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THE IMPORTANCE OF INTENSIVE TECHNOLOGIES IN THE DEVELOPMENT OF THE LIVESTOCK INDUSTRY

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Abstract
This scientific article analyzes the role of intensive technologies in the development of the livestock sector, their types, and their economic, social, and environmental effectiveness. Additionally, the main obstacles encountered in implementing intensive technologies - financial, personnel, infrastructural, and institutional factors - are scientifically examined. Priority tasks and implementation mechanisms to address these issues are proposed.

Keywords: Intensive livestock farming, agricultural innovation, sustainable animal husbandry, technological barriers, smart farming, livestock productivity, digital agriculture, infrastructure development, public-private partnership, veterinary biotechnology.

Introduction

Currently, the implementation of intensive technologies based on resource-efficient, highly effective, and innovative approaches in the development of agriculture, including livestock farming, is becoming increasingly important. The demands of population growth, ensuring food security, increasing export potential, and reducing negative environmental impact necessitate the introduction of new technological solutions in the livestock sector.

Relevance of the topic. Intensive technologies are understood as a set of measures aimed at achieving high productivity based on feeding, care, additional biotechnological and information-communication methods. These technologies allow for increased productivity through efficient use of available resources, unlike traditional extensive methods (growth due to large areas or high number of livestock).

One of the main advantages of implementing intensive technologies in animal husbandry is increased economic efficiency. For instance, automated milking equipment, feed preparation, and delivery systems significantly boost labor productivity, reduce labor costs, and minimize errors associated with the human factor. Additionally, through technologies such as genetic selection and artificial insemination, high-yielding breeds are developed, leading to substantial growth in meat and milk production.

Reducing methane gas emissions from livestock activities is one of the pressing issues of today. Intensive technologies, including optimized nutrition programs, waste recycling, and the use of biogas equipment, significantly reduce greenhouse gas emissions. Furthermore, environmental sustainability is ensured through the efficient use of water resources and waste recycling.

In recent years, the concept of "smart farming" has been widely adopted in animal husbandry. Processes such as monitoring livestock health, controlling feed quantities, and assessing productivity are now managed using information technologies. For example, sensors attached to

cattle can provide accurate data about their movement, feeding habits, health, and even reproductive cycles. This enables effective farm management, early disease detection, and increased profitability.

Literature review. According to FAO (2022, "Livestock Primary Data - Global and Regional Trends"), the introduction of intensive technologies plays an important role in achieving productivity. For example, in Europe and America, 7-10 thousand liters of milk are obtained per dairy cow annually, while in many developing countries this figure remains around 1500-2500 liters. This demonstrates that intensive approaches constitute the main difference.

Sh.J. Bakhtiyorova (2021, "The Role of Animal Husbandry in the Innovative Development of Agriculture") analyzed the institutional foundations for introducing modern technologies in Uzbekistan's livestock sector, state programs, and farmers' readiness for innovation. The study emphasizes the importance of education, financial support, and information services. It helps to understand the practical application of intensive technologies in local conditions.

Van der Zijpp, A. J. (2019, "Animal production systems and the environment") compares intensive and extensive livestock systems in terms of environmental sustainability. The author emphasizes that intensive technologies, when properly managed, can help reduce environmental impact. Additionally, it was noted that it is possible to reduce greenhouse gas emissions through high-yielding breeds, optimal feed balancing, and waste recycling.

The OECD/FAO joint report (2023, "Agricultural Outlook 2023-2032") presents medium- and long-term development forecasts for agricultural sectors. It particularly emphasizes the role of intensive livestock models in the global supply chain and the importance of resource-saving and automation technologies. The report also analyzes the impact of biotechnologies (breeding, artificial insemination) and digital technologies.

N. Buriyev (2022, "Innovative Technologies in Livestock Product Production") demonstrates the practical application of bio-fortification, intensive care, modern milking equipment, and computerized management systems. Numerical examples are provided for the productivity and economic efficiency of each technology.

The IFAD report (2021 "Rural Development Report: Transforming food systems for rural prosperity") analyzes the role of animal husbandry in effectively transforming food systems in developing countries. It presents the possibility of increasing small farmers' incomes, ensuring their competitiveness, and achieving efficiency in agriculture through intensive methods.

Analysis and results. In recent years, Uzbekistan has been actively implementing state policies to modernize livestock farming, introduce new breeds, and adopt intensive methods. Notably, the Agricultural Development Strategy for 2021-2025 has identified the digitalization of livestock farming and the introduction of modern livestock housing and care technologies as priority areas. Additionally, innovative projects are being supported through international financial institutions and projects (IFAD, FAO, UNDP).

However, the existing infrastructure, farmers' qualifications, and the level of technological equipment provision are still inadequate. Therefore, it is necessary to strengthen the state's

provision of concessional loans, educational services, and agrotechnological consulting to facilitate the widespread adoption of intensive technologies.

The implementation of intensive technologies in animal husbandry can ensure food security, increase export potential, and reduce negative environmental impacts. In the context of Uzbekistan, there is currently a great need for the application of these technologies, and the organizational, economic, and technological measures in this area are crucial for ensuring the competitiveness of farms.

The application of intensive technologies in the livestock sector not only increases productivity but also makes the production process resource-efficient, systematic, and competitive. For example, ration preparation and automated feeding systems aimed at improving feed efficiency lead to increased productivity and reduced waste. This significantly enhances cattle body weight, milk yield, or egg production percentage (Table 1).

Table 1 Types of intensive technologies in animal husbandry and their importance

Technology Type	Examples	Significance
Innovative feed and nutrition	Balanced rations, automatic feed delivery, bioenzymes, silage	Increases feed efficiency, reduces waste, improves metabolism
Genetic and biotechnological methods	Breeding, artificial insemination, embryo transplantation, genome analysis	Increases productivity several-fold, develops high-quality breeds
Automation and robotization	Milking robots, sensors, automatic air and humidity control	Increases labor productivity, reduces human error
Information and digital management	Farm management software, IoT, mobile applications	Enables precise technical calculations, ensures prompt and efficient management
Waste recycling and bioenergetics	Biogas equipment, organic fertilizer, waste processing	Ensures environmental sustainability, creates an additional energy source

At the same time, genetic and biotechnological approaches are considered one of the main pillars of intensive livestock farming. High-yielding livestock breeds can be developed through artificial insemination, breed selection, and genomic analysis. When these technologies are implemented, an increase in production volume is achieved without increasing livestock numbers, which reduces pressure on land, water, and feed resources.

On the other hand, farm management automation, livestock health monitoring, and waste recycling processes become much more effective through digital technologies and robotization. With the help of information technologies, the accuracy of calculations, security, and control over resource consumption are enhanced. The production of biogas through waste processing, the preparation of organic fertilizers, and the systematic management of waste manure contribute to environmental sustainability. Thus, intensive technologies are an important tool in transforming livestock farming into not only an efficient but also a sustainable industry.

The biggest obstacle to the widespread adoption of intensive technologies in animal husbandry is limited financial capabilities. Due to the high cost of new technologies, particularly automated

equipment and genetic methods, small and medium-sized farms cannot afford them. Additionally, the insufficient functioning of the concessional loan and technical leasing services system, as well as limited opportunities for attracting private investment, are slowing down the process.

Table 2 Table of barriers to the implementation of intensive technologies

Barrier type	Specific issues
Lack of financial resources	- Equipment is expensive - No preferential loans or leasing options - Small farmers have low investment potential
Lack of personnel and knowledge	- Shortage of qualified specialists - Education system is outdated - Cautious attitude towards innovation
Underdeveloped infrastructure	- Weak water, electricity, and road infrastructure - Limited supply of refrigeration and technical equipment
Legal and institutional barriers	- Insufficient legal framework - Impractical state programs - Suppressed potential of the private sector
Psychological and social factors	- Dependence on traditional methods - Distrust of new technologies - Underdeveloped farming culture

Furthermore, the shortage of personnel and the education system's failure to meet current requirements pose serious obstacles to the adoption of intensive technologies. Only knowledgeable and skilled specialists can effectively manage technologies that require innovative approaches. However, in practice, there is a lack of knowledgeable personnel in this field, and among farmers, there are many instances of caution towards innovation and fear of change.

At the same time, the problem is exacerbated by weak infrastructure, inadequate legal frameworks, and socio-cultural barriers. For example, the lack of infrastructure for water, electricity, roads, refrigeration, and technical supplies limits the operation of modern technologies. Legislation contains few mechanisms to stimulate innovation, and government programs often remain on paper. While farmers rely excessively on traditional methods, distrust of new technologies also emerges as a force against technical development.

Conclusions and Suggestions

Today, agricultural sectors, including livestock farming, play a crucial role in ensuring global food security, meeting population needs, and stimulating economic growth. However, traditional working methods are insufficient to achieve high productivity and sustainable development. Therefore, the introduction of intensive technologies in animal husbandry has become an urgent task. Nevertheless, there are financial, infrastructural, personnel, and institutional barriers in this process. This scientific analysis substantiates priority tasks and implementation mechanisms for addressing these problems.

Intensive technologies require expensive equipment, high-quality feed, genetic material, and digital programs. Farmers do not have sufficient financial reserves to purchase them. Therefore, one of the priority tasks is to improve the system of financial support for farmers.

For the effective implementation of intensive livestock technologies, the qualifications of specialists, the results of scientific research, and the education system must work in harmony. Scientifically-based breeds, biotechnological and agro-engineering solutions are guarantees of efficiency.

In livestock farming, intensive models heavily depend on infrastructure such as electricity, water, roads, refrigeration, laboratory, and biological safety systems. Therefore, modernizing these systems and equipping farms with necessary tools is an important task.

To utilize intensive technologies, it is necessary to provide farmers with digital data, implement mobile applications, digital platforms, and "smart farm" models. This will help create a reliable information base, especially for small farmers.

The intensive development of animal husbandry should be carried out not only through state programs but also with the participation of private investments, scientific startups, technology hubs, and clusters. Therefore, improving the business environment and expanding public-private partnerships are among the priority tasks.

The mechanisms for implementing these priority tasks will be as follows. Including:

1. System of concessional financing and subsidies

It is necessary to establish long-term, preferential, and needs-based credit lines for farmers. Through financial institutions:

- Leasing and guaranteed payment mechanisms for intensive livestock equipment;
- Subsidies for biotechnology, automation equipment, and digital programs;
- The establishment of grants and funds aimed at innovation is required.

This system not only eliminates financial barriers but also incentivizes farmers to adopt technological innovations.

2. Training of qualified personnel and agro-innovative education

It is necessary to train specialists in intensive animal husbandry at agricultural universities and secondary specialized educational institutions. Quality in this area can be improved through the following measures:

- Adapting educational programs to international standards;
- Creating educational and scientific practice zones;
- Organizing retraining and advanced training courses for agricultural workers.

In addition, it is necessary to organize training sessions for farmers themselves based on short-term modules, such as "Management in intensive livestock farming."

3. Development of agricultural infrastructure

Infrastructure is the foundation of technological development. Therefore:

- Electricity and water supply should be transitioned to stable systems;
- Centers for processing, storage, and logistics of livestock products should be established;
- Biosafety and veterinary infrastructure must be improved in each district or zone.

These measures will create a favorable environment for intensive farms, and small farms will be integrated through clusters.

4. Implementation of digital platforms

Through an agricultural database, digital livestock records, online monitoring systems for dairy and meat products, and farm management applications:

- Electronic ID, vaccination, and productivity data are maintained for each head of cattle;
- Feed balance and expense tracking are automated;
- The ability to automatically obtain analyses, forecasts, and reports will be created.
- Such platforms reshape decision-making processes in the agricultural sector on a digital basis.

5. Reforms in legislation and state policy

It is necessary to create a regulatory framework that encourages intensive technologies. Specifically:

- Exemption of innovative technology imports from customs duties;
- Tax benefits for livestock projects organized on an innovative basis;
- Legal guarantees for public-private partnerships.

If the state establishes a system for evaluating and monitoring projects, reliable practical results will be observed.

The development of livestock farming based on intensive technologies is one of the strategic directions of modern agriculture. However, a comprehensive approach is necessary for the successful implementation of this process: financial mechanisms, education and personnel, infrastructure, digital solutions, and the legal environment must work in harmony with each other. Only then will intensive technologies become a guarantee of economic efficiency, food security, and a sustainable ecological system.

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