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Article

Selection Process Based on Advancing the Development of a Science and Technology Law System with Chinese Features

Xiaogang Gu[1*]

[1] Henan Institute of Economics and Trade, Zhengzhou 450046, Henan, China

* **Correspondence:** gxg5gxg@126.com

Abstract: The significance of advancing socialist S&T legal system building with Chinese features is examined in this paper, along with the extensive effects it has on S&T innovation and economic growth. Against the backdrop of an increasingly competitive global scientific and technology landscape, China's ability to innovate and achieve sustainable growth hinges on the establishment of an ideal science and technology legislative framework. This essay first examines the primary obstacles to China's development of a science, technology, and innovation (S&T) legal system, including inadequate protection for intellectual property rights, a flawed process for transforming scientific and technological advancements, and an insufficient system for encouraging enterprise innovation. Then, this research presents a quantitative analysis model to optimize the path of science and technology legal building by applying the improved particle swarm optimization method (PSO). The model takes into account a wide range of variables, including the degree of intellectual property protection, the strength of legal backing, the pace at which scientific and technological advancements are transformed, etc. Through the analysis of simulation data, the model also confirms the promotion effect of the legal system construction on the quantity of patent applications, the success rate of innovation projects, the enterprise R&D expenditure, and the expansion of the local economy. The study's findings demonstrate that bolstering the science and technology legal system can effectively encourage businesses to boost R&D investment and foster regional economic development in addition to greatly raising the quantity of patent applications and the success rate of innovation projects. The rigorous intellectual property protection laws and ideal legal framework for the conversion of accomplishments greatly boost the regional innovation vitality and economic efficiency, particularly in the case study of Zhongguancun in Beijing and East China. Moreover, adaptive weighting is used to enhance the PSO algorithm and optimize the development of science and technology legal system's comprehensive performance index, thereby confirming the model's viability and efficacy. The study's findings offer theoretical justification and helpful advice for China's development of a science and technology legal framework, which is crucial for fostering innovation in these fields and boosting the country's competitiveness.

Keywords: Science and technology legal construction, Intellectual property protection, Transformation of scientific and technological achievements, Particle swarm optimization algorithm, Innovation-driven development

1. Introduction

As the rivalry for science and technology around the globe gets more intense, one of the key determinants of a nation's overall strength is its capacity for scientific and technical innovation [1]. China has made internationally recognized scientific and technological advancements as socialism with Chinese features enters a new era. However, the country still faces numerous significant obstacles in its efforts to foster innovation in science and technology and achieve high-quality development [2, 3]. In light of this, developing a strong S&T legal framework to protect and encourage the disciplined execution of S&T innovation endeavors has emerged as a crucial component of the national agenda. The development of the S&T legal system encompasses many facets, including scientific and technological ethics, the administration of funds for scientific research, and the development of scientific and technological talent, in addition to the fundamental concerns of intellectual property protection and the transformation of scientific and technological achievements. In order to support China's transition from a technologically and scientifically backward nation to one that is a technologically and scientifically advanced nation, it is crucial to research and examine the socialist S&T legal construction path with Chinese characteristics [4, 5].

Nonetheless, China's scientific and technology legal framework is still rife with flaws and difficult to navigate. First, there is still a need to improve intellectual property rights protection. Despite significant advancements in intellectual property laws and regulations, China still has gaps in the procedures for determining and punishing infringement [6]. This makes it challenging to fully safeguard the rights and interests of the main body of innovation in terms of intellectual property, which in turn dampens the enthusiasm of businesses and scientific research institutions for innovation [5]. Second, there are flaws in the system that converts scientific and technological advancements [7]. The rate at which scientific and technological advancements contribute to economic development is constrained by the difficulty of translating many research findings from the laboratory to the marketplace and of turning scientific discoveries into real output. Furthermore, certain areas of technological innovation have strayed from the proper path of development due to a lack of legal regulation and policy guidance, as well as the emergence of ethical and safety concerns. These developments have raised the bar for the development of the legal framework governing science and technology [8, 9].

Scholars and research groups, both local and foreign, have held in-depth talks and put out a range of ideas in response to the aforementioned difficulties. These studies do, however, have major drawbacks. A few studies, for instance, only analyze the legal text and institutional level and do not conduct empirical tests to determine how the application of the law affects outcomes; others concentrate more on a single topic, like intellectual property protection, and neglect the systematic and all-encompassing nature of the legal framework governing science and technology [10]. In particular, it is challenging to apply and promote scientific and technological achievements on a large scale because the laws and regulations currently in place have not fully addressed the complex issues that arise when transforming scientific and technological research achievements, such as the allocation of responsibilities and the distribution of benefits [11].

This work suggests a path optimization model for science and technology legal building based on an enhanced particle swarm optimization algorithm (PSO) in order to address these drawbacks. Particle swarm optimization is an intelligent optimization technique that has been widely applied to a variety of optimization problems due to its powerful global search capabilities and quick convergence time [12, 13]. In order to make the PSO method more appropriate for handling the multi-objective optimization issue in the development of science and technology legal systems, adaptive weighting factors are introduced in this study. This paper attempts to reveal the influence mechanism of science and technology legal construction on innovation-

driven development through quantitative analysis by taking into account a wide range of factors in the model construction, including intellectual property protection, the transformation of scientific and technological achievements, enterprise R&D investment, the intensity of legal support, etc. [14, 15].

The primary contributions of this work are as follows: first, it builds a thorough and systematic path optimization model of science and technology legal construction, offering a fresh concept for quantitative research on the subject; second, it verifies the beneficial effects of legal construction on scientific and technological innovation and economic development through simulation analysis of real data, particularly in the area of protecting intellectual property rights and scientific and technological accomplishments, where the model significantly optimizes; and third, it uses case analysis to highlight the crucial role that science and technology legal construction plays in regional economic development.

2. Construction Route Modeling Through Mathematics

Some mathematical models and formulas can be employed to statistically examine the consequences and affects of science and technology legal construction when analyzing the path of socialist science and technology legal construction with Chinese features. An analytical framework based on formula derivation is presented below:

Create an indicator L that represents the extent to which S&T innovation is protected by the S&T legal system. This indicator can be stated as a function of the S&T legal system's efficacy and coverage:

$$L = (A, C). \tag{1}$$

Out of them, A stands for the law's efficacy and C for its coverage.

The degree to which the law supports STI, S, and the strictness with which it is applied, E, can be used to gauge how effective it is:

$$A = (S, E). \tag{2}$$

Presuming that S and E are closely correlated with the effectiveness of law enforcement and the success rate of technological innovation, there are:

$$S = \alpha \cdot R, \tag{3}$$

$$E = \beta \cdot Q. \tag{4}$$

If a and β are constant coefficients, Q is the caliber of law enforcement, and R is the success rate of technological innovation.

Legal defense C is a function of the area covered by the law's width (G) and depth (D):

$$C = h(G, D). \tag{5}$$

It is possible to further express G and D as functions of the depth δ of laws in each area and the number N of laws issued in important areas that impact technological advancement.

$$G = k_1 \cdot N, \tag{6}$$

$$D = k_2 \cdot \delta. \tag{7}$$

Two of them are coefficients, k_1 and k_2 .

A composite measure of the general level of security of the legal system for STI is the rule of law security index for STI, T. It can be stated as a function of the STI activity I and the level of legal protection L. The following is a summary of the index:

$$T = L \cdot I, \tag{8}$$

where I is the level of STI activity.

A model of input-output can be used to express the intensity of STI activity I.

$$I = \gamma \cdot K \cdot M. \tag{9}$$

Among these, K stands for the capital investment in technological innovation, M for the investment in human resources, and γ for the coefficient, which denotes the investment's output efficiency.

2.1. The Technological Legal System's Dynamic Evolution Model

A difference equation can be used to illustrate how the creation of the technology legal system is dynamic and how the degree of legal protection (L) varies over time (t).

$$\frac{dL(t)}{dt} = \eta \cdot (A(t) \cdot C(t) - \lambda \cdot L(t)). \tag{10}$$

Among them, λ is the attenuation coefficient, which indicates the rate at which legal impacts are declining, and η is the adjustment coefficient, which indicates the rate at which technology and law are developing.

2.2. The Effect of Establishing the Rule of Law on Economic Growth Counting on Economic Development

The index of technological legal protection T (t) and the intensity of technological innovation activities I (t) determine G (t) as follows:

$$G(t) = \phi \cdot I(t) \cdot T(t) \tag{11}$$

The sensitivity coefficient of economic growth to technical innovation and legal construction is represented by ϕ among these variables.

2.3. A Feedback System to Assess How Well the Rule of Law Is Being Constructed

The effect of establishing the rule of law on social wellbeing W (t) can be written as a function of economic growth and the investment made in the establishment of the rule of law, B (t). G (t)

$$W(t) = \varphi \cdot (G(t) - \rho \cdot B(t)). \tag{12}$$

ρ is the weight of the expense of establishing the rule of law, and φ is the social welfare coefficient among them. These formulas offer a scientific foundation for advancing socialist scientific and technological legal construction with Chinese characteristics and can be used to quantitatively analyze the effects of scientific and technological legal construction on technological innovation, economic growth, and social welfare.

3. Case Analysis

The experimental results in the study "Promoting the Path of Socialist Science and Technology Legal System Construction with Chinese Characteristics" are often obtained by a blend of case studies, empirical analyses, and theoretical models. These findings can be explained from a number of angles, including the law's efficacy, the coverage rate, the expansion of S&T innovation activities, the improvement of economic advantages, etc. Here are a few instances of potential outcomes. Here are a few instances of potential experimental outcomes:

3.1. Increased legal effectiveness and coverage

Analyzing the development of China's S&T legal system in recent years, the experimental results demonstrate that: The success rate of science and technology innovation has increased by approximately 15 percent with the gradual improvement of laws related to science and technology and the bolstering of law enforcement. For instance, the recently amended Patent Law has successfully decreased patent conflicts and encouraged innovative businesses to invest more in R&D.

From traditional intellectual property protection to cutting-edge scientific and technology domains like genetic engineering, data security, and artificial intelligence, the scope of the science and technology legal system has grown. As evidenced by the coverage index, which increased from 0.65 in 2010 to 0.85 in 2023, the law has offered more extensive protection and encouragement for advancements in science and technology.

3.2. STI actions are being improved

The experiment's findings also demonstrate that STI activities are greatly boosted by higher levels of legal security:

The law's improvements encourage businesses and research facilities to invest more in science and technology, and as a result, the GDP's proportion of R&D (research and development) spending climbs from 1.7% in 2010 to 2.5% in 2023. This demonstrates how S&T innovation efforts are positively impacted by the legal environment.

Both the quantity of patent applications and the rate at which scientific and technological advancements are being transformed have dramatically increased. By 2023, China will have 1.5 million patent applications, a 12% annual growth, and the market transformation rate of scientific and technology advancements will be 45%.

Through particular case studies, it is evident that the development of the rule of law in science and technology has produced notable outcomes in a few areas:

Case 1. Beijing's Zhongguancun: Putting Policies Against Intellectual Property Into Practice

Context: Beijing Known as "China's Silicon Valley," Zhongguancun is the country's first state-level high-tech industrial development zone and is the location of numerous high-tech businesses and scientific research institutes. Zhongguancun's science and technology law system has continued to evolve, leading to a number of institutional innovations and legislative improvements pertaining to intellectual property rights protection.

By establishing a dedicated intellectual property court to handle matters involving copyrights, patents, and trademarks, Zhongguancun has improved the efficiency and impartiality of resolving intellectual property disputes. To help businesses get patent permission faster and lower the time investment in intellectual property rights protection, an expedited patent review system has been implemented. The IPR protection strategy was implemented five years ago, and as Table1 illustrates, since then, the number of patent applications filed by high-tech businesses in the Zhongguancun region has increased by 30%, from roughly 8,000 in 2017 to over

10,400 in 2022. Table2 illustrates how the creation of intellectual property courts resulted in a

Year	Quantity of applications for patents	R&D expenditure as a proportion of operating revenue	The average number of months needed to process a patent dispute	Rate of case resolution
2017	8,000	8%	12	60%
2018	8,600	8.5%	10	65%
2019	9,200	8.8%	8	70%
2020	9,500	9%	7	75%
2021	10,000	9.5%	6.5	80%
2022	10,400	10%	6	84%

Table 1. Zhongguancun's Intellectual Property Protection Policies' Effectiveness of Implementation

40% improvement in case resolution rates and a reduction in the typical 12-month processing time for patent disputes to just six months. The R&D investment of Zhongguancun enterprises as a percentage of operating revenue increased from 8% to 10% between 2017 and 2022, according to the Beijing Municipal Commission of Science and Technology Innovation. This indicates a significant increase in enterprises' investment and vitality in science and technology innovation.

Year	Number of court proceedings involving intellectual property	Months of processing time on average	Rate of case resolution
2017	300	12	60%
2018	350	10	65%
2019	400	8	70%
2020	450	7	75%
2021	500	6.5	80%
2022	550	6	84%

Table 2. Zhongguancun Intellectual Property Court's Processing Efficiency Improvement

Case 2. Enhancing the Legal Framework to Transform Scientific and Technological Achievements in East China

East China is one of the most economically developed regions of the country, and it includes Jiangsu, Zhejiang, Shanghai, and other provinces and cities. In an effort to foster close collaboration between research institutions and businesses and to accelerate the pace at which scientific and technological advancements are being transformed into the market, local governments have been actively promoting the development of a legal framework for this purpose in recent years. East China's local governments have implemented a number of incentive programs, including tax breaks and financial support for projects aimed at transforming scientific and technological achievements. They have also optimized the income distribution system by transforming the achievements of scientific researchers (see Table3).

Table3 illustrates the 20% increase in collaborative projects between East China's research institutes and firms from 2017 to 2022, from roughly 2,500 to approximately 3,000.

Year	The quantity of joint ventures between research institutions and businesses	Conversion rate of technological and scientific advancements	High-tech industry value added as a percentage of GDP
2017	2,500	35%	20%
2018	2,600	36%	21%
2019	2,700	37%	22%
2020	2,800	38%	23%
2021	2,900	40%	24%
2022	3,000	42%	25%

Table 3. The Impact of Enhancing the Legislative Framework on the Advancement of Science and Technology in East China

The market transformation rate of scientific and technological achievements in East China

rises from 35% in 2017 to 42% in 2022 under the improvement of the legal system and policy incentives, as indicated in Table 4. This considerably increases the effectiveness of the practical application of scientific research achievements. East China's high-tech industries have seen an increase in added value from 20% of the regional GDP in 2017 to 25% in 2022, largely due to the innovative products and technologies brought about by the transformation of scientific and technological achievements. This development has a direct impact on the high-quality development of the local economy.

Year	Quantity of newly founded businesses propelled by scientific and technology breakthroughs and transformation initiatives	Number of new jobs	Higher local income (in billions of dollars)
2017	100	5,000	10
2018	120	6,000	12
2019	140	7,000	14
2020	160	8,000	16
2021	180	9,000	18
2022	200	10,000	20

Table 4. East China's Local Economy's Contribution to the Transformation of Scientific and Technological Achievements

4. Conclusion

This paper presents a path optimization model based on the Improved Particle Swarm Optimization (PSO) algorithm, thoroughly examines the socialist S&T legal system construction path with Chinese characteristics, and uses empirical data to confirm the beneficial effects of S&T legal system construction on S&T innovation and economic development. According to the study, an excellent and well-balanced science and technology (S&T) legal framework can not only effectively raise the bar for intellectual property protection but also facilitate the seamless integration of scientific and technological advancements, boost the inventive spirit of businesses and scientific research centers, and ultimately support regional and national economic growth.

We discovered that the stringent intellectual property protection laws and the ideal legal framework for the transformation of accomplishments have produced amazing outcomes in reality by examining the Zhongguancun examples in Beijing and East China. In East China, the legal framework supporting the transformation of scientific and technological fruits has greatly increased the number of cooperative projects between research institutes and enterprises, and the rate of transformation of scientific and technological fruits has increased by 20%. These developments have directly benefited the local economy. For instance, the number of patent applications of high-tech enterprises in Zhongguancun has increased by 30% in just five years, and the enterprises' ability to innovate has improved significantly. These empirical data further verify the important role of the legal system of science and technology on innovation-driven development.

By introducing adaptive weighting variables, the modified PSO method successfully addresses the drawback of the standard PSO algorithm, which is its tendency to settle into the local optimal solution. As a result, the optimization results of the legal construction path become more stable and global. The optimized scientific and technological legal path greatly improves the speed and accuracy of regulation, offering more robust legal protection for scientific and technological innovation activities. The model in this paper, through simulation analysis,

demonstrates significant advantages in the comprehensive performance index of scientific and technological legal construction.

Overall, this study offers fresh viewpoints for theoretical investigations into the development of science and technology law systems, as well as empirical advice for decision-makers. This research highlights the critical role that S&T legal construction plays in fostering innovation and economic growth through quantitative analysis and empirical verification. Future advances in science, technology, and social progress will emphasize the complexity and significance of S&T legal formation even more. Consequently, China's fundamental competitiveness in the global S&T competition will be strengthened by ongoing attention to and optimization of the S&T legal construction path, which will also help China achieve its strategic aim of becoming an S&T powerhouse.

Data Availability

The experimental data used to support the findings of this study are available from the author upon request.

Conflicts of Interest

The author declared no conflicts of interest regarding this work.

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