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Research on the Mechanism and Path of Sci-Tech Finance Empowering the Sustainable Development of Animal Husbandry

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Abstract

As an important part of agriculture, animal husbandry plays a crucial role in ensuring national food security, promoting rural economic development, and safeguarding the ecological environment. However, the traditional development model of animal husbandry is characterized by high resource consumption and heavy environmental pressure, facing multiple constraints such as insufficient sustainable development level, inadequate scientific and technological investment, and backward financial services. As an important support system integrating technological innovation and financial resources, sci-tech finance has the potential to help animal husbandry transform and upgrade, enhance green production capacity, and strengthen risk prevention and control capabilities. Starting from the connotations of sci-tech finance and the sustainable development of animal husbandry, this paper sorts out the interactive relationship between the two, and based on multiple theoretical foundations such as innovation theory, financial development theory, and sustainable development theory, deeply analyzes the operational mechanisms through which sci-tech finance empowers the sustainable development of animal husbandry in terms of resource allocation, risk management and control, and technological innovation. On this basis, it proposes path choices such as improving sci-tech finance policies, innovating financial product services, constructing a collaborative ecological system, and strengthening talent guarantee. The purpose is to provide theoretical support and practical ideas for improving the high-quality development level of animal husbandry, promoting agricultural modernization and ecological civilization construction.

Keywords

Sci-tech Finance, Animal Husbandry, Sustainable Development, Resource Allocation, Innovation-driven, Financial Services

1. Introduction

In recent years, with the in-depth adjustment of the urban-rural development pattern and the continuous upgrading of the consumption structure, the role of animal husbandry in ensuring agricultural product supply and promoting rural economic growth has become increasingly prominent. However, under the development pattern where high input coexists with high pollution, animal husbandry is facing problems such as increasingly tightened environmental constraints, low resource utilization efficiency, and weak industrial and technological foundation, making the traditional extensive development path unsustainable. The modern financial system has structural shortcomings in serving agriculture, rural areas and farmers. Especially in the field of animal husbandry, problems such as low conversion rate of scientific and technological achievements, single financing channel, and difficulty in effectively evaluating credit risks are relatively prominent, which restrict the optimal allocation of production factors and the continuous improvement of innovation capabilities. As a bridge linking the innovation chain and the capital chain, sci-tech finance has gradually demonstrated important value in the sustainable development of animal husbandry by virtue of its information advantages, risk dispersion mechanism and resource integration capabilities. By improving the professionalism and precision of financial services and promoting the efficient application of scientific and technological achievements in animal husbandry, it is expected to achieve a win-win situation of ecological and economic benefits. In the long run, promoting the in-depth integration of sci-tech finance and animal husbandry is not only a key path to solve the development bottlenecks of animal husbandry, but also an important supporting force to promote agricultural green transformation and realize the strategic goal of rural revitalization.

2. Connotations and Interrelationship between Sci-Tech Finance and Sustainable Development of Animal Husbandry

2.1 Connotation and Characteristics of Sci-Tech Finance

Sci-tech finance is not a single financial tool or financing model, but a comprehensive financial service system that emphasizes the precise allocation of financial resources throughout the entire process of scientific and technological activities. From scientific and technological research and development to achievement transformation, from technology incubation to market promotion, sci-tech finance runs through all links of technological value realization.

The sci-tech finance system has the characteristics of diversification, integration and high risk tolerance. It not only relies on conventional financial means such as traditional bank credit and equity financing, but also focuses on the application of innovative financial tools such as venture capital, sci-tech insurance, and intellectual property pledge. In terms of resource allocation mechanism, sci-tech finance

shows strong forward-looking and selectivity, tending to invest in technological achievements or innovative enterprises with high growth potential, and pursuing long-term value rather than short-term returns (Dang & Hu, 2025). In terms of operation mode, sci-tech finance emphasizes the collaborative linkage of government, industry, university and research institutes, and focuses on building a comprehensive service platform with sci-tech enterprises as the main body, capital strength as the support, and policy guidance as the guarantee. Its operation logic not only emphasizes the allocation efficiency of capital, but also emphasizes the value realization ability of technological achievements.

2.2 Connotation and Challenges of Sustainable Development of Animal Husbandry

Under the framework of sustainable development, animal husbandry needs to achieve the coordinated unity of economic benefits, social benefits and ecological benefits. This development goal not only requires animal husbandry production to have high resource utilization efficiency, product quality and technological content, but also emphasizes the protection of the natural environment, respect for animal welfare, and the construction of an integrated agriculture-livestock system. From the practical operation level, this concept requires the full-chain green upgrading in links such as breed improvement, feed optimization, epidemic prevention and control, and manure treatment, and improves the operation efficiency of the entire production system through intelligent management and precision breeding.

However, the current animal husbandry still faces multiple challenges in the process of sustainable development. Firstly, resource constraints are becoming increasingly severe, and the shortage of basic factors such as cultivated land, feed and water resources limits the disorderly expansion of the industry scale. Secondly, the environmental burden cannot be ignored, and problems such as livestock manure discharge and antibiotic residues continue to attract social attention. Thirdly, the foundation of technological accumulation is weak, and traditional methods are still dominant in some areas, with limited popularization of intelligent and digital means (Liang & Dai, 2025). In addition, small and medium-sized breeding entities face difficulties in financing, low insurance coverage and weak anti-risk capabilities, and the financial support system has not really covered the entire production process, which to a certain extent weakens their motivation and ability to transform and upgrade.

2.3 Interrelationship between Sci-Tech Finance and Sustainable Development of Animal Husbandry

There is a close interactive relationship between sci-tech finance and the sustainable development of animal husbandry. Their connection is not only reflected in the level of capital supply and technical support, but also in the process of industrial structure adjustment and development model reshaping.

Sci-tech finance can play multiple roles in the development of animal husbandry. By guiding social capital to enter scientific research institutes and sci-tech enterprises, it can promote the transformation of high-quality scientific research achievements into the animal husbandry breeding link, promote the implementation and application of key technologies such as intelligent equipment, biological breeding and animal vaccines, and significantly improve the technological content and production efficiency of animal husbandry. Through venture capital, agricultural insurance, loan interest subsidies and other methods, sci-tech finance can effectively alleviate the capital pressure of breeding entities in the

process of technological renewal and scale expansion, and improve their ability to resist market and natural risks.

The development of animal husbandry also provides a broad application scenario and value creation space for sci-tech finance. In the process of building a modern agricultural industrial system, the large-scale, intensive and industrial chain characteristics presented by animal husbandry provide a practical foundation for the embedding and innovation of sci-tech finance (Na, 2025). Especially in new formats such as intelligent breeding, digital animal husbandry and green supply chain, the in-depth embedding of financial services has become an important guarantee for improving the operation efficiency of the industry. The benign interactive relationship between sci-tech finance and animal husbandry not only improves the sustainable development capacity of animal husbandry, but also expands the service boundary and functional space of sci-tech finance.

3. Theoretical Basis of Sci-Tech Finance Empowering Sustainable Development of Animal Husbandry

3.1 Perspective of Innovation Theory

Innovation theory emphasizes the important driving role of technological progress and knowledge creation in economic growth and industrial evolution. From this theoretical perspective, technological innovation is not only the core way for enterprises to gain competitive advantages, but also the fundamental driving force for promoting industrial upgrading and realizing green development. As an industry with increasing technological intensity, the sustainable development of animal husbandry is highly dependent on the introduction and promotion of new technologies. From biological breeding to nutrition regulation, from epidemic prevention and control to digital supervision, technological innovation has been deeply integrated into the entire industrial chain of animal husbandry.

The introduction of sci-tech finance has expanded the practical path of innovation theory in animal husbandry. By providing diversified financing tools and risk-sharing mechanisms, sci-tech finance can effectively reduce the entry threshold and uncertainty of innovative activities, and stimulate the technological research and development motivation of breeding enterprises and scientific research institutions. The technology incubation platform and achievement transformation mechanism supported by sci-tech finance can also accelerate the transformation process of scientific and technological achievements into actual productivity and improve the overall innovation efficiency of animal husbandry (Wang, Li, Nie et al., 2025). As innovation-driven has increasingly become the main axis of animal husbandry development, sci-tech finance constitutes an important bridge linking technology and the market, making technological innovation truly a core resource supporting sustainable development.

3.2 Perspective of Financial Development Theory

Financial development theory emphasizes the profound impact of the improvement of the financial system on economic growth and structural optimization. An effective financial system can promote resources to concentrate in high-benefit areas through mechanisms such as capital allocation, risk

dispersion and information integration, and improve the resource utilization efficiency of the whole society. In the animal husbandry industry, which coexists with capital intensity and cyclical risks, the efficient allocation of financial resources is particularly crucial.

As an emerging form in financial development, sci-tech finance has expanded the boundary of traditional financial services, making the financial system more inclusive and targeted. According to the characteristics of the capital demand of animal husbandry, sci-tech finance can provide personalized and differentiated service support for different types of breeding entities by building a multi-level financial market, developing exclusive financial products, and establishing a credit rating and risk assessment system. Especially in new animal husbandry projects with high technological content and large initial investment, sci-tech finance can effectively mitigate investment risks through policy-based financing, venture capital, sci-tech insurance and other mechanisms, guide resources to flow in the direction of technology-intensive and eco-friendly, and enhance the sustainability and resilience of the entire industry (Chen & Dai, 2025).

3.3 Perspective of Sustainable Development Theory

Sustainable development theory advocates that economic development must take into account social equity and ecological environmental protection. Under the background of the current global ecological crisis and climate change, the sustainable development of animal husbandry has received unprecedented attention. The traditional production-oriented breeding model has frequent problems in terms of environmental burden, energy consumption and resource waste, and green transformation has become an irresistible trend.

The function of sci-tech finance under the framework of sustainable development theory is mainly reflected in resource optimization allocation and green transformation promotion. By supporting the research and development and promotion of green technologies, and encouraging practices such as low-carbon production, recycling and ecological restoration, sci-tech finance makes environmental protection no longer a cost burden, but an important means to enhance industrial competitiveness. The wide application of new financial tools such as green credit, ecological insurance and carbon finance has not only improved the resource utilization structure, but also promoted the establishment of a positive incentive mechanism for society to protect the environment.

In the long run, sci-tech finance plays an irreplaceable role in guiding animal husbandry to build a resource-saving, environment-friendly and socially coordinated development pattern. It not only provides necessary economic support, but also promotes the effective transformation of ecological value into economic value through system design and incentive mechanisms, realizing the win-win goal of ecological protection and industrial development.

4. Mechanism of Sci-Tech Finance Empowering Sustainable Development of Animal Husbandry

4.1 Resource Allocation Mechanism

Sci-tech finance has shown significant institutional advantages and tool value in optimizing resource

allocation. Through the precise linkage of capital and technology factors, sci-tech finance enables limited financial resources to be concentrated in key links with high potential and strong driving force, breaking the limitations of traditional resource allocation models.

In practice, the guiding role of sci-tech finance is reflected in multiple levels. On the one hand, the policy arrangement combining sci-tech credit, sci-tech guarantee and financial subsidy can promote financial institutions such as banks to provide more targeted financing support in the direction of animal husbandry technological transformation, equipment upgrading and intelligent management, so that capital resources and technical resources can form an effective joint force (He, 2025). On the other hand, the introduction of market-oriented mechanisms such as venture capital funds and industrial funds can guide social capital to pay attention to technological entrepreneurship projects in the field of animal husbandry and enhance the driving force of industrialization of scientific and technological achievements. This resource allocation method can not only improve investment efficiency, but also promote the in-depth optimization of the animal husbandry industrial structure.

In addition, sci-tech finance also plays an important role in regional coordinated development. In major agricultural producing areas, animal husbandry resource-rich areas and ecologically fragile areas, financial resources often show a mismatch phenomenon. Sci-tech finance can implement differentiated credit strategies and project-oriented policies according to the industrial foundation, technological accumulation and development potential of different regions, improve the accuracy and adaptability of resource allocation, realize the rational flow and efficient integration of resources between different spatial units, and help the coordinated development and gradient advancement of regional animal husbandry.

4.2 Risk Management and Control Mechanism

Animal husbandry faces multiple uncertainties in the production process, including epidemic transmission, market fluctuations, climate change and policy adjustments, which constitute significant systematic and non-systematic risks. Due to information asymmetry and lack of credit, traditional financial institutions often show risk aversion when facing the financing needs of animal husbandry, resulting in difficulty in capital sinking to the actual production front line. By building a diversified, dynamic and technology-empowered risk management and control system, sci-tech finance can effectively improve its support capacity for animal husbandry.

In the risk identification link, sci-tech finance can improve the precise identification ability through data-based means. Relying on information technologies such as the Internet of Things, remote sensing and big data, real-time monitoring and evaluation of breeding scale, population structure, epidemic prevention and control measures and environmental conditions are carried out, making the risk status dynamically transparent and providing a scientific basis for risk assessment. In the risk pricing link, sci-tech finance can build a risk pricing system based on behavioral data and operational data by using credit scoring models, blockchain technology and smart contract mechanisms, realize differentiated interest rates and flexible guarantee methods, and reduce the financing threshold for small and

medium-sized breeding entities.

In terms of risk mitigation, sci-tech finance has promoted the in-depth development of the agricultural insurance system. By developing a mechanism combining policy-based animal husbandry insurance and commercial insurance, the scope of risk coverage can be expanded. The promotion of sci-tech insurance products enables breeding entities to obtain basic protection in the event of epidemic disasters and market fluctuations, stabilize their cash flow and credit status, and indirectly enhance the lending willingness of financial institutions (He & Zheng, 2025). In addition, the construction of sci-tech finance platforms also creates conditions for information exchange and cooperative coordination among multiple participants, and can form a risk-sharing network among the government, banks, insurance and enterprises, improving the anti-risk ability of the entire industrial system.

4.3 Innovation-Driven Mechanism

As an important institutional arrangement to promote technological progress, the core value of sci-tech finance lies in encouraging and supporting the aggregation and diffusion of innovative factors in the industry. In the process of animal husbandry transformation and upgrading, technological innovation is the fundamental path to improve production efficiency, reduce environmental load and enhance product added value. From the perspective of R&D investment, sci-tech finance can provide multi-channel and full-chain financing support for scientific research institutes, technology enterprises and innovative entities. The establishment of R&D loans, sci-tech bonds and achievement transformation funds enables R&D activities to obtain stable capital supply and ensure the smooth progress of projects from concept verification to pilot test stage. In the achievement transformation link, sci-tech finance helps to promote the construction of intermediary service systems such as technology evaluation, intellectual property pledge and scientific and technological achievement trading market, making technological achievements have the attributes of pricing, financing and circulation, and shortening the technical path from the laboratory to the breeding farm.

In addition, sci-tech finance also plays a catalytic role in promoting technology promotion and large-scale application. Through the combination of financial leasing, equipment subsidies and sci-tech loans, intelligent equipment, biosafety systems and digital management platforms can be rapidly popularized in the breeding front line, improving technology penetration rate and production efficiency. In the service process, financial institutions not only provide capital support, but also participate in enterprise operation analysis and production process management through fintech tools, promoting the simultaneous improvement of management methods and technical level.

In terms of system innovation, sci-tech finance focuses on building a two-wheel drive system oriented by market mechanisms and supported by government guidance. Through policy tools such as setting up guidance funds, innovation rewards and tax incentives, the government can reduce the institutional cost of sci-tech finance participating in innovation (Bao, 2025). Market entities can establish professional financial platforms and service models for animal husbandry through resource integration and mechanism innovation, promote the rapid transformation of scientific and technological resources to

the application end, and form a virtuous cycle of innovation ecology.

5. Path of Sci-Tech Finance Empowering Sustainable Development of Animal Husbandry

5.1 Improve the Sci-Tech Finance Policy System

Sci-tech finance needs solid policy support in promoting the green transformation and high-quality development of animal husbandry. At present, although governments at all levels have issued a number of supportive policies, there are still certain gaps and inadequacies in system coordination, policy implementation and supervision mechanisms, which affect the coverage and support intensity of sci-tech finance services. Building an efficient and coordinated policy system helps to stimulate the endogenous motivation for the in-depth integration of financial capital and scientific and technological resources.

In terms of top-level design, it is necessary to strengthen the collaborative linkage between science and technology, finance and agricultural competent departments, and build a cross-departmental and cross-field collaborative governance structure. Policy formulation should fully consider the industry characteristics and regional differences of animal husbandry, set up a sci-tech finance support plan specifically for the animal husbandry industrial chain, and guide financial resources to be prioritized to green breeding, smart agriculture, technological transformation and other directions. In terms of policy tools, the government should improve the policy combination such as financial interest subsidies, guarantee compensation and tax reduction and exemption, establish a long-term and stable incentive mechanism, and improve the enthusiasm and initiative of financial institutions to support animal husbandry sci-tech projects.

In addition, the government should also focus on optimizing the supervision system and evaluation mechanism to ensure the effective implementation of sci-tech finance policies. By building a scientific and reasonable performance evaluation system, quantitatively evaluate the effect of sci-tech finance supporting the development of animal husbandry, continuously improve the policy adjustment and feedback mechanism, and promote the standardization and refinement of policy implementation. The government also needs to enhance the predictability and sustainability of policies, and provide stable development expectations and investment confidence for market entities.

5.2 Innovate Sci-Tech Financial Products and Services

The effectiveness of sci-tech finance services depends to a large extent on the adaptability of financial products and service models. Traditional credit products are difficult to accurately match the diversified, long-term and high-risk capital needs of animal husbandry. It is urgent to promote financial institutions to innovate in product design, risk assessment and service methods, and build a multi-level and multi-dimensional sci-tech financial product system.

In terms of product design, banks, guarantee institutions and investment funds can be guided to launch special financial products covering seedling cultivation, equipment renewal, intelligent management, achievement transformation and other links according to the different development stages and project

characteristics of animal husbandry. For example, financial institutions can promote combined credit products of "scientific and technological achievements + credit evaluation + insurance guarantee" to provide low-threshold and high-flexibility financing channels for small and medium-sized farmers and start-up sci-tech enterprises. On this basis, further develop tools such as order financing, accounts receivable pledge and intellectual property financing, expand the scope of refinanceable assets, and enhance the financing capacity of breeding entities (Wang, 2024).

In terms of service methods, financial institutions should accelerate the transformation to a comprehensive direction of "service + management + consulting", not only providing capital support, but also participating in enterprise business strategies, financial optimization and technology application links, so as to improve the depth and breadth of financial services. By setting up sci-tech finance service counters, industrial consultant teams and online financial platforms, enhance the accessibility and user experience of financial products. At the same time, accelerate the promotion of mobile finance, remote credit approval and online risk control models, so that financial services and the digital transformation process of animal husbandry can form a benign interaction.

5.3 Construct a Sci-Tech Finance Ecosystem

The empowerment effect of sci-tech finance on animal husbandry depends not only on the function of a single policy or product, but also on a stable, efficient and coordinated sci-tech finance ecosystem. In this system, the government, financial institutions, scientific research institutions, leading enterprises and breeding entities participate together, forming a cooperation pattern of information exchange, resource sharing and mechanism linkage, and improving the operation efficiency and innovation capacity of the entire industrial chain.

The primary link in building an ecosystem is to strengthen the construction of information infrastructure. By building an animal husbandry information platform covering scientific research, production, sales and other links, systematic collection and sharing of project data, credit records, achievement dynamics and risk early warnings can be realized. On this basis, financial institutions can build precise risk control models and personalized service plans to improve the efficiency and safety of capital allocation. Government departments can implement dynamic supervision and policy regulation with the help of platform data, enhancing the scientificity and timeliness of policy implementation.

Secondly, the establishment and improvement of multi-subject cooperation mechanisms should be promoted. Encourage banks, insurance, investment institutions and technology companies to carry out joint product development and risk-sharing cooperation, and establish unified service standards and evaluation mechanisms. Scientific research institutions and universities can act as technical supporters to provide professional services such as intellectual property evaluation, technical plan demonstration and project consultation. Leading enterprises should give play to the driving role of the industrial chain, drive the common development of small and medium-sized farmers by forming sci-tech finance alliances, co-building incubation platforms and sharing experimental resources, and improve the technological content and organizational level of the entire industry.

In addition, the government also needs to create a good market environment and legal foundation. By strengthening the judicial protection of intellectual property rights and building a fair and transparent financial market order, provide institutional guarantee for the stable operation of the sci-tech finance ecosystem. At the same time, increase the crackdown on illegal financial activities, prevent the spread of financial risks, and maintain a benign interactive environment between industry and finance.

5.4 Strengthen the Training of Sci-Tech Finance Talents

The effective operation of sci-tech finance is inseparable from the support of high-quality and interdisciplinary talents. At present, professional talents who understand both science and technology and finance are still scarce, and there is a mismatch between the talent training system and the actual industrial needs, which restricts the pace of in-depth integration of sci-tech finance and animal husbandry. Building a systematic and diversified talent training and introduction mechanism is a key support for the long-term sustainable development of sci-tech finance.

In terms of the education system, it is necessary to promote universities, scientific research institutions and financial enterprises to jointly carry out interdisciplinary construction, set up curriculum systems and research projects integrating sci-tech finance and agricultural economy, and cultivate a group of interdisciplinary talents with systematic thinking and practical ability. At the same time, explore the establishment of a technical broker system for grass-roots units, guide professional and technical talents to flow to rural areas, and realize the precise docking of scientific and technological resources and financial services at the production front line.

In terms of career development path, a sound professional certification mechanism and talent evaluation system should be established to promote the formation of a clear career development channel for sci-tech finance talents in multiple dimensions such as policy, projects, scientific research and practical work, and improve the industry's attractiveness (Sun, 2024). Government departments can attract high-level sci-tech finance talents to gather in key areas such as agriculture and animal husbandry by providing talent subsidies, entrepreneurship support, project funding and other methods.

In addition, it is necessary to strengthen the continuing education and training platform construction for on-the-job personnel. By setting up sci-tech finance training bases and online learning systems, improve the understanding ability of financial practitioners on the characteristics and technical logic of animal husbandry, enable them to have the professional ability to identify, evaluate and serve sci-tech agricultural projects, and improve the accuracy and forward-looking of financial services.

6. Conclusion

As a key link in the process of agricultural modernization, animal husbandry undertakes an important mission in realizing rural revitalization, ensuring food safety and maintaining ecological balance. However, facing the practical difficulties such as increasingly intensified resource constraints, continuous rising environmental pressure and insufficient technical support capacity, the traditional development model can no longer support the future high-quality transformation. In this context, as an

important link connecting capital and technology, sci-tech finance shows broad prospects and far-reaching value in optimizing resource allocation, strengthening risk management and promoting innovation-driven development.

By improving the policy system, enriching financial products, constructing a collaborative ecology and strengthening talent support, sci-tech finance can effectively solve the structural obstacles in the sustainable development of animal husbandry, and realize the full-chain value guidance from capital injection to technology empowerment, and from risk prevention and control to ecological improvement. In the long run, the empowerment of sci-tech finance to animal husbandry is not a temporary measure, but a systematic and long-term strategic arrangement. Only under the joint promotion of government guidance, market drive and multi-party participation can sci-tech finance be truly integrated into the animal husbandry production system and become an important pillar for promoting agricultural modernization, ecological civilization construction and rural economic revitalization.

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