

**The Guarantee of the Rule of Law in the Development of Scientific and Technological Innovation:
American Experience and Guangdong-Hong Kong-Macau Greater Bay Area Road**

Zhengmin Xu*^a, Pengwei Zhan^{1, b}

* Corresponding author, Master Degree Candidate of Law School, Guangdong University of Foreign Studies,
Guangzhou, China

¹ Master Degree Candidate of Law School, Guangdong University of Foreign Studies, Guangzhou, China

^a370101348@qq.com, ^b1552393183@qq.com

Keywords: The United States; the development of science and technology; Guangdong-Hong Kong-Macau Greater Bay Area; experience of the rule of law

Abstract. Scientific and technological innovation is an important pillar force for the development of Guangdong-Hong Kong-Macau Greater Bay Area (GBA). <The development plan for Guangdong-Hong Kong-Macau Greater Bay Area> emphasizes that the development of science and technology should be raised to the guiding principle position of the development of GBA. However, GBA's scientific and technological development is facing the bottleneck of the rule of law about "one country, two systems", and there is an urgent need to seek a breakthrough path. As a powerful country in science and technology of the world, the experience of the rule of law in the development of science and technology of the United States can be used for reference dialectically. On the basic premise of combining it with our current national conditions, GBA can continue to work together to build an international first-class scientific and technological innovation bay area by attaching importance to the role of the market, strengthening interregional cooperation, establishing the interregional legal system of GBA and the cross-border scientific and technological dispute-resolving system.

1. Introduction

The development plan for Guangdong-Hong Kong-Macau Greater Bay Area> points out that it is necessary to build Guangdong-Hong Kong-Macau Greater Bay Area (hereinafter referred to as GBA) into an international scientific and technological innovation center. However, due to the background of the rule of law of "one country, two systems", there have many conflicts between the scientific and technological innovation policies and relevant laws and regulations in Guangdong, Hong Kong and Macau. Therefore, the weak foundation of the rule of law in the development of science and technology, the uncoordinated relationship between the government and the market, the disjunction existed between the development of industry and researches in university and the predicament of transforming scientific and technological achievements are the realistic bottlenecks faced by the development of GBA. Compared with the GBA, the United States, as the most developed country in the world, has maintained a leading position in technological innovation and scientific and technological research and development, and has formed an efficient and developed innovation system. The

New York Bay area and the San Francisco Bay area in the United States are famous in the world, and its innovation and development of science and technology has brought further developing opportunities for the economic prosperity of the United States. As American Robert Cook said in the waist of his book: “without the rule of law, there is no future. Without innovation, the economy cannot thrive. Without trust, innovation cannot flourish. Without the rule of law, trust cannot grow. The rule of law can build a Solomon bond which symbolizes trust and eternity between the state and the people, between innovators and investors.” [1] The United States, as the strongest country in science and technology of the world, its experience in the development of scientific and technological innovation plays an important role in building China into a scientific and technological power, and it is also an important frame of reference for the development of scientific and technological innovation in China. Hence, the GBA can learn from the experience of the United States in their development of scientific and technological innovation, actively solve the difficulties encountered in building an international scientific and technological innovation center, and finally open up a path to achieve the goal of becoming a strong scientific and technological country.

2. The History and Changes of the Development of Scientific and Technological Innovation in the United States

Although the development of science and technology of the United States has so far been the most powerful country in the world, its developed path has not been smooth and easy all the time. America also has gone through a tortuous history before it reached its present stable position. In the system of scientific and technological innovation, the United States has well combined the government, the market and the scientific research forces of colleges and universities together, so that these three forces have formed a close relationship.[2] The state did not intervene too much in the development of science and technology before the 19th century, but with the establishment and development of various universities, scientific research is gradually and closely related to the development of the country. The scientific and technological development after founding the United States has a greatly close connection with the establishment of the Ivy League school and its scientific research and personnel training. [3] With the intervention of science and technology, the western development of the United States has made unprecedented development and a large number of engineers have emerged during this period. From the middle and late 19th century to the beginning of the second World War, the outbreak of the Civil War has continuously increased the desire for science and technology in the United States. The government began to seek for the improvement of science and technology by initiatively intervening it, in order to meet the demands of the war. After the promulgation of the Morrill Act and the Hutch Act, the United States Government began to further participate in those activities about scientific and technological innovation. After promulgating the Morrill Act, the principle of “common national defense and national welfare” in the interpretation of the US Constitution has become the constitutional basis for the US government to intervene in various scientific and technological innovation activities. The Constitution of the United States implies that the federal government should strongly support the development of science. As a result, the federal government has always regarded scientific innovation as an important means of promoting

national and social development. Even in the period of second World War, the United States federal government still choosed to maintain this policy and continue this until today, which has strongly supported the rapid development of science and technology of the United States. As Brooks said, an authoritative professor of scientific and technological policy research in the United States, “the second World War brought about permanent changes to the scientific research and development system and science policy in the United States.” [4] In 1940, President Roosevelt approved the establishment of the Defense Science Commission (NDRC), which was later expanded into the Office of Scientific Research and Development (OSRD). This Bureau has laid a solid scientific and technological foundation for the victory of the second World War and deeply influenced the formulation of American scientific and technological policy after World War II. The establishment of NDRC and OSRD marks the further deepening relationship between the government and the development of science and technology. The amazing power from science and technology in the second World War made the United States more aware of the strong power on social development, which brought by the development of science and technology After the second World War, the US government spared no efforts to support scientific and technological innovation. The government has naturally become the main supporter of science and technology, and gradually developed the country’s unique scientific and technological innovation system. As a result, the United States has established an innovation system based on the interdependence of government, science and industry, and has rapidly become the global leader of scientific and technological innovation. The growing expansion about the scale of the American innovation system not only depends on the support of the federal government’s policies, but also continues to develop and improve itself in practice, which helped the United States to win the “second World War”. The United States has pioneered many scientific fields in the world, such as landing on the moon and decrypting the human genome. [5] Nevertheless, we cannot deny that the role of the Government is not everything. The phenomenon of “government failure” in the development of scientific and technological innovation in the United States has gradually become prominent in its later development. To a certain extent, this has hindered scientific and technological innovation and the further development of the economy. Thus, the United States has also begun to explore that how to put the government in the right position in the development of science and technology.

3. The Experience of Rule of Law in the Development of Scientific and Technological Innovation in the United States

The continuous accumulation of science and technology in the early days has laid a solid foundation for the development of the United States. The Bay area is nothing more than a concentrated form of economic development. Through the Bay area, the United States has further concentrated science and technology to make the distribution and cooperation between urban science and technology industry and other industries more reasonable and scientific. In the process of scientific and technological development, the United States has gradually corrected the status of government being an intervenor and perfected the government supporting mechanism. From the legislative point of view, the Bayh-Dole Act and a series of bills effectively resolved the bottleneck of the development of science and technology in the Bay area of the United States, and laid the legal

foundation for the development of science and technology in the Bay area. At the same time, in the process of encouraging social forces to widely participate in the development of scientific and technological innovation, the United States has gradually improved the rights and interests protecting mechanism for social participation in scientific and technological development. In addition, the United States pays more attentions on the establishment of intellectual property rights protecting mechanism. in the aspect of settling disputes. Through the above-mentioned the rule of law, the level of scientific and technological development in the United States has reached an unprecedented height.

3.1 Perfecting the legislation of science and technology and promoting the innovative development

Although the US government has spared no efforts to participate in innovation and technology activities, it seems that government's intervention will never have any side effects and all policies can perfectly promote the development of scientific and technological innovation. However, the excessive intervention of the government has led to the separation of industry, academy and research. A large number of scientific research achievements cannot be transformed into productive forces, the development of scientific and technological innovation is facing a bottleneck. It ultimately leads to the decline of the level of national development, resulting in the "domino effect" in the economic recession of the United States. In response to this phenomenon, senators Bayer and Doyle proposed a reform plan to Congress (the Bayh-Dole Act), which was formally passed by Congress on December 12, 1980. The promulgation and implementation of the bill made the United States form a situation in which the government and the market jointly helped to transform scientific research achievements. Moreover, the bill also promoted the integration of production, academy and research, devolved patents to universities and scientific research institutions, promoted the transformation of patent achievements to the market, ultimately prompting the rate of entrepreneurship and employment through technological innovation. [6] The Act was subsequently being amended to include Section 35 of the United States Code. The Bayh-Dole Act has clearly contributed to the further development of the American economy. The United States authorized relevant university research institutions, non-profit organizations and small and medium-sized enterprises to apply for scientific research to the federal government by law, and allowed them to enjoy independent rights of scientific research results. That is to say, patents can be transferred commercially and automatically. This is a good way for enterprises in scientific research institutions to actively integrate scientific and technological achievements into the market and to promote the development of the actual demand of the market. On the one hand, the number of patents in American universities and scientific research institutions were continuously increasing owing to the legislation of science and technology, and a multitude of scientific research achievements have been effectively transformed. Meanwhile, it also provided numerous employment opportunities for Americans, enhanced the development of productivity, which has brought unprecedented economic and social benefits to the United States. On the other hand, from the legal and policy level, the construction of laws and related legal systems has prompted the transformation of scientific and technological innovation achievements. Through the support of the government and the establishment of a market-oriented model of industry-university-research cooperation, the United States has encouraged the broad participation of the whole society to promote the

transformation of scientific and technological achievements. The operation of the Bayh-Dole Act and a series of related laws has not only laid a solid foundation for the rule of law and practice in the construction of the later high-tech innovation system in the San Francisco Bay area and the New York Bay area, but also effectively coordinated the contradiction between the phenomenon of “government failure” and the realistic demands of the market. More importantly, it adjusted the position of the government and the market, provided the rule of law for a series of scientific and technological innovations in the Bay area, and strengthened the status of the United States in the fields of scientific and technological innovation.

3.2 A sound mechanism for the protection of intellectual property rights

The intellectual property system in the United States has a long history. In terms of legislation, the United States has promulgated relevant laws about the protection of intellectual property rights, such as the Patent Law, the Internet Act and the Software Patent and so on. For example, the ownership system of intellectual property rights was clarified through legislation. On the one hand, these legislations have formulated civil and commercial liability when intellectual property rights once meets with infringement. On the other hand, the United States has established a unique system of criminal protection of intellectual property rights, constantly strengthening the criminal punishment on intellectual property crimes. For instance, it is stipulated in the copyright Law and the Invention Law that an individual commits a crime for infringing intellectual property rights, the minor one shall be sentenced to fixed-term imprisonment of not more than 10 years or a fine of not more than 2 million yuan, and those who are serious shall be sentenced to fixed-term imprisonment of not more than 20 years or a fine of not more than 5 million yuan. A fine of up to \$15 million is imposed on non-individuals. [7] Under the heavy penalty system, intellectual property crimes have been severely cracked down. Secondly, the United States has established a sound and complete intellectual property management system in administration. Intellectual property management in the United States can be divided into two categories. First, agencies such as the United States Patent and Trademark Office and the United States copyright Office are responsible for the enrollment, registration and publication of patents and works. Secondly, an administrative body has been established to promote the transferring of intellectual property rights. The State Technology Transfer Center, the Ministry of Commerce and other departments shall have the responsibility and obligation to assist in propagating and transferring those patented technologies throughout the country. To a great extent, the establishment of these intellectual property management organizations has given a big impetus to the transformation of scientific research achievements and broken the dilemma of “Death Valley” in the development of science and technology. Finally, as the last line of defense for safeguarding rights and interests, the multi-level judicial system provides a solid guarantee for the protection of intellectual property rights in the United States. The Federal District Court of the United States is responsible for the jurisdiction of first instance cases of intellectual property infringement, the division of the sources of intellectual property disputes, and the improvement of judicial efficiency and cases’ accuracy. In addition, the United States has especially set up a federal circuit court to hear patent cases, just in order to avoid conflicts in jurisdiction.

3.3 Perfect dispute-resolving mechanism for the development of science and technology

In addition to establishing a multi-level judicial system to protect the rights and interests of intellectual property rights, the United States has also established a sound multi-dispute resolution mechanism for intellectual property rights. Different from the general ADR model, the United States prefers to advocate the BANR (Best Alternative Negotiated Resolution) model, that is to explore the best dispute-resolving mechanism in many dispute resolution models. There are many kinds of dispute-resolving mechanisms in the United States. The ADR Act of 1998 provides for nearly ten alternative dispute-resolving mechanisms, including Mediation, Mini-trial, Early neutral evaluation and Summary Jury Trial. This provides a multi-channel solution to scientific and technological disputes in the United States. Among these methods, the BANR (the Neutral Listener Agreement) model for dealing with scientific and technological disputes is a kind of mode of mediation and listener agreement. This model is equivalent to a settlement model based on an intermediary, in which the parties submit a dispute resolution to a third party (that is, the listener), and then convey feedback to the parties on the basis of the third party's careful attention, and propose a final solution. A final agreement can be reached to promote the peaceful settlement of the dispute if the two sides agree with each other. This model not only saves the judicial resources to the maximum extent, but also avoids the conflict between the two sides and maintains the harmony and stability of the society.

3.4 Rich social forces participating in the development of science and technology

The market-oriented transformation mechanism of science and technology determines that social forces will play an important role in the development of science and technology of the United States. "Everyone Innovation" is an essential feature of American science and technology construction. First, there are many research-based universities in the United States, such as Stanford University and the Massachusetts Institute of Technology, which are world-famous research-based universities. They can cultivate stable, high-quality scientific and technological personnel for the United States. In addition to their own research, these universities encourage researchers to cooperate with enterprises to facilitate the transformation and docking of research results. Stanford University's Industrial Exchange Program, for example, encourages teachers to set up companies or work with other companies to bring research results to market. The University of Wisconsin's "Wisconsin Project" emphasizes that educational outcomes should serve society, the local economy, and science and technology. This concept has not only contributed to the successful transformation of the University of Wisconsin into a research-based university, but also played a great role in advancing the integration of scientific technology and society. [8] Second, private investment is also the main driving force for the development of science and technology of the United States except the participation of universities. Silicon Valley, for example, has substantial venture capital firms that provide operational fund for scientific research and development. These venture capital funds have almost completely replaced government funds. Supporting by a wealthy of private moneys from people, technology startups in Silicon Valley can continue with only small subsidies from the government. In this way, the enterprises in Silicon Valley have further got rid of the

institutional constraints, and provided a broader developing space and good financial support for the development of scientific research.

4. The Legal Path of Scientific and Technological Innovation and Development in GBA

Due to the differences in national conditions and developing environment, the GBA cannot completely copy the experience of the development of scientific and technological innovation of the United States. Learning from the US, we should combine the current situation and national conditions. We should focus on government's support and legislation to guide scientific and technological innovation, so as to correct the position of the government and gradually transfer to the market-led condition. At the same time, we are supposed to give full play to combine the geographical advantages of Guangdong, Hong Kong and Macao with the institutional advantages of "one country, two systems" policy for promoting the integration of science and technology.

4.1 Establishing interregional legal system of scientific and technological innovation and strengthening Interregional administrative cooperation

The development plan for Guangdong-Hong Kong-Macau Greater Bay Area points out that regional coordination is an important basis for the development of scientific and technological innovation in GBA. Consequently, it is necessary to establish the corresponding cross-regional legal systematic framework of scientific and technological innovation in GBA. The collaborative system of scientific and technological innovation in GBA can be divided into formal system, informal system and institutional implementation mechanism. For instance, deeply and further practicing the CEPA and exploring interregional rules is regarded as a new legal rule under the existing legal framework. At present, the administrative functions of Guangdong, Hong Kong and Macau are still in a state of isolation, which is not conducive to cooperation of scientific and technological innovation in the GBA. With the in-depth construction of the GBA, Guangdong, Hong Kong and Macau are more and more closely linked together in customs clearance, logistics, information flow and so on. The scientific and technological cultures of the three places are also constantly converging and colliding with each other. On the one hand, the cooperation and exchange of scientific research in colleges and universities will be closer and closer. On the other hand, the transfer of intellectual property rights and high-tech commodity trades in the market will be more and more frequent and close. However, whether in the market or in scientific research-based colleges and universities, it is necessary for us to establish a sound cross-regional administrative and cooperative system in the development of scientific and technological innovation, so as to successfully promote cooperation of scientific and technological innovation in GBA. For example, the governments of Guangdong, Hong Kong and Macau can take advantage of the interregional rules to hold regular meetings on scientific and technological innovation and developing cooperation in the GBA, to sign interregional agreements and to establish a mutually recognized mode of cooperation about scientific and technological innovation. In the jointly signed agreement, we will clarify the functions of local governments and jointly promote the development of scientific and technological cooperation in GBA. Simultaneously, establishing a unified intellectual property management organization in the Great Bay area through agreement is to assist with

the unified management of intellectual property rights in the GBA. Besides, the administrative department of technology transferring should also be set up in the intellectual property management organization to connect with universities and scientific research institutions. In this way, we can build a cooperative bridge between enterprises, scientific research institutions, universities, individuals and the government in GBA, which benefits the transformation of scientific research achievements. Enhancing the circulation and integration of innovative elements in GBA is needed by technology transferring among Guangdong, Hong Kong and Macau through technology-transferring managerial departments

4.2 Making advantage of market to accelerate the development of science and technology

The development plan for Guangdong-Hong Kong-Macau Greater Bay Area emphasizes that the construction of a market-oriented scientific and technological innovation system with deep integration of production, academy and research is an important means to prompt the development of science and technology in GBA. Public-private interaction and public-private partnership are increasingly becoming the developing trend of administrative management. [9] The extensive participation of society can promote to form a good transformation relationship among science and technology, society and market. First of all, society should be encouraged to participate in the construction of scientific and technological innovation. Under the premise of jointly building and sharing the scientific and technological infrastructure in GBA, it can provide a good scientific research environment for scientific and technological innovation in the GBA. At the same time, we should make social forces participate in the development of technological innovation and promote the further development of enterprises and individuals through technological innovation under the leadership of the government. Second, we also should encourage the combination of venture capital investment and scientific and technological research. For example, private investment is still welcomed to accelerate the transformation of scientific and technological achievements. Due to the limited government funds, private funds can provide a steady stream of financial support for the development of science and technology. This way can increase the proportion of investment in the transformation of scientific and technological achievements, which is a good mechanism for transforming the scientific and technological achievements. Finally, we should encourage society to build scientific and technological service institutions, especially intermediary institutions for the transformation of scientific and technological achievements. With the help of jointly building a professional, open and international platform for transforming scientific and technological achievements, we can promote the effective transformation of scientific and technological achievements. It is worth mentioning that the government's purchase service has the characteristics of high demand and high credibility. Therefore, we can also provide supports for scientific and technical corporations through the government purchase model, so as to encourage corporations to produce more scientific research results. For example, judicial organs, law enforcement departments, and administrative departments all need a large number of scientific and technological products to improve service efficiency. Then the Guangdong, Hong Kong and Macau Science and Technology Innovation Development Committee can stimulate market demand by encouraging these organs to purchase scientific and technological products from enterprises, forming a mutually beneficial development

trend of promoting a virtuous circle of politics, industry, academy, and research. Of course, the government can also encourage colleges and universities, scientific research institutions and enterprises to cooperate with each other through policies, so as to promote the transformation of scientific research achievements into practice. Major scientific and technical enterprises can also formulate business plans and sign industrial cooperation agreements, or draw up government purchasing-plans. The government can also provide channels for the publicity of scientific and technical enterprises and learn about the information of emerging scientific and technical products and perfect the government purchasing-service system as well. and finally strive to achieve good docking with enterprise products.

4.3 Construction of cross-border dispute-resolving mechanism for scientific and technological innovation and development in GBA

In the beginning of 2019, the mainland and Hong Kong formally signed the arrangement on Mutual recognition and Enforcement of judgments in Civil and Commercial cases between the mainland and the Hong Kong Special Administrative region, and interregional judicial assistance between the two places has been further developed. In addition, there are the arrangements for the Mutual entrustment and Service of Civil and Commercial Judicial documents between the mainland and the Hong Kong Special Administrative region, and the arrangements for the Mutual Enforcement of Arbitration Awards between the mainland and the Hong Kong Special Administrative region. <The development plan for Guangdong-Hong Kong-Macau Greater Bay Area> points out that we should strengthen mutual legal assistance between Guangdong, Hong Kong and Macau through the establishment of a closely connected cross-border pluralistic dispute-resolving mechanism, and it is stressed that special attention should be paid to the construction of non-litigation channels in the field of intellectual property rights. Compared with the general civil and commercial cases, intellectual property disputes have the characteristics of more specialization and complexity. Therefore, in order to construct the cross-border dispute resolution mechanism of technological innovation and development in GBA, it is necessary for us to establish an appropriate judicial assistance system for intellectual property disputes. For example, a common and specialized system of mutual legal assistance for intellectual property courts could be established in three places. Except for providing clerical services and mutual recognition of judgments, relevant intellectual property and mutual legal assistance documents can also be signed to link information with the intellectual property courts of the three places. The establishment of an open network for the disclosure of information on intellectual property cases in GBA can facilitate the people of the three places to learn about the information on intellectual property cases. At the same time, the conflicts of jurisdiction among the three places can be reduced by establishing the intellectual property Circuit Court in GBA. For example, we can clearly regulate the scope of accepting cases and organizational functions of the intellectual property Circuit Court through the legislative authorization of the National people's Congress. The trial Chamber of the intellectual property Circuit Court should be composed of the same proportion of officers from Guangdong, Hong Kong and Macau, and its judgment can be enforced in Guangdong, Hong Kong and Macau. Therefore, taking the intellectual property Court as a pilot can not only provide a more convenient and efficient way to resolve

intellectual property disputes, but also show new experience for promoting the integration of the judicial system in GBA.

5. Conclusion

The GBA has a strong driving force for scientific and technological innovation, and has incomparable advantages comparing with other Bay areas in the world in some key development areas. Shenzhen, for example, is one of the world's leading innovation hub. The Pearl River Delta and Hong Kong have also accumulated a lot of innovative resources, with Hong Kong being an international financial center, Guangzhou has a large-scale industrial chain and a complete manufacturing industry, and a complete modern industrial system has been formed in the GBA. In addition, the GBA also gathered an array of well-known enterprises with the ability to lead the world in science and technology, such as Huawei, Tencent, Gree, Shunfeng and others. "one country, two systems" policy and the three independent customs areas can be said to be the dilemma of the rule of law in the development of science and technology in the GBA. Meanwhile, they are also the advantages of the development of GBA. It is believed that under the background of dialectically drawing lessons from the experience of the rule of law in the development of science and technology in the United States, we can give full play to the unique advantages of the GBA, which provides more flexible institutional conditions and the advantages of international development for GBA. As long as the rule of law is used to promote the integration and development of scientific and technological innovation in GBA, the goal of becoming an international scientific and technological innovation center will eventually be achieved.

References

- [1] Cited in Solomon's knot: What can the Law do for Fighting Against Poverty? see Robert Kurt, Hans Berndt Schaeffer, translator: Zhang Wei, Xu Ke, Beijing: Peking University Press, 2014. Solomon's knot: originated in ancient Rome and appeared in many historical periods and cultures, it can still be found on the rope of Hong Kong ships today, which has different meanings in different cultures, including trust and eternity.
- [2] Fan Chunliang: Establishing a Leading Scientific and Technological Innovation System in the World-the Way for the United States to become a Strong Scientific and Technological Power in the World, published in the Proceedings of the Chinese Academy of Sciences (2018).
- [3] Lan Zhiyong, Liu Yang: Review and Enlightenment of American Talent Strategy, Journal of Chinese Academy of Governance (2017).
- [4] Brooks H. The Evolution of US Science Policy. In: Bruce L R Smith, Claude E Barfield (eds). Technology, R&D, and the Economy. Washington D C: The Brookings Institution and American Enterprise Institute (1996).

- [5] Lambright W H. Government and Science: A Troubled, Critical Relationship and What can be done about it. *Public Administration Review* (2008).
- [6] Christopher S. Hayter, Jacob H. Rooksby. A Legal Perspective on University on University Technology Transfer. *J Technol Transf* (2016).
- [7] Yang Jing: The Criminal Protection System of Intellectual Property Rights in the United States from the Ramazia Case, cited in *Chinese Prosecutors* (2017)
- [8] Hu Changsheng: An Analysis of the Path Dependence and Social Role of Scientific and Technological Innovation in Colleges and Universities in Western Developed Countries-Taking Stanford University (Silicon Valley) as the Main Example, *Journal of Jiangxi School of Administration* (2005).
- [9] Jiang Mingan, ed. *Administrative Law and Administrative Procedure Law*. Beijing: Peking University Press, Higher Education Press (2015).