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## **THE IMPACT OF INTELLECTUAL PROPERTY PROTECTION ON AGRICULTURAL SCIENCE AND TECHNOLOGY INNOVATION IN CHINA**

After more than 30 years of reform and development, China's agriculture has played an important role in the rapid growth of the agricultural economy, the efficient utilization of agricultural resources, and the sustainable development of agriculture, such as rural market-oriented reform, technological progress and the liberalization of farm products trade (Huang 2010). The focus on agriculture, rural areas, and farmers in the future should be Rural Revitalization from the perspective of science and technology, talent, culture, ecology, and Governance (Wen et al. 2018). With the increase in scientific and technological innovation investment, scientific research output has also increased rapidly, and its contribution to the economic development of enterprises has also increased (Tangy et al. 2015). It can be seen that science and technology play an important role in the development of the agricultural economy, in which technological progress depends on innovation ability. There are many factors affecting agricultural science and technology innovation, among which the degree of intellectual property protection is one of the important factors.

Agricultural science and technology innovation: Research on agricultural science and technology innovation is to study the application of technological innovation in the agricultural field, specifically the whole process of the discovery, transformation, value realization, and commercialization of Agricultural Technology (Bao 2017). Dai et al. (2014) studied from the perspective of Finance and found that accelerating the construction of agricultural financial systems and service systems and paying attention to the cultivation of agricultural financial talents will contribute to the breakthrough and application of agricultural scientific and technological innovation. Cui (2013) took the government as the starting point of research, analyzed the supply main body of China's rural scientific and technological innovation in the market environment, explored the main factors affecting rural scientific and technological innovation from the macro and micro aspects, and studied the relationship between government incentives and the efficiency of agricultural scientific and technological innovation. Based on the first-hand data of 125 agricultural science and technology enterprises, Gao (2008) analyzed the current situation of technological innovation of agricultural science and technology enterprises in China, and systematically studied the technological innovation ability of agricultural science and technology enterprises and the influencing factors by using 26 indicators. The conclusion is: the organizational structure of independent innovation of enterprises is not perfect, the personnel and

funds invested in technological innovation are insufficient, and the technological level of leading products of enterprises is low; The technological innovation ability of enterprises is generally at the general level, among which the input ability of technological innovation is stronger than the implementation ability and output ability of technological innovation; The internal factors of enterprises are the key factors affecting their technological innovation ability, while the external factors of enterprises are relatively weak. Du (2011) studied from the perspective of policy and believed that China's agricultural science and technology innovation policy system did not pay enough attention to agricultural enterprises, lacked strong support, and had produced serious consequences. Therefore, it is necessary to carry out creative reform of the current policy system to highlight the dominant position of agricultural enterprises. Du (2013) established an input-output evaluation model of agricultural science and technology based on DEA and analyzed the input-output efficiency of agricultural science and technology innovation according to the direction, intensity, proportion and innovation output level of agricultural science and technology investment in China. The results show that increasing the scale of agricultural science and technology input and improving the efficiency of resource output are the key to improve the efficiency of agricultural science and technology input and output in China.

Different scholars explore it from different perspectives, and the research conclusions are also different. Some scholars believe that improving the level of intellectual property protection does not promote enterprise innovation. Yi et al. (2007) found that when China's technological level is at a relatively low stage, independent innovation does not have a positive effect on technological progress, and the weak intellectual property protection system is conducive to technological progress based on imitation. However, with the continuous improvement of technological level, the effect of independent innovation on technological progress will become more and more significant. Li et al. (2014) found that at this stage, the level of intellectual property protection in China is not positively correlated with the R & D investment of Chinese enterprises through the inspection and analysis of China's provincial panel data. Gu et al. (2015) analyzed the panel data of American multinational companies in 26 countries from 2003 to 2012, and the results showed that in a certain period of time, the stronger the level of intellectual property protection, the lower the success rate of innovation of high-quality products. Schneider (2005) made an empirical analysis using the sample data of 47 developing and developed countries from 1970 to 1990. The results showed that the intensity of intellectual property protection was positively correlated with the technological innovation capacity of developed countries, while negatively correlated with the technological innovation capacity of developing countries. Some scholars also believe that the improvement of intellectual property protection can promote enterprise innovation. For example, Yin et al. (2013) found that the improvement of intellectual property protection has enhanced the R&D investment of enterprises, which has a

positive and significant impact on enterprises. Cai and Chen (2016) analyzed the sample data of 287 cities in China and believed that the intellectual property protection system can promote the entrepreneurship of knowledge-based enterprises in China. Strengthening intellectual property protection can not only protect the entrepreneurial achievements of enterprises but also stimulate the innovation enthusiasm of knowledge-based enterprises in the whole society. Some scholars believe that intellectual property protection and enterprise innovation are not linear. Yu and Wang (2009) conducted empirical analysis based on panel data from developing countries. The results showed that intellectual property protection and technological innovation in 60 developing countries showed an inverted U-shaped relationship of first promotion and then inhibition. Sheng et al. (2017) believe that intellectual property protection and enterprise innovation ability show an "inverted U" relationship, and exist in both growth and maturity periods, while enterprises in recession show a negative correlation. Among foreign scholars, Chen (2005) data analysis shows that there is a "U-shaped" relationship between intellectual property protection and enterprise innovation ability, while Koleda (2005) believes that there is an "inverted U-shaped" relationship between the two.

Some scholars analyze the relationship between them from the perspective of the rule of law. Li et al. (2010) analyzed the legal protection of agricultural science and technology intellectual property from the perspective of law. Some scholars theoretically analyzed the importance of intellectual property protection to China's agricultural science and technology. Wang (2003) pointed out the strategic significance of the intellectual property system and operation to improve the international competitiveness of China's agriculture. China's agricultural science and technology urgently needs a development strategy based on and guided by the intellectual property system to create new growth points in agricultural economy and meet the needs of sustainable economic and social development.

According to the above literature reviews, we find that there are many kinds of papers studying agricultural scientific and technological innovation from the perspective of government, policy, finance, and so on. There are few kinds of literature investigating the relationship between intellectual property and agricultural scientific technological innovation by empirical analysis based on datasets. This study plan to explore to the impact of intellectual property protection and agricultural technological innovation through empirical analysis.

*Methods:* First, according to the existing theories of scholars, combined with the direction of their own research, carry out theoretical analysis, select listed enterprises in related fields and statistical yearbook data as samples, put forward research assumptions, establish econometric models, and empirically test the relationship between intellectual property protection and agricultural scientific and technological innovation. Second, to solve the endogenous problem of intellectual property

protection in model estimation, 2SLS, did, system, and differential GMM estimation methods are proposed. Third, to investigate the impact mechanism of intellectual property protection on agricultural scientific and technological innovation, it is proposed to use the did method (by constructing the interaction term between intellectual property protection and channel variables) to estimate. At the same time, according to the characteristics of data samples, fixed effect model, random effect model, and other estimation methods will also be used. Fourth, it is proposed to test the robustness of the core variables in the model.

*Expected results:* the impact of intellectual property protection on Agricultural enterprise innovation shows ownership differences. Compared with state-owned enterprises, provinces with stronger intellectual property protection may have more significant innovation incentives for private enterprises. Intellectual property protection may promote agricultural scientific and technological innovation in China, or it may be nonlinear.

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