for the variables used in our analyses are shown in Table 1, and the main results are presented in Table 2. The correlation matrix shown in Table 1 indicates that the correlations between variables are generally low, although a few of them are relatively high. A further test of variance inflation factors (VIF) shows that the VIFs range between 1.16 and 5.48. The mean VIF is 2.72, which is well below the critical value of 10 suggested by Belsley, Kuh, and Welsch (1980). The test shows no multicollinearity problems in the model. Table 2 presents six models from the negative binomial regressions. Overall, the models are robust, showing significant χ^2 statistics. The α values are also significant, implying a good fit of the binomial regression model with our data. In Table 2, Column 1 contains the estimates of the base model. Notably, patenting performance depends on the size of the R&D teams ($\beta = 0.009$; $p = 0.000$), level of R&D expenses ($\beta = 0.201$; $p = 0.000$), and number of patent applications ($\beta = 0.011$; $p = 0.000$).

As per Hypothesis 1, controlling for R&D and external patent law expertise has a significant positive effect on patenting performance. We tested for the impact of external patent law expertise in Model 2 by adding a variable in the presence of R&D. The coefficient of external patent law expertise is negative and significant ($\beta = -0.071$; $p = 0.000$), whereas the coefficients of external patent law expertise are positive and significant in other models with the moderating effect of R&D. This indicates that the moderating effect of R&D on the influence of external patent law expertise is important and significant when examining the relationship between external patent law expertise and patenting performance. Thus, by combining the results of all the models, Hypothesis 1 is supported.

Table 1
Descriptive statistics and correlations matrix.

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Patenting performance	9.690	18.323	1											
2. R&D (logged)	17.283	1.217	0.511	1										
3. External patent law expertise	3.057	4.764	0.761	0.435	1									
4. Local incentive (logged)	8.231	0.468	0.130	0.043	0.109	1								
5. Local litigation	28.279	31.735	-0.002	0.140	0.060	-0.126	1							
6. Capability of external patent law expertise (logged)	3.827	1.564	0.236	0.210	0.252	-0.012	0.179	1						
7. Knowledge diversity	5.491	2.306	-0.039	0.078	0.011	-0.066	0.211	0.812	1					
8. Capability of patent law agencies (logged)	5.099	1.773	0.237	0.171	0.293	0.002	0.210	0.786	0.612	1				
9. Patent applications	17.314	35.843	0.904	0.460	0.823	0.135	-0.041	0.207	-0.037	0.208	1			
10. Firm size (logged)	7.421	1.043	0.389	0.486	0.384	-0.005	-0.030	0.118	0.041	0.121	0.398	1		
11. Research team	27.729	45.018	0.876	0.547	0.783	0.078	0.014	0.212	-0.033	0.239	0.783	0.421	1	
12. Outsourcing ratio	0.885	0.284	0.065	0.021	0.175	0.055	0.077	0.531	0.531	0.628	0.058	0.051	0.079	1

Notes: Number of observations = 229. Bold values indicate significance at $p < 0.05$.

According to Hypothesis 2, there is a negative interactive effect between the levels of R&D and external patent law expertise on patenting performance. We tested for this complementary relationship by adding the R&D \times external patent law expertise interaction term in Models 3–6. Consistent with our expectations, R&D and external patent law expertise have a negative and statistically significant interactive effect on patenting performance in all models. In Model 3, the coefficient of the interaction term is -0.028.

To interpret the magnitude and direction of the impact of the interaction terms in the nonlinear model, we evaluated the joint impact of R&D and external patent law expertise on patenting performance using representative high and low values from our data, which were the 25th and 75th percentiles of the variable, respectively (Huang & Shields, 2000; Hoetker, 2007; Mayer et al., 2012). As Fig. 2 shows, external patent law expertise has a positive effect on patenting performance when the R&D level is low; however, its impact on patenting performance becomes negative when the R&D level is high.

As per Hypothesis 3 the capability and knowledge diversity of external patent expertise positively affect patenting performance. According to Hypothesis 4, the capability of patent law agencies negatively affects their patenting performance. In Model 4, we included these variables and obtained some reasonable results. External patent law expertise has a positive and consistently significant influence on patenting performance ($\beta = 0.269$; $p = 0.000$). Knowledge diversity has a negative and significant effect on patenting performance ($\beta = -0.084$; $p = 0.047$). Therefore, a focus on certain technical areas improves patenting outcomes; however, the capability of patent agencies does not have a significant impact on patenting performance ($\beta = -0.077$; $p = 0.147$), suggesting that although outsourced legal expertise counts, the patent agencies to which legal service providers belong do not count.

As per Hypothesis 5, litigation pressure increases the impact of external patent law expertise on patenting performance. We find a consistent result with this hypothesis: the interaction term of local litigation pressure \times external patent law expertise has a positive and significant effect on patenting performance ($\beta = 0.001$; $p = 0.000$) in Model 5. This finding suggests that firms facing greater litigation pressure may leverage external patent law expertise to develop more qualified patents.

Finally, contrary to Hypothesis 6, the interaction between external patent law expertise and local institutional incentives is negative and significant ($\beta = -0.165$; $p = 0.000$) in Model 6. Firms located in jurisdictions, where the government provides more economic subsidies for patent applications, are likely to generate less granted patents using external patent law expertise. To better interpret the moderating effects of Hypotheses 5–6, we evaluated the joint impact of interaction variables at representative high and low values at the average R&D level (see Fig. 3). As Fig. 3 illustrates, the level of external patent

law expertise has a negative marginal effect on patenting performance. However, this negative marginal impact diminishes when local litigation pressure increases, and increases when institutional incentives are high. To further examine the interaction effects considering the R&D level, we evaluated the joint impact of the interaction variables when the R&D level was low (25% percentile of the variable). Fig. 4 shows that the level of external legal expertise has a positive marginal effect on patenting performance. This positive marginal impact increases when local litigation pressure increases and decreases when institutional incentives are high, which provides more insights into the impact of external patent law expertise and its contextual factors.

Robustness tests

To strengthen the empirical evidence, we conducted several additional robustness tests (Table 3). First, we reported on the full model. Then, we used the same model with a trimmed sample that excluded the top 2.5 percent and bottom 2.5 percent of firms based on their invention patent applications. This trimmed model excluded the influence of these potential outliers in our model. As it did not affect our negative binomial model, outlier observations did not drive our results. In addition, to avoid further impact of outlier observations, we excluded firms that did not use external patent law experts. Across the two models, we found the same pattern of results as the full sample with one exception. In the trimmed sample and the outsourcing sample, the coefficients for the local litigation pressure \times external patent law expertise interaction term, which measures the moderating role of institutional pressure, were still positive but not significant.

In our empirical analysis, there was an additional concern that external patent law expertise may be endogenous to the output of patentable inventions generated by R&D (Somaya et al., 2007). We evaluated the endogeneity issue using a two-step generalized method of moments estimation model and two instrumental variables for external patent law expertise (Cameron & Trivedi, 2009; Wooldridge, 2010; Hilbe, 2011). The instrumental variables included: (1) the lagged value of the level of external patent law expertise and (2) a firm's lagged net profits (which influence the capabilities of outsourcing patent law expertise). The estimates from this model also strongly support our results. After instrumenting for endogeneity, the level of external patent law expertise continued to be a significant predictor of patenting performance. All interaction effects were also consistent with the previous results, except that the p-value of the coefficient of the interaction term between external law patent expertise and local litigation pressure was higher than 0.1. From the robustness analyses above, we can see that the coefficients of the interaction term between external patent law expertise and local litigation pressure are not significant in our robustness test models. To

Table 2
Main results from the negative binominal models of patenting performance.

Variables	Dependent variable = number of successful patents filed					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
R&D	0.201 (0.057) [0.000]	0.198 (0.055) [0.000]	0.276 (0.057) [0.000]	0.241 (0.056) [0.000]	0.263 (0.054) [0.000]	0.251 (0.053) [0.000]
External patent law expertise		−0.071 (0.020) [0.000]	0.493 (0.129) [0.000]	0.376 (0.130) [0.004]	0.733 (0.148) [0.000]	2.047 (0.342) [0.000]
R&D*External patent law expertise			−0.028 (0.006) [0.000]	−0.022 (0.006) [0.000]	−0.044 (0.008) [0.000]	−0.037 (0.007) [0.000]
Litigation pressure					−0.001 (0.002) [0.646]	
Local incentive						0.356 (0.128) [0.005]
External patent law expertise*						
Litigation pressure					0.001 (0.000) [0.000]	
Local incentive						−0.165 (0.031) [0.000]
Capability of external patent law expertise				0.269 (0.077) [0.000]	0.224 (0.074) [0.002]	0.211 (0.073) [0.002]
Knowledge diversity				−0.084 (0.042) [0.047]	−0.064 (0.041) [0.117]	−0.066 (0.040) [0.098]
Capability of patent law agencies				−0.077 (0.053) [0.147]	−0.092 (0.051) [0.074]	−0.073 (0.050) [0.146]
Patent applications	0.011 (0.003) [0.000]	0.014 (0.003) [0.000]	0.01 (0.003) [0.000]	0.009 (0.002) [0.000]	0.013 (0.003) [0.000]	0.015 (0.003) [0.000]
Firm size	0.128 (0.060) [0.034]	0.136 (0.058) [0.019]	0.087 (0.058) [0.134]	0.103 (0.057) [0.068]	0.141 (0.054) [0.009]	0.111 (0.053) [0.036]
Research team	0.009 (0.002) [0.000]	0.012 (0.002) [0.000]	0.015 (0.002) [0.000]	0.014 (0.002) [0.000]	0.013 (0.002) [0.000]	0.012 (0.002) [0.000]
Outsourcing ratio	0.008 (0.189) [0.967]	0.188 (0.191) [0.326]	0.010 (0.191) [0.958]	−0.078 (0.233) [0.738]	−0.006 (0.222) [0.977]	−0.092 (0.219) [0.675]
Cons	−3.589 (0.965) [0.000]	−3.654 (0.934) [0.000]	−4.731 (0.952) [0.000]	−4.231 (0.937) [0.000]	−4.811 (0.907) [0.000]	−7.560 (1.392) [0.000]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Alpha	0.374 (0.052) [0.000]	0.331 (0.049) [0.000]	0.309 (0.045) [0.000]	0.273 (0.042) [0.000]	0.222 (0.038) [0.000]	0.217 (0.037) [0.000]
LR chibar2(01)	536.01 [0.000]	409.48 [0.000]	417.33 [0.000]	294.11 [0.000]	189.41 [0.000]	188.36 [0.000]
Pseudo R-squared	19%	20%	21%	22%	24%	24%
Log-likelihood	−602.13	−596.45	−586.76	−580.22	−568.52	−567.27

Notes: Number of observations = 229. Standard errors are in parentheses. P-values are between square brackets.

further test the strength of our results, we checked the robustness analyses using Model 5 in Table 2. The coefficients of the interaction term between external patent law expertise and local litigation pressure are positive and significant at the 0.05 level. The results of additional robustness tests are available upon request. Overall, these robustness checks provide great confidence in our empirical results.

Discussion

Several past studies have examined the causes of patenting performance (Hall et al., 1984; Hall & Ziedonis, 2001; Joshi & Nerkar, 2011; Penner-Hahn & Shaver, 2005; Somaya et al., 2007). That said, how patent institutions influence firms' patent acquisition strategies

and subsequent patenting performance have not been adequately explored (Ziedonis, 2004; Somaya et al., 2007; Somaya, 2012). Patent institutions in China have been shifting to a stronger IPR protection regime through legal amendments and social interactions among organizations (Huang et al., 2017). We began our study with the expectation that external patent expertise plays an important role in patenting performance in the Chinese institutional context, and that institutional factors moderate the impact of external patent law expertise on patenting performance. The results of our study support these initial expectations with more details and insights. Our results, which are specific to the Chinese context, add to the literature on how patent institutions influence firms' patenting strategies and performance.

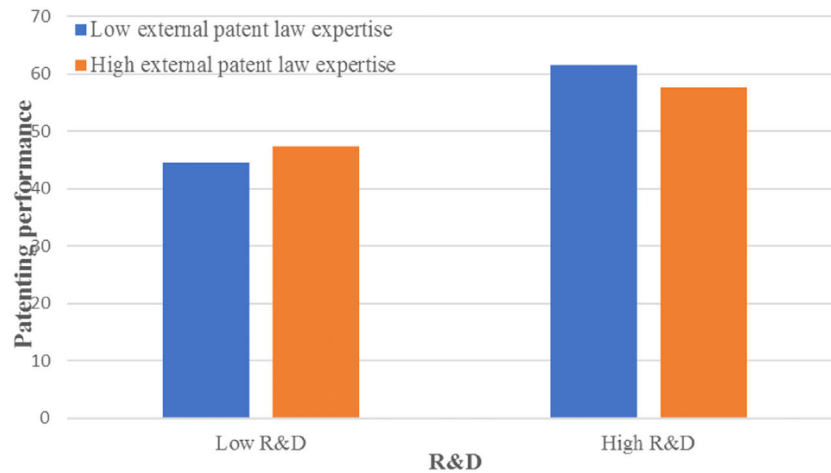


Fig. 2. Interaction effect of R&D and external patent law expertise on patenting performance.

Theoretical contributions

This study makes several theoretical contributions in response to calls for integration between institution-based views and patent strategies (Somaya, 2012). We add to the literature by illustrating that (1) patent institutions directly influence firms' patent acquisition

strategies by defining the social norms and resource needs of firms, and (2) institution-based considerations complement resource-based considerations when crafting patent acquisition strategies (Oliver, 1991, 1997; Barney, Ketchen & Wright, 2011). Therefore, we enrich the institution-based view of patent strategy (Webb, Tihanyi, Ireland & Sirmon, 2009; Tolbert, David & Sine, 2011; Somaya, 2012; Paik &

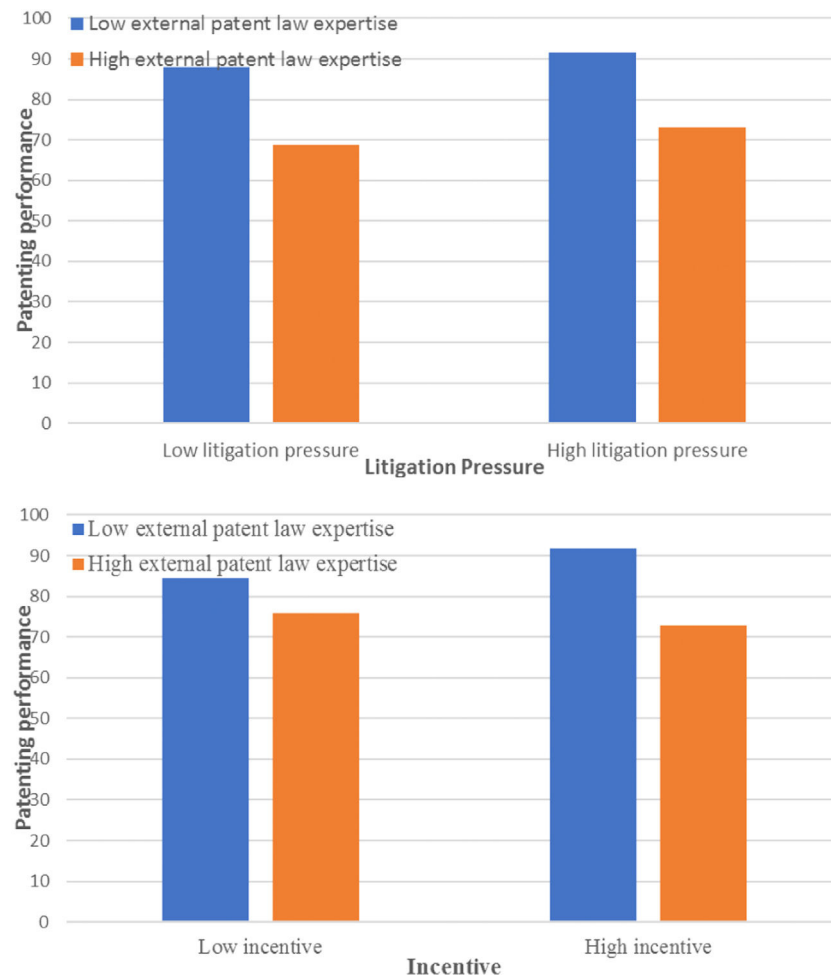


Fig. 3. Interaction effect of external patent law expertise and institutional factors on patenting performance.

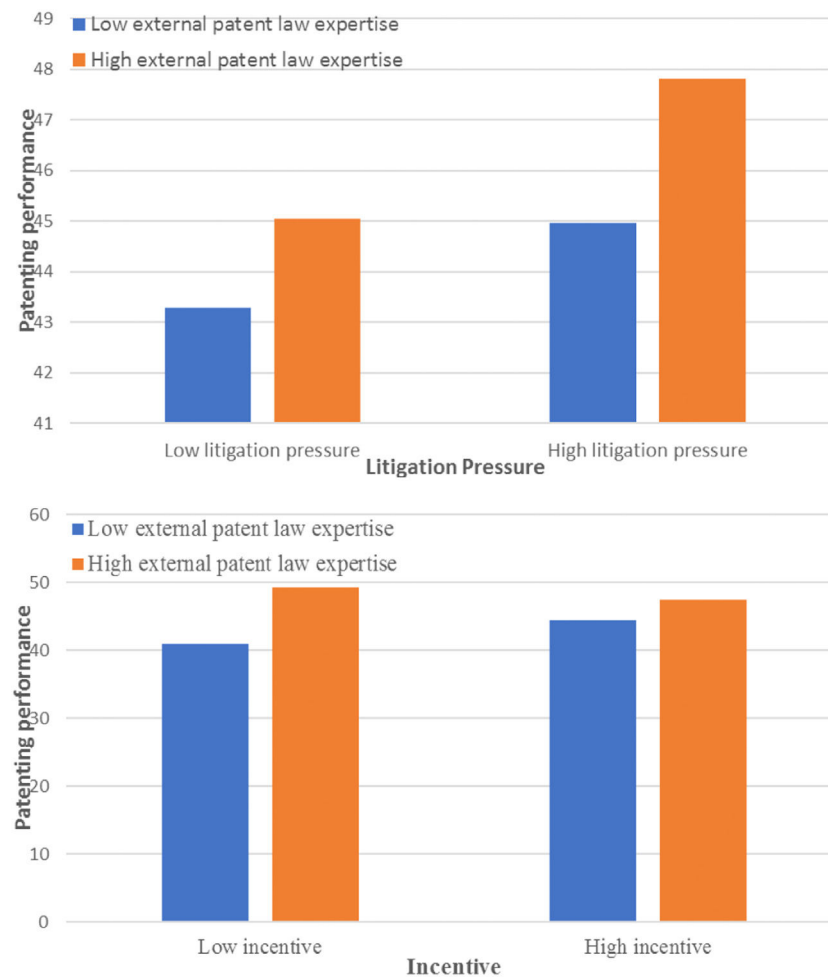


Fig. 4. Interaction effect of external patent law expertise and institutional factors on patenting performance when R&D is low.

Zhu, 2016). The findings show that firms rely on external legal resources for patenting inventions in weak and transitional IPR institutions in China because of path dependence, government support, and informal institutions such as industrial norms and *guanxi*. These mechanisms influence firms' choice of legal resources (Xin & Pearce, 1996; Huang et al., 2017). The leverage of legal resources was found to be more concentrated on patent quality where IPR protection is stronger. The appropriability perspective is concerned with patent enforcement through a judicial approach (Lanjouw & Schankerman, 2001). The leverage of legal resources was found to be more concentrated on patent quantity, where governments initiate more non-market interventions (Marquis & Raynard, 2015).

Some of our findings are consistent with those of Somaya et al. (2007), who identified a positive moderating role of industrial patenting pressures on the effectiveness of legal resources. This implies that China's ongoing pro-market patent institutional transition and interactions between organizations could jointly motivate patent application quality by changing firms' perceptions and enforcement of patent rights through market competition. Thus, our findings illustrate how pro-market patent institutions can co-evolve with firms' strategies in transition economies (Marquis & Raynard, 2015; Peng et al., 2017). Our findings also extend patent strategy research by showing that firms proactively resort to strategies that pursue institutional rent (Ahuja & Yayavarma, 2011). A higher level of economic incentive may induce firms to focus on specific goals such as patent quantity, which in turn creates an impetus for organizational mechanisms that facilitate the conversion of inventions into more patent outputs. This

is consistent with the idea that patent institutions define opportunities according to the context and push firms to pursue institutional rent (Ahuja & Yayavaram, 2011).

Furthermore, we examine how institution-based and resource-based factors complement and interact to predict patent acquisition strategies and the outcomes of such strategies. We argue that these two levels of factors are interdependent because both institutional and resource factors affect the channel and leverage of legal resources. Hence, studies on patent acquisition strategies focusing on knowledge and firm characteristics may generate results that cannot be generalized beyond the specific host context where a study is conducted (Somaya et al., 2007; Wagner et al., 2014).

Practical implications

Using data from Chinese listed firms, we find that the capability of patent law experts positively affects patenting performance, and knowledge diversity negatively influences patenting performance. The marginal effect of the level of external patent law expertise on patenting performance is positive when the R&D level is low and negative when the R&D level is high. These results contribute to innovation management literature by showing how firms can resort to suitable legal resources to convert R&D outcomes into patent rights in transition economies (Somaya et al., 2007; Mayer et al., 2012; Sako, Chondrakis & Vaaler, 2016).

Our findings have implications for Chinese firms engaging in patenting activities (Gilley & Rasheed, 2000; Somaya et al., 2007). First,

Table 3
Robustness checks on negative binomial models of patenting performance.

Variables	Dependent variable = number of successful patents filed			
	Full model from Table 2 (1)	Trimmed 2.5% sample (2)	Outsourcing sample (3)	IV model (4)
R&D	0.247 (0.053) [0.000]	0.098 (0.048) [0.041]	0.240 (0.054) [0.000]	0.270 (0.110) [0.014]
External patent law expertise	1.698 (0.384) [0.000]	0.023 (0.024) [0.350]	1.848 (0.403) [0.000]	3.060 (1.801) [0.089]
R&D*External patent law expertise	−0.041 (0.007) [0.000]	−0.035 (0.007) [0.000]	−0.039 (0.007) [0.000]	−0.041 (0.022) [0.060]
Litigation pressure	0.001 (0.002) [0.483]	0.002 (0.001) [0.166]	0.002 (0.002) [0.298]	0.006 (0.005) [0.269]
Local incentive	0.278 (0.142) [0.051]	−0.089 (0.101) [0.380]	0.380 (0.159) [0.017]	0.954 (0.686) [0.164]
External patent law expertise* Litigation pressure	0.001 (0.000) [0.171]	0.001 (0.000) [0.145]	0.003 (0.004) [0.439]	−0.001 (0.001) [0.460]
Local incentive	−0.117 (0.042) [0.006]	−0.102 (0.038) [0.008]	−0.139 (0.045) [0.002]	−0.262 (0.157) [0.096]
Capability of external patent law expertise	0.214 (0.073) [0.003]	0.249 (0.069) [0.000]	0.220 (0.072) [0.002]	0.250 (0.096) [0.009]
Knowledge diversity	−0.068 (0.040) [0.090]	−0.100 (0.039) [0.010]	−0.069 (0.040) [0.090]	−0.074 (0.059) [0.208]
Capability of patent law agencies	−0.089 (0.050) [0.077]	−0.078 (0.048) [0.108]	−0.087 (0.055) [0.117]	−0.131 (0.085) [0.123]
Patent applications	0.016 (0.003) [0.000]	0.015 (0.002) [0.000]	0.015 (0.003) [0.000]	0.007 (0.007) [0.307]
Firm size	0.134 (0.054) [0.013]	0.118 (0.051) [0.020]	0.122 (0.053) [0.022]	0.011 (0.169) [0.946]
Research team	0.012 (0.002) [0.000]	0.011 (0.002) [0.000]	0.011 (0.002) [0.000]	0.009 (0.003) [0.001]
Outsourcing ratio	−0.025 (0.219) [0.910]	−0.043 (0.211) [0.839]	0.014 (0.272) [0.959]	−0.338 (0.363) [0.352]
Cons	−6.936 (1.428) [0.000]	−0.07 (0.518) [0.892]	−7.649 (1.599) [0.000]	−11.98 (6.015) [0.046]
Industry dummies	Yes	Yes	Yes	Yes
Alpha	0.208 (0.036) [0.000]	0.165 (0.030) [0.000]	0.196 (0.036) [0.000]	
Number of firms	229	213	214	229
LR chibar2(01)	176.53 [0.000]	136.96 [0.000]	156.09 [0.000]	
Pseudo R-squared	24%	26%	25%	
Log-likelihood	−564.50	−532.79	−532.28	

Notes: Standard errors are in parentheses. P-values are between square brackets.

firms should hire external patent law expertise with high capability and low knowledge diversity. Second, firms with high R&D investment may generate more complex inventions for which they want to apply for high-quality patents. Patent law experts with firm-specific knowledge, high commitment, and contributions to firms' downstream ability to achieve defensive or appropriate patent strategies are required in this scenario (Somaya, 2012). Therefore, for complex inventions with high R&D levels, fewer external patent law experts with deep immersion or internal patent law expertise might be more suitable. Third, if a firm wants to apply for more patents from less explorative and complex inventions when the R&D level is low, it should use more external patent law expertise. While it may be effective for these firms to rely on external patent law expertise to apply

for low-quality patent applications, such reliance could prevent them from gaining well-protected patent rights and developing strategic capabilities to use patent portfolios for market competition. Fourth, as IPR protection grows stronger in China, firms should improve their patent quality and patent management capabilities to meet local and global competition challenges.

Our findings also have policy implications for the governments of China and other transition economies that are moving from weak IPR regimes to stronger versions. By combining the findings of patent institutional pressure and support, we propose that IPR development in China is still lower than in Western countries. Patent quality is generally low in China because of non-market-related measures, such as subsidy policies (Dang & Motohashi, 2015). The economic

incentives provided by governments continue to drive the quantity of patenting applications but not quality. However, interactions between organizations, such as patent litigation, are shifting IPRs to a more developed regime in China. Both pro-market and non-market institutions are operating within this phase of patent institution transition. Firms are not only adapting to patent institutional environments but also shaping the transition by adopting more proactive strategies (Tan & Tan, 2005). Therefore, although patent agencies and economic incentives have promoted China's current patent quantity surge, policymakers should encourage high-quality innovations and patents by designing and implementing more effective laws to reinforce the current IPR model. Moreover, when formulating policies to stimulate high-quality innovation and patents, they should consider enhancing litigation laws and encouraging enforcement of patent rights. By shedding light on patent institutions that affect firms' strategic choices and performance implications, our study provides useful insights for macro-level innovations and helps policymakers better evaluate the effectiveness of IPR policies, while further encouraging important innovations and growth (Peng et al., 2017). For other transition economies, the mechanisms behind the coevolution of institutions and firms' patent acquisition strategies may help balance the competitive strength and legitimacy of local firms in the global market by switching their institutions from valuing patent quantity to patent quality.

Limitations and future research directions

Although our findings contribute to the understanding of patent strategies, they have some limitations. By addressing these limitations, opportunities for further research may emerge. Although our study improves the understanding of the impact of patent institutions on patent acquisition strategies and performance, it only considers the Chinese context. Further, it considers only patent quantity to analyze patenting performance, even though patents are heterogeneous. Some patented technological schemes are more valuable than others, and some well-developed patents provide greater exclusionary rights through refined claims or patent portfolios (Lanjouw & Schankerman, 2004; Somaya et al., 2007). Therefore, refined measurements of patenting performance (e.g., a combination of patent quantity and quality) may provide insights into the connection between patent strategies and patent performance.

Owing to the dominant role of external patent law expertise in China, we focus on its impact on patent generation. However, as IPR protection becomes stronger in China and the country gets more integrated with the global economy in this aspect, internal patent experts may play increasingly important roles in patent management. Further research could extend our study by analyzing the trade-offs and complementary effects of internal and external patent legal resources on firms in China (Reitzig & Wagner, 2010; Mayer et al., 2012; Sako et al., 2016).

Finally, given the data-related limitations, we used only cross-sectional data of listed firms on a large scale in our empirical analysis. Future studies could expand our study by analyzing small firms or panel data to examine the impact of institutions on patent strategies. We also suggest that researchers consider analyzing patent strategies from a network perspective. For example, a promising research direction is to examine how network structures affect patent strategies (Carnahan & Somaya, 2013; Moeen, Somaya & Mahoney, 2013). As our study suggests, the rich patent database and transition economy context in China will be valuable for the development of the patent strategy literature.

Conclusions

This study examines what determines patent legal resource acquisition strategies and their outcomes in transition economies. We find

that (1) institutions directly influence strategies regarding legal resource acquisition decisions, (2) the characteristics of legal resources have to fit the needs of a specific firm, and (3) the leverage of legal resources is influenced by institutional pressures and support. Our theoretical framework shows that firms' patenting behavior and its outcomes are better predicted by the integration of institutional- and resource-based views. These findings may serve as an important step toward a better understanding of firms' patent strategies in transition economies.

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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References

- Agarwal, R., Ganco, M., & Ziedonis, R. H. (2009). Reputations for toughness in patent enforcement: Implications for knowledge spillovers via inventor mobility. *Strategic Management Journal*, 30(13), 1349–1374.
- Ahuja, G., & Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal*, 22(3), 197–220.
- Ahuja, G., & Yayavaram, S. (2011). Perspective—explaining influence rents: The case for an institutions-based view of strategy. *Organization Science*, 22(6), 1631–1652.
- Andries, P., & Faems, D. (2013). Patenting activities and firm performance: Does firm size matter? *Journal of Product Innovation Management*, 30(6), 1089–1098.
- Ayerbe, C., Lazaric, N., Callois, M., & Mitkova, L. (2014). The new challenges of organizing intellectual property in complex industries: A discussion based on the case of Thales. *Technovation*, 34(4), 232–241.
- Barney, J. B., Ketchen, Jr. D. J., & Wright, M. (2011). The future of resource-based theory: Revitalization or decline? *Journal of Management*, 37(5), 1299–1315.
- Barros, H. M. (2015). Exploring the use of patents in a weak institutional environment: The effects of innovation partnerships, firm ownership, and new management practices. *Technovation*, 45, 63–77.
- Belsley, D. A., Kuh, E., & Welsch, R. E. (1980). *Regression diagnostics: Identifying influential data and sources of collinearity*. New York: Wiley.
- Bessen, J. E., & Meurer, M. J. (2008). *The private costs of patent litigation*. Boston University School of Law Working Paper 07–08.
- Blind, K., Edler, J., Frietsch, R., & Schmoch, U. (2006). Motives to patent: Empirical evidence from Germany. *Research Policy*, 35(5), 655–672.
- Bourgeois, L. J. (1980). Strategy and environment: A conceptual integration. *Academy of Management Review*, 5(1), 25–39.
- Cameron, A. C., & Trivedi, P. K. (2009). *Microeconometrics using stata*. College Station, TX: Stata Press Vol. 5.
- Cameron, A. C., & Trivedi, P. K. (2013). *Regression analysis of count data*. New York: Cambridge University Press.
- Carnahan, S., & Somaya, D. (2013). Alumni effects and relational advantage: the impact on outsourcing when a buyer hires employees from a supplier's competitors. *Academy of Management Journal*, 56(6), 1578–1600.
- Ceccagnoli, M. (2009). Appropriability, preemption, and firm performance. *Strategic Management Journal*, 30(1), 81–98.
- Chang, S. J., & Wu, B. (2014). Institutional barriers and industry dynamics. *Strategic Management Journal*, 35(8), 1103–1123.
- Choudhury, P., & Haas, M. R. (2018). Scope versus speed: team diversity, leader experience, and patenting outcomes for firms. *Strategic Management Journal*, 39(4), 977–1002.
- Clarkson, G., & Toh, P. K. (2010). Keep out' signs: The role of deterrence in the competition for resources. *Strategic Management Journal*, 31(11), 1202–1225.
- Cohen, W. M., Nelson, R. R., & Walsh, J. P. (2000). Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not). NBER working paper 7552. Cambridge, MA: National Bureau of Economic Research. Available at: <http://www.nber.org/papers/w7552>.
- Conti, A., Thursby, J., & Thursby, M. (2013). Patents as signals for startup financing. *The Journal of Industrial Economics*, 61(3), 592–622.
- Dang, J., & Motohashi, K. (2015). Patent statistics: A good indicator for innovation in China? Patent subsidy program impacts on patent quality. *China Economic Review*, 35, 137–155.
- DiMaggio, P., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160.

- Fox, S. P. (1998). Intellectual property management: From theory to practice. *Profiting from intellectual capital* (pp. 142–156). New York: John Wiley and Sons Sullivan P (ed.).
- Ganco, M., Ziedonis, R. H., & Agarwal, R. (2015). More stars stay, but the brightest ones still leave: Job hopping in the shadow of patent enforcement. *Strategic Management Journal*, 36(5), 659–685.
- Gilley, M. K., & Rasheed, A. (2000). Making more by doing less: An analysis of outsourcing and its effects on firm performance. *Journal of Management*, 26(4), 763–790.
- Gray, B., Purdy, J. M., & Ansari, S. S. (2015). From interactions to institutions: Micro-processes of framing and mechanisms for the structuring of institutional fields. *Academy of Management Review*, 40(1), 115–143.
- Greenwood, R., & Suddaby, R. (2006). Institutional entrepreneurship in mature fields: The big five accounting firms. *Academy of Management Journal*, 49(1), 27–48.
- Gupta, A. K., Tesluk, P. E., & Taylor, M. S. (2007). Innovation at and across multiple levels of analysis. *Organization Science*, 18(6), 885–897.
- Hall, B. H., & Ziedonis, R. H. (2001). The patent paradox revisited: An empirical study of patenting in the US semiconductor industry, 1979–1995. *RAND Journal of Economics*, 32(1), 101–128.
- Hall, B. H., Griliches, Z., & Hausman, J. A. (1984). Patents and R&D: Is there a lag? *NBER Working Paper 1454*. Cambridge, MA: National Bureau of Economic Research. Available at: <http://www.nber.org/papers/w1454>.
- Hatch, N., & Dyer, J. H. (2004). Human capital and learning by doing as a source of sustainable competitive advantage. *Strategic Management Journal*, 25(12), 1155–1178.
- Hätönen, J., & Eriksson, T. (2009). 30+ years of research and practice of outsourcing: Exploring the past and anticipating the future. *Journal of International Management*, 15(2), 142–155.
- Hilbe, J. M. (2011). *Negative binomial regression*. Cambridge: Cambridge University Press.
- Hoetker, G. (2005). How much you know versus how well I know you: Selecting a supplier for a technically innovative component. *Strategic Management Journal*, 26(1), 75–96.
- Hoetker, G. (2007). The use of logit and probit models in strategic management research: Critical issues. *Strategic Management Journal*, 28(4), 331–343.
- Hu, A. G., & Jefferson, G. H. (2009). A great wall of patents: What is behind China's recent patent explosion? *Journal of Development Economics*, 90(1), 57–68.
- Huang, C., & Shields, T. G. (2000). Interpretation of interaction effects in logit and probit analyses: Reconsidering the relationship between registration laws, education, and voter turnout. *American Politics Quarterly*, 28(1), 80–95.
- Huang, K. G. L. (2016). Uncertain intellectual property conditions and knowledge appropriation strategies: Evidence from the genomics industry. *Industrial and Corporate Change*, 26(1), 41–71.
- Huang, K. G. L., Geng, X., & Wang, H. (2017). Institutional regime shift in intellectual property rights and innovation strategies of firms in China. *Organization Science*, 28(2), 355–377.
- Huo, D., Motohashi, K., & Gong, H. (2019). Team diversity as dissimilarity and variety in organizational innovation. *Research Policy*, 48(6), 1564–1572.
- Ingram, P. L., & Silverman, B. S. (2002). Introduction. In P. Ingram, & B. Silverman (Eds.), *The new institutionalism in strategic management (advances in strategic management, vol. 19)* (pp. 1–30). JAI: Amsterdam.
- Joshi, A. M., & Nerkar, A. (2011). When do strategic alliances inhibit innovation by firms? Evidence from patent pools in the global optical disc industry. *Strategic Management Journal*, 32(11), 1139–1160.
- Kelly, D., & Amburgey, T. L. (1991). Organizational inertia and momentum: A dynamic model of strategic change. *Academy of management journal*, 34(3), 591–612.
- Kogut, B., & Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization Science*, 7(5), 502–518.
- Kshetri, N. (2009). Institutionalization of intellectual property rights in China. *European Management Journal*, 27(3), 155–164.
- Lanjouw, J. O., & Schankerman, M. (2001). Characteristics of patent litigation: a window on competition. *RAND Journal of Economics*, 32(1), 129–151.
- Lanjouw, J. O., & Schankerman, M. (2004). Patent quality and research productivity: Measuring innovation with multiple indicators. *The Economic Journal*, 114(495), 441–465.
- Li, N., Wang, X., & Zhou, X. (2007). The comparative study of patent agent system. *Intellectual Property Rights*, 17(2), 39–42.
- Li, X. (2012). Behind the recent surge of Chinese patenting: an institutional view. *Research Policy*, 41(1), 236–249.
- Lippman, S. A., & Rumelt, R. P. (2003). A bargaining perspective on resource advantage. *Strategic Management Journal*, 24(11), 1069–1086.
- Liu, H., Yang, J. Y., & Augustine, D. (2018). Political ties and firm performance: The effects of prosocial and prosocial engagement and institutional development. *Global Strategy Journal*, 8(3), 471–502.
- Markman, G. D., Espina, M. I., & Phan, P. H. (2004). Patents as surrogates for inimitable and non-substitutable resources. *Journal of Management*, 30(4), 529–544.
- Marquis, C., & Raynard, M. (2015). Institutional strategies in emerging markets. *The Academy of Management Annals*, 9(1), 291–335.
- Mayer, K. J., Somaya, D., & Williamson, I. O. (2012). Firm-specific, industry-specific, and occupational human capital and the sourcing of knowledge work. *Organization Science*, 23(5), 1311–1329.
- Moeen, M., Somaya, D., & Mahoney, J. T. (2013). Supply portfolio concentration in outsourced knowledge-based services. *Organization Science*, 24(1), 262–279.
- Moran, P., & Ghoshal, S. (1999). Markets, firms, and the process of economic development. *Academy of Management Review*, 24(3), 390–412.
- North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- Oliver, C. (1991). Strategic responses to institutional processes. *Academy of Management Review*, 16(1), 145–179.
- Oliver, C. (1997). Sustainable competitive advantage: Combining institutional and resource-based views. *Strategic Management Journal*, 18(9), 697–713.
- Paik, Y., & Zhu, F. (2016). The impact of patent wars on firm strategy: Evidence from the global smartphone industry. *Organization Science*, 27(6), 1397–1416.
- Pakes, A. (1985). On patents, R&D, and the stock market rate of return. *Journal of Political Economy*, 93(2), 390–409.
- Peng, M. W., & Heath, P. S. (1996). The growth of the firm in planned economies in transition: Institutions, organizations, and strategic choice. *Academy of Management Review*, 21(2), 492–528.
- Peng, M. W., Ahlstrom, D., Carraher, S. M., & Shi, W. S. (2017). History and the debate over intellectual property. *Management and Organization Review*, 13(1), 15–38.
- Penner-Hahn, J., & Shaver, J. M. (2005). Does international research and development increase patent output? An analysis of Japanese pharmaceutical firms. *Strategic Management Journal*, 26(2), 121–140.
- Polidoro, F., & Toh, P. K. (2011). Letting rivals come close or warding them off? The effects of substitution threat on imitation deterrence. *Academy of Management Journal*, 54(2), 369–392.
- Reitzig, M. (2004). Improving patent valuations for management purposes: Validating new indicators by analyzing application rationales. *Research Policy*, 33(6–7), 939–957.
- Reitzig, M., & Wagner, S. (2009). *Patent grant success as a function of patent filing outsourcing*. London, UK: Mimeo, London Business School.
- Reitzig, M., & Wagner, S. (2010). The hidden costs of outsourcing: Evidence from patent data. *Strategic Management Journal*, 31(11), 1183–1201.
- Rudy, B. C., & Black, S. L. (2018). Attack or defend? The role of institutional context on patent litigation strategies. *Journal of Management*, 44(3), 1226–1249.
- Sako, M., Chondrakis, G., & Vaaler, P. M. (2016). How do plural-sourcing firms make and buy? The impact of supplier portfolio design. *Organization Science*, 27(5), 1161–1182.
- Shu, C., Wang, Q., Gao, S., & Liu, C. (2015). Firm patenting, innovations, and government institutional support as a double-edged sword. *Journal of Product Innovation Management*, 32(2), 290–305.
- Somaya, D. (2003). Strategic determinants of decisions not to settle patent litigation. *Strategic Management Journal*, 24(1), 17–38.
- Somaya, D. (2012). Patent strategy and management: an integrative review and research agenda. *Journal of Management*, 38(4), 1084–1114.
- Somaya, D., Williamson, I. O., & Zhang, X. (2007). Combining patent law expertise with R&D for patenting performance. *Organization Science*, 18(6), 922–937.
- Stasik, E. (2003). *Patent or Perish: A Guide for Gaining and Maintaining Competitive Advantage in the Knowledge Economy*. NC: Althos: Fuquay Varina.
- Süzeroglu-Melchior, S., Gassmann, O., & Palmie, M. (2017). Friend or foe? The effects of patent attorney use on filing strategy vis-a-vis the effects of firm experience. *Management Decision*, 55(6), 1122–1142.
- Swift, T. (2016). The perilous leap between exploration and exploitation. *Strategic Management Journal*, 37(8), 1688–1698.
- Tan, D. (2015). Making the news: Heterogeneous media coverage and corporate litigation. *Strategic Management Journal*, 37(7), 1341–1353.
- Tan, J., & Tan, D. (2005). Environment-strategy co-evolution and co-alignment: A staged model of Chinese SOEs under transition. *Strategic Management Journal*, 26(2), 141–157.
- Taylor, A., & Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of Management Journal*, 49(4), 723–740.
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(6), 285–305.
- Tolbert, P. S., David, R. J., & Sine, W. D. (2011). Studying choice and change: the intersection of institutional theory and entrepreneurship research. *Organization Science*, 22(5), 1332–1344.
- Trigeorgis, L., Baldi, F., & Makadok, R. (2022). Compete, cooperate, or both? Integrating the demand side into patent deployment strategies for the commercialization and licensing of technology. *Academy of Management Review*, 47(1), 31–58.
- Wagner, S., Hoisl, K., & Thoma, G. (2014). Overcoming localization of knowledge—the role of professional service firms. *Strategic Management Journal*, 35(11), 1671–1688.
- Wang, Y., Wang, N., Jiang, L., Yang, Z., & Cui, V. (2016). Managing relationships with power advantage buyers: the role of supplier initiated bonding tactics in long-term buyer–supplier collaborations. *Journal of Business Research*, 69(12), 5587–5596.
- Washington, M., & Ventresca, M. J. (2004). How organizations change: the role of institutional support mechanisms in the incorporation of higher education visibility strategies, 1874–1995. *Organization Science*, 15(1), 82–97.
- Webb, J. W., Tihanyi, L., Ireland, R. D., & Sirmon, D. G. (2009). You say illegal, I say legitimate: entrepreneurship in the informal economy. *Academy of Management Review*, 34(3), 492–510.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.
- Xin, K., & Pearce, J. (1996). Guanxi: connections as substitutes for formal institutional support. *Academy of Management Journal*, 39(6), 1641–1658.
- Yang, D. L. (2004). *Remaking the Chinese Leviathan: Market transition and the politics of governance in China*. Redwood City, CA: Stanford University Press.
- Zhou, C., Delios, A., & Yang, J. Y. (2002). Locational determinants of Japanese foreign direct investment in China. *Asia Pacific Journal of Management*, 19(1), 63–86.
- Ziedonis, R. H. (2004). Don't fence me in: Fragmented markets for technology and the patent acquisition strategies of firms. *Management Science*, 50(6), 804–820.