



On Cost Compensation Mechanism for Independent Research and Development of Military Products Based on Technology Insurance

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Abstract. The design Problem of the cost compensation mechanism for the independent research and development of the military products based on the technology insurance, in fact, is to explore how to introduce the science and technology insurance into the cost compensation activities of the independent research and development of military products. Combined with the practical experience of the local governments in the compensation of the science and technology insurance, the authors of the paper think that the basic framework of the cost compensation mechanism of the independent research and development of the military products based on the science and technology insurance should be designed through game, feasibility and advantage analysis. And then, the problems of who to compensate, how to compensate and how much to compensate are solved by defining the compensation object, calculating the compensation standard and designing the compensation process. Finally, through the improvement of supporting policies and measures, the coupling effect of the mutual correlation and interaction among various elements is formed, and then an effective compensation mechanism is established.

Keywords: Military Products · Technology Insurance · Independent Research and Development · Cost Compensation

1 Introduction

Military powers attach great importance to the cost compensation work of independent research and development of military products, and to supporting national defense enterprises and key research and development projects. Specifically speaking, in terms of policies, these countries have formulated key development plans at the national level to support the development of various scientific research institutions and small and medium-sized innovative enterprises; in terms of economy, they have adopted low interest or even interest free loans, advanced a higher proportion of deposits, and implemented effective tax incentives and special subsidy policies. Therefore, understanding the importance of independent research and development costs compensation work of military products not only embodies in targeted policy documents, should also be embodied in many

aspects, such as setting up the corresponding functional departments and corresponding training class to support the development of the cost compensation military independent research and development work with the manpower and material resources and financial resources.

Some scholars have conducted related studies from the perspectives of incentive mechanism, principal-agent relationship and cost compensation efficiency. Changchen Liu, Bing'an Ji and Yunfeng Luo pointed out that the research and development stage is the key stage of the national defense acquisition, in which the military is the only buyer of the weapon systems, not only the physical products, but also the intermediate products of the research and development must be purchased [1]. Huijun Ma believed that the establishment of the military procurement incentive mechanism can mobilize the enthusiasm and initiative of all aspects and contribute to the realization of the equipment construction objectives. The theory of principal-agent is a common tool to solve the moral hazard and adverse selection problems in compensation [6]. From the perspective of the principal-agent relationship, Huijun Ma and Min Luo revealed the internal mechanism of the national defense research and development activities and the deep reasons for inefficient investment. They also pointed out that there were multiple principal-agent relationships in the equipment research and development cost compensation, and that the subsidy mechanism was an effective way to encourage and guide non-public capital to participate in the national defense research and development under the condition of insufficient national overall investment [8]. Griliches and Lichtenberg concluded that the government can not only help the contractors to share the risk of the national defense research and development innovation by providing incentives, but also compensate them by providing research and development cost subsidies and that the combination of incentives and subsidies is the most efficient way [3]. Chakrabarti, Baily and Lichtenberg studied the compensation efficiency of the equipment research and development costs, and held that the compensation provided by the military had a high elasticity of supply, which can motivate the research and development subjects to invest more in the equipment research and development, and cost much less than the way of bonus [7].

This paper starts with the basic analysis of the introduction of the cost compensation mechanism of the independent research and the development of military products into the science and technology insurance. Through game, feasibility and advantage analysis, it concludes that the mode of "subsidy support and market operation" is suitable for the compensation mechanism designed in this paper. At the same time, it designs three processes of insurance, claim settlement and compensation.

2 Feasibility of Introducing Science and Technology Insurance into Cost Compensation Mechanism of Independent Research and Development of Military Products

2.1 Fruitful Results in Practice Being Achieved in Local Science and Technology Insurance

Science and technology insurance has been extended in China. For example, in 2014, a batch of orders of a science and innovation company in Wuhan made mistakes in

the production process and the products could not be used. However, the company had taken out the technology insurance, and the loss was paid for by the insurance company. In 2015, an auto parts company in Ningbo suffered customers' losses due to the design defects in its products, and the insurance company paid 1.4 million yuan in compensation to help the company overcome the difficulties. At the same time, many regions have introduced premium subsidies and special reward policies for the science and technology insurance [10].

2.2 Advanced Practices of Foreign Countries Being Powerful Reference

The United States makes full use of the risk sharing function of insurance, and hires professional insurance brokers to design and implement the insurance schemes at different stages of the whole life of the military products such as the research and development, the procurement and support, and adjusts the claim settlement procedures according to the needs of the military and enterprises [11]. At the same time, in order to maintain the confidentiality, the participating insurance institutions are required to sign the confidentiality agreements with the military. All these provide the reference experience for the army to introduce the science and technology insurance into the cost compensation mechanism of the independent research and development of the military products.

2.3 Conditions for Independent Research and Development of Military Products to Introduce Science and Technology Insurance Having Been Met

From the perspective of supply, the insurance industry has been booming in recent years, with gradually enriched insurance products, gradually expanded service level and gradually improved service mode, which provides the important support for the introduction of sci-tech insurance compensation mode in the independent research and development activities of the enterprises. From the perspective of demand, the enterprises are eager to share risks in research and development activities with low cost due to huge research and development costs and many uncertain factors when conducting the independent research and development activities of the military products. When the military compensates the independent military research and development activities of the enterprises, the traditional compensation method occupies much military funds and has limited the incentive effect. Therefore, it is necessary to introduce a more efficient and economical way to realize the compensation to the enterprises. The introduction of the technology insurance compensation means by the military is also a manifestation of giving full play to the role of the market mechanism in the cost compensation of the independent research and development of the military products.

3 Basic Idea of Science and Technology Insurance Being Introduced into Cost Compensation Mechanism of Independent Research and Development of Military Products

Through the above analysis and drawing on the current local experience, the technology insurance compensation mode can be introduced into the cost compensation mechanism of the independent research and development of the military products. That is the

Table 1. Proportion and limit of technology insurance subsidy in different regions.

Region	Subsidies proportion (%)	Allowance (en thousand yuan)
Beijing	70	50
Tianjin	30–50	50
Xi'an	40–60	10
Chongqing	30–70	10
Suzhou	30–50	30
Shenzhen	<50	100

military in the early stage, according to the urgent degree of the military technology demand, advanced the degree of the echnology and the comprehensive strength of the enterprise, the military selected the representative military research institutes and the civilian enterprises. Then, under the premise of the confidential review of the independent research and development activities of the enterprise, the enterprise shall purchase one or more technology insurance for the independent research and development activities of the military products such as the military research and development liability insurance, the key research and development equipment insurance, the product liability insurance, etc. Finally, in the process of the research and development, the enterprise provides relevant information to the military regularly, and participates in the evaluation and appraisal meeting of the research and development achievements on time. And the military calculates the standard of the military compensation according to the technical level of the independent research and development achievements of the enterprise and the compensation proportion of the government where the enterprise is registered.

4 Compensation Standard of Science and Technology Insurance Being Introduced into Cost Compensation Mechanism of Independent Research and Development of Military Products Introduces

The core of determining the compensation standard of introducing the science and technology insurance into the cost compensation mechanism of the independent research and development of the military products is to determine the compensation proportion of the science and technology insurance premiums of the enterprises shared by the military. At present, in China, different provinces have different premium apportionments for the sci-tech innovation-oriented enterprises. The compensation proportion ranges from 30% to 70%, and the compensation limit standard is also different. It is shown in Table 1.

For example, the subsidy ratio of science and technology insurance in Beijing is as high as 70%, and the subsidy limit is less than 500,000 yuan, while the subsidy ratio in Chongqing is only 30–70%, and the subsidy limit is less than 100,000 yuan [4]. So it can be seen that it is particularly important to determine a set of scientific compensation standards in the design of the cost compensation mechanism for the independent research and development of military products based on the science and technology insurance.

Table 2. Differential compensation ratio based on the level of military independent research and development achievements.

Technical level	Compensation ratio
Ahead of the world (95–100)	$B_1 = B_i * (1 + 30\%)$
Technical level	Compensation ratio
The world's advanced (90–95)	$B_2 = B_i * (1 + 25\%)$
Ahead of the country (85–90)	$B_3 = B_i * (1 + 20\%)$
The country's advanced (90–95)	$B_4 = B_i * (1 + 15\%)$
Ahead of the army (75–80)	$B_5 = B_i * (1 + 10\%)$
The army's advanced (70–75)	$B_6 = B_i * (1 + 5\%)$
General technical level (60–70)	$B_7 = B_i$
Low technical level (Below 60)	No compensation

According to the proportion and quota of the technology insurance subsidies in different regions, the compensation standard for the introducing technology insurance into the cost compensation mechanism of the independent research and development of the military products is designed as follows. Based on the scoring level of the independent research and development achievements of the military products, different compensation proportions are adopted for different evaluation levels [2]. In view of the high risk of the independent military research and development activities, the proportion of the military independent research and development cost compensation should be higher than that of the local government compensation for the innovative enterprises. Therefore, when determining the compensation standard for the military, based on the upper limit of the compensation ratio of the government where the enterprise is registered, the compensation standard for introducing the technology insurance into the compensation mechanism for the cost of independent research and development of military products can be given by distinguishing different percentages of the addition of different technology levels and introducing the addition ratio. Its calculation formula is as follows:

$$B = B_i \times (1 + B_t)$$

B_i represents the upper limit of the compensation ratio of the government where the enterprise registered, B_t represents the military independent research and development level of the percentage of the increase and B stands for the standard of military compensation (Table 2).

Compensation process of science and technology insurance being introduced into cost compensation mechanism of independent research and development of military products introduces.

The independent research and development of the military products often requires high confidentiality. Combined with the characteristics of the current four operating modes of the science and technology insurance, the technology insurance is introduced into the cost compensation mechanism of the independent research and development

of the military products, which is suitable for the insurance-claim settlement mode. Namely, the enterprise insured technology insurance is the starting point of the whole process, and the military compensation enterprise technology insurance premium is the end point. The cost compensation mechanism of the military independent research and development based on science and technology insurance includes three processes: the technology insurance for enterprises, the claim settlement for insurance companies and the military compensation for the technology insurance premiums for the enterprises.

4.1 Process of Science and Technology Insurance for Enterprises

In the teaching process of the management science in the process of the science and technology insurance begins when the independent military research and development enterprise, as the insurant, expresses its insurance intention to the science and technology insurance underwriting the company and puts forward its demand for the science and technology insurance. Both parties shall establish the intention of insurance and underwriting, and the enterprise shall focus on understanding the technology insurance clauses, the scope of insurance liability and the exemption of liability [9]. After the preliminary communication and negotiation, the enterprise shall submit the insurance data to the insurance company and accept the data review after the actual situation of the independent research and development project of the military products and the approval of the technology insurance terms. Subsequently, the insurance company and the enterprise negotiate on the insurance plan to form the final insurance plan. Finally, the enterprise pays the premium to the insurance company which issues the policy for the enterprise.

4.2 Process of Insurance Company Claiming Technology Insurance

The process of the insurance company claiming the technology insurance begins after an accident occurred in the independent research and development activities of the military products. The enterprise shall timely report the accident situation to the insurance company and the military, collect and preserve the relevant texts and images of the accident and protect the accident site, and provide necessary assistance when the insurance company investigates the cause, the course and the loss of the accident. After the completion of the relevant investigation, the enterprise shall provide the claim related materials to the insurance company and negotiate with the insurance company on the amount of the claim settlement. After the two sides reach an agreement, the insurance company pays the claim and closes the case.

4.3 Process of Military Reimbursing Enterprise Technology Insurance Premium

Based on the science and technology insurance compensation policies issued by many places such as *Chongqing Science and Technology Insurance Subsidy Subvention Management Measures* and *Guangzhou Science and Technology Insurance Pilot Work Plan*, the compensation process of the technology insurance premiums for the military compensation enterprises is mainly divided into three parts: the compensation application, the military evaluation and the compensation issuance. Its compensation flow begins after

the enterprise and the insurance company sign the insurance contract, undertakes to put on record to the army and according to the military product independent research and development achievement technology grade evaluation table the examination content, on schedule fixed point provides the data. After the end of the research and development, the compensation standard is calculated according to the technology level [5].

5 Conclusion

With great theoretical and practical significance, the innovation of the cost compensation mechanism of the independent research and development of the military products can not only enrich and develop the theory of the military material procurement, but also improve the quality and benefit of the military equipment construction and development.

This paper uses the game theory, the risk management theory, the new price theory, the externality theory and the mechanism design theory to analyze the independent research and development equipment cost compensation mechanism construction and the purpose is to explore equipped with independent research and development cost compensation mechanism of the construction of the rule and method, provide a reference for the independent research and development of the innovative equipment cost compensation mechanism.

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