The Development of Sheep Breeding in the Doctrine of Food Security: Problems and Design

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Abstract. The article discusses the experience of restoring sheep stock in the Samara region under counter-sanctions. During the economic reform years, the number of sheep in the region decreased by 10 times. However, the introduction in 2014 of reciprocal restrictions on the import of food products from European countries made it possible to partially restore the population. Over this period, it has grown almost 2 times. As the experience of creating new sheep farms in modern conditions shows, it is necessary to change the old specialization (wool production) to a new one - lamb production. Polyester sheep breeds are better suited for this purpose. With an integrated approach to the implementation of an investment project in sheep farming, high profitability indicators can be achieved. Starting with 300 ewes and spending about 15 million rubles for the purchase of breeding stock, equipment, construction, in two and a half years, the number of productive stock can be brought up to 1000 head. The calculations showed that in this case the payback period of the projects is no more than 4-5 years, depending on the scale of production, the chosen pace of development, and the depth of products processing.

1. Introduction

One of the animal husbandry branches is sheep husbandry, which is distinguished by a large variety of products. At the same time sheep breeding is an extensive and unprofitable industry. Nevertheless, foreign experience in the sheep husbandry development indicates its high economic efficiency. Namely, the production of lamb (in Western Europe, the USA) and sheep’s milk (Middle East countries). Sheep breeding in Australia and New Zealand specializes in the production of high-quality merino fine wool. [1, 2].
The imposition of US and EU sanctions on the Russian Federation required an adequate response from the country's government related to the introduction of counter-sanctions against these countries and an understanding of the need for self-sufficiency in agricultural products, including sheep breeding. And in these conditions, the revival of sheep breeding, which was almost completely destroyed as a result of market transformations from 1991 to 1999, became important. However, the development of sheep farming faces many problems that need to be addressed immediately in order for the industry to be efficient and develop. And here two levels should be distinguished. The first is the desire of the agricultural producer himself to develop. And second, his support from the state. And this is primarily the development of breeding and genetic centers, increasing the production of high-quality breeding material and its implementation in the domestic market, stimulating breeding work aimed at improving breeding productive qualities, subsidizing part of the interest rate on investment loans. At the same time, agricultural producers also need to solve the following problems: select the breed that meets the requirements of intensive production to the maximum extent, form the optimal parameters of the investment project and calculate its results under given conditions. Based on this situation, it is necessary to optimize the parameters of investment projects in the industry [3, 4].

2. Methods and materials
Using the data of the Federal State Statistics Service for the Samara Region, we study the sheep husbandry industry for the period from 1991 to 2019. The study used the abstract-logical method, the statistical method, including the graphical method of presenting the results, as well as the expert estimation method for determining the parameters of the investment project.

3. Results and discussion
In 1991, the Russian Federation declared its independence and the beginning of radical political and economic transformations that affected all areas of the country's activity, including agriculture. Market transformations in the agricultural sector negatively affected the state of sheep breeding. Since 1992, in the Samara region there has been a sharp decrease in the number of sheep from 808.1 thousand head up to 70.8 thousand head in 2010. Currently, a change in the situation is planned — as of 01.01.2019, 136.5 thousand head were registered. Of these, 12.6% is contained in agricultural organizations [5]. Another 32.6% of the livestock is in farm enterprises, the rest are in private household plots (Fig. 1). The formation of such a situation is based on two premises: the use of extensive technological approaches in the industry and the mismatch of market requirements and production capabilities of existing enterprises. Unlike such high-tech industries as dairy cattle and pig breeding in the production of sheep products, intensive technological approaches have not yet been developed, and the principle “the simpler, the more efficient” is applied [6, 7].

Figure 1. The number of sheep in the Samara region (January 1), thousand head.
The impossibility of using modern highly productive technical complexes, automation and computerization tools, the extremely high need for manual labor makes sheep breeding an unattractive industry for the vast majority of heads and specialists of agricultural organizations, for representatives of district and regional agro-industrial complex management bodies [8-10]. In addition to this, the industry specialization in the production of significant volumes of high-quality wool from the point of view of the current state of the market is not acceptable. The insufficient number of wool processing enterprises, the inaccessibility for agricultural producers to conclude direct agreements with processing enterprises, the existing system of semi-legal intermediaries - all this provides the prerequisites for the formation of an extremely low price for wool, which is inexplicable from the view point of market mechanisms. As a result, in large farms, wool can lie in the warehouse for several years due to the fact that the proposed price does not even cover the cost of cutting, and small ones simply throw it in landfills. At the same time, there is a steady growing demand for lamb in the market [11-14].

Based on this, it is clearly seen that the potential of the sheep industry by agricultural producers is not fully utilized. The production of meat in farms specializing in sheep breeding should receive priority in comparison with other types of the final product (sheepskin, wool, etc.) [15-18].

The main tool to correct the situation is an investment project, the key elements of which are presented in Fig. 2.

In its preparation and implementation, it is necessary to optimize all elements of the project, based on possible results (indicators of economic activity, financial, project sustainability, investment efficiency). State support in agricultural projects plays a significant role, although it is not taken into account by banks when financing projects [19].

![Figure 2. The main components of the investment project in sheep breeding.](image-url)

The main thing that prevents this is the selection work many years results, which stimulated the development of animals individual biological characteristics at the expense of others [20]. To increase the production of meat, it is necessary either to ensure the birth of young animals significant amount per unit time, or to create the prerequisites for a high growth rate of live weight in fattening. Based on the latter indicator, sheep breeding is not able to compete with either beef cattle breeding or pig breeding.
The increase in live weight per unit time in the industry is much less. As a result, the only possible way out under these conditions is an increase in the number of lambs at one lambing and an increase in the lambing number in one period of time. At present, in the Samara region, the Kuibyshevskaya sheep breed is mainly grown. She specializes in producing large quantities of quality wool. The meat qualities of this breed are high (faster set of live weight, greater live weight of one animal). At the same time, the rate of meat yield per 1 ewe is insignificant. Lambing takes place round (1 time per year), the average yield of lambs is 105-120 head per 100 ewes. Under current market conditions, this potential is not enough. Therefore, at the Druzhba Breeding Plant OJSC of the Koshkinsky district (creator and distributor of this breed), sheep production remains low profitable, despite the fact that in recent years the demand for breeding animals has grown significantly. The existing breed structure of the sheep head in agricultural enterprises of the Samara region is shown in Fig. 3.

Higher meat production can be achieved by raising sheep breeds with pronounced polyesterity, as well as a significant yield of business lambs. The most common of these breeds in the Russian Federation is Romanovskaya. Under standard conditions of keeping, 250-270 lambs per 100 ewes, on average, get more than twice as many sheep of the Kuibyshev breed per lamb. Additionally, unlike other breeds from Romanov ewe, you can get 3 lambing in 2 years. The phenomenon of polyesterity makes it possible to reduce the dependence on seasonality in the production of mutton (the transition from touring to stream organization of lambing). As a result, agricultural producers will not only receive a more uniform production process throughout the year, but also reduce the need for hiring seasonal workers (co-workers), thereby reducing the cost of keeping animals. Usually, co-workers are attracted during the period of seasonal seasonal lambing and at the beginning of the growing of lambs for a period of 2 months. With in-line cultivation technology, lambing will be planned evenly throughout the year and the need for seasonal staff is greatly reduced.

Figure 3. Breed composition of sheep in the Samara region agricultural enterprises.

When organizing specialized farms for raising sheep, it is necessary to plan the construction of three basic types of industrial buildings (excluding auxiliary ones): a sheepyard for keeping ewes, a sheepyard for lambing, and summer camp buildings.

Each room for keeping pregnant ewes should include six large pens (according to the number of groups of ewes contained), technological and feed passages, and the corresponding number of sheepcote for sheep walking. The room for lambing should include a maternity area, five sites for placing sackpans for different numbers of animals. All sheepyards should be lightweight wooden structures with a roof made of thick polycarbonate. Such design features of the buildings being erected will not only reduce investment costs compared to traditional options, they are maximally consistent with the needs of animals in relation to the microclimate, lighting, and reduce the cost of keeping sheep.

The minimum required set of agricultural machinery for serving a livestock of sheep within 1000 head includes: MTZ-82.1 tractor with grab hitch PKU-0.9, SRK-6V mixer-feeder, tractor cart 2PTS-4,
mini loader MKSM-800. With the appropriate set of equipment, all types of mechanized work can be performed by 1 tractor driver. The cost of acquiring such a set of equipment does not currently exceed 4 million rubles.

Currently, the cost of feed per sheep in the Samara region is quite high (Fig. 4). To reduce them, it is necessary to optimize the feeding system. The organization of animal feeding in the climatic conditions of the region can be divided into two periods: pasture (from April to October) and stall. Due to the deep snow cover in Samara region, the organization of year-round grazing of sheep is impossible. From October to April (in the stall period), the basis of sheep nutrition is formed by haylage, concentrated feed and hay. In terms of nutrition, their ratio is 45:25:30. In the summer, the need for nutrients is provided by green feed and fodder. An additional need for feed is associated with a significant amount of young animals. The high fecundity of Romanovskaya sheep is the reason for a significant number of orphaned lambs (more than 20% of the total number), which are raised through manual feeding.

![Figure 4](image-url)  
**Figure 4.** The cost of feed per 1 sheep in the Samara region.

Cow or goat milk is mainly used for these purposes. The experience of using a sheep milk substitute in Step LLC turned out to be negative, so they abandoned it. The implementation of the proposed measures will increase the productivity of sheep 2.0-2.5 times compared with the existing level - up to 150-200 g / day. (Fig. 5).

![Figure 5](image-url)  
**Figure 5.** Sheep productivity in agricultural organizations of the Samara region.
The final step in the technology should be the creation of your own slaughter and carcass cutting point. For small enterprises, the best option may be modular workshops designed for slaughtering animals, butchering carcasses, cooling. Their sizes vary widely and depend on the needs of enterprises (from 5 to 70 goals per shift). The modular design allows them to be delivered in place and mounted in a short time. Connection to networks (electricity, water) is carried out through standard connectors. The price of such a module is from 2.5 million to 11 million rubles. The use of a slaughterhouse at minimal cost can significantly increase the selling price of products in comparison with the sale of animals by live weight. A further increase in the profitability of sheep farming is associated with a deeper processing: the production of semi-finished products, smoked products, etc.

4. Conclusion
Despite the fact that sheep farming is currently an inefficient sector in agriculture, nevertheless, with the implementation of state support in implementing an investment project in sheep farming, high profitability indicators can be achieved. Starting with 300 ewes and spending about 15 million rubles for the purchase of a parent livestock, equipment, construction, in two and a half years, the number of productive livestock can be brought up to 1000 head. The calculations showed that in this case the payback period of the projects is no more than 4-5 years, depending on the scale of production, the pace of development, and the depth of processing of products. This will contribute to the development of sheep husbandry both in the Samara region in particular, and in the Russian Federation as a whole, and will positively affect the implementation of the country's food security doctrine.

5. References
[1] Gorbacheva A, Balashova N, Chekrygina T, Chernovanova N, Yagupova E and Vorontsova E 2020 IOP Conference Series: Earth and Environmental Science 422 (1) 012073
[2] Nurumbetov T, Botabayev N, Akbashева A and Bektursunova A 2019 Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Teknologiya Tekstil'noi Promyshlennosti 1 258-261
[3] Michalk D L, Kemp D R, Badgery W B, Wu J, Zhang Y and Thomassin P J 2019 Land Degradation and Development 30(5) 561-573
[4] Herrero M, Grace D, Njuki J, Johnson N, Enahoro D, Silvestri S and Rufino M C 2013 Animal 7 (SUPPL.1) 3-18
[5] Zhichkin K, Nosov V, Zhichkina L, Andreev V and Mahanova T 2020 IOP Conference Series: Earth and Environmental Science 422 012054
[6] Bhatia J, Pandey U K and Suhag K S 2005 Indian Journal of Animal Sciences 75 (12) 1423-1432
[7] Biswas W K, Graham J, Kelly K and John M B 2010 Journal of Cleaner Production 18 (14) 1386-1392
[8] Benoit M 1998 Productions Animales 11 (3) 199-209
[9] Benoit M and Laiguel G 2011 Productions Animales 24 (3) 211-220
[10] Nyam Y S, Matthews N and Bahta Y T 2020 Agronkon 59 (1) 1-15
[11] Dumont B, Groot J C J and Tichit M 2018 Animal 12 (s2) S210-S219
[12] Ripoll-Bosch R, Joy M and Bernués A 2014 Animal 8 (8) 1229-1237
[13] Pismennaya E, Stucalo V, Volters I, Kipa L and Azarova M 2019 Engineering for Rural Development 18 337-342
[14] Ripoll-Bosch R, Díez-Unquera B, Ruiz R, Villalba D, Molina E, Joy M, Olaizola A, (...) and Bernués A 2012 Agricultural Systems 105 (1) 46-56
[15] Tindano K, Moula N, Leroy P, Traoré A and Antoine-Moussiaux N 2017Animal 11 (10) 1873-1880
[16] Ruiz R, Díez-Unquera B, Beltrán De Heredia I, Mandaluniz N, Arranz J and Ugarte E 2010 Global Food Security: Ethical and Legal Challenges EurSafe 138-140
[17] Villalba D, Díez-Unquera B, Carrascal A, Bernués A and Ruiz R 2019 Agricultural Systems 173 107-118
[18] Benoit M and Laiguel G 2014 International Journal of Sustainable Development 17 (1) 35-48
[19] Zhichkin K, Nosov V and Zhichkina L 2019 *IOP Conference Series: Earth and Environmental Science* **403** 012073

[20] Singaravadivelan A, Kumaravelu N, Vijayakumar P and Sivakumar T 2019 *Journal of Animal Health and Production* **7** (2) 58-64