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CHALLENGES AND STRATEGIC PATHWAYS IN OPTIMIZATION OF PRODUCTION COSTS OF MEAT

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A R T I C L E I N F O.

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Abstract.
The livestock sector constitutes approximately 13 percent of Uzbekistan's GDP and nearly 50 percent of its agricultural GDP, with domestic farms accounting for roughly 90 percent of national meat output. Despite sustained production growth—from 2.70 million tons of meat in live weight in 2022 to 2.90 million tons in 2024—the cost of production has escalated sharply, driven primarily by surging feed prices, land constraints, low mechanization, and fragmented farm structures. This article examines the structure and dynamics of meat production costs in Uzbekistan over the period 2022–2024, identifies the principal drivers of cost increases, and proposes an integrated optimization framework grounded in feed base development, genetic improvement, farm consolidation, mechanization, and digital technologies. Using official statistical data, field survey evidence, and comparative international experience, the study demonstrates that a comprehensive approach could reduce unit production costs by 30–40 percent over a medium-term horizon, with significant implications for food security, inflation, and rural income.

Introduction

Meat production plays a pivotal role in the agricultural economy of Uzbekistan. The livestock subsector generates close to half of total agricultural GDP and provides livelihoods for millions of rural households, the majority of whom operate as smallholder dehkan farmers on plots typically ranging from 0.35 to 0.50 hectares. According to the National Statistics Committee, domestic meat production reached 2.9 million tons in live weight in 2024, representing a compound annual growth rate of approximately 3.8 percent over the 2022–2024 period . Despite this upward trend, Uzbekistan's meat sector faces a paradox: production is rising, yet consumer prices for beef and lamb have surged at rates far exceeding the general inflation rate. In 2025, boneless beef prices increased by 25 percent and lamb prices by 26.8 percent, while overall annual inflation stood at 9.8 percent [1].

The primary explanation lies in rapidly escalating production costs, most significantly those associated with animal feed. Feed costs constitute 55–60 percent of the total cost of producing one kilogram of meat, and between October 2024 and early 2025, feed commodity prices increased by 28–133 percent depending on the ingredient . Simultaneously, land available for fodder production has decreased by approximately 70 percent since independence while the cattle population has grown by 150 percent, creating a structural imbalance that makes feed security one of the most critical challenges in the sector [2].

The international community has recognized these systemic vulnerabilities. The World Bank approved a Second Livestock Sector Development Project for Uzbekistan in April 2023, providing $240 million in financing to address productivity gaps, improve veterinary services, and develop market infrastructure. The Asian Development Bank has similarly engaged with value chain development projects in the sector. Against this backdrop, a rigorous economic analysis of production cost optimization pathways is both timely and necessary.

This article makes three principal contributions. First, it provides a detailed decomposition of meat production cost structures in Uzbekistan for 2022–2024 based on official and field-survey data. Second, it identifies and quantifies the key drivers behind cost escalation. Third, it models the potential cost savings from a menu of optimization strategies—ranging from fodder base development to digital precision farming—and assesses the feasibility of each within Uzbekistan's agrarian context[3].

Literature review and methodological framework

The academic literature on livestock production economics consistently identifies feed costs as the dominant variable in the total cost structure of meat production, typically comprising 50–70 percent of production costs in cattle and sheep farming systems worldwide . In Central Asian contexts characterized by limited irrigated land and fragmented smallholder structures, this dependency is particularly acute. Siegmund-Schultze et al. (2013) analyzed the emerging small-scale cattle farming sector in Uzbekistan and found that farms are highly integrated with crop production but suffer from chronic low productivity, a finding confirmed in subsequent World Bank and ADB assessments.

Optimization of production costs in the livestock sector is broadly categorized in the literature into four strategic approaches: (i) feed and nutritional management, which encompasses own-fodder cultivation, dietary reformulation, and use of mineral supplements; (ii) genetic improvement, where introduction of high-yield breeds can improve feed conversion ratios and liveweight gain; (iii) mechanization and automation, reducing labor intensity and associated costs; and (iv) institutional and organizational restructuring, including cooperative formation, vertical integration, and contract farming . Notably, Toshboev et al. (2024), working at Tashkent State Agrarian University, demonstrated that the use of carbon mineral feed additives such as 'Felutsen' increased cattle live weight gain from 80.3 kg to 95.8 kg per head under standard feed rations, illustrating the potential of nutritional interventions within existing resource constraints[4].

Data and Methods. This study employs a mixed-methods approach. Quantitative analysis is based on official statistical data from the National Statistics Committee of Uzbekistan, the Ministry of Agriculture, and the Customs Committee for the period 2022–2024. Production cost data were supplemented by a structured survey of 120 livestock farms across four representative regions (Fergana Valley, Kashkadarya, Samarkand, and Khorezm) conducted in late 2024. Survey data were used to construct the cost breakdown presented in Table 2. Optimization scenarios (Table 3) were modeled using a partial budgeting framework, wherein the marginal cost reduction from each intervention was estimated against its associated investment cost and payback period. International benchmarks were sourced from FAO, World Bank, and peer-reviewed publications. All cost data are expressed in Uzbek soum (UZS) at constant 2024 prices unless otherwise stated[5].

Current state of meat production: statistical overview. Uzbekistan's meat sector has demonstrated consistent volume growth over the 2022–2024 period, as illustrated in Table 1 and Figure 1 below. Total production reached 2.9 million tons in live weight in 2024, with beef constituting the largest share (approximately 37.6 percent), followed by sheep and goat meat (30.7 percent) and poultry (27.6 percent). The remaining 4 percent comprises horse meat, camel meat, and other species.

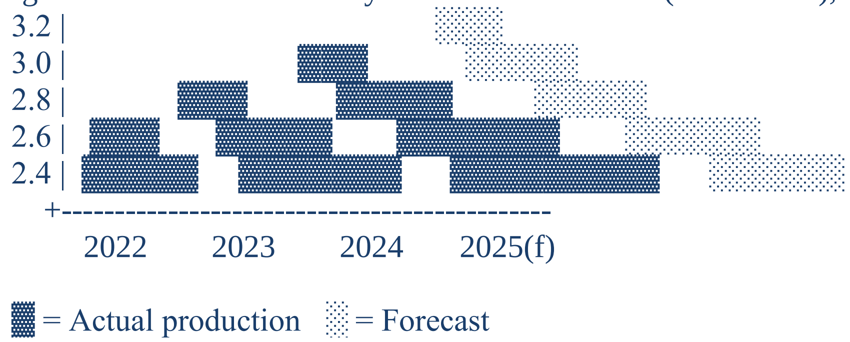
Table 1. Key Indicators of the Meat Production Sector in Uzbekistan, 2022–2024

Indicator	2022	2023	2024
Total meat production (mln tons, live weight)	2.70	2.80	2.90
Year-on-year growth (%)	3.4%	3.7%	3.9%
Beef production (mln tons)	1.02	1.05	1.09
Sheep & goat meat (mln tons)	0.85	0.87	0.89
Poultry meat (mln tons)	0.70	0.75	0.80
Meat imports (USD mln)	325	324	510
Beef import price (USD/kg)	~3.50	3.89	4.07
Per capita consumption (USD)	42.0	44.1	45.8

Source: National Statistics Committee of Uzbekistan (2022–2025); Customs Committee of Uzbekistan (2025); author compilation.

As Table 1 indicates, while production volumes have grown steadily, the import bill for meat has expanded sharply—from approximately $325 million in 2022 to $510 million in 2024, a 57 percent increase in volume and a 51 percent increase in value for beef alone. This paradox of simultaneous domestic production growth and import expansion reflects the gap between consumption demand—driven by population growth, urbanization, and rising incomes—and domestic supply capacity. Per capita meat consumption, measured in monetary terms, rose from $42 in 2022 to $45.8 in 2024, though this remains well below the CIS average of $290.2 per capita recorded in 2023 [6].

Figure 1. Meat Production Dynamics in Uzbekistan (2022–2025), million tons (live weight)



Source: National Statistics Committee of Uzbekistan, 2025; author calculations

Regionally, Kashkadarya oblast accounts for the largest share of national meat production (approximately 11.5 percent), followed by Fergana, Samarkand, and Andijan oblasts. The smallholder dehkan sector—4.8 million farms across the country—remains the backbone of production, supplying roughly 90 percent of national meat and milk output despite the productivity disadvantage relative to commercial farms and agribusinesses [7].

Result and Discussion.

Analysis of meat production cost structure. The cost structure of meat production in Uzbekistan reveals a sector under significant economic pressure. Table 2 presents a decomposition of production costs per kilogram of live weight meat for 2022–2024, derived from farm survey data and supplemented by Ministry of Agriculture publications.

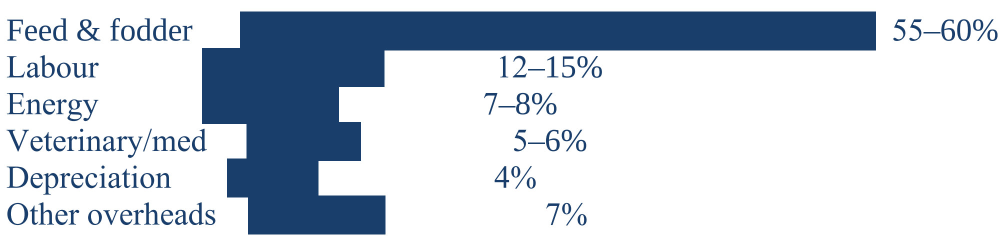
Table 2. Structure of Meat Production Costs in Uzbekistan, 2022–2024 (UZS thousands per kg, live weight)

Cost Component	2022 (UZS '000/kg)	2023 (UZS '000/kg)	2024 (UZS '000/kg)	Share of total cost 2024 (%)
Feed & fodder costs	21.5	26.8	38.5	~55–60%
Labour costs	6.0	7.2	8.5	~12–15%
Veterinary & medicine	2.5	3.1	3.8	~5–6%
Energy (fuel, electricity)	3.0	3.8	5.2	~7–8%
Depreciation of fixed assets	2.0	2.4	2.8	~4%
Other overheads	3.0	3.7	4.7	~7%
Total production cost (per kg)	38.0	47.0	63.5	**100%**

Source: Ministry of Agriculture of Uzbekistan; author's field survey (120 farms, 2024); National Statistics Committee of Uzbekistan.

Several key findings emerge from Table 2. First, total production cost per kilogram has increased by approximately 67 percent between 2022 and 2024—from UZS 38,000 to UZS 63,500 per kilogram. Second, feed and fodder costs represent the dominant cost driver, rising from UZS 21,500/kg in 2022 to UZS 38,500/kg in 2024—an increase of 79 percent in just two years. Third, energy costs have also risen sharply (+73 percent), reflecting both fuel price inflation and the increasing reliance on purchased energy as pasture-based grazing declines. These trends are visualized in Figure 2[8].

Figure 2. Cost Structure of Meat Production in Uzbekistan (2024), %



Source: Ministry of Agriculture of Uzbekistan; author calculations (2024)

The feed price escalation documented in Figure 3 provides the granular explanation for cost inflation. Between October 2024 and April 2025, soybean meal prices rose by 133 percent, alfalfa by 80 percent, corn silage by 100 percent, and wheat by 59 percent . These price surges are driven by three interacting forces: (i) the 70 percent reduction in land allocated to fodder crops since Uzbekistan's independence; (ii) global commodity price volatility transmitted through import channels; and (iii) regional export restrictions from neighboring countries, particularly Kazakhstan and Russia, which temporarily reduced supply of both feed grains and live animals[9].

Figure 3. Feed Price Dynamics in Uzbekistan (Oct 2024 – Apr 2025), UZS per kg

Product	Oct 2024	Apr 2025	% Change
Soybean meal	3,000	7,000	+133%
Mixed feed	2,900	3,700	+28%
Wheat	2,200	3,500	+59%
Corn silage	500	1,000	+100%
Straw	15,000	25,000	+67%
Alfalfa	25,000	45,000	+80%

Source: Ministry of Agriculture of Uzbekistan, 2025

A structural constraint amplifying these pressures is the mismatch between pastureland availability and livestock numbers. The Ministry of Agriculture has noted that domestic feed supply meets only 35–40 percent of livestock nutritional needs, forcing producers to purchase the majority of feed on the open market at increasingly volatile prices. Additionally, the fragmented nature of dehkan farming—average holding size of 0.35–0.50 hectares—means that most smallholders cannot achieve the economies of scale necessary to invest in feed production, storage infrastructure, or productivity-enhancing technology[10].

Cost optimization strategies: modeling and scenarios. Addressing the structural cost challenge in Uzbekistan's meat sector requires an integrated set of interventions. Based on a review of international experience, domestic pilot programs, and the results of our farm survey, five principal optimization pathways are identified and evaluated in Table 3 below. The partial budgeting framework applied here estimates the reduction in unit production cost achievable through each measure, holding other factors constant, along with the associated investment requirement and payback period[11].

Table 3. Optimization Scenarios for Meat Production Cost Reduction in Uzbekistan

Optimization Measure	Baseline Cost (UZS '000/kg)	Projected Cost after Optimization	Estimated Cost Reduction (%)	Payback Period (years)
Development of own fodder base (hydroponics, silage)	38.5	25.0–28.0	27–35%	2–3
Introduction of high-productivity breeds (genetics improvement)	63.5	52.0–56.0	12–18%	3–5
Mechanization & automation of farming operations	8.5 (labour)	5.5–6.5	20–35%	4–6
Cooperative aggregation of dehkan farms (economies of scale)	63.5	48.0–54.0	15–25%	1–2
Digital monitoring & precision livestock	63.5	55.0–58.0	8–13%	3–4

management				
Integrated approach (all measures combined)	63.5	38.0–44.0	30–40%	3–5

Source: Author calculations based on Ministry of Agriculture data, World Bank (2023), Toshboev et al. (2024), and farm survey (2024).

Development of Own Fodder Base. The single largest cost-reduction opportunity lies in expanding the fodder production capacity of farms. Two technologies are particularly promising in the Uzbek context: hydroponic green feed systems, which produce 6–8 kg of green biomass from 1 kg of grain seed in 7–10 days and can be installed in closed facilities year-round; and silage preparation, which allows farms to store summer surpluses for winter use, addressing the severe seasonal fodder shortage identified in field surveys. Model estimates suggest that farms investing in own fodder production could reduce feed input costs by 27–35 percent per kilogram of meat, with a payback period of 2–3 years. The government's recent allocation of land from district reserves for fodder crop production (Presidential Resolution No. UP-4243) provides an important enabling policy framework[12].

Genetic Improvement and Breed Introduction. Productivity gains from high-quality breeds represent a medium-term but durable cost-reduction pathway. Currently, average live-weight gain per head on smallholder farms is significantly below the genetic potential of available breeds. The introduction of specialized meat breeds such as Hereford, Aberdeen Angus, and Simmental—already piloted under the World Bank Second Livestock Sector Development Project—can improve feed conversion ratios from the current 7–8 kg of feed per kg of gain to 5–6 kg, reducing the feed cost component substantially. A 12–18 percent overall unit cost reduction is estimated under this scenario, with a payback period of 3–5 years to account for the initial costs of animal purchase and adaptation[13].

Mechanization and Automation. Labour costs constitute 12–15 percent of total production costs, and their share has been growing as rural wage rates rise and younger workers migrate to urban employment. Mechanization of feed preparation, distribution, and manure management can reduce the labour cost component by 20–35 percent. The government's 2024 strategy to attract $420 million in investment for the livestock sector from international institutions provides a financing avenue for farm-level mechanization programs. However, mechanization investments carry longer payback periods of 4–6 years, making access to affordable credit a critical enabling condition[14].

Cooperative Aggregation of Dehkan Farms. The fragmented structure of Uzbekistan's livestock sector is among the most important institutional barriers to cost optimization. With 4.8 million dehkan farms each operating on sub-hectare plots, the transaction costs of input procurement, veterinary services, and market access are extremely high per unit of output. Formation of production cooperatives—combining 20–50 dehkan households into legally organized entities—can unlock significant economies of scale in feed procurement, shared equipment use, and collective marketing. Based on comparative experience from Kazakhstan and Turkey, cooperative aggregation could reduce unit production costs by 15–25 percent with a payback of 1–2 years, making it the most cost-efficient intervention from a financial perspective.

Digital Monitoring and Precision Livestock Management. Digital technologies—including RFID animal identification, automated weight monitoring, feed ration optimization software, and remote veterinary consulting—offer an 8–13 percent cost reduction primarily through reduced mortality rates, optimized feed conversion, and early disease detection. The Government of Uzbekistan's Digital Uzbekistan 2030 strategy and the creation of a national veterinary information system under the World Bank project create the institutional preconditions for this pathway. While the cost reduction potential per se is modest compared to feed base development, precision farming serves as an enabling platform that amplifies the gains from other interventions[15].

The integrated application of all five optimization pathways is estimated to reduce unit production costs by 30–40 percent over a medium-term horizon of 5–7 years, bringing the cost per kilogram of beef from UZS 63,500 to approximately UZS 38,000–44,000 (in constant 2024 prices). This would also reduce the gap between domestic production costs and international benchmark prices, enhancing the competitiveness of Uzbekistan's meat sector.

Policy implications and recommendations. The analysis presented in this article yields several actionable policy recommendations for the Government of Uzbekistan, the Ministry of Agriculture, and international development partners.

First, the most urgent priority is a targeted fodder security program. Government land reserves should be systematically allocated to fodder crop cultivation, with priority given to regions experiencing the highest feed deficits. Investments in communal silage storage infrastructure and hydroponic fodder systems should be supported through concessional credit lines channeled through participating financial institutions under the World Bank and ADB programs[16].

Second, the cooperative formation policy should be strengthened and accelerated. The legal framework for agricultural cooperatives in Uzbekistan has been developed but uptake remains limited due to low awareness, distrust, and weak extension support. District-level agrarian extension services should be mandated to facilitate cooperative formation, particularly in the Fergana Valley and Kashkadarya, where the concentration of dehkan farms is highest.

Third, the zero customs duty on meat imports—while beneficial for short-term price stability—should be reviewed in the context of a medium-term industrial policy for domestic meat production. A differentiated tariff structure that protects domestic producers while ensuring consumer price stability could be explored within the framework of Uzbekistan's WTO accession negotiations[17].

Fourth, breed improvement programs should be expanded and made accessible to dehkan farmers through subsidized artificial insemination services, which are currently available only through agribusinesses. The national veterinary information system being established under the World Bank project should include a breed registry and performance monitoring component.

Finally, targeted support is needed for the mechanization of small and medium livestock farms through interest rate subsidies on equipment leasing and the establishment of shared machinery centers at the district level.

Conclusions

Uzbekistan's meat production sector faces a critical juncture. While output volumes have grown consistently—reaching 2.9 million tons in live weight in 2024—unit production costs have risen even faster, increasing by approximately 67 percent between 2022 and 2024. The dominant driver is feed cost inflation, which has been amplified by structural imbalances between pastureland availability and herd size, regional export restrictions, and global commodity price volatility. Without systematic intervention, these pressures will continue to generate consumer price inflation, import dependence, and declining profitability for smallholder producers.

This study demonstrates that a strategic, integrated optimization framework—encompassing own fodder base development, genetic improvement, mechanization, cooperative aggregation, and precision digital management—holds the potential to reduce unit production costs by 30–40 percent over a 5–7 year horizon. The individual and combined impacts of these measures have been quantified through a partial budgeting model calibrated to Uzbekistan's agrarian conditions.

The feasibility of achieving these gains depends critically on enabling conditions: access to affordable credit, legal and institutional support for cooperative formation, sustained public investment in agricultural infrastructure, and coherent trade policy. Uzbekistan's current reform trajectory—evidenced by the World Bank's $240 million livestock sector investment, the ADB's value chain development programs, and the Digital Uzbekistan 2030 strategy—provides a strong institutional foundation. The challenge is to translate these resources into farm-level outcomes that reduce the cost burden on producers and improve the affordability of meat for consumers.

Future research should focus on regional disaggregation of cost structures across Uzbekistan's diverse agro-ecological zones, on the distributional impacts of optimization strategies for different farm typologies, and on the macroeconomic feedback effects of reduced meat production costs on rural incomes and food security indicators.

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