International Journal of Emerging Trends in Social Sciences
ISSN: 2521-3539
Vol. 17, No. 1, pp. 1-15, 2024
DOI: 10.55217/103.v17i1.801

Power distance, legal protection of intellectual property rights and corporate R&D human resources

Jingchao Dai

Business School, Hebei Normal University, Shijiazhuang Hebei 050024, China.
Email: jingchaodai2017@163.com

Abstract

Existing studies have mainly investigated the pairwise relationship between culture, intellectual property rights (IPR) protection, and enterprises' innovation input. This paper links culture and IPR law to study their joint impact on enterprises' innovation human input. Based on the panel data of Chinese listed companies in Shanghai and Shenzhen Stock Exchange, studying a specific cultural dimension (i.e., power distance) and its influence with legal protection of IPR on corporate research and development (R&D) human resources (defined in terms of scale and efficiency). Power distance is negatively related to the R&D human resources scale and positively related to their efficiency. This is because power distance affects the R&D personnel's job satisfaction and turnover rate. Relaxed IPR legal environment is not conducive to expanding the scale of R&D human resources. Because the vital interests of R&D personnel are not legally protected, and the turnover cost is reduced. There is an interaction between Power Distance and Legal Protection of IPR, which can moderate relationship between Power Distance and R&D Human Resources Scale. Weak Legal Protection of IPR may enhance the positive correlation between Power Distance and R&D Efficiency. Enterprises should take corresponding measures to enhance their ability of independent innovation and R&D human resource management in culture, IPR protection, and human resources management.

Keywords:
Chinese listed companies
Innovation
Intellectual property rights
Power distance
R&D human resources.

Publisher:
Scientific Publishing Institute

Received: *12 June 2024*
Revised: *15 July 2024*
Accepted: *24 July 2024*
Published: *30 July 2024*

Funding: This research is supported by Science Research Project of Hebei Education Department (Grant number: SQ2022021).
Institutional Review Board Statement: Not applicable.
Transparency: The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

1. Introduction

Innovation theory points out that long-term investment is fundamental to continuously improving innovation ability and maintaining competitive advantage. Since China proposed the innovation-driven development strategy in 2012, its innovation capacity has continued to improve, and the scale of research and development (R&D) investment has proliferated. However, there is still a gap between China's human input in innovation and that of developed countries. As shown in Table 1, during the decade from 2012 to 2021, the number of people engaged in R&D activities per 10,000 employed people in China shows a downward trend (from nearly 70 people to more than 30 people), while the number in Japan, Germany and the United Kingdom

is basically two to three times that in China. Human input in innovation directly affects the progress and completion of R&D projects. It also reflects the degree of importance companies attach to R&D activities and the level of R&D investment. Enterprises are more inclined to invest R&D funds in human resources, an essential innovation determinant. Therefore, enterprises need to reserve human resources, that is, to build a high-quality and stable R&D team. It is an inevitable requirement for improvement of sustainable independent innovation capability.

Table 1. A Comparison of human input in R&D activities in different countries.

Country	Persons engaged in R&D activities per 10,000 employed persons			
	China	German	Japan	UK
2012	60	142	133	113
2013	65	143	134	121
2014	69	141		
2015	49	143	134	133
2016	50	150	130	132
2017	52	155	132	132
2018	56	158	131	143
2019	62			
2020	30	100	98	97
2021	32	100	101	96

Note: Data was collected from ministry of science and technology of China, National Bureau of Statistics of China, compiled by EPS (Easy Professional Superior) China Data.

A growing body of research highlights the factors that influence firms' input in innovation. The existing literature includes studies on the effects of firms' conditions, external macroenvironment, and government policies on innovation human input. Nevertheless, there are fewer studies from the following two perspectives.

On the one hand, the literature examining the factors influencing R&D human resources from the perspective of informal institutional environment, especially culture related to intellectual property rights (IPR) protection, is not comprehensive. According to institutional economics theory, influenced by the same institutional environment (including formal and informal), firms' behavior will converge and have similarities in decisions of innovation human input. Therefore, culture, an informal institution, is indispensable to enhancing firms' innovation capability by influencing their R&D human resources. Among the studies on the influence of the cultural environment on innovation input, many pieces of literature study traditional culture, such as religious culture, Confucian culture, etc. Some literature studies cultures with specific characteristics, such as trust, social capital, dialect, gambling culture, maritime culture, etc. Nevertheless, there is a lack of cultural studies related to IPR protection.

In addition, national/regional culture is based on various cultural dimensions to capture the most important cultural differences among countries or regions, leaving aside specific historical and cultural contexts. These cultural dimensions include the most widely used (Hofstede, 1980) model, Global Leadership and Organizational Behavior Effectiveness (GLOBE) project (House, Hanges, & Javidan, 2004) and the World Values Survey. Much of the literature examines the impact of culture on innovation using all or a few dimensions of the national/regional culture mentioned above (Álvarez-Gallego & Pucheta-Martínez, 2021; Ángeles, Piñeiro-Chousa, Quiñoá-Piñeiro, & Santos-Rodrigues, 2021; Das, 2021; Narjess, Chkir, Saadi, & Zhu, 2021). One of these dimensions is Power Distance. Power Distance refers to the degree to which members of a society or organization accept hierarchy and unequal power distribution. This inequality is reflected in social contributions, power distribution, and rewards for rights and obligations.

On the other hand, it is urgent to study how to play a more comprehensive role in the positive effect of IPR protection on R&D human resources. Enterprises cannot enhance their innovation capability without the IPR protection system. The IPR protection system is closely related to enterprises' decisions regarding innovation input. That is because the strength of IPR protection directly affects innovation costs and expected returns of knowledge products, affecting their willingness to input in R&D. IPR protection is a systematic project. In addition to strengthening IPR laws, it also needs to play the role of culture. Because culture also influences people's perceptions of IPR protection and behavior patterns.

Unlike other property rights, China has historically lacked the specialized ideology that recognizes and values IPR. The public's awareness of protecting their or others' intellectual achievements is weak. There is also no incentive or opportunity for a complete IPR legal system to emerge in China. Furthermore, most of the present-day legal systems for IPR were first introduced from foreign countries. It does not mean, however, that Chinese culture has no components relevant to protecting IPR. The factors influencing people's awareness of the need to protect their intellectual output existed in culture long before IPR law was formalized. Even after the advent of IPR laws, these cultural factors continue to play a role in IPR-related awareness or behavior. Moreover, the feudal dictatorship and strict hierarchical order in China's history have led to a power culture. It requires that the junior obey the senior, whether in the family or the enterprise. Power distance, as an essential

type in national/regional culture, may also impact the legal protection of IPR, which in turn affects corporate input in innovation.

Based on the above analysis, many studies have investigated the pairwise relationship between culture, IPR protection, and enterprises' innovation input. However, there is a lack of literature linking culture and IPR law to study their joint influence on Chinese innovation human input. This paper studies a specific cultural dimension (i.e., power distance) and its influence with IPR law on firms' human input in innovation (i.e., R&D human resources). It also defines R&D human resources in terms of both scale and efficiency.

This paper uses panel data of listed companies in Shanghai and Shenzhen Stock Exchange from 2006 to 2019 (Given that the variables related to Legal Protection of Intellectual Property Rights are only available until 2018, I only use data from 2006 to 2019). It proceeds as follows. In Section 2, I review the relevant literature and put forward six research hypotheses. In Section 3, after describing the variable and data, I study the influence of power distance and IPR legal protection on the scale and efficiency of R&D human resources and conduct robustness tests. Then, I study the interaction between power distance and legal protection of IPR. Section 4 concludes.

2. Literature Review and Research Hypothesis

Firms may be influenced by the local culture of power distance when making decisions on human resources. The degree of subordinates' compliance with superiors and the acceptance of power gaps within the enterprise deeply affect R&D human resources. The choices of corporate innovators can also be influenced. R&D personnel have the initiative. The level of a firm's R&D human resources is not only limited by the number of inflows and outflows of R&D personnel but also depends on their efficiency. Therefore, I measure R&D human resources in scale and efficiency.

2.1. The Relationship between Power Distance and R&D Human Resources

2.1.1. The Relationship between Power Distance and R&D Human Resources Scale

R&D input, as a vital venture capital decision, is directly in corporate executives' hands (Chen, 2017). Executive power significantly affects the intensity of R&D input (Ke & Li, 2020). While the size of the power distance directly leads to whether the power in the hands of managers is decentralized or centralized. In cultures with a high level of power distance, power is unequally distributed and often concentrated in the hands of management. In contrast, cultural environments with a low level of power distance tend to favor power equality, dispersion, and sharing (Su, Yu, & Luo, 2017).

In addition, the culture of power distance affects the working environment, the mobility of R&D staff, and their enthusiasm, willingness and efficiency. In companies with a large power distance, both the emotional and position gaps between superiors and subordinates are large. Subordinates are highly dependent on their superiors. They follow the instructions of their superiors and do not easily conflict with them (Ng, Koh, Ang, Kennedy, & Chan, 2011; Xu, Van de Vliert, & Van der Vegt, 2005). When subordinates become very dissatisfied with their superiors, they also become psychologically contemptuous of the authority. This extreme change is called anti-dependence. However, at this time, subordinates still act in a way that shows compliance with their superiors (Lin, 2007).

According to the Human Capital Drain Theory, such a culture is not conducive to improving job satisfaction and thus leads to instability and high turnover of R&D staff. It is because innovation culture is embodied in the values that encourage and protect innovative behavior. Furthermore, the cultural atmosphere tolerates failure, encouraging trial and error (Jing, Tang, & Yan, 2011). For example, it advocates full empowerment of employees, delegating essential responsibilities, and allowing reasonable mistakes. Employees can control their work process, participate in company decisions, and have flexible working time. The company has democratic management and smooth communication channels. Employees can fight for and defend their rights. As knowledge-based employees, R&D personnel pays more attention to realizing self-worth and self-direction in the work process (Long, 2012). They also want to have reasonable control and access to innovation resources and to be given autonomy in their work environment. In comparison, external coercive orders do not positively affect the willingness of R&D personnel to innovate (Zhang & You, 2014; Zhao, Zhao, Lu, & Zhao, 2018). R&D personnel's pursuit of self-worth and free space can lead to turnover if unsatisfied with the working environment (Liang & Cao, 2010). Price (2001) also points out that employee autonomy and self-direction can reduce the likelihood of turnover by increasing job satisfaction.

That is to say, in large-power distance cultures, power is concentrated in management. R&D staff cannot fully exercise the right to self-manage their R&D activities, reducing job satisfaction and increasing turnover. At this time, the scale of R&D human resources is reduced. Based on this, our formal hypothesis is as follows:

Hypothesis 1: Power distance may be negatively related to the R&D human resources scale.

2.1.2. The Relationship between Power Distance and R&D Human Resources Efficiency

A high level of power distance means that individuals in the firm can accept the concentration of power in the hands of leadership, as well as the unequal distribution of power (Su et al., 2017). At this time, compliance of subordinates to the authority of superiors helps break down barriers in the process of new product innovation

and production (Ambos & Schlegelmilch, 2008). Because a culture with a large power gap makes it easier for R&D personnel to comply with their managers (Hsiung & Tsai, 2017; Khatri, 2009; Lian, Ferris, & Brown, 2012) thus avoiding unnecessary conflicts and reducing the costs of communication, bargaining, and time, etc. R&D personnel only need to carry out R&D activities in an orderly manner according to the project schedule and the requirements of their superiors. Efficient execution of R&D programs facilitates the smooth output of innovative results (Luo, Wang, & Tong, 2020; Nakata & Sivakumar, 1996). Especially if the management has a certain prestige, the R&D staff will follow their instructions. In addition, if a company focuses on imitation innovation, the unified management of R&D staff brought by large power distance may further reduce management costs, reducing imitation costs and increasing innovation output. At this time, the large power distance culture improves R&D efficiency. With a given workload, firms require fewer R&D staff. This further validates that power distance is negatively related to the R&D human resources scale. Based on this, our second hypothesis is as follows:

Hypothesis 2: Power distance may be positively related to the R&D human resources efficiency, which in turn is negatively related to the R&D human resources scale.

2.2. The Relationship between Legal Protection of Intellectual Property Rights and R&D Human Resources

2.2.1. The Relationship between Legal Protection of Intellectual Property Rights and R&D Human Resources Scale

The flow of R&D human resources creates technology spillovers and accelerates technology diffusion. The negative externalities from spillover effects can also reduce firms' willingness to input in R&D human resources (Peng, 2006). Moreover, IPR protection is closely related to employee mobility and spillover effects. Inadequate legal protection of IPR will lead to a high turnover of R&D personnel (Fang & Fu, 2012). This may be since weaker IPR legal protections can lead to problems such as rampant counterfeiting. It will then lead to a lack of protection for the personal interests of R&D personnel and discourage them from engaging in R&D work. The mobility and turnover rate of R&D personnel will increase, and they may even switch to non-R&D fields, decreasing the number of personnel supplied. The technology spillover in the process of the same industry flow is prone to IPR infringement. Furthermore, the tolerance of infringement further reduces the cost or risk of job-hopping for R&D personnel and increases the expected return, leading to more outflow of R&D personnel. The technology spillover from high employee mobility will also make companies focus not only on the number of R&D staff but also on internal training, R&D efficiency and retention of existing staff, or bringing in senior talents with high salaries, etc. The number of R&D personnel will decrease when the supply of R&D personnel is insufficient or when the company's demand for R&D personnel decreases. These arguments lead to the following empirical hypothesis:

Hypothesis 3: The strength of IPR legal protection may be positively related to the R&D human resources scale.

2.2.2. The Relationship between Legal Protection of Intellectual Property Rights and R&D Human Resources Efficiency

The efficiency of a firm's R&D human resources (i.e., the number of patents per R&D employee) is strongly influenced by the strength of IPR legal protection. The strength of IPR laws affects the number of patent applications granted to a firm.

On the one hand, the patent system, as an essential part of the legal system of IPR, plays a positive role in clarifying property rights, diffusing technology, and reducing technological innovation costs. Companies will actively apply for patents if the actual protection of IPR laws is adequate. However, if the actual protection of the law is not practical, i.e., the deterrence of patent infringement is not strong enough, the benefit obtained after the patent is granted will be less than the cost paid for the patent application. Companies may also face the risk of imitation by competitors after the technology is publicly announced. At this time, companies will not actively apply for patents.

On the other hand, based on the theory of late-stage advantage, the theory of optimal IPR protection, and the theory of equilibrium of IPR rights and interests, strict IPR laws may hinder firms' patent output. Firstly, it will narrow the channels for imitation, absorption, and reinvention, slowing down technological progress and reducing the innovative achievements that patents can authorize. Secondly, it will not be conducive to fair market competition.

It can also give rise to unfavorable phenomena such as excessive monopoly, patent jungle, patent blockade, abuse, etc. The innovation process of enterprises needs to constantly absorb advanced external knowledge and technology (Kim, Steensma, & Heidl, 2021). Critical technologies in the R&D process cannot be used because they have been patented, thus reducing the company's knowledge base (Stiglitz, 2014) or requiring additional costs for average production. Thirdly, the difficulty in obtaining authorization for patents leads to a lower willingness to apply (Dai, Wang, & Huang, 2020).

Based on China's current competitive, innovative, and cultural environment, a more lenient IPR law may be more conducive to learning advanced technologies. Then imitating them and achieving secondary innovation, thus rapidly improving the R&D capabilities.

It is also conducive for local R&D personnel to receive systematic training, master cutting-edge knowledge, and achieve implicit technology spillover. It also helps maintain fair market competition, enables enterprises to acquire sufficient knowledge reserves, and satisfies the reasonable needs of enterprises for their technological

achievements to be protected. In turn, it achieves the direct purpose of enhancing the skills of R&D personnel and promoting the increase of patent output, ultimately realizing technological catch-up and independent innovation. These arguments lead to the following empirical hypothesis:

Hypothesis 4: The strength of IPR legal protection may be negatively related to the R&D human resources efficiency.

2.3. Interaction Effects of Power Distance and Legal Protection of Intellectual Property Rights

Culture is an informal institution. As a formal institution, the law may regulate the role of culture. The weaker the legal protection of IPR, the more it strengthens or weakens the influence of power distance on firms' R&D human resources. Conversely, the cultural level of a region related to IPR protection will also affect the degree of legal influence. This leads to the following empirical hypothesis:

Hypothesis 5: There is an interaction between power distance and IPR legal protection, which can moderate relationship between power distance and R&D human resources.

In addition, in provinces with weak IPR punishment and deterrence, large power distance may increase the per capita patent output of R&D personnel. The weak protection of IPR means that the standards for obtaining authorization after applying for patents are easily met. Higher standards for identifying IPR infringement, or more minor penalties for IPR infringement, also mean that enterprises are more likely to learn and imitate advanced technologies, and then make second innovations. At this time, technology spillover from R&D personnel is also greater. if local enterprises focus on imitative innovation, they do not need R&D personnel with high original, innovative ability and self-assertion. Such enterprises need R&D personnel who can quickly learn and master advanced technologies and quickly realize the second innovation, finally transforming it into innovative achievements.

Large power distance concentrate power in management, and subordinate would obey their superiors. In this way, R&D personnel can be managed in a unified way and would be more efficient. Management costs and communication costs are also reduced. Such a culture and management model may be more conducive to imitative innovation. It can reduce the cost of imitation and accelerate the output of imitation. Therefore, a more relaxed IPR law environment is suitable for imitative innovation. It can give companies more opportunities to imitate innovation.

Researchers in large-power cultures can also produce more technological achievements. Moreover, the willingness of enterprises to apply for patents and the probability of obtaining authorization is high, which makes the number of patents granted for the technical achievements of R&D staff also larger.

This result also reflects that Chinese enterprises may still be in the stage of pursuing patent quantity. Although many enterprises attach importance to and actively practice patent reserve, there are still problems, such as "large quantity, but poor quality and poor application of patents."

There are also problems such as "lots of technologies, but no patent" or "lots of patents, but no innovation." In the absence of legal protection of IPR, why do companies still want to increase their patent output and focus on the number of patents? This is because companies apply for patents for other strategic purposes, including using patents for technology blocking, as bargaining chips, preventing rivals from R&D, attracting customers, attracting investment, improving reputation, making mergers and acquisitions, establishing standards, etc. (Hall, Helmers, Rogers, & Sena, 2014; Holgersson, 2013; Torrisi et al., 2016; Walsh, Lee, & Jung, 2016). These arguments lead to the following empirical hypothesis:

Hypothesis 6: Weak IPR legal protection may enhance the positive correlation between power distance and R&D human resources efficiency.

3. Empirical Analysis

3.1. Model Setting, Variable Interpretation and Data Description

The sample scope includes listed companies in Shanghai Stock Exchange and Shenzhen Stock Exchange, covering 30 provincial administrative regions in China (Tibet, Hong Kong, Macau, and Taiwan were excluded from the analysis due to a significant lack of data.).

I processed the sample data as follows. First, ST companies and companies in the financial and insurance industries were excluded. Second, companies may not invest in R&D yearly, so some companies have zero R&D investment in certain years. However, if the enterprise has no R&D demand, the R&D investment will also be zero. The culture does not affect the R&D investment in this kind of enterprise. Therefore, to avoid such enterprises' influence on the regression results, I excluded the enterprises that did not have R&D input data during the sample period. Third, some enterprises' registration places changed during the sample period, and the culture of provinces where enterprises are located also changed. Therefore, I excluded these enterprises so that the culture data would not change over time. After data collation, the final sample includes 21,844 observations.

Referring to relevant literature on IPR protection and enterprise innovation behavior, the specification is as follows:

$$R\&DHumanResources_{ipt} = \alpha + \beta_1 PowerDistance_{ip} + \beta_2 IPRProtection_{ipt} + \gamma_1 FirmControls_{ipt-1} + \gamma_2 ProvinceControls_{ipt-1} + \eta_2 IndustryFE + \eta_1 YearFE + \varepsilon \quad (1)$$

Where $PowerDistance_{ip}$ is the level of power distance in the province p where the listed company i is located. $IPRProtection_{ipt}$ is the legal protection of intellectual property rights in the province p of this year t. $FirmControls_{ipt-}$

$_{i}$ is the variable that describes the characteristic of firm i in the previous year t-1. $ProvinceControls_{ipt-1}$ is the variable that describes the characteristic of province p in the previous year t-1. $IndustryFE$ stands for industry-fixed effects, and $YearFE$ stands for year-fixed effects. Moreover, i denotes the listed company, p denotes the province where the listed company is registered, and t denotes the year. The dependent variable is $R\&DHumanResources_{ipt}$, which is either the R&D Human Resources Scale ($HRScale_{ipt}$) or the R&D Human Resources Efficiency ($R\&DEfficiency_{ipt}$).

3.1.1. Dependent Variable: R&D Human Resources (R&DHumanResources)

Referring to the methods of Li, Xu, and Lin (2021); Ma and Yu (2021); Xiao and Fan (2019) and Tian and Wang (2018) R&D Human Resources Scale (HRScaleipt) is measured as the ratio of the number of R&D personnel and the number of employees *100%. The data was obtained from China Stock Market & Accounting Research (CSMAR) Database.

In addition to the number of R&D personnel, R&D efficiency is also an important factor in measuring the level of a company's R&D human resources. The alternative variable of R&D human resources, namely R&D Human Resources Efficiency ($R\&DEfficiency_{ipt}$), is measured as the ratio of the final number of patent applications granted and the number of R&D personnel *100%. More patents each R&D staff applied for means more innovative achievements of R&D staff. It also means that the R&D staff is more efficient. The data were obtained from CSMAR Database.

3.1.2. Core Independent Variables

The core independent variables in this paper mainly include two categories. One is the cultural variable, i.e., power distance. The other is the infringement of IPR which represents the legal protection of IPR in each province.

3.1.2.1. Culture: Power Distance (PowerDistance)

Most works of literature use the cultural dimension of Hofstede or GLOBE (Global Leadership and Organizational Behavioral Effectiveness) to study cultural differences among countries and the impact of national cultures on IPR protection and corporate innovation. Given China's vast territory, long history, and cultural diversity, the cultural dimension of Hofstede or GLOBE project can be used to identify the differences and influences of regional cultures in China's provinces.

I choose the more modern and comprehensive cultural dimension of GLOBE to measure Power Distance. The specific indicators of GLOBE project include nine cultural dimensions: Performance Orientation, Future Orientation, Uncertainty Avoidance, Assertiveness, Gender Egalitarian, Societal Collectivism, In-group Collectivism, Power Distance, and Humane Orientation. The data came from the provincial-level score measured by Zhao, Li, and Sun (2015). Zhao et al. (2015) adopted the same cultural dimension according to the guidance manual of GLOBE project. They designed questionnaires and conducted surveys. The scores at the individual level in the questionnaire were integrated into the regional cultural data of 31 provinces.

In addition, the culture definition methods of Zhao, Li, and Rauch (2012); Shen and Gu (2016) and Wang, Liu, and Dong (2022) are used for reference. I divide the above nine cultural indicators into Traditionalism Culture, Modernism Culture, and Other Cultures. Traditionalism Culture is defined as the average of Power Distance, In-group Collectivism, and Humane Orientation. Modernism Culture is defined as the average of Performance Orientation, Future Orientation, and Uncertainty Avoidance. The above data on Power Distance, In-group Collectivism, and Humane Orientation included in Traditionalism Culture were all from the provincial-level scores measured by Zhao et al. (2015).

Another standard measure of regional culture is Schwartz's seven social values, including Autonomy (Intellectual Autonomy and Emotional Autonomy)/Embeddedness, Egalitarianism /Hierarchy, and Harmony/Mastery. I use Hierarchy to calculate the average power distance. In order to make the data calculation caliber consistent, the provinces with the highest values of Power Distance and Hierarchy are respectively given 10 points. Other provinces are assigned points according to the proportion of provincial value and highest value. After reassignment, the average value of Power Distance and Hierarchy is taken as Power Distance Average. The data source of Schwartz's social values was the same as the cultural dimension of GLOBE project, which was from Zhao et al. (2015). They used self-rating scales and measures developed by Schwartz to measure scores at the provincial level.

3.1.2.2. Legal Protection of Intellectual Property Rights (IPRProtection)

Local governments and courts in China follow the same IPR laws. What differs is the implementation of IPR laws and the effectiveness of implementation in each province. Each province has local administrative regulations (Fang & Zhao, 2011). The strength of legal protection of IPR is mainly reflected in the enforcement of laws and the effectiveness of implementation in each province. The higher the level of IPR enforcement, the more influential the law implementation, which indicates that the role of the law in protecting IPR will be entirely played. Therefore, Legal Protection of Intellectual Property Rights in this paper is not measured by such dimensions as whether the relevant legislation is comprehensive but by the enforcement and

implementation effect of IPR laws. IPR Infringement is taken as the proxy variable for Legal Protection of Intellectual Property Rights.

IPRs related to business and innovation usually appear in the form of patents. I refer to the methods of Shi and Gu (2013); Wu and Tang (2016) and Xiao and Li (2023) describe the local legal protection of IPR by measuring the degree of patent infringement. The government and the court can enforce the law and prosecute the infringement of IPR. Given the availability of data and the relevance of data to business behavior, I only analyze the enforcement of IPR by government patent administration departments. The infringement cases handled by the patent administration office include patent infringement disputes, counterfeit patent cases, and other disputes.

Patent infringement disputes refer to the infringement caused by the unauthorized use of the patent. Investigation and handling of counterfeit patent cases refer to patents' fake and fraudulent use. Other disputes include ownership disputes, qualification disputes, reward disputes, temporary protection fee disputes, etc. Other disputes occur mainly between inventors and their stakeholders and do not represent the strength of IPR protection. Therefore, I divide the variables of IPR Infringement into Severity of IPR Infringement and Efficiency of Handling IPR Infringement. (Data related to counterfeit patent cases investigated and handled by the State Intellectual Property Office in 2010 and beyond include only the number of cases settled. Given the nature of counterfeit patent cases, the settling numbers are close to the filing numbers. Therefore, I measure the degree of infringement by the cumulative number of cases settled in the year of handling counterfeit patents.) Furthermore, I only focus on Severity of Counterfeit Patents and Severity of Patent Infringement Disputes.

$$IPR\ Infringement = Severity\ of\ IPR\ Infringement + Efficiency\ of\ Handling\ IPR\ Infringement \quad (2)$$

$$Severity\ of\ IPR\ Infringement = Severity\ of\ Counterfeit\ Patents + Severity\ of\ Patent\ Infringement\ Disputes \quad (3)$$

$$Severity\ of\ Counterfeit\ Patents = (Cumulative\ Number\ of\ Cases\ Settled\ of\ Counterfeit\ Patents) / (Total\ Cumulative\ Number\ of\ Patents\ Granted) \quad (4)$$

$$Severity\ of\ Patent\ Infringement\ Disputes = (Cumulative\ Number\ of\ Patent\ Infringement\ Disputes\ Filed) / (Total\ Cumulative\ Number\ of\ Patents\ Granted) \quad (5)$$

$$Efficiency\ of\ Handling\ IPR\ Infringement = 1 - Patent\ Infringement\ Settlement\ Rate = 1 - (Total\ Cumulative\ Number\ of\ Patent\ Infringement\ Disputes\ Settled) / (Total\ Cumulative\ Number\ of\ Patent\ Infringement\ Disputes\ Filed) \quad (6)$$

The higher the value of above indicators, the more IPR infringement, i.e., the weaker the IPR legal protection. Data was collected from China National Intellectual Property Administration. In addition, to standardize the caliber of indicator data, the province with the highest value of above indicators is given 10 points. The other provinces are given points according to the proportion of provincial value and highest value.

3.1.3. Control Variables

Control variables include firm characteristics variables, province characteristics variables, and fixed effects. Referring to the variables commonly used in domestic and foreign works of literature on IPR protection and enterprise innovation, I select the following control variables:

3.1.3.1. Control Variables of Firms (FirmControls)

Enterprise Age; Number of Employees (add 1 to the data and then take the natural logarithm); Intangible Assets Ratio, measured as the ratio of intangible assets and total assets; Tobin's Q, measured as market value/(total assets-net intangible assets-net goodwill); Capital Intensity, measured as the ratio of total assets and operating income; Operating Revenue (add 1 to the data and then take the natural logarithm); The dummy variable of Patent-Intensive Industry was calculated by referring to the compilation method of Patent-Intensive Industry Catalog in 2016 by State Intellectual Property Office. The standard of "Industrial Invention Patent Intensity and Invention Patent Granted Scale reaching above the average level" was used to judge whether an enterprise belonged to a patent-intensive industry (Dai et al., 2020). Industrial Invention Patent Intensity is the average number of invention patents granted per 10,000 employed persons during the sample period. The total number of invention patents granted in the past 14 years is divided by the average number of employed persons during the corresponding period. Invention Patent Granted Scale refers to the sum of industrial invention patents granted during the sample period. If Industrial Invention Patent Intensity and Invention Patent Granted Scale are both higher than the average industrial level, the dummy variable of Patent-Intensive Industry is equal to 1, 0 otherwise.

3.1.3.2. Control Variables of Provinces (ProvinceControls)

GDP (Gross Domestic Product) Growth Rate; Per Capita GDP (add 1 to the data and then take the natural logarithm); Proportion of Secondary Industry in GDP; Proportion of Urban Population; Education Level, measured as the average number of students enrolled in regular colleges and high schools per 100 000 population (add 1 to the data and then take the natural logarithm); Proportion of General Budget Expenditure, measured

as the ratio of general budget expenditure and GDP; Foreign-Trade Dependence, measured by the ratio of total import and export of goods and GDP. Urban Registered Unemployment Rate; and Marketization Process, measured by the Marketization Total Index Score Ranking from 2008 to 2019 in Marketization Index of China's Provinces: Neri Report 2021 (Wang, Hu, & Fan, 2021).

3.1.3.3. Fixed Effects

The regression models also control for Industry Fixed Effects and Year Fixed Effects.

Since corporate R&D decisions are usually made based on previous years' operating and R&D conditions, data of control variables were taken as one-period lagged values. In addition, enterprise data, as micro data, may have outliers. So winsorizing (i.e.,99.5% and 0.5% quantile winsorization) was required to reduce the interference of outliers. The data of enterprise characteristic variables and province characteristic variables were obtained from CSMAR Database, Wind Database, and National Bureau of Statistics.

3.2. Descriptive Statistics

Table 2 shows the descriptive statistics of the variables. The dependent variable R&D Human Resources Scale is the ratio of R&D personnel to the number of employees. The largest enterprises have R&D personnel accounting for up to 69%, and some have no R&D personnel in some years. The R&D human resources scale varies greatly among enterprises, averaging 7.7%. R&D Human Resources Efficiency is the final number of patent applications granted per 100 R&D personnel, with a maximum of 41 patents and a minimum of 0 patents. The number of patents granted per R&D personnel varies widely, with an average of just 1.5.

Table 2. Descriptive statistics.

Variable	N	Mean	Std. dev.	Min.	Max.
(1) Dependent variable: R&D human resources					
HR scale	27010	7.657	12.241	0	68.56
R&D efficiency	21844	1.479	5.178	0	40.323
(2) Independent variable					
①Culture					
Traditionalism culture	24831	4.694	0.073	4.543	4.877
Power distance	24831	4.627	0.169	4.34	4.91
Power distance average	24831	9.406	0.287	8.858	9.923
② Legal protection of intellectual property rights					
IPR infringement	24831	2.345	1.539	0.093	8.973
Severity of counterfeit patents	24831	0.903	1.561	0	10
(3) Control variables					
Enterprise age	24743	14.927	5.647	2	33
Number of employees	24831	7.633	1.282	3.638	11.479
Intangible assets ratio	24795	4.638	5.294	0	40.062
Tobin's Q	23754	2.937	2.192	0.854	15.104
Capital intensity	24818	2.354	2.088	0.32	17.885
Operating revenue	24821	12.094	1.473	8.344	16.845
Patent-intensive industry	24833	0.386	0.487	0	1
GDP growth rate	24831	0.114	0.055	-0.224	0.323
Per capita GDP	24831	10.891	0.564	8.664	11.851
Secondary industry in GDP	24831	44.33	9.116	18.63	61.5
Urban population	24831	62.631	14.342	27.46	89.6
Education	24831	8.639	0.143	8.04	9.248
General budget	24831	0.181	0.067	0.084	0.627
Foreign-trade dependence	24831	0.551	0.436	0.017	1.721
Urban unemployment rate	24831	3.12	0.765	1.2	5.1
Marketization process	22717	21.808	7.242	1	30

3.3. Basic Model and Robustness Test

Table 3 shows the influence of Traditionalism Culture, Power Distance (which has traditionalism characteristics), and Legal Protection of Intellectual Property Rights on R&D Human Resources Scale. Column (1) shows that when Traditionalism Culture and IPR Infringement work together, there is a significant negative correlation between Traditionalism Culture and R&D Human Resources Scale. It indicates that in areas with rich traditionalism culture, enterprises have less human input in R&D. On the other hand, in areas with a heavy modernism culture, there may be more emphasis on the proportion of R&D personnel in the workforce. However, there is no significant correlation between local Legal Protection of Intellectual Property Rights (i.e., IPR Infringement) and R&D Human Resources Scale, indicating that Traditionalism Culture plays a significant role. Column (2) shows that when Power Distance in Traditionalism Culture and IPR Infringement work together, there is also a significant negative correlation between Power Distance and R&D Human Resources Scale, which is consistent with *Hypothesis* 1. Nevertheless, IPR Infringement is still not significant.

To further test the stability of the regression results and refine the research objects, columns (3) to (5) show the regression results of the cultural variables and Severity of Counterfeit Patents (which belong to the variables of IPR Infringement). The results show that the regression coefficients of Traditionalism Culture, Power Distance /Power Distance Average are still significantly negative. The regression coefficient of Severity of Counterfeit Patents in columns (3) and (4) is still insignificant, while the coefficient of Severity of Counterfeit Patents in column (5) is significantly negative. This result indicates that when Power Distance (which belongs to the variables of Traditionalism Culture) and Severity of Counterfeit Patents (which belongs to the variables of IPR Infringement) act together, Legal Protection of Intellectual Property Rights could play a role at the same time. It is significantly positively correlated with R&D Human Resources Scale. With weaker legal protection, companies may have fewer R&D staff. It is consistent with *Hypothesis 3*. However, the regression coefficient significance of Severity of Counterfeit Patents is not robust. Therefore, further testing the robustness of Severity of Counterfeit Patents is necessary.

Table 3. Regression results of power distance, legal protection of IPR and R&D human resources (HR scale).

Culture type	**Traditionalism culture & power distance**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variable	**HR scale**				
Traditionalism culture	-4.683***		-4.917***		
	(1.597)		(1.597)		
Power distance		-1.706**		-1.918***	
		(0.677)		(0.678)	
Power distance average					-0.724*
					(0.387)
IPR infringement	0.052	0.048			
	(0.066)	(0.066)			
Severity of counterfeit patents			-0.063	-0.082	-0.086*
			(0.05)	(0.05)	(0.052)
Enterprise age	-0.089***	-0.089***	-0.089***	-0.09***	-0.089***
	(0.02)	(0.02)	(0.019)	(0.019)	(0.019)
Number of employees	-1.161***	-1.17***	-1.163***	-1.173***	-1.172***
	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)
Intangible assets ratio	-0.04**	-0.04**	-0.04**	-0.04**	-0.041**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Tobin's Q	0.708***	0.708***	0.709***	0.709***	0.708***
	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)
Capital intensity	0.239***	0.239***	0.238***	0.238***	0.237***
	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)
Operating revenue	0.877***	0.887***	0.88***	0.892***	0.889***
	(0.134)	(0.134)	(0.134)	(0.134)	(0.134)
Patent-intensive industry	2.698***	2.704***	2.696***	2.703***	2.705***
	(0.655)	(0.655)	(0.655)	(0.655)	(0.655)
GDP growth rate	12.74***	12.465***	13.379***	13.082***	13.695***
	(2.883)	(2.889)	(2.938)	(2.936)	(2.968)
Per Capita GDP	-0.935	-0.897	-0.746	-0.637	-1.15*
	(0.665)	(0.671)	(0.680)	(0.690)	(0.669)
Secondary industry in GDP	-0.016	-0.030*	-0.022	-0.039**	-0.026
	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)
Urban population	0.117***	0.119***	0.105***	0.105***	0.119***
	(0.030)	(0.030)	(0.029)	(0.029)	(0.029)
Education	-3.098***	-3.084***	-3.157***	-3.159***	-3.520***
	(0.792)	(0.793)	(0.798)	(0.799)	(0.832)
General budget	-4.25**	-3.583*	-4.311**	-3.606*	-4.268**
	(2.024)	(2.035)	(2.031)	(2.039)	(2.040)
Foreign-trade dependence	-4.227***	-4.146***	-4.224***	-4.191***	-3.765***
	(0.758)	(0.752)	(0.761)	(0.757)	(0.732)
Urban unemployment rate	-1.080***	-0.920***	-1.086***	-0.918***	-0.940***
	(0.253)	(0.237)	(0.254)	(0.236)	(0.240)
Marketization process	0.041*	0.040*	0.036	0.035	0.0230
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Constant	53.184***	38.451***	53.988***	38.774***	43.913***
	(12.026)	(9.687)	(12.054)	(9.693)	(10.800)
Observations	18728	18728	18728	18728	18728
R^2	0.533	0.532	0.533	0.532	0.532
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Note: Coefficients are reported with robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4 is the robustness test of the relationship between Power Distance, Legal Protection of Intellectual Property Rights, and R&D Human Resources Scale by adding control variables. Columns (1) to (4) show the regression results after successively adding the control variable Enterprise Age^2, Market Concentration, Growth Rate of Total Assets, and Net Profit Growth Rate. Column (5) shows the regression results after simultaneously adding the control variable Enterprise Age^2, Market Concentration, Growth Rate of Total Assets, and Net Profit Growth Rate. All the above data were from the CSMAR Database. The regression results are robust. Therefore, the following contents mainly study the influence of Power Distance and Severity of Counterfeit Patents on R&D Human Resources.

Table 4. Robustness test of power distance, legal protection of IPR and R&D human resources (HR scale).

Culture type	**Power distance**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Variable	**HR Scale**				
Power distance	-1.969***	-1.904***	-1.726**	-1.723**	-1.762**
	(0.678)	(0.678)	(0.695)	(0.695)	(0.695)
Severity of counterfeit patents	-0.086*	-0.081	-0.091*	-0.091*	-0.094*
	(0.05)	(0.05)	(0.051)	(0.051)	(0.051)
Enterprise age	0.136	-0.091***	-0.097***	-0.097***	0.126
	(0.095)	(0.019)	(0.021)	(0.021)	(0.101)
Enterprise age^2	-0.007**				-0.007**
	(0.003)				(0.003)
Market concentration		-0.03***			-0.029***
		(0.01)			(0.01)
Growth rate of total assets			0		0
			(0.001)		(0.001)
Net profit growth rate				0***	0***
				(0)	(0)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	18728	18728	17252	17254	17252
R^2	0.533	0.533	0.533	0.533	0.534
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Note: Coefficients are reported with robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

Column (1) of Table 5 tests the relationship between Power Distance and R&D Human Resources Efficiency to verify whether power distance affects the work efficiency of R&D personnel and then affects the demand for R&D personnel and the proportion of R&D personnel in enterprises. Column (1) shows that Power Distance is significantly positively correlated with R&D Human Resources Efficiency, indicating that the higher the level of power distance in a region, the higher the R&D efficiency may be, which is consistent with *Hypothesis* 2. To a certain extent, it shows that power distance can facilitate and guarantee more results for R&D personnel to research.

Table 5. Regression results of power distance, legal protection of IPR and R&D human resources (R&D efficiency).

Culture type	**Power distance**			
Model	**(1)**	**(2)**	**(3)**	**(4)**
Variable	**R&D efficiency**			
Power distance	0.702*	0.703*	0.724*	0.725*
	(0.423)	(0.424)	(0.437)	(0.437)
Severity of counterfeit patents	0.013	0.013	0.02	0.02
	(0.026)	(0.026)	(0.027)	(0.027)
Market concentration		-0.002		
		(0.004)		
Growth rate of total assets			0***	
			(0)	
Net profit growth rate				0
				(0)
Control variables	Yes	Yes	Yes	Yes
Observations	15959	15959	14820	14821
R^2	0.184	0.184	0.181	0.181
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note: Coefficients are reported with robust standard errors in parenthesis. * significant at 10%; *** significant at 1%.

However, Legal Protection of Intellectual Property Rights loses its significance at this point. It means that how strong local laws protect IPR does not significantly affect the number of patents awarded to R&D staff, while culture plays a significant role. This is not consistent with *Hypothesis* 4. It may be because the positive and negative effects of IPR laws on the work efficiency of R&D personnel offset each other, but the adverse effects are more significant. It may also be that local culture, rather than laws, has a more significant impact on the efficiency of R&D personnel.

Columns (2) to (4) of Table 5 test the robustness of the relationship between Power Distance, Legal Protection of Intellectual Property Rights, and R&D Human Resources Efficiency by adding control variables. Columns (2) to (4) show the regression results after successively adding the control variable Market Concentration, Growth Rate of Total Assets, and Net Profit Growth Rate. They are robust.

3.4. Interaction Effects of Power Distance and Legal Protection of Intellectual Property Rights

Table 6 shows the regression results of the interactive model of Power Distance and Legal Protection of Intellectual Property Rights. Columns (1) to (3) show the regression results using cultural variables (including Power Distance, dummy variable of Power Distance, and dummy variable of Power Distance Average) and legal variables (including Severity of Counterfeit Patents and its dummy variable), respectively and adding their interaction terms. If Power Distance (or Power Distance Average) of the province where the enterprise is registered is greater than the provincial median value, the province's dummy variable of Power Distance (or Power Distance Average) is set as 1, 0 otherwise. If Severity of Counterfeit Patents in the province is greater than the provincial median in the previous year, the dummy variable of Severity of Counterfeit Patents is set as 1, 0 otherwise.

The regression results show that the coefficients of interaction terms in columns (1) to (3) are significantly positive, indicating that a high level of power distance can reduce the negative impact of local IPR infringement on R&D human resources. In comparison, the negative influence of power distance on the R&D human resources scale will be weakened by the extensive infringement of IPR (namely, the weak legal protection of IPR). It is consistent with *Hypothesis* 5.

Table 6. Interaction of power distance and legal protection of IPR on R&D human resources (HR scale).

Culture type	**Power distance**		
Model	**(1)**	**(2)**	**(3)**
Variable	**HR scale**		
Power distance	-1.887*** (0.676)		
Power distance (Dummy)		-0.812*** (0.269)	
Power distance (Average)(Dummy)			-0.608** (0.268)
Severity of counterfeit patents	-0.062 (0.048)		
Severity of counterfeit patents (Dummy)		-0.827*** (0.236)	-0.816*** (0.252)
Power distance * severity of counterfeit patents	0.613** (0.306)		
Power distance * severity of counterfeit patents (Dummy)		0.938*** (0.342)	
Power distance (Average)* severity of counterfeit patents (Dummy)			0.935*** (0.343)
Observations	18728	18728	18728
R^2	0.533	0.533	0.532
Control variables	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Note: Coefficients are reported with robust standard errors in parenthesis. ** significant at 5%; *** significant at 1%.

Columns (1) and (2) of Table 7 show the regression results of the impact of interaction terms between Power Distance and Legal Protection of Intellectual Property Rights on R&D Human Resources Efficiency. Column (1) is the regression model with an interaction term between Power Distance Average and Severity of Counterfeit Patents. Column (2) is the regression model with the interaction term of Power Distance Average (dummy variable) and Severity of Counterfeit Patents (dummy variable) added. The results show that the regression coefficients of interaction terms are significantly positive, indicating that the weaker the legal protection of IPR in a province, the more significantly the positive correlation between power distance and R&D efficiency will be enhanced. It is consistent with *Hypothesis* 5 and *Hypothesis* 6.

Table 7. Interaction of power distance and legal protection of IPR on R&D human resources (R&D efficiency).

Culture type	**Power distance**	
Model	**(1)**	**(2)**
Variable	**R&D efficiency**	
Power distance (Average)	0.395*	
	(0.228)	
Power distance (Average)(Dummy)		-0.055
		(0.159)
Severity of counterfeit patents	0.062*	
	(0.033)	
Severity of counterfeit patents (Dummy)		-0.078
		(0.134)
Power distance (Average)* severity of counterfeit patents (Dummy)		0.483**
		(0.218)
Power distance (Average)* severity of counterfeit patents	0.202*	
	(0.105)	
Observations	15959	15959
R^2	0.184	0.185
Control variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes

Note: Coefficients are reported with robust standard errors in parenthesis. * significant at 10%; ** significant at 5%. All interaction terms are centralized.

4. Conclusion

Enterprises cannot enhance independent innovation capability without a reasonably sized, well-qualified, loyal, and stable innovation team. R&D personnel has subjective initiative and technology spillover. Employee mobility, turnover rate, and R&D efficiency deeply affect R&D human resources. I discuss the relationship among Power Distance, Legal Protection of IPR, and R&D Human Resources. I hope to provide some theoretical basis and policy inspiration for enterprises to enhance their independent innovation capability in terms of culture, IPR protection, and human resources management.

4.1. Research Results

According to the sample data and empirical results, the research conclusions are mainly reflected in the following seven aspects:

First, Power Distance is negatively correlated with R&D Human Resources Scale and positively correlated with R&D Efficiency. This result indicates that the large power distance leads to power inequality between the superior and the subordinate. Thus, the job satisfaction of R&D staff is reduced, and the turnover rate is increased. Furthermore, large power distance can further improve execution willingness, reduce management costs, increase patent output, and improve R&D efficiency. It further leads to the negative relationship between Power Distance and R&D Human Resources Scale.

Second, the Legal Protection of Intellectual Property Rights positively correlates with R&D Human Resources Scale. This result indicates that the loose legal environment of IPR is not conducive to increasing the number of R&D personnel. Strengthening the crackdown and containment of IPR infringement have provided legal protection for the vital interests of R&D personnel. It also discourages infringement from technological spillovers. R&D personnel will be more cautious about decisions such as job hopping. As a result, the technology spillover is reduced, and the R&D human resources scale will be more significant and stable.

Third, there is an interaction between Power Distance and Legal Protection of IPR, which can moderate relationship between Power Distance and R&D Human Resources Scale. On the one hand, in provinces with a large power distance, the negative impact of local IPR infringement severity on R&D human resources scale will be weakened. While in provinces with low levels of power distance, the negative impact of IPR infringement severity may be more severe. On the other hand, weak IPR punishment can significantly weaken the negative impact of power distance on the R&D human resources scale.

Fourth, weak Legal Protection of IPR may enhance the positive correlation between Power Distance and R&D Efficiency. In other words, in provinces with weak IPR punishment and deterrence, large power distance may significantly increase the per capita patent output of R&D personnel. This empirical result also reflects that Chinese enterprises may still be in the stage of pursuing patent quantity. However, these patents may not be technical.

It will not bring technological contribution to public social interests or economic benefits, and even hinder technological progress.

4.2. Implications

First, enterprises should recognize their power cultural environment and its influence. They should also grasp the extent to which employees accept the unequal power distribution and then adjust their power structure to maintain the power gap at the optimal level. On the one hand, the power gap should be controlled. Enterprises could create a flat management structure and reduce the power gap between superiors and subordinates. To be specific, they should create an innovative environment that is people-oriented, fully empowered, and self-governing. The key is to ensure R&D personnel, especially core personnel, have independent rights and independent research space. It should focus on whether the evaluation of R&D staff's creative value is reasonable and whether the ownership and income distribution of the IPR is fair. At the same time, enterprises should allow for different points of view and encourage brainstorming and the development of creative ideas. In order to retain talents to meet the needs of R&D human resources and establish a creative and loyal R&D team, enterprises should make innovative ideas and results more flexible and diverse, improving the job satisfaction and loyalty of R&D personnel. On the other hand, a reasonable power distance should be maintained. This is done to reduce management and communication costs, improve R&D staff execution, and remove unnecessary obstacles to meet work requirements and achieve innovative results. This way, the R&D human resources scale can be ensured to maintain the optimal level. The creative ability of R&D personnel can be continuously stimulated. Moreover, it can strengthen the execution efficiency of R&D personnel and accelerate the speed of innovation output.

The second is to improve the IPR law and use the interaction between power distance and IPR law. It is necessary to strengthen the legal protection of IPR and deterrence against IPR infringements, which involve the disclosure of trade secrets and violation of non-competition agreements. Protecting the rights and interests of patent owners and increasing the infringement cost of R&D staff leaving at will can effectively reduce the turnover rate of R&D personnel to improve the R&D human resource reserve and stability. It is also necessary to properly adjust the protection of IPR by law, reducing the outflow of R&D personnel to non-R&D fields and attracting the inflow of R&D personnel to R&D departments. R&D expenditure and R&D personnel input would be maintained in an appropriate proportion to achieve continuous innovation. In provinces with small power distance, more attention should be paid to improving the protection of IPR to reduce the negative impact on the R&D human resources. In provinces with large power distance, appropriate relaxation of the punishment of IPR can alleviate the adverse impact on the input of R&D human resources.

Third, enterprises should enhance the quality of R&D output by improving R&D efficiency. They should make the optimal arrangement in the strategic choice of pursuing patent quantity and guaranteeing patent quality. This requires ensuring that the input of human, material and financial resources can produce enough innovative results and paying attention to the product conversion rate and industrialization rate of innovation achievements. The requirement for R&D personnel efficiency should also be reflected in the quality of technological achievements rather than the quantity. In addition, the strategic focus of IPR law construction needs to change from "paying attention to protection" to "paying equal attention to protection and application." Innovation and practicability should be taken into account in formulating patent licensing standards. Reasonably set the definition and punishment standard of counterfeiting patents and patent infringement, granting patents to meet a high standard for practical use and technical contribution. The basic needs of enterprises to protect innovation results can also be satisfied to promote the sustainability of R&D human input willingness.

References

Álvarez-Gallego, I., & Pucheta-Martínez, M. C. (2021). Hofstede's cultural dimensions and R&D intensity as an innovation strategy: A view from different institutional contexts. *Eurasian Business Review*, *11*(2), 191-220. https://doi.org/10.1007/s40821-020-00168-4

Ambos, B., & Schlegelmilch, B. B. (2008). Innovation in multinational firms: Does cultural fit enhance performance? *Management International Review*, *48*(1), 189-206.

Ángeles, L.-C. M., Piñeiro-Chousa, J., Quiñoá-Piñeiro, L., & Santos-Rodrigues, H. (2021). How can cultural values and entrepreneurship lead to the consideration of innovation-oriented or non-innovation-oriented countries? *Sustainability*, *13*(8), 4257. https://doi.org/10.3390/su13084257

Chen, X. (2017). Who is the real innovator: Executive or core employee?——Evidence from the relationship between human capital incentive system and firm innovation. *Finance & Trade Economics*, *38*(12), 127-144.

Dai, J., Wang, L., & Huang, S. (2020). Does culture have an effect on the way of enterprises' intellectual property protection?—an empirical study based on the pantent tendency of Chinese listed companies. *Jianghan Tribune*, *503*(5), 16-29.

Das, R. (2021). Followership practices as determinants of national innovativeness: A study across 56 cultures. *Leadership & Organization Development Journal*, *42*(8), 1282-1294. https://doi.org/10.1108/lodj-05-2021-0240

Fang, Y., & Zhao, Y. (2011). Looking for instruments for institutions: Estimating the impact of property rights protection on Chinese economic performance. *Economic Research Journal*, *46*(5), 138-148.

Fang, Z., & Fu, Y. (2012). Intellectual property protection, human capital and R&D level of foreign firms—a test of constraints basing on intellectual property protection and labor mobility. *Economist*, *09*, 13-21.

Hall, B., Helmers, C., Rogers, M., & Sena, V. (2014). The choice between formal and informal intellectual property: A review. *Journal of Economic Literature*, *52*(2), 375-423. https://doi.org/10.1257/jel.52.2.375

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: SAGE Publications, Inc.

Holgersson, M. (2013). Patent management in entrepreneurial SMEs: A literature review and an empirical study of innovation appropriation, patent propensity, and motives. *R&d Management*, *43*(1), 21-36. https://doi.org/10.1111/j.1467-9310.2012.00700.x

House, R. J., Hanges, P. J., & Javidan, M. (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. London: SAGE Publications, International Educational and Professional Publisher.

Hsiung, H. H., & Tsai, W. C. (2017). The joint moderating effects of activated negative moods and group voice climate on the relationship between power distance orientation and employee voice behavior. *Applied Psychology*, *66*(3), 487-514.

Jing, X., Tang, B. Y., & Yan, H. (2011). *System analysis and model construction of innovative culture*. Paper presented at the 2011 International Conference on Management and Service Science, IEEE.

Ke, D., & Li, L. (2020). Managerial power and R&D investment intensity of enterprise: The inhibitory effect of legal environment. *Science Research Management*, *41*(1), 244-253.

Khatri, N. (2009). Consequences of power distance oritentation in organizations. *The Journal of Business Perspective*, *13*(1), 1-9.

Kim, J. Y., Steensma, H. K., & Heidl, R. A. (2021). Clustering and connectedness: How inventor network configurations within incumbent firms influence their assimilation and absorption of new venture technologies. *Academy of Management Journal*, *64*(5), 1527-1552. https://doi.org/10.5465/amj.2018.0225

Li, S., Xu, M., & Lin, Z. (2021). Research on the impact of international knowledge spillovers on the innovation performance of high-tech industries under the effection of R&D human capital. *Chinese Journal of Management*, *9*, 1354-1362.

Lian, H., Ferris, D. L., & Brown, D. J. (2012). Does power distance exacerbate or mitigate the effects of abusive supervision? It depends on the outcome. *Journal of Applied Psychology*, *97*(1), 107-123.

Liang, L., & Cao, Q. (2010). On the relationship between the amount and change of R&D staff and R&D expense of enterprises——empirical evidence from the domestic listed companies. *R&D Management*, *22*(01), 104-111.

Lin, X. (2007). A Research on the cultural ecology of Chinese entrepreneur's growth. *Journal of Renmin University of China*, *05*, 85-90.

Long, X. (2012). The research of knowledge employees' immaterial motivation mechanism and innovation performance. Chinese Doctoral Dissertations Full-text Database.

Luo, S., Wang, J., & Tong, D. (2020). Does power distance necessarily hinder individual innovation? A moderated-mediation model. *Sustainability 12*(6), 2526-2526. https://doi.org/10.3390/su12062526

Ma, B., & Yu, D. (2021). Research on the influence of R&D human resources on innovation capability—Empirical research on GEM-listed enterprises of China. *Managerial and Decision Economics*, *42*(3), 751-761. https://doi.org/10.1002/mde.3270

Nakata, C., & Sivakumar, K. (1996). National culture and new product development: An integrative review. *The Journal of Marketing*, *60*(1), 61-72.

Narjess, B., Chkir, I., Saadi, S., & Zhu, H. (2021). Does national culture affect corporate innovation? International evidence. *Journal of Corporate Finance*, *66*, 101847.

Ng, K.-Y., Koh, C., Ang, S., Kennedy, J. C., & Chan, K.-Y. (2011). Rating leniency and halo in multisource feedback ratings: Testing cultural assumptions of power distance and individualism-collectivism. *Journal of Applied Psychology*, *96*(5), 1033. https://doi.org/10.1037/a0023368

Peng, Z. (2006). A review of Western research on human capital flow and technology spillover. *Economic Review*, *04*, 77-79.

Price, J. L. (2001). Reflections on the determinants of voluntary turnover. *International Journal of Manpower*, *22*(7), 600–624.

Shen, H., & Gu, N. (2016). Traditional culture, family size and social service spending of residents. *Finance and Trade Research*, *27*(6), 1-10.

Shi, Y., & Gu, Q. (2013). Intellectual property protection, heterogeneous firms and innovation: Evidence from China's manufacturing enterprises. *Journal of Financial Research*, *8*, 136-149.

Stiglitz, J. E. (2014). Intellectual property rights, the pool of knowledge, and innovation. Retrieved from NBER Working Pa-pers No. 20014, National Bureau of Economic Research:

Su, Y., Yu, Y., & Luo, X. (2017). Pricing for innovative product based on process uncertain. *Management of Innovation and Entrepreneurship*, *02*, 112-122.

Tian, X., & Wang, J. (2018). Research on the disequilibrium development of output of regional innovation based on R&D personnel. *Sustainability*, *10*(8), 2708. https://doi.org/10.3390/su10082708

Torrisi, S., Gambardella, A., Giuri, P., Harhoff, D., Hoisl, K., & Mariani, M. (2016). Used, blocking and sleeping patents: Empirical evidence from a large-scale inventor survey. *Research Policy*, *45*(7), 1374-1385. https://doi.org/10.1016/j.respol.2016.03.021

Walsh, J. P., Lee, Y.-N., & Jung, T. (2016). Win, lose or draw? The fate of patented inventions. *Research Policy*, *45*(7), 1362-1373. https://doi.org/10.1016/j.respol.2016.03.020

Wang, H., Liu, H., & Dong, J. (2022). Research on the selection of state-owned syndication partner by cross-border vc from the perspective of culture. *Management Review*, *34*(7), 17-32.

Wang, X., Hu, L., & Fan, G. (2021). *Marketization index of China's provinces: Neri report 2021*. Beijing: Social Sci-ences Academic Press (China).

Wu, C., & Tang, D. (2016). Intellectual property rights enforcement, corporate innovation and operating performance: Evidence from China's listed companies. *Economic Research Journal*, *51*(11), 125-139.

Xiao, Z., & Fan, J. (2019). Research on the impact of scientific and technological human resources input on regional innovation performance. *Studies in Science of Science*, *37*(11), 1944-1954.

Xiao, Z., & Li, Y. (2023). Industry-university-research collaborative innovation, intellectual property protection and technological innovation performance—an empirical analysis based on dynamic panel thresh-old mechanism. *Management Review*, *35*(6), 72-81.

Xu, H., Van de Vliert, E., & Van der Vegt, G. (2005). Breaking the silence culture: Stimulation of participation and employee opinion withholding cross-nationally. *Management and Organization Review*, *1*(3), 459-482. https://doi.org/10.1111/j.1740-8784.2005.00023.x

Zhang, Y., & You, D. (2014). The empirical study about innovative intention of staff in the science and technology enterprises: Based on the theory of planned behavior. *Nankai Business Review*, *17*(4), 110-119.

Zhao, Q., Zhao, W., Lu, D., & Zhao, Q. (2018). Lottery and enterprise innovation: A research based on the view of culture. *Finance & Trade Economics*, *39*(9), 122-140.

Zhao, X., Li, H., & Rauch, A. (2012). The differences among countries (regions) in entrepreneurial activity: The interaction effect between culture and the level of a country (regions)'s economic growth. *Management World*, *8*, 78-90.

Zhao, X., Li, H., & Sun, C. (2015). The regional cultural map in China: Is it "the great unification" or "the diversification". *Management World*, *2*, 101-119.