

Article

# Main Problems of Innovation Activity in the Sericulture Industry

Aliyeva Nadirakhon Abdumalikovna<sup>1</sup>

1. PhD, Associate Professor, Department of Trade, TSUE

**Abstract:** Innovation activity is a key driver of competitiveness and sustainable development in modern agricultural sectors. The sericulture industry, despite its historical and economic significance, remains characterized by low levels of technological modernization and limited innovation diffusion. This paper investigates the main systemic barriers hindering innovation activity in sericulture. Using a qualitative analytical approach and comparative industry analysis, the study identifies financial, technological, human capital, institutional, and risk-related constraints that limit innovation implementation. The results demonstrate that innovation failures in sericulture are not isolated issues but rather interconnected structural problems. The study also highlights international best practices, particularly the experience of China, where digital transformation and advanced technologies have significantly improved productivity. The findings provide implications for policy development and strategic innovation management in agrarian sectors.

**Keywords:** Sericulture, Innovation Activity, Agricultural Innovation, Digital Transformation, Constraints, Innovation Management

## 1. Introduction

In the context of global economic transformation, innovation has become a fundamental factor determining the competitiveness of industries. Agricultural sectors, including sericulture, are increasingly required to adopt advanced technologies in order to improve productivity, ensure sustainability, and respond to global market demands. However, despite its long-standing economic importance, the sericulture industry remains largely traditional in many countries and demonstrates slow innovation dynamics [1]. Sericulture is a biologically sensitive and labor-intensive industry, which makes it highly dependent on environmental conditions and manual processes [2]. Although technological advancements such as artificial intelligence, digital monitoring systems, and biotechnology offer significant potential for modernization, their adoption in the sector remains limited. This gap between technological potential and actual implementation raises the question of what structural barriers hinder innovation activity in sericulture. The purpose of this study is to identify and analyze the main problems of innovation activity in the sericulture industry and to determine their systemic nature and interconnections [3].

### Review of Relevant Literature

The issues of managing the innovative activities of enterprises have been studied by many scientists, such as: A.B. Borisov, I. Stepanova, A. Ivanitskaya, N. Maksimov, S. Samal, N.K. Yuldoshev, M.L. Tursunkhodzhaev, M.S. Kosimova, S.S. Gulyamov, B.Yu. Khodiev, B.E. Toshmurodova, G.A. Khamdamova, R.H.Ergashev, S.R.Khalikov, A.Zh.Toshboev. Many scientific works have been carried out by scientists of our country

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on the development of the sericulture industry in the republic and the study of its economic problems. In this area, such scientists as: S. Artikova, R. Israilov, D.T. Mukhamedieva, Sh. Urokov, B.K. Sharipov, O. Zhumaev conducted scientific research [4-7].

## 2. Methodology

When writing the article, decrees and resolutions of the President of the Republic of Uzbekistan, resolutions of the Cabinet of Ministers, scientific works of foreign and Uzbek scientists who studied economic and managerial problems in the silk industry and contributed to its development were used. Industry and educational literature were analyzed. The research methodology included theoretical and statistical analysis.

## 3. Result and Discussion

Innovation activity in agriculture is generally defined as a process of developing, adopting, and diffusing new technologies, organizational solutions, and production methods aimed at increasing efficiency and sustainability [8]. According to international development frameworks proposed by Food and Agriculture Organization, agricultural innovation includes technological, institutional, and digital transformations that enhance productivity and resilience.

In the context of sericulture, innovation may include improved mulberry cultivation techniques, automated silkworm rearing systems, digital environmental monitoring, and advanced cocoon processing technologies. However, the degree of innovation adoption depends on multiple interconnected economic and institutional factors [9].

The analysis shows that innovation activity in sericulture is constrained by a combination of structural barriers. The first and most significant limitation is the insufficient level of financial support. Innovation projects in this sector require substantial investment in infrastructure, digital technologies, and research and development. However, most producers, especially small and medium-sized farms, face limited access to financial resources [10].

High credit costs, lack of investment incentives, and insufficient state subsidies reduce the ability of enterprises to implement innovative solutions at scale. The second major problem is technological backwardness. In many regions, sericulture production is still based on traditional manual methods with minimal mechanization. The absence of modern digital tools, such as sensor-based monitoring systems, automated feeding mechanisms, and artificial intelligence-based analytics, significantly limits productivity growth. In contrast, countries with advanced sericulture systems, such as China, have successfully integrated automation and digital technologies into production processes, achieving substantial efficiency gains [11].

A third critical barrier is the shortage of qualified human resources. Innovation-driven development requires specialists with interdisciplinary competencies in biotechnology, data analytics, and digital agriculture. However, the existing educational and training systems in many sericulture-producing countries are not sufficiently aligned with modern industry demands. This results in a mismatch between technological opportunities and human capacity to implement them effectively [12].

Another important issue is the weak integration between science and production. Although scientific research in sericulture-related fields such as genetics, pest control, and production optimization is continuously developing, its practical application remains limited. The lack of effective mechanisms for technology transfer, commercialization of research results, and collaboration between research institutions and enterprises significantly reduces the innovation potential of the industry [13].

Institutional and regulatory barriers also play an important role. In many cases, innovation activity is not sufficiently supported by clear policy frameworks or incentive systems. The absence of well-developed innovation infrastructure, including technology

parks, incubation centers, and specialized innovation clusters, further restricts the diffusion of new technologies within the sector.

Finally, innovation in sericulture is associated with high levels of uncertainty and risk. Biological factors such as disease outbreaks in silkworm populations and environmental variability significantly increase production risks. This uncertainty reduces the willingness of producers to invest in innovative technologies, particularly when risk-sharing mechanisms such as insurance or government guarantees are underdeveloped [14].

Directions for Solving the Problems of Innovation Activity in the Sericulture Industry. The elimination of barriers to innovation activity in the sericulture industry requires a systemic and multi-level approach that combines financial, technological, institutional, and human capital development measures. The fragmented nature of existing problems indicates that isolated interventions are insufficient; instead, a coordinated innovation policy framework is necessary to ensure sustainable modernization of the sector [15].

First of all, the strengthening of financial mechanisms for innovation development is a critical prerequisite for technological transformation. Innovation projects in sericulture are capital-intensive due to the need for modernization of production infrastructure, implementation of digital technologies, and integration of advanced biological and information systems. Therefore, it is necessary to develop specialized financial instruments aimed at supporting innovation-oriented enterprises. These instruments may include preferential credit lines, targeted subsidies, innovation grants, and public-private co-financing schemes. In addition, the establishment of sector-specific innovation funds can significantly increase access to capital for small and medium-sized producers, which currently represent the most vulnerable segment of the industry. Financial support should be linked not only to production output but also to measurable innovation indicators such as technology adoption rate, digitalization level, and productivity improvement.

Secondly, technological modernization must be considered as a core direction of development. The transition from traditional sericulture systems to smart and digitalized production models requires the widespread adoption of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), machine learning, and automated environmental control systems. These technologies enable real-time monitoring of production conditions, predictive analysis of biological processes, and optimization of resource utilization. The experience of technologically advanced countries, particularly China, demonstrates that the integration of digital platforms and automated systems can significantly increase productivity and reduce operational risks. Therefore, the creation of digital sericulture ecosystems, including smart farms and data-driven management platforms, should be prioritized.

Thirdly, the development of human capital is a fundamental condition for successful innovation implementation. The effectiveness of technological transformation largely depends on the availability of qualified specialists capable of operating, managing, and improving innovative systems. In this context, it is necessary to reform educational programs in agricultural universities and vocational training institutions by incorporating disciplines related to digital agriculture, data analytics, biotechnology, and innovation management. In addition, continuous professional development programs and retraining initiatives should be introduced for existing workforce participants. Strengthening cooperation between educational institutions, research centers, and industrial enterprises will facilitate the formation of a competent innovation-oriented workforce.

Another important direction is the strengthening of the integration between science and production. One of the main reasons for the low level of innovation diffusion in the sericulture industry is the weak connection between scientific research and practical application. To address this issue, it is necessary to develop effective mechanisms for technology transfer, including innovation hubs, research-industry consortia, and applied research centers focused on sericulture development.

Scientific institutions should be encouraged to engage in problem-oriented research that directly addresses the needs of production enterprises. At the same time, enterprises

should be actively involved in the formulation of research agendas to ensure practical relevance and applicability of scientific outcomes.

Institutional reforms also play a decisive role in fostering innovation activity. The development of a supportive regulatory environment is essential for creating favorable conditions for innovation adoption. This includes the introduction of legal frameworks that protect intellectual property rights, incentivize innovation investment, and reduce administrative barriers for technology implementation. Furthermore, the establishment of innovation clusters and specialized development zones for sericulture can enhance collaboration among stakeholders and accelerate the diffusion of new technologies. Cluster-based development models have proven to be particularly effective in promoting knowledge exchange and increasing innovation efficiency in agricultural sectors.

Finally, an important aspect of innovation development is the creation of effective risk management systems. Given the biological nature of sericulture, production processes are highly vulnerable to environmental fluctuations and disease outbreaks. This increases the uncertainty associated with innovation adoption and reduces the willingness of producers to invest in new technologies. To mitigate these risks, it is necessary to develop agricultural insurance mechanisms specifically tailored to innovation-based production systems. In addition, the use of predictive analytics and early warning systems based on artificial intelligence can significantly reduce production risks and increase decision-making reliability.

In conclusion, the effective solution to the problems of innovation activity in the sericulture industry requires a comprehensive and integrated approach that combines financial support, technological modernization, human capital development, institutional reform, and risk management. Only through the coordinated implementation of these measures can the industry achieve a sustainable transition toward a modern, competitive, and innovation-driven development model. The international experience, particularly that of technologically advanced countries, confirms that systematic innovation policy is the key factor in transforming traditional agricultural sectors into high-tech industries with strong global competitiveness.

The findings of this study indicate that the problems of innovation activity in sericulture are systemic and mutually reinforcing. Financial constraints limit technological modernization, while technological backwardness reduces productivity and discourages investment. At the same time, human capital deficiencies and weak institutional frameworks prevent effective implementation of available innovations.

International experience demonstrates that these barriers can be overcome through coordinated policy measures. In countries with advanced sericulture systems, innovation is supported by integrated policy frameworks, strong public-private partnerships, and significant investment in digital technologies. In particular, the case of China shows that systematic adoption of digital and automated solutions leads to substantial improvements in productivity, quality, and competitiveness.

#### **4. Conclusion**

The conducted study has demonstrated that innovation activity in the sericulture industry is constrained by a complex and interrelated system of financial, technological, human capital, institutional, and risk-related barriers. These problems are not isolated in nature but form a structural framework that limits the overall modernization and competitiveness of the sector. The analysis shows that insufficient financial support restricts access to modern technologies, technological backwardness slows productivity growth, while the shortage of qualified personnel and weak science–production linkages further hinder the diffusion of innovations. In addition, institutional inefficiencies and high production risks significantly reduce the attractiveness of innovation investment in the industry.

At the same time, the research confirms that overcoming these challenges requires a comprehensive and systemic approach rather than fragmented policy measures. The

proposed directions for solving these problems emphasize the importance of strengthening financial mechanisms through targeted subsidies, preferential crediting, and innovation funds; accelerating technological modernization through the adoption of digital technologies, artificial intelligence, and automated production systems; and improving human capital through reforms in education and professional training systems. Equally important is the development of effective mechanisms for integrating scientific research with industrial practice, ensuring that innovations are not only developed but also successfully implemented in production processes.

The international experience, particularly the successful transformation of the sericulture sector in China, confirms that systematic and coordinated innovation policies can lead to substantial improvements in productivity, efficiency, and global competitiveness. This demonstrates that innovation is not merely a technological issue but a strategic factor of long-term sectoral development.

In conclusion, the transition of the sericulture industry toward an innovation-driven development model requires a holistic policy approach that integrates financial, technological, educational, and institutional reforms. Only through the coordinated implementation of these measures can the sector overcome existing structural barriers and achieve sustainable growth in the context of the global digital economy. Future research should focus on empirical evaluation of proposed policy measures, quantitative assessment of innovation impact, and development of region-specific innovation models adapted to local conditions.

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