

Research on Compensation Mechanism of Science and Technology Insurance Brought in Costs of Independent Equipment Research and Development

Huibin Yu^{1,*}, Changren Yu²

¹ Army Logistics Academy of PLA, Chongqing, China

² Army Logistics Academy of PLA, Chongqing, China

*Corresponding author. Email: 31577889@qq.com

ABSTRACT

The equipment research and development investment has its high risk. Therefore, the introduction of technology insurance compensation mechanism in the independent research and development of the military equipment enterprises is conducive to creating a situation of mutual benefit and mutual win, promoting the healthy, sustainable and high-level development of military equipment construction, and also improving the enthusiasm of enterprises in independent research and development of the equipment. The military enterprises should follow the thinking of "market operation, government subsidy and risk sharing", constantly innovate the operation mode, pay attention to solve the possible problems in the operation, and ensure its healthy development.

Keywords: *Equipment, independent research and development, science and technology insurance, cost compensation technique Introduction.*

1. INTRODUCTION

The equipment Research and Development investment is a kind of high investment and high risk behavior. The military enterprises that fully bear the capital and risks in the process of research and development, due to the uncertainty of their research and development results, once the results do not meet the expectations, it will increase the difficulty for them to obtain benefits through technological innovation, and then weaken their enthusiasm for independent research and development. In the absence of any compensation or protection measures, it is difficult to realize the optimal allocation of social resources only by relying on the market to stimulate the innovation of enterprises. Therefore, the army must make up for the defect of "market failure", reduce the research and development risk of military enterprises and improve their motivation. The science and technology insurance is a kind of insurance business jointly launched by the Ministry of Science and Technology and the Insurance Regulatory Commission of China in 2006 to promote the implementation of the national independent innovation strategy and support the development of high-tech enterprises. And the science and technology

insurance organically combines insurance resources with the science and technology resources, and takes the science and technology innovation activities as the subject matter of insurance, which can effectively provide the risk protection for the high-tech enterprises. The introduction of the science and technology insurance compensation in the cost of the equipment independent research and development can effectively share the risks in innovation activities and improve the enthusiasm of the enterprises in innovation and research. In this paper, the author introduces the government-supported innovation incentive and the local enterprise cost risk management method into the field of the equipment independent research and development, and designs the operation mechanism of the science and technology insurance in the field of equipment independent research and development to stimulate innovation and reduce risks.

2. ROLE OF SCIENCE AND TECHNOLOGY INSURANCE IN SUPPORTING DEVELOPMENT OF SCIENCE AND TECHNOLOGY ENTERPRISES

The science and technology are the primary productive forces and the main force driving the economic and social development. The practice of the industrial revolution has proved that in the process of the scientific and technological innovation, the enterprises often face the dilemma of high risk and high cost. Lags in research and development, staff turnover, mismanagement, and market changes can lead to significant costs.[1] Therefore, at the same time of scientific and technological innovation, how to prevent and control risks and protect the promotion and application of scientific and technological achievements has become the key for the enterprises to seek survival and development. As a risk management method, the insurance is a risk transfer mechanism, and also a method to share the risks and unexpected losses and reduce the uncertainty of losses. In order to prevent and disperse all kinds of risks that the enterprises may face in the process of technology development and application, the science and technology insurance emerges at the historical moment.

The technology insurance is a general term of insurance types and other supporting methods designed and developed by the insurance companies to prevent and resolve all kinds of risks that may appear in technology research and development, achievement transformation and market application of the technology enterprises. It reduces the loss caused by the scientific and technological risks.[2] On the one hand, it is beneficial to improve the profitability of the scientific and technological enterprises, effectively stimulate the research and development power of the enterprises, help the enterprises improve their core competitiveness, promote the process of the scientific and technological innovation and improve the efficiency of innovation. On the other hand, it creates a good environment for the venture capital to some extent, provides a strong guarantee for the development of the venture capital industry, and is conducive to promoting the prosperity of science and technology and economy, as well as promoting social progress and economic growth.

2.1. Science and technology insurance preventing and resolving the risk of science and technology enterprises

The support of the science and technology insurance to the innovation and development of the science and technology enterprises is mainly reflected in the prevention and resolution of the enterprise risks. The details are as follows.

First, the science and technology insurance provides the science and technology insurance products to prevent and resolve all kinds of risks of the science and technology enterprises. The development of the science and technology enterprises needs to go through different stages, such as science and technology research and development, achievements transformation and market application. The risk types and risk degrees in different stages are different, so it is necessary to "transfer" risks to the outside to control the risks of technology enterprises within a reasonable range.[3] The insurance companies underwrite the science and technology insurance to compensate for the losses in the process of innovation and development of the science and technology enterprises, thereby dispersing all kinds of risks of the science and technology enterprises and eliminating the worries of the science and technology enterprises, their management and research and development personnel.

Second, the technology insurance provides risk management support and services to assist the enterprises to establish and improve the risk management system. In addition to "transferring" the risks, the internal control and risk management mechanism of the technology enterprises is an important guarantee to prevent their own risks. The insurance companies can give full play to their ability and experience in risk management, through publicity, training, communication and other ways, strengthen the risk management awareness of the science and technology enterprises, improve the ability of risk control and evaluation of research and development projects of the science and technology enterprises, and assist the enterprises to establish and improve their own risk management system.

2.2. Technology insurance helping science and technology enterprise raise money

First, the technology insurance can increase the reputation of the enterprises. Narrow financing channels and difficult capital turnover are the prominent problems facing the development of many technology enterprises. In practice, the financing of the science and technology enterprises mainly depends on commercial bank loans.[4] However, due to the high risk of the science and technology enterprises, the proportion of intangible assets is relatively high and the valuation is difficult and other reasons, the bank loan, the "main channel" of financing is often not smooth. Therefore, broadening the enterprise financing channels has become the key to support the innovation and development of the science and technology enterprises. The science and technology insurance can play a role in increasing the credit of the enterprises. When the science and technology enterprises are unable to repay the principal and interest of the loans, such products as

loan guarantee insurance for the science and technology enterprises and patent pledge loan guarantee insurance, the insurance companies will assume the corresponding repayment obligations, thus dispersing the bank lending risks and facilitating the financing of enterprises.

Second, the science and technology insurance can deliver good information to promote the investment and financing support. In the start-up and growth period of the technology enterprises often lack of effective external information transmission channels to attract "cost-effective" investment and financing. The investors and banks often take the general situation of the industry and enterprise of the technology enterprise as an important consideration in investment and credit decision-making, which will increase the financing cost of the technology enterprise with great development potential and strong risk prevention ability. Since the general risks and premium rates of the industry are important considerations for the insurance companies to underwrite, their underwriting actually demonstrates the risk management awareness and basic ability of technology enterprises to the outside world, which is conducive to obtaining investment and financing support from the insurance companies and other financial institutions.

2.3. Science and technology insurance enhancing innovation and profitability of science and technology enterprises

Some science and technology insurance products can boost the innovation and development of the science and technology enterprises and improve their competitiveness. Through a questionnaire survey of 238 technology enterprises, the structural equation model is used to study the impact of the technology insurance on innovation and profitability of the technology enterprises. The results show that the technology insurance can directly promote the improvement of profitability of the technology enterprises.

3. OPERATION MECHANISM OF TECHNOLOGY INSURANCE COMPENSATION MECHANISM INTRODUCED INTO COST OF EQUIPMENT INDEPENDENT RESEARCH AND DEVELOPMENT

Inherently compatible with and mutually beneficial to the science and technology innovation activities, the science and technology insurance is an effective marketization mechanism in the science and technology risk management, and an important measure to promote the national innovation-driven development strategy. China's pilot technology insurance program began in 2006. After more than ten years of development, it now has been vigorously promoted and adopted the mode of

"market operation and government subsidy" in more than a dozen cities such as Beijing, Shanghai, Chongqing and Shenzhen.[5] In this mode, the enterprise chooses the science and technology insurance varieties determined by the Ministry of Science and Technology and the Insurance Regulatory Commission, signs a contract with the insurance company underwriting the premium, and then, according to the application requirements of the local science and technology insurance subsidy funds, provides corresponding materials, and obtains a certain proportion of subsidies after the approval of the competent authorities. There are four modes of operation of science and technology insurance, which are the insurance-claim settlement type, the guarantee type, the semi-participation type and the full participation type. In general, China's science and technology insurance shows the characteristics of accelerated development, gradually rising scale and obvious role in supporting innovation.

When the technology insurance mode is introduced into the cost compensation of the independent research and development of the equipment, the benefit goal of the military is to use certain compensation to help the independent research and development enterprises share the research and development risks, stimulate their enthusiasm for research and development, and finally obtain the advanced research and development achievements or equipment. On the one hand, the profit goal of the enterprise is to reduce the risk in the independent research and development of the equipment and improve the possibility of successful research and development and obtain the compensation from the military. And the interest goal of the insurance company is to make a profit by collecting premiums.[6] In the context of the national strategy of the innovation-driven development, the construction of the effective scientific and technological compensation mechanism for the cost of the equipment independent research and development is conducive to creating a situation of mutual benefit and mutual win, promoting the modernization of the military equipment development and management, and improving the enthusiasm of the enterprises for the equipment independent research and development.

The enterprise is insured to the insurance company, the insurance company is in charge of compensation, the army undertakes compensation to the military industrial enterprise or the insurance company again, which can reduce its research and development or the cost burden in the compensation insurance process. Drawing on the current cost compensation practices of the governments in many places to the high-tech enterprises, the independent cost technology insurance compensation mechanism of the military enterprises should follow the "market operation, government subsidies and risk sharing" and implement the following operation modes. The first is the insurance-claims type and it is a

traditional model. In this kind of mode, the military industrial enterprise pays insurance gold to the insurance company, after producing the risk loss, the insurance company is in charge of compensating it. The second is the guarantee type. In this mode, the insurance companies provide credit guarantees for the transformation of the scientific and technological achievements, and jointly avoid the technological innovation risks of the military enterprises with the banks. The characteristic of this mode is to introduce the bank credit resources to solve the financing problems of the enterprises and share the risks. [7] The third is the semi-participatory type. In this mode, when the risk loss occurs to the scientific research and development project, the insurance company should pay the indemnity to the insured party. When the scientific research and development project is successful and profitable, the insurance company participates in the profit sharing with a certain proportion. The characteristic of this mode is to reduce the insurance cost of the enterprises and solve the risk caused by information asymmetry. The last is the fully participatory type. In this mode, the insurance companies directly participate in the research and development activities of the military enterprises as venture investors, and realize the benefit sharing and the risk sharing with the enterprises or other investors. The characteristic of this mode is to reduce the insurance cost of the enterprises and solve the risk caused by the information asymmetry. In the modes above, the first is the traditional mode of operation which is a common one and it is the latter models that need to be promoted. The promotion of these modes can not only reduce the insurance cost of the enterprises, but also help to intervene in advance and solve their worries.

4. MATH AND EQUATIONS POSSIBLE PROBLEMS AND SOLUTIONS DURING INTRODUCTION OF TECHNOLOGY INSURANCE

The introduction of the independent research and development of the equipment into the science and technology insurance is still a relatively new field and relevant practices are not yet mature. Therefore, possible problems should be carefully anticipated and certain preventive measures should be taken to solve them.

4.1. Expanding target of cost compensation

At present, the local government technology insurance subsidies have been promoted for many years, but the relevant subsidy policies only benefit the technology enterprises. In order to motivate the insurance companies to the research and develop new types of insurance, the military can provide subsidies for the cost of science and technology insurance of the

insurance companies, and coordinate with the government to the implement tax reduction policies for the insurance companies' profits from the science and technology insurance so as to improve the enthusiasm of the insurance companies to research and develop and operate the science and technology insurance types. [7] The implementation of the echelon subsidies can be applied for the first time the insurance of the military enterprises to the higher subsidies, to have applied for the insurance of the military enterprises to maintain the basic level or multiple application of the implementation of differentiated subsidies.

4.2. Establishing a cost-risk sharing mechanism

The high risk of research and development activities of the equipment enterprises will make the insurance companies less willing to underwrite the "high risk and low yield" financing guarantee insurance. And the best way to solve this problem is for the military to establish a risk sharing mechanism of "military + insurance + bank" to determine the appropriate risk sharing comparison, to clarify the rights and obligations of the parties, to relieve the pressure of the insurance companies in the form of the risk compensation, and to solve the problems that the insurance companies are unwilling to insure and the banks are afraid to lend.

4.3. Overcoming moral hazard caused by information asymmetry

From the perspective of the innovation process of the military enterprises, the moral hazard of the science and technology insurance in the pre-research and development stage is mainly represented as insurance before the insurance and false project approval. In the research and development stage, the main performance is insurance type false report and passive sabotage. In the post-research and development stage, the main performance is one risk and multiple losses, low risk and high losses. From the perspective of the subject of behavior, the possible moral hazard between the technology enterprises and the insurance companies mainly includes insurance fraud and false insurance. The possible moral hazard between the technology enterprises and the military mainly includes applying for compensation for non-existent matters, or packaging other non-science and technology activities to get compensation. [8] And the possible moral hazard between the insurance company and the military mainly includes false insurance fraud and false insurance fraud. The possible moral hazard between the technology enterprises and the military mainly includes applying for the compensation for non-existent matters, or packaging other non-science and technology activities to get the compensation. The moral hazard between the insurance company and the military mainly includes the fraudulent

subsidy and the fraudulent compensation through the fraudulent insurance. Therefore, the information transparency is very necessary and the strict audit is also essential. The military, the government and the banks can all be the subject of audit. It is also feasible to conduct a joint audit among the military, the banks and the insurance companies to review their qualifications, process of scientific and technological activities, application materials, etc.

4.4. Strengthening enterprise risk control

As a kind of rational investment, the subject of the equipment research and development investment is also the interest preference and the risk aversion. In view of the possible investment risks, the enterprises can take various measures to reduce the risks, such as the risk avoidance, the risk control, the risk assumption and the risk transfer, so as to carry out the scientific assessment of the research and development risks. The equipment development is generally divided into two stages: the pre-research and the model development which can be further subdivided into the comprehensive demonstration, the scheme demonstration, the preliminary design, the technical design, the achievement transformation and other processes. In the process of the equipment development, the degree of the risk and uncertainty are gradually reduced with the process of demonstration, design and achievement transformation. The enterprises should carry out the risk assessment at each stage of the equipment development in order to grasp the key links and strengthen the collection of wisdom to tackle the key problems. When there are unpredictable sunk costs or immeasurable follow-up investment which results in great risk, the enterprise should stop the loss in time to exit.

5. CONCLUSION

In the context of the national strategy of the innovation-driven development, it is of great practical significance to construct an effective cost compensation mechanism for the independent research and development of the equipment to reduce the risk of the enterprise research and development and promote the sustainable construction and healthy development of the equipment. This paper draws on the current practice of local government's compensation for the high-tech enterprises, puts forward several operating modes, and proposes solutions to the cost compensation of the independent research and development of the equipment. And further research needs to be detailed. For example, the research and development activities with compensation value can be identified by constructing the compensation object selection model of equipment independent research and development cost based on science and technology insurance to solve the problem of who should be compensated, etc

REFERENCES

- [1] W. Fang & L. Zhen, "40 years of reform and opening up: China's road to the integration of military and civilian science and technology," *China Science and Technology Forum*, p153, 2019(5).
- [2] P. Song, "Research on relationship between government R&D subsidy and enterprise innovation performance and R&D capability in China," *Journal of soft science*, p65-66, 2019(5).
- [3] P. Wang & J. Mu, "A study on the mechanism of government fund compensation for failed projects in science and technology innovation," *Journal of science and technology management*, p3-8, 2014(1).
- [4] H. Ren, "Current situation and prospect of science and technology insurance in China," *Journal of Guangxi University of Finance and Economics*, p82-90, 2019(2).
- [5] W. Lu & Y. Zhao, "Analysis of science and technology insurance related issues," *Insurance research*, p36-40, 2009(2).
- [6] J. Sui, "Evaluation of implementation effect in the first batch of science and technology insurance pilot cities," *Auditing and Economic Research*, p113-115, 2018(4).
- [7] P. Wang, "Research on compensation mechanism of failed scientific and technological innovation projects from perspective of government," *Journal of financial theory and teaching*, p33-36, 2020(1).
- [8] H. Ma, "Equipment procurement cost control theory and practice," *Journal of northern economy*, p44-47, 2018(10).
- [9] Y. Luo & J. Yin, "Research on science and technology insurance risk compensation under fair preference," *Journal of Audit and Economic Research*, p25-36, 2019(6).
- [10] D. Zhao, "Research on the operation of science and technology insurance in China," *China's collective economy*, p84-87, 2017(32).