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The Impact of Government Subsidy Policies on Industrial Innovation

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Abstract

In the context of global innovation-driven development, government subsidy policies, as important tools to support industrial innovation, have garnered widespread attention regarding their effects and impact mechanisms. This paper systematically reviews the relevant theoretical foundations of the impact of government subsidy policies on industrial innovation and conducts an in-depth analysis of the mechanisms through which subsidy policies function, including direct financial support, signal transmission, and innovation network effects. The research indicates that the effectiveness of subsidy policies is influenced by multiple factors, including policy design, enterprise innovation capabilities, and external environmental factors. In terms of policy design, factors such as the selection of subsidy recipients, subsidy methods, subsidy intensity, and dynamic adjustment mechanisms are crucial. At the enterprise level, R&D strength, absorptive capacity, and innovation management capabilities significantly affect the outcomes of subsidies. External environmental factors, such as market competition, institutional environment, and industrial clusters, also largely determine the implementation effects of subsidy policies. Based on these findings, this paper proposes policy recommendations for optimizing subsidy policy design, enhancing enterprise innovation capabilities, and improving the innovation environment, with the aim of providing theoretical and practical guidance for increasing the effectiveness of subsidy policies and promoting industrial innovation.

Keywords

Government Subsidies, Industrial Innovation, Innovation Policy, Innovation Networks, Policy Effect Evaluation

1. Introduction

In the increasingly complex global economic landscape, industrial innovation has

become a critical driver for sustained economic growth and enhanced national competitiveness. Government subsidies, as a vital policy tool, have attracted significant attention from academia and policymakers regarding their impact on industrial innovation. In recent years, as governments worldwide have strengthened innovation-driven development strategies, subsidy policies have played an increasingly prominent role in supporting industrial innovation. However, there is still controversy regarding the mechanisms and effects of government subsidies on industrial innovation. On the one hand, some studies have demonstrated that government subsidies effectively alleviate financial constraints in the innovation process, reduce innovation risks, and thus promote industrial innovation activities (Li et al., 2020). On the other hand, some scholars have pointed out that excessive reliance on government subsidies may lead to insufficient innovation motivation among enterprises and even "rent-seeking" behavior, which could hinder genuine innovation (Chen et al., 2019). Additionally, factors such as the design and implementation of subsidy policies and industry characteristics can also affect innovation outcomes. Therefore, an in-depth exploration of the relationship between government subsidy policies and industrial innovation not only helps enrich innovation economics theory but also has significant practical implications for optimizing innovation policy systems and enhancing subsidy fund utilization efficiency.

This study aims to systematically review the theoretical foundations of the impact of government subsidy policies on industrial innovation, analyze the main mechanisms through which subsidy policies function, explore the key factors influencing the effectiveness of subsidy policies, and provide reference suggestions for formulating more scientific and effective innovation support policies. The main contributions of this study are as follows: 1) it systematically summarizes and reviews existing research findings and highlights the innovations and theoretical contributions of this study; 2) it thoroughly discusses the multi-dimensional impact mechanisms of subsidy policies in promoting industrial innovation, analyzing the factors affecting policy effectiveness from policy design, enterprise innovation capabilities, and external environment perspectives; and 3) it proposes policy recommendations with practical guidance to enhance the effectiveness of subsidy policies and promote industrial innovation.

The remainder of this study is structured as follows: Section 2 presents a literature review, Section 3 discusses the theoretical foundations, Section 4 explores the impact mechanisms of government subsidy policies on industrial innovation, Section 5 analyzes the key factors affecting the effectiveness of subsidy policies, and Section 6 provides the conclusion and policy recommendations.

2. Literature Review

In recent years, a significant body of research has explored the impact of government subsidy policies on industrial innovation from various perspectives. On one hand, many studies focus on how government subsidies alleviate financial

constraints for firms through direct financial support, thereby promoting their innovation activities. For example, Dimos and Pugh (2016), through a meta-regression analysis, found that R&D subsidies have a positive effect on corporate innovation activities, particularly in small and medium-sized enterprises. Additionally, Guo et al. (2018) examined R&D subsidies in China and concluded that subsidies can effectively reduce the innovation costs of firms and incentivize more firms to engage in innovation. However, Baruch et al. (2021) pointed out that the effects of subsidies may vary depending on firm characteristics, with some firms potentially developing a dependency on government subsidies, which could weaken their autonomous innovation capabilities.

On the other hand, research has also highlighted the signaling mechanism of government subsidy policies. Chen et al. (2019) provided empirical evidence that different levels of government subsidies (e.g., central vs. local) have varied signaling effects, with central government subsidies exhibiting a stronger signaling effect. Moreover, the role of subsidy policies in fostering innovation networks has attracted increasing attention. Lin and Luan (2020), within the framework of industrial policy theory, proposed that government subsidies are not only a way to correct market failures but also can strengthen industrial innovation capabilities by promoting collaborative innovation among upstream and downstream firms in the industrial chain and forming regional innovation clusters. Zhang et al. (2024), in a study on regional innovation in China, indicated that government subsidies, by supporting collaborative R&D projects within specific regions, promote the formation of innovation networks and enhance overall innovation efficiency.

While these studies reveal various aspects of the impact of government subsidy policies on industrial innovation, most of the existing literature focuses on the direct effects of subsidies on firms' innovation capabilities. There is limited attention to the multidimensional mechanisms of subsidy policies, particularly how they influence industrial innovation through indirect mechanisms such as signal transmission and innovation networks. Additionally, although some studies mention that the effectiveness of subsidy policies is influenced by factors such as policy design, enterprise capabilities, and the external environment, there is a lack of systematic analysis on how these factors interactively influence policy effectiveness.

3. Theoretical Foundations of Government Subsidy Policies

3.1. Market Failure Theory

Market failure theory is an important theoretical basis for government implementation of subsidy policies. In a perfectly competitive market, resource allocation can achieve Pareto optimality. However, in the real economy, numerous factors cause market mechanisms to fail to function effectively, with the externalities and uncertainties of innovation activities being particularly prominent. Innovation has significant positive externalities, and innovation outcomes are often difficult to fully appropriate, resulting in innovators being unable to obtain returns

commensurate with their efforts. This knowledge spillover effect causes enterprises to underestimate the social benefits of innovation activities when making innovation decisions, leading to insufficient innovation investment. On the other hand, innovation activities are highly uncertain, making it difficult for enterprises to accurately predict the probability of success and potential returns of innovation, increasing the risk of innovation projects. These factors collectively lead to insufficient market investment in innovation activities, failing to reach the socially optimal level (Dimos & Pugh, 2016). In this context, government intervention through subsidies and other policy measures can effectively compensate for the innovation shortfall caused by market failure, promote the allocation of social resources towards innovation activities, and thus drive industrial innovation and technological progress.

3.2. Endogenous Growth Theory

Endogenous growth theory provides another important theoretical support for government subsidy policies. This theory emphasizes the core role of knowledge accumulation and technological innovation in economic growth, asserting that long-term economic growth mainly stems from endogenous technological progress and human capital accumulation. According to endogenous growth theory, innovation activities not only improve current production efficiency but also lay the foundation for future innovation through knowledge accumulation and spillover effects, forming a sustained driving force for economic growth. However, due to the high-risk and long-cycle characteristics of innovation activities, market mechanisms often struggle to provide sufficient financial support for innovation. Government subsidy policies can effectively reduce the innovation costs of enterprises, incentivizing more enterprises to engage in innovation activities, thereby accelerating knowledge accumulation and technological progress (Guo et al., 2018). Furthermore, government subsidies can attract more social capital to the innovation field through guidance and demonstration effects, forming a virtuous innovation ecosystem. Therefore, from the perspective of endogenous growth theory, government subsidy policies are not only a correction of current market failures but also a strategic measure to cultivate long-term economic growth momentum.

3.3. Industrial Policy Theory

Industrial policy theory provides a more macro-level theoretical perspective for government subsidy policies. This theory posits that at different stages of economic development, the government should selectively support and guide the development of specific industries based on national strategic needs and industrial development patterns. Within this theoretical framework, government subsidy policies are viewed as important tools for achieving industrial upgrading and structural optimization. By implementing targeted subsidies for strategic emerging industries, high-tech industries, or industries with potential comparative advantages, the government can accelerate the concentration of resources

in these areas, promoting the enhancement of industrial innovation capabilities and the formation of core competitiveness. Industrial policy theory also emphasizes the role of government in coordinating industrial chains and fostering industrial clusters, arguing that well-designed subsidy policies can promote inter-industry collaborative innovation, creating scale effects and agglomeration effects of innovation (Lin & Luan, 2020). However, the implementation of industrial policies also faces challenges such as information asymmetry and rent-seeking behavior, which require the government to fully consider market signals when formulating subsidy policies, and to improve the precision and flexibility of policies to maximize the positive impact of subsidy policies on industrial innovation.

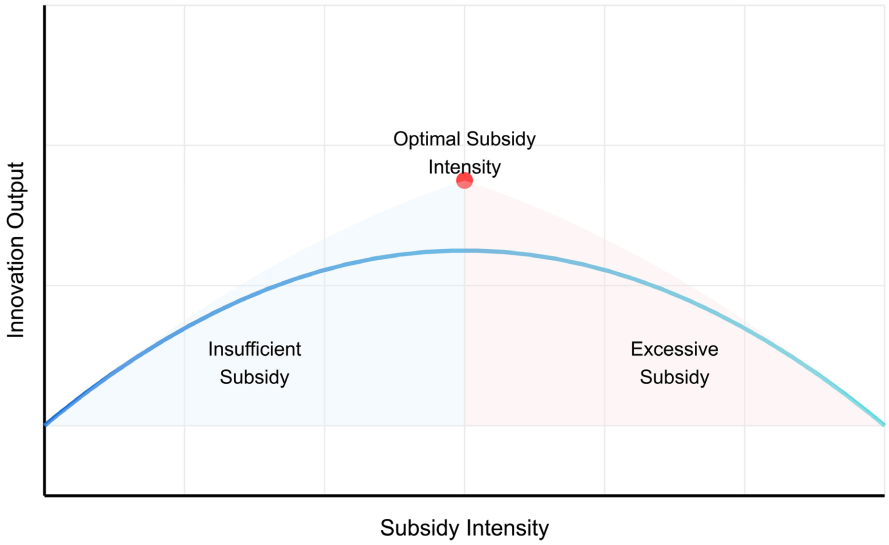
4. Impact Mechanisms of Government Subsidy Policies on Industrial Innovation

4.1. Direct Financial Support Mechanism

Government subsidy policies have a significant impact on industrial innovation through the direct financial support mechanism. This mechanism is mainly reflected in the following aspects: Subsidy funds can effectively alleviate the financial constraints faced by enterprises in the innovation process. Innovation activities typically require substantial financial investment, and traditional financing channels often struggle to meet the needs of innovative enterprises. Government subsidies can directly provide innovation funds to enterprises, reducing their innovation costs and enabling them to undertake more R&D activities. Subsidy funds can help enterprises diversify innovation risks. Innovation is highly uncertain, and government subsidies are equivalent to sharing risks with enterprises. This risk-sharing mechanism can encourage enterprises to attempt more challenging innovation projects. Subsidy funds can support enterprises in acquiring advanced R&D equipment and recruiting high-quality talent, enhancing their innovation capabilities. Finally, for some frontier technology fields or basic research projects, which are often difficult to obtain market funding support due to their long commercialization cycles and high uncertainty, government subsidies play a crucial role in promoting breakthroughs in key technologies and their industrialization (Wang et al., 2017). However, it is worth noting that the effect of the direct financial support mechanism is also influenced by factors such as the method and intensity of subsidies, as shown in **Figure 1**. Subsidy intensities that are too high or too low may affect policy effectiveness, so the government needs to design subsidy programs reasonably based on industry characteristics and enterprise realities.

4.2. Signal Transmission Mechanism

Government subsidy policies have a profound impact on industrial innovation through the signal transmission mechanism. This mechanism is mainly reflected in the information conveyed by government subsidies to the market and the chain



Source: Wang, Li, & Furman, 2017

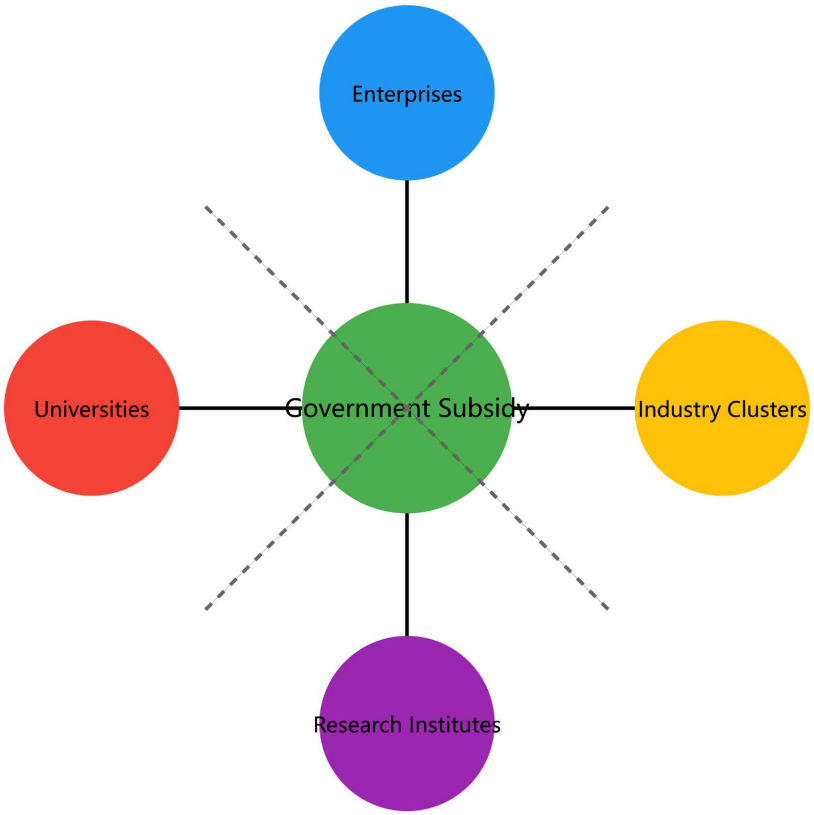
Figure 1. Relationship between subsidy intensity and innovation output.

reactions it triggers. Government subsidies can be seen as recognition and support for the development prospects of specific enterprises or industries. When an enterprise or project receives government subsidies, the market often interprets this as indicating that the enterprise or project has high innovation potential and development prospects. This positive signal can enhance the enterprise's position in the capital market and industrial chain, facilitating its access to more external resource support. Government subsidies can also convey policy orientation signals to the entire industry. Through the design and implementation of subsidy policies, the government can explicitly express support for certain technological routes or innovation directions, guiding more enterprises and capital to focus on and invest in these areas, thereby accelerating the process of industrial innovation. Subsidy policies can also stimulate innovation competition among enterprises. When certain enterprises receive subsidy support, other enterprises may feel competitive pressure and increase their own innovation investments, forming a virtuous cycle of innovation competition. However, the effectiveness of the signal transmission mechanism largely depends on the credibility and transparency of government subsidy policies. If the market questions the fairness and effectiveness of subsidy policies, it may lead to signal distortion or even negative effects. Therefore, when implementing subsidy policies, the government needs to focus on the openness, transparency, and scientific rationality of policies to maximize the positive effects of the signal transmission mechanism.

4.3. Innovation Network Effects

Government subsidy policies have a significant impact on industrial innovation by promoting the formation and development of innovation networks. The innovation network effects are mainly manifested in the following aspects: First, subsidy policies can promote the deepening of industry-university-research cooperation.

By setting up subsidies for collaborative R&D projects, the government can encourage enterprises to engage in closer cooperation with universities and research institutions, promoting the flow and integration of knowledge and technology, and improving innovation efficiency. Second, subsidy policies can promote collaborative innovation among upstream and downstream enterprises in the industrial chain. Subsidies targeting key links or common technologies in the industrial chain can incentivize upstream and downstream enterprises to jointly invest in R&D, forming a synergy for innovation and enhancing the innovation capability of the entire industrial chain. Third, subsidy policies can promote the formation and development of innovation clusters. By supporting innovation activities in specific geographic areas, the government can attract the concentration of innovative elements, promote knowledge spillovers and technology diffusion, and create scale effects and agglomeration effects. Lastly, subsidy policies can promote the construction of international innovation cooperation networks. By supporting transnational cooperative R&D projects, the government can help domestic enterprises integrate into global innovation networks and access advanced technologies and innovation resources. As shown in Figure 2, innovation network effects significantly enhance the promotional effect of subsidy policies on industrial innovation through multi-dimensional connections and interactions. However, it should be noted that the formation and development of innovation networks is a



Data Source: Zhang & Guan, 2021.

Figure 2. Government subsidies promoting innovation network effects.

complex process, and relying solely on subsidy policies may not achieve the expected results. The government also needs to create a favorable environment for the healthy development of innovation networks through complementary measures such as improving intellectual property protection and building innovation platforms.

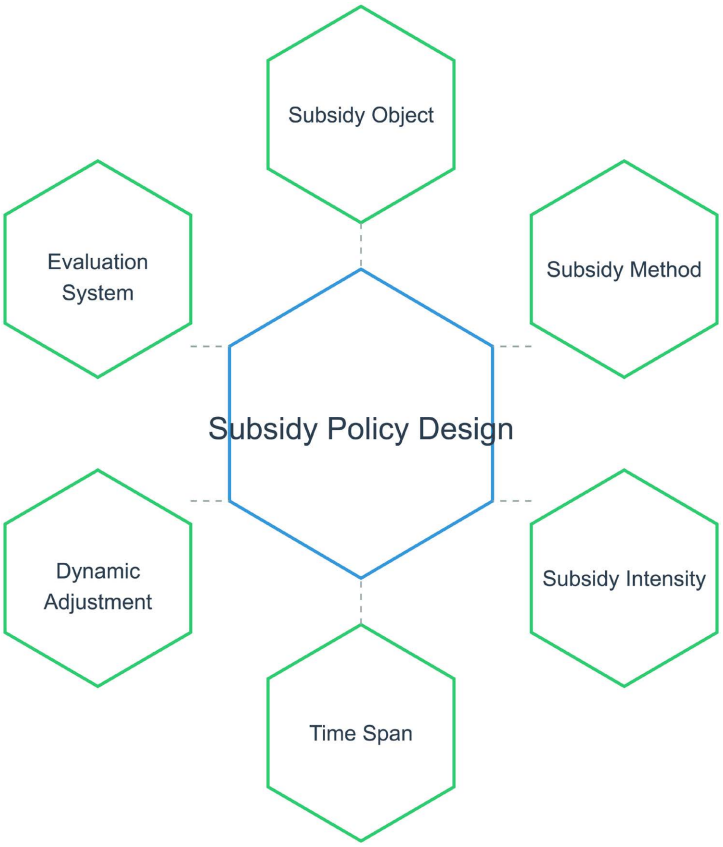
5. Key Factors Affecting the Effectiveness of Government Subsidy Policies

5.1. Subsidy Policy Design

The design of subsidy policies is one of the key factors determining their impact on industrial innovation. Rational policy design can maximize the efficiency of subsidy fund utilization and effectively incentivize enterprise innovation behavior. First, the selection of subsidy recipients is crucial. The government needs to accurately identify enterprises or projects with innovation potential to avoid resource misallocation. This requires the government to establish a scientific evaluation system that comprehensively considers factors such as enterprise innovation capabilities, market prospects, and strategic value. Second, the choice of subsidy methods also significantly affects policy outcomes. Direct subsidies, indirect subsidies (such as tax incentives), and matching subsidies each have their advantages and disadvantages, and need to be flexibly chosen based on industry characteristics and innovation stages. Third, determining the intensity of subsidies requires balancing pros and cons. Subsidy intensities that are too low may fail to effectively incentivize enterprise innovation, while intensities that are too high may lead to resource waste and enterprise dependence on subsidies. Furthermore, the time span of subsidies also needs careful consideration. For basic research and frontier technology development, longer-term continuous support may be needed, while for innovation projects close to marketization, short-term concentrated support may be more effective. Finally, the dynamic adjustment mechanism of subsidy policies is also important. As the innovation environment and market demand constantly change, policy design needs to have sufficient flexibility to respond to these changes in a timely manner (Li et al., 2021). As shown in **Figure 3**, multi-dimensional subsidy policy design factors jointly influence the implementation effects of policies.

5.2. Enterprise Innovation Capability

Enterprise innovation capability is another important factor affecting the effectiveness of government subsidy policies. The level of enterprise innovation capability directly relates to whether they can effectively utilize subsidy funds and transform them into actual innovation outcomes. First, the R&D strength of enterprises is a core element determining innovation capability. Enterprises with strong R&D teams and advanced R&D facilities are more likely to transform subsidy funds into breakthrough innovations. Second, the absorptive capacity of enterprises is also crucial. Enterprises with strong absorptive capacity can better



Data Source: Li, Miao, & Zhang, 2021.

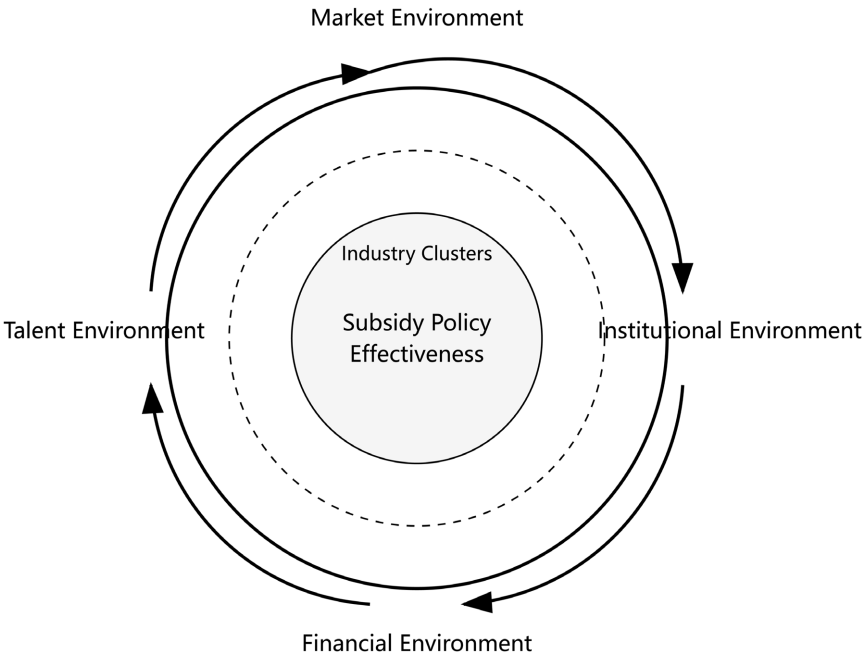
Figure 3. Key factors in subsidy policy design.

identify, assimilate, and utilize external knowledge, thereby improving the efficiency of subsidy fund utilization. Third, the innovation management capability of enterprises also affects the effectiveness of subsidy policies. A good innovation management system can ensure that subsidy funds are effectively allocated to the most promising innovation projects and achieve efficient project execution. Furthermore, the market-oriented capability of enterprises cannot be overlooked. Enterprises that can accurately grasp market demands are more likely to transform innovation outcomes into market value, thus realizing the ultimate goal of subsidy policies. Lastly, the innovation culture and innovation strategy of enterprises are also important factors affecting the effectiveness of subsidy policies. Enterprises with a strong innovation atmosphere and clear innovation strategies are often better able to utilize subsidy funds to continuously drive innovation. Therefore, when implementing subsidy policies, the government needs to fully consider the innovation capabilities of enterprises and adopt differentiated support measures for enterprises with different capability levels to maximize policy effectiveness.

5.3. External Environmental Factors

External environmental factors have a profound impact on the effectiveness of

government subsidy policies. These factors constitute the broader context of enterprise innovation activities, directly or indirectly influencing the implementation effects of subsidy policies. The market environment is a key factor. The degree of market competition, changes in demand, and technological development trends all affect the innovation motivation and direction of enterprises, thereby influencing the effectiveness of subsidy policies. In highly competitive markets, subsidies may stimulate more intense innovation impulses, while in monopolistic markets, the incentive effect of subsidies may be weakened. The institutional environment also plays an important role. The level of intellectual property protection, the construction of a fair competitive market environment, and the soundness of mechanisms for transforming innovation outcomes all affect the enthusiasm and effectiveness of enterprises in utilizing subsidies for innovation. Furthermore, the financial environment has a significant impact on the effectiveness of subsidy policies. A good financial environment can provide enterprises with more financing channels, complementing subsidy policies, while deficiencies in the financial environment may limit the leverage effect of subsidy policies. The talent environment is also a factor that cannot be ignored. The supply of high-quality innovative talents directly affects the innovation capabilities of enterprises, thereby influencing the efficiency of subsidy fund utilization. Lastly, the development status of industrial clusters and innovation networks also affects the effectiveness of subsidy policies. In areas where innovation resources and elements are highly concentrated, subsidy policies often produce greater innovation spillover effects (Chen et al., 2020). As shown in **Figure 4**, these external environmental factors interact with each other, collectively forming a complex



Data Source: Chen, Liu, & Zhu, 2020.

Figure 4. External environmental factors affecting subsidy policy effectiveness.

ecosystem that influences the effectiveness of subsidy policies. Therefore, in formulating and implementing subsidy policies, it is necessary to comprehensively consider these external environmental factors and make policy adjustments and complementary measures based on specific circumstances to ensure that subsidy policies can exert maximum utility in specific environments.

6. Conclusion

As an important tool for promoting industrial innovation, government subsidy policies and their impact mechanisms and effects on innovation activities have long been a focus of attention for academia and policymakers. Through a systematic review of relevant theories and empirical research, this paper has conducted an in-depth exploration of the impact mechanisms of government subsidy policies on industrial innovation and their key influencing factors. The research shows that government subsidy policies mainly influence industrial innovation through mechanisms such as direct financial support, signal transmission, and innovation network effects. The effectiveness of these mechanisms is influenced by multiple aspects, including subsidy policy design, enterprise innovation capabilities, and external environmental factors. To fully leverage the positive role of subsidy policies, governments need to fully consider these influencing factors in the process of policy formulation and implementation, adopting more precise and flexible policy measures. Specifically, governments should optimize the selection mechanism for subsidy recipients, reasonably design subsidy methods and intensities, and establish dynamic adjustment mechanisms to adapt to the innovation needs of different industries and enterprises. At the same time, governments should also focus on enhancing the independent innovation capabilities of enterprises, improving innovation support systems, and creating an environment conducive to innovation. Strengthening the supervision and evaluation of subsidy policies and establishing a scientific policy effect evaluation system are also important guarantees for improving the effectiveness of subsidy policies. Future research can further explore the synergistic effects between subsidy policies and other innovation policy tools, as well as their differentiated impacts in various industries and technological fields, to provide theoretical and practical guidance for formulating more precise and effective innovation support policies.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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