Uzbekistan livestock sector analysis: Baseline report

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The Uzbekistan livestock sector analysis: Baseline report was prepared by the International Livestock Research Institute (ILRI), livestock master plan (LMP) team, with input from the Uzbekistan Ministry of Agriculture and Water Resources (MAWR) and Rural Reconstruction Agency (RRA), as well as other Uzbekistan livestock experts. The study was funded by the World Bank Group (World Bank).

Abbreviations and acronyms

AgSOs	Agricultural production support organizations
AI	Artificial insemination
AID	Animal Identification Database
AU–IBAR	African Union-InterAfrican Bureau for Animal Resources
BAU	Business-as-usual
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
HACCP	Hazard Analyses and Critical Control Point
HESM	Herd and Economic Sector Model
LMP	Livestock master plan
LSA	Livestock Sector Analysis
LSUs	Livestock standard units
LSIPT	Livestock Sector Investment and Policy Toolkit
masl	Metres above sea level
MAWR	Uzbekistan Ministry of Agriculture and Water Resources
MPZs	Main production zones
ROI	Return on investment
RRA	Rural Reconstruction Agency
SP	Specialized production units
U-LMP	Uzbekistan livestock master plan
UZS	Uzbekistani Som
ZVS	Zoo-Vet stations

1 Livestock in Uzbekistan: Introduction and overview

1.1 Importance of the livestock sector to Uzbek economic development, including rural livelihoods

Currently, the livestock sector of Uzbekistan contributes up to 46% of the total agricultural output in the country and is an important source of income for the rural population (UzStat 2017a). Since 1991, the cattle population in the country has increased by almost 2.5 times, which has resulted in an increase in the share of livestock production in the gross agricultural output of Uzbekistan from 30–35% in the 1980s to 46% in 2016. A similar trend has been observed for small ruminants. Between 1991 and 2016, the sheep and goats population increased by 1.9 times (UzStat 2017a). This has positively affected the welfare of all people in the country since it has increased rural incomes, and at the same time, it has contributed to the increased availability of animal protein in rural and urban household diets.

The main feature of the sector is that the largest share of livestock products are produced by dehkan households (rural smallholder family farms) with an average land size of 0.35 ha in non-irrigated areas and from 0.04–0.08 ha in irrigated lands. Dehkans produce more than 94% of the beef/mutton/chicken, 95.6% of the milk, 85.4% of the wool and 57.3% of the eggs. They own more than 11.5 million heads of cattle (94% of the total cattle population), 16 million heads (or 83%) of sheep and goats, 85% of horses and 63% of chicken (UzStat 2017a).

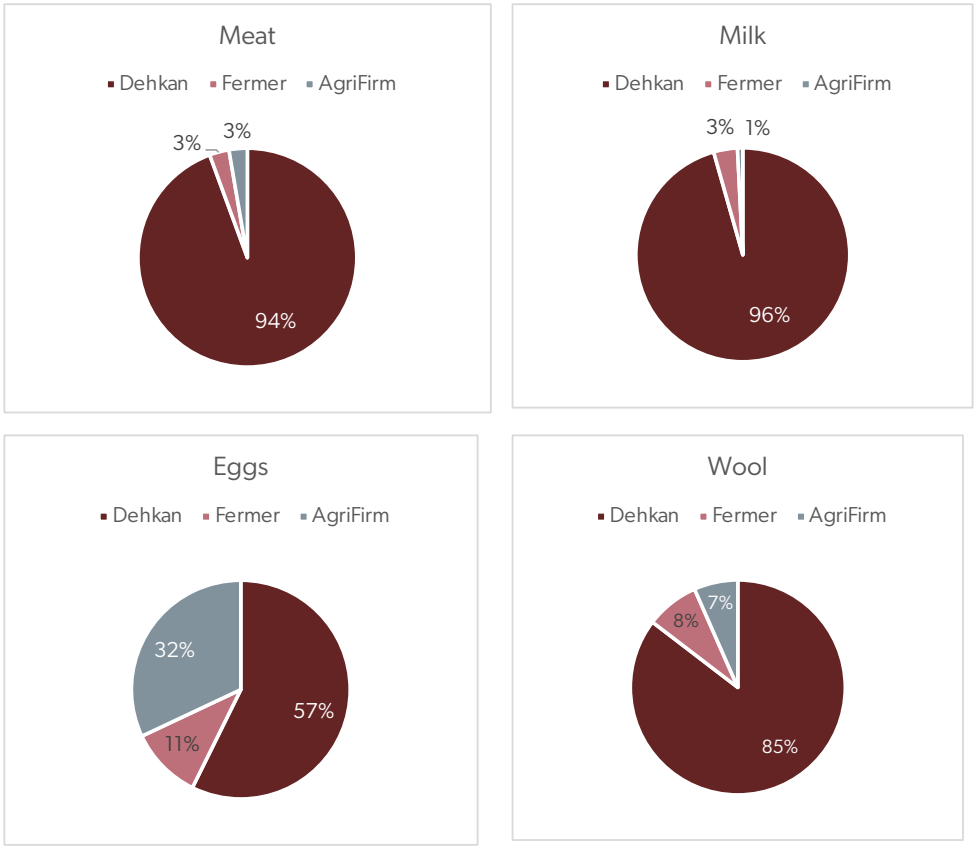
Private livestock farms (i.e. fermers), meanwhile, produce only 2.9% of the beef, 3.6% of the milk, 10.7% of the eggs and 8% of the wool.

In the baseline report, specialized commercial farms or agriculture enterprises are called AgriFirms and specialized production units (or SP). The contribution or share of AgriFirms or SP in meat production is about 2.7%; in milk, it is less than 1%; in wool less than 7%, while in eggs production, SP supplies 1/3 of the total produced (UzStat 2017a). Figure 1 shows the production contribution by farm type.

Further modernizing and growth in the livestock sector of Uzbekistan, particularly in the production of meat and milk, has great social and economic importance for the nation. These products are both foods for human nutrition and a good source of cash income for rural families. Further developing the sector could also turn these products into export-oriented commodities, which would increase the foreign exchange earnings of the country. Since the independence of the country, dehkan households have greatly benefited from the growth of livestock production: first due to allocation of land for their ownership (0.024 ha was allocated to the dehkan families in rural areas in the early 1990s); and second, the main share of livestock is owned by them. There is a direct correlation between the welfare level of dehkan families and the size of land and the number of livestock heads they own (UzStat 2017b).

Many consider the productivity of livestock to be the key to further increasing income gains for families in rural areas (ICARDA 2015). Currently, livestock-keeping activities contribute about 45% of family incomes in the piedmont areas and more than 50% in desert and steppe and semi-desert areas, while animal husbandry in the highland areas contribute up to 67% of family income. The well-being of rural families depends not only on the size of the land they can use and the size of the herd, but more so on the quality of their livestock and access to productivity-enhancing technologies especially feed (due to severe shortages and proper care for animals (ICARDA 2015).

Figure 1: Production contribution by farm type.



Source: Compiled from UzStat 2017a.

Finally, it is important to note that livestock also fulfils a critical function in the growth and accumulation of family savings since it is not just an income generator but also a walking asset. The rural population in Uzbekistan do not yet widely use bank services such as deposit savings and securities. This is due to the lack of broad access to financial services. Therefore, for rural people buying and keeping livestock is often the main way of creating assets.

1.2 Justifying the Uzbek livestock master plan (LMP) project

There is often considerable underinvestment in livestock development despite the growing importance of livestock in rural economies and animal source foods in urban diets (Delgado et al. 1999; Herrero et al. 2014). This underinvestment is a major constraint to modernizing the livestock sector and can prevent it from making an even more substantial contribution to national and/or state development goals; including poverty reduction, food security, economic growth and even mitigating climate change (Herrero et al. 2014; Shapiro et al. 2015). Moreover, livestock ministry leaders usually lack convincing quantitative evidence of potential impacts to get sufficient financial resources from ministries of finance (Shapiro et al. 2015). To attract more substantial investments from finance ministries and private sector investors, returns on investment (ROIs) based on ***ex-ante*** impact assessments of combined technologies and policies are needed to help the livestock ministries compete with investment returns in other sectors.

Another hindrance to generating convincing evidence to motivate public planners and private investors to increase their livestock investments is a lack of capacity to build and use quantitative herd and sector models, which can demonstrate the substantial ROIs possible from new technologies and policies for the livestock sector transformation. Such modelling skills are not common in most livestock agencies in developing countries.

At the request of the government of Uzbekistan and using available data from secondary sources and national livestock experts, the International Livestock Research Institute (ILRI) livestock master plan (LMP) team has developed a livestock herd and economic sector model (HESM) for Uzbekistan and then has carried out the baseline assessment (for the base year of 2017/18) of the 15-year livestock sector analysis (LSA). The LSA will, in turn, inform the 5-year investment analysis, which will result in developing the Uzbekistan livestock master plan (U-LMP), which will be a series of five-year investment implementation plans or 'roadmaps'.

1.3 Context for the LSA and baseline in current national strategies and planning

The Uzbekistan economy has demonstrated high and stable average annual growth rates in recent years, largely as a result of deepening economic reforms aimed at modernizing production and improving both infrastructure and the overall quality of life. This stable growth has laid the basis for the country to further enhance its competitiveness and achieve the average global level of economic development. During 2010–2016 alone, the gross domestic product (GDP) grew at average annual rates of more than 8% (UzStat 2017b). Per capita gross national income (GNI) during 2000–2016 has more than tripled: from USD 1,950 to 6,640 (World Bank 2013).

As income per capita doubled in real terms in less than a decade, absolute poverty has almost halved (World Bank 2013). At the same time, Uzbekistan has made notable strides towards other national Millennium Development Goals such as environmental protection and reduction of under-5 child mortality. Encouraged by this outstanding growth performance, Uzbek authorities have set an ambitious goal for the country—to join the group of upper-middle-income countries by 2030 (World Bank 2013).

One of the most visible transformations in Uzbekistan over the last 25 years has been the gradual change in the structure of the economy away from monoculture agriculture (mainly cotton) in the late 1990s towards greater reliance on industry and services by 2016 (UNDP 2016).

Currently, the Government of Uzbekistan is implementing a National Actions Strategy 2017–2021. The goal of the strategy is to drastically increase the efficiency of reforms and the creation of conditions for assurance of comprehensive and accelerated development of society, through economic modernization and liberalization of all life spheres (Government of the Republic of Uzbekistan 2017). There are specific objectives for strengthening reforms and transformation. In relation to agricultural sector development, the strategy puts forward the following main development objectives:

a. Improving the quality of public services, the enabling environment, the rule of law and institutions;

b. Modernizing agriculture to contribute to agricultural development, industrialization and growth in national GDP;

c. Reducing unemployment and increasing household incomes, including addressing rural poverty (through creating farm jobs, improving farm productivity and educating rural people);

d. ncreasing the nutritional security of rural and urban people (through improved farm output and food diversification);

e. Developing rural infrastructure (roads, housing, electricity, gas and water supply, schools and rural clinics);

f. Contributing to exports (creating farm surpluses for export to increase foreign exchange earnings); and

g. Sustainable use of land and water resources.

The government has recognized the employment challenges the rural population faces and has taken a number of steps to address issues related to economic governance and improving the business environment to promote private sector development. These include the development of diverse farming enterprises and the application of new technologies and innovations to boost employment for the rural population, including women and youth. The government also plans implementing employment programs through the creation of about 256 thousand workplaces as a result of about 25 thousand investment projects for integrated territories development. In the areas with the highest unemployment rates, it plans to create 47 thousand new workplaces, provide loans to 10 thousand educational institution graduates to start enterprises (Government of the Republic of Uzbekistan 2017). To increase foreign exchange earnings, the government is planning to increase agriculture exports by supporting the implementation of modern technologies and innovations for the manufacturing of export-oriented products and materials and through facilitating investments by developing entrepreneurship and attracting foreign investors.

The national plans for modernizing agriculture during 2017–2020 have also been spelled out in the President's Resolution no. PP-2,460 of 29 December 2015, on 'Further reforming and developing agriculture in 2016–2020'. It includes:

- Developing competitive value chains for domestic and export markets;
- Stimulating rural job creation;
- Improving reproduction, multiplication and dissemination of animal forage seeds;
- Creating elite or demonstration farms with high quality pedigree animals for reproduction;
- Reaping economic benefits through improved productivity and targeted land allocation; and
- Developing viable, sustainable and climate-resilient farming systems.

In the livestock sector, in particular, the President's Resolution highlights developing livestock value chains, improving provision of private and public veterinary services, enhancing animal feed marketing to increase feed supply, boosting animal productivity by carrying out national livestock breeding programs and by importing high quality stock of pedigree animals.

1.4 Current constraints and challenges and opportunities at the policy and institutional level and present strategies to overcome them

This section highlights the major policy constraints and institutional challenges in the Uzbekistan livestock sector and recommended policies. It is based on a review of the available literature and consultations with Uzbek livestock experts. It covers animal health services, feeding, breeding, research and extension service system, access to banking services, livestock trade issues and considered the red meat, dairy, chicken and the hides and skin value chains.

Animal health services

The veterinary services are considered the most developed subsector supporting livestock, considering its regional and district branches and set of services provided. At the district and village levels, the veterinary services are made up of the public and private Zoo-Vet stations (ZVS). The public ZVS provides animal vaccines, treatment,

and artificial insemination (AI) services to farmers, while private ZVSs mostly deal with general animal health issues and, upon agreement with the state veterinary services, provide animal vaccination and AI. The state program for livestock development (Yusupova et al. 2010) envisages the continuous establishment of both public and private ZVSs. However, inadequate buildings and equipment and the insufficient state budget to support services of remote veterinary stations hamper the establishment of more ZVSs. Additional constraints include the lack of needed veterinary drugs and their high cost.

The main approaches to promoting more effective and viable veterinary services (both public and private) require creating an enabling environment to encourage the private sector through providing incentive packages such as access to better technologies and training; improving the budget allocation to facilitate the provision of essential public animal health infrastructure; strengthening the capacity of ZVSs and establishing a reporting system such as Animal Identification Database (AID) that will facilitate collecting information on veterinary drugs/vaccine performance at all levels (Yusupova et al. 2010).

Animal nutrition

The continuous livestock herd increase in Uzbekistan has not been matched by a corresponding increase in the production of animal feed. The livestock feed base has shrunk dramatically since 1991 (Yusupov et al. 2010). As part of the state strategy, land used for feed production was allocated to crop production, mainly wheat and cotton. Most of the family and smallholder private livestock farms suffer from insufficient feed supplies. The key reasons for insufficient feed production are lack of land, low feed crop yields and administrative targets and restrictions (GAIN 2011).

IFAD notes that now the government has a policy of crop diversification, it should play an active role in making more land available for feed production and removing administrative restrictions related to land allocation, as long as the value of feed production is competitive with alternative crops. The government should strive to also encourage and help improve feed marketing and supply channels, implement feed quality standards and monitoring, encourage scientific research to develop higher yield feed crops and provide training, extension, and professional education to farmers and the entire rural population. Moreover, the government needs to address land tenure rights and state control over the production of strategic agricultural crops (IFAD 2017).

The State Statistics Committee of Uzbekistan reports that currently there are about 317 thousand ha of land allocated for animal forage production. These areas are going to be increased by an additional 70 thousand ha over the next 4 years (President's Resolution No. PP-2,460, 2015). However, even with extended land areas put under forage crops, and even with 2–3 harvests of green biomass per year, it is not likely to be sufficient to meet the growing demand for animal feeding (ICARDA 2015).

It will be crucial to more effectively use available land resources and apply more intensive, higher productivity cropping practices, and also to more effectively and widely use available pastoral areas for the production of animal feed (Mirzabaev et al. 2016).

Animal breeding

There is a continuous effort by the Uzbek State Program for Livestock Development to improve the quality of livestock breeds (Lerman 2008a). However, there still exist critical issues that hamper animal breeding services. These include insufficient research support for pedigree breeding; insufficient pedigree stock and frozen semen procurement from abroad; insufficient feed resources and veterinary services; lack of required hygiene norms in livestock management; and incomplete public awareness about pedigree breeding. A number of objectives set forth by the 'Law on pedigree animal breeding' have not been fulfilled, including conservation and rational use of pedigree resources (Ibragimov 2016). Additional constraints include a lack of awareness of the importance of AI; and an insufficient number of AI units, and lack of qualified specialists for AI and their low motivation.

The recommended policy actions include reinforcing genetic improvement; revisiting the 'Law on pedigree animal breeding'; encouraging public–private partnership; developing a breed standard and initiating herd/flock books for existing local breeds, establishing an identification, registration and performance testing system for purebred animals; ensuring adequate expertise and infrastructure; and establishing livestock breeders associations and societies (Ibragimov 2016).

Live animals and meat

The main sources of meat in Uzbekistan include cattle, sheep and goats, chicken, horse and fish. Most of the red meat production comes from cattle. Uzbekistan practised a restriction on meat exports hence meat produced from beef cattle was strictly for domestic consumption (Ibragimov 2016). In early 2017, the government lifted all export restrictions for meat products, and now Uzbek producers can export their meat produce based on regional market demand and supply. However, the country imports beef to meet domestic demand (Ibragimov 2016). Currently, the red meat industry is constrained by low genetic potential of existing stock; inadequate marketing system including undue payments, low prices and transportation problems; inadequate infrastructure for veterinary services infrastructure, inadequate feed resources, weak livestock farmers' organizations, and inadequate technical support services (Ibragimov 2016).

The essential required policy actions include providing cost effective and relevant AI technologies, improving marketing infrastructure, strengthening livestock market price and related information, promoting public–private partnerships for infrastructure investments, and reinforcing the extension services and farmer organizations (Ibragimov 2016).

Dairy

Dairy is the major livestock subsector in Uzbekistan, contributing about 45% to livestock GDP during 2016 (UzStat 2017b). The small family producers, dehkan farms, sustain the dairy sector. About 95% of the milk produced during 2016/2017 comes from the smallholder dehkan farms. However, milk production in Uzbekistan operates well below its potential. Average cow milk yields within farms rarely exceed 7 kg per day and 1,200 kg per lactation (GAIN 2011). The principal constraints to dairy subsector development include the limited dehkan farmer access to land; lack of access to sufficient fresh and conserved forage and the unreliable quality of forage and feed; limited access to reliable, quality animal health services; low genetic merit of much of the national herd; inadequate sanitary conditions at farms and processors; constrained direct access to processors and markets; and lack of asset building resources including training/advisory services, accessible financing, and business capacity to increase sectoral and micro-enterprise productivity and efficiency (IFAD 2015).

The appropriate policy response will consist of improving the capacity and quality of the AI service delivery through capacity building programs and public–private partnerships; strengthening cooperatives; strengthening milk inspection; improving marketing infrastructure; improving farmers' linkage to existing and emerging markets and providing land for household level improved grass and leguminous feed production (Ibragimov 2016).

Chicken

The number of chicken has been increasing rapidly since 2007. The sector has a promising future and is projected to increase its share in livestock GDP by 6% during 2032 (Ibragimov 2016). However, the sector is constrained by inadequate availability of feed resources and poor quality and expensive feeds. Additional constraints include inadequate marketing infrastructure, inadequate technical support services and poor access to credit (Ibragimov 2016).

The recommended policy responses include strengthening quality audit and compliance of the commercial feeds, creating an environment for private–public partnership in feed provision, controlling disease and genetic

improvement, improving marketing infrastructure, providing technical support and availing credit access to farmers and other actors in the value chain (Ibragimov 2016).

Hides and skins

The most important sources of hides and skins in Uzbekistan are cattle, sheep, goats and camels. The production of Karakul sheep is also well developed for its unique skin, which is mostly produced on semi-desert and desert rangelands located in central and western territories of Uzbekistan. Most of the hides and skins are produced from the dehkan household farming system. The hides and skins sector and volumes of exported Karakul sheep skin are constrained by less awareness of rural Dekhans on the economic importance of hides and skins; low supplies due to low prices and inadequate marketing infrastructure, coupled with insufficient technological support and investments in processing facilities and value-added production (Ibragimov 2016).

Recommended policies will include increasing awareness of livestock farmers, providing adequate marketing infrastructure and promoting investments in processing facilities of hides, skins and the Karakul fur. More efforts should be directed to build strategies for concentrating critical product volumes with desirable qualities that attract local and international buyers, so that differential prices can be negotiated on a quality basis. Improved management of production resources (land, water, biodiversity) and enhanced breeding strategies, along with an improved value chain and marketing for hides and skins, are crucial (Ibragimov 2016).

Land availability

Access to land resources is the major constraint affecting the livestock sector productivity of Uzbekistan (Lerman et al. 2007). Future livestock development in the country directly depends on the government's ability to address land tenure and land use rights (Lerman et al. 2007). Currently, any private livestock farming entity can legally be registered by the state authorities with at least 30 heads of animal livestock standard units (LSUs) (equal to 30 head of cattle or 300 head of sheep), and the state goal is to allocate from 0.3 to 0.6 ha of land per LSU for livestock farming purposes and forage crop production (Ibragimov 2016). However, the smaller livestock keepers are more restricted in accessing land areas and struggle to supply their animals with seasonal feeding, especially during the winter period when demand for animal feeding and market prices are at the highest (Ibragimov 2016).

Lack of inter farmland revenue due to bans on land subleasing leads to difficulty for efficient rural producers to expand their land plots by acquiring inefficient plots. Consequently, smallholder livestock keepers with successful cattle breeding operations are restricted in their growth capacity (Ibragimov 2016).

Moreover, a farmer cannot easily use land allocated by the government for cotton and wheat produced for other purposes, including for cattle breeding. Some of the knowledgeable livestock farmers are managing to produce maize, alfalfa, and lucerne or legume crops for animal feeding purposes by applying intercropping or double cropping practices (Ibragimov 2016). However, the general lack of knowledge and restricted land areas for forage cropping are badly impacting livestock sector performance (Ibragimov 2016).

The recommended policy includes allowing farmers to allocate land for crop production within their farms. This will enable farmers to optimize their crop patterns according to the market demand and supply. Meanwhile, it will also be necessary to improve the legal framework for subleasing and land transfer and possibly allow the right to resell land tenure rights so that farmers can use those rights as collateral to access bank loans (Ibragimov 2016).

Livestock research institutional capacity

The development and application of modern technologies is the most important technical factor for raising the productivity and production of the livestock sector (FAO 2009). Cattle, sheep and chicken are the main focus of

the Uzbek Research Institute of Livestock Production and the Uzbek Research Institute of Karakul Sheep Husbandry, respectively (Ibragimov 2016). Currently, livestock research institutions are constrained by:

- insufficient budget
- high investment costs
- low motivation of researchers
- inadequate or outdated research/lab facilities and infrastructure
- weak coordination among research collaborators with other stakeholders
- low private sector participation (Ibragimov 2016).

Recommended policy actions required are: increasing the budget of research organizations, improving research facilities and infrastructure, decentralizing and orienting the agricultural research system towards the demands of the farmers, capacity building for research scientists including animal scientists, establishing continuity of research system by promoting the involvement and mentoring of young scientists and promoting public–private sector partnerships for infrastructure investments (Ibragimov 2016).

Extension services

The responsibility of rural extension services is to transmit the necessary knowhow to farmers and thus enable them to increase production levels, improve farm management and achieve higher profitability. However, in Uzbekistan, there is no integrated management system for disseminating professional information on livestock farm issues (Lerman et al. 2007). The agricultural production support organizations (AgSOs) can hardly fill the knowledge gap of farmers and the lack of links to research organizations and communication modus. Many non-governmental organizations (NGOs) involved in providing extension services and training of farmers in the country do not target animal production; they are active mostly in the areas of farm management, crop production, horticulture, drying fruits and vegetables, beekeeping, wheat, etc. Most of the services are usually completed after the completion of donor funding (Lerman et al. 2007). Additional constraints include low allocation of public or private funding to extension services, low private sector involvement and low capacity of extension agents (Lerman et al. 2007).

To improve the livestock extension delivery system, the services should be user-oriented, cost-effective and demand-driven. Public–private partnership in extension service delivery is crucial. Besides, sufficient expertise in both quantity and quality, research-training-extension-farmer linkage and adequate infrastructure and facilities are important for efficient livestock extension service delivery (Ibragimov 2016).

Constraints in accessing banking services

There are several public and private service banks operating in the agricultural sector of the country, such as Hamkorbank, Xalq Banki, Agro Bank, Qishloq Qurilish Bank and others. However, their high interest rates (14–20% per annum) are not affordable for most of the livestock keeping smallholders. Moreover, there is a general reluctance in rural communities to borrow bank credits as they require collaterals to guarantee loan repayments. Such experiences have created a sense of insecurity among members of society who are generally reluctant to use credit-based collateral (Ibragimov 2016). Some banks have recently announced the distribution of state-supported rural credits (with an annual 9% interest rate) for smallholders amounting up to 15 million Uzbekistani Som (UZS) without collateral (USD 1 = UZS 10,914.914 on 5 March 2022). But lengthy banking procedures and the number of paperwork requested decrease the motivation of households to apply for such loans. Instead, most rural smallholders prefer buying young animals in the spring (early March), when green biomass becomes widely available in the surrounding pastures, with the purpose of reproducing, fattening and reselling them in the autumn (October) when the demand for beef/mutton increases (Ibragimov 2016).

In mid-2017, the government had initiated monetary reforms towards foreign currency exchange liberalization (Reuters 2017). Now it also should encourage more liberal banking policies by encouraging foreign capital investments in private banking services to increase competition among local and regional banks. In general, this will stimulate the financial sector based on demand and supply in the capital markets (Reuters 2017).

Marketing and trade challenges

There is a lack of specialized trade and financial institutions and inadequate market infrastructure in rural areas that limit opportunities for smallholder livestock producers to modernize and diversify animal production (Ibragimov 2016).

To provide coordinated services and to encourage formal livestock marketing at the district level, there should be a special yard for animal marketing with necessary facilities such as fencing, protective shelter from rain and heat, veterinary clinics, watering and feeding lots, loading and unloading ramps, butchery services, cooling facilities, as well as banking services, weighing instruments and auction tribune (Ibragimov 2016).

One of the important institutional constraints lies in the absence of animal marketing information to pastoral and smallholder producers. For example, information on market prices is not institutionalized, and there is huge uncertainty in seasonal market price shocks: the price of sheep may vary by more than 50%, from UZS 500 thousand to 800 thousand per head (Ibragimov 2016).

The district office of agriculture is supposed to be the major source of information about prices and consumer preferences for animal producers, especially comprehensive information about the development of market-oriented livestock production (Ibragimov 2016).

The district agriculture officers should monitor current animal commodity prices, not only for statistical purposes, but also to analyse seasonal consumer preferences, market demand and supply curves, and ensure that livestock producers have access to information on demand and quality requirements in livestock markets (Ibragimov 2016).

Available data and parameters required for the herd models have been collected from published papers and consultancy reports, as well as other grey literature. For the livestock population and production data, available data are collected by the National Statistics Bureaus, but this data needs to be assessed to determine how representative the surveys are. Gaps have been filled through consultations with state experts.

1.5 LSA baseline results in the LMP process

The baseline assessment presented here analyses the current contribution of the sector to meeting the Uzbek national development objectives and the long-term potential for livestock development in Uzbekistan over the next 15 years—given present technologies and policies and the present level of investment, or a business-as-usual (BAU) scenario. Given the analytical results of the baseline assessment, new technologies and/or policies and existing technologies whose increased use appear to have the potential to bring about further sector development, as well as new emerging systems and value chains identified through the baseline analysis to have significant potential are also identified for further testing with the HESM to determine their potential investment returns (ROIs).

This baseline analysis is thus the first step in carrying out an Uzbekistan livestock sector analysis (U-LSA), which will ascertain the sector's potential future contributions to meeting national development objectives and potential for further modernization through additional investments in either existing technologies or new technologies and better policies. The results of the LSA will, in turn, then guide the preparation of the Uzbekistan livestock master plan (U-LMP), which will be a series of five-year investment implementation plans or 'roadmaps', which will provide input into the new livestock sector development program being funded by the Government of Uzbekistan (GoU) and the World Bank to further modernize and transform the country's livestock sector.

To create the livestock HESM for Uzbekistan and carry out the LSA baseline analysis, the ILRI LMP team has used the livestock sector investment and policy toolkit (LSIPT) developed by the World Bank, CIRAD and FAO and related tools developed by ILRI under the auspices of African Union–Inter African Bureau for Animal Resources (AU–IBAR). For more technical information see the LSIPT methodology below.

As has been done in other countries such as Ethiopia and Tanzania, where the full process of developing a LMP has been carried out, specifying the HESM for Uzbekistan involved using existing data available from secondary sources for the most recent year. Expert opinion was also used where appropriate and needed to fill gaps in specifying the parameters of the HESM. Livestock research and development specialists were consulted and they provided, based on their expertise, experience and the available literature, performance parameters such as fertility, mortality, productivity, as well as prices of inputs and outputs, marketing margins, etc.

ILRI, together with the World Bank and the Rural Restructuring Agency (RRA) under the Ministry of Agriculture, also held a livestock and stakeholder consultation with government and other key livestock sector experts and stakeholders (farmers, cooperative managers, private investors, etc.) to explain the LMP process and to identify and agree upon the major development objectives of the state, as well as a long-term vision for modernizing the sector.

Through the creation of the HESM, a comprehensive national database and baseline (depicting the current state of development in the sector both productivity levels and livestock numbers and value) was also established to form the basis for the 15-year LSA and 5-year LMP scenario analyses to inform the sector planning of the LSA and LMP and also to be available for other future planning and analytical work, as well.

Now that the baseline results have been obtained, a second stakeholder consultation meeting will identify the key challenges and opportunities facing the sector and the most promising production systems, strategic value chains and development interventions (combined technologies and policies) and these investments will be tested in the next phase of preparing the LSA strategy to help achieve further modernizing of the sector. These combined technology and policy options will then be tested using the sector model to measure their ***ex-ante*** investment returns and impacts on national objectives, using quantitative indicators or measures of their impact (productivity, production, income, etc.).

1.6 The LSA baseline report—analytics, objective and purpose

In Uzbekistan, the following national development objectives (and indicators) were specified and agreed upon by the senior livestock experts and sector stakeholders in the first stakeholder workshop. The participants agreed upon the national development objectives for Uzbekistan—presented to RRA and MAWR for approval. The HESM has been used in the baseline assessment to test the degree to which the existing technologies and innovations and investments, help achieve the livestock sector's contribution to the following national development objectives:

- Improving household incomes (household income from livestock production)
- Contributing to national economic growth (livestock production and national GDP)
- Increasing the nutritional security of rural and urban people (more animal source foods [ASFs], as well as more protein and carbohydrates)
- Contributing to exports (whether a surplus exists for export to increase foreign exchange earnings)
- Contributing to industrialization (more employment, including for women and youth).

The measurable indicators for these national development objectives provided the criteria for analysing the impacts of current practices and investments to form the LSA baseline and will also be used to test and compare the potential individual and combined technology/policy interventions proposed for the LSA foresight analysis. Besides measures of indicators for the five economic objectives outlined above, the toolkit can also help to assess environmental and climatic sustainability.

Based on discussions with these same key sector experts and stakeholders, the key livestock commodity value chains focused on in the LSA baseline assessment included: dairy animals and products, live cattle and beef/milk, live sheep and goats (shoats) and mutton and goat meat/milk, live horses and horse meat, live camels and camel meat and milk and backyard dual purpose chicken, as well as broilers and layers.

- Three farm systems types (dehkan, fermer, specialized or SP) were considered in the LSA baseline assessment.
- In both dehkan and fermer household farming systems, the species considered were cattle, sheep, goats, horses, camels and household or backyard chicken systems—scavenging birds.
- The Specialized systems included cow, goat and horse dairy, beef and mutton fattening and chicken—broilers and layers.

The quantities and values of critical intermediate products, including manure and traction, are also to be measured.

1.7 LSIPT methodology

The ILRI training and supporting team propose to use LSIPT, to develop the LSA and LMP for Bihar. LSIPT had been widely reviewed and field tested in Zambia and Mali before being used in Ethiopia and Tanzania by ILRI and state teams. LSIPT has been used in Ethiopia and Tanzania and found to be an appropriate set of tools for developing long-term strategies and master plans. Moreover, ILRI believes LSIPT can be used as a standard toolkit to help develop country-specific livestock investment strategies and plans in countries considering investing in modernizing the livestock sector, such as in Bihar.

LSIPT was developed under the direction of ALive, the partnership for Africa livestock development, poverty alleviation and sustainable growth in Africa (www.Alive-online.org). ALive, housed in AU–IBAR, spearheaded the development of LSIPT with technical support from CIRAD (the French Agricultural Research Center for International Development), the World Bank and FAO.

LSIPT is the suite of tools or quantitative methods used to build a dynamic livestock herd model and a bio-economic livestock sector model (HESM), which in turn enables in-depth and systematic quantitative analysis of the major constraints facing the livestock sector and then be used for carrying out scenario analysis of the ***ex-ante*** impacts of proposed interventions (technologies and policies) on economic growth, poverty alleviation and other agreed upon development objectives. LSIPT will thus be used to test technology interventions for improving primary productivity on farm, but also to carry out quantitative diagnostic value chain assessments to identify the most economically and socially attractive postharvest investment options for adding value to livestock sector products or to test the ***ex-ante*** impacts of changes in policies and institutions.

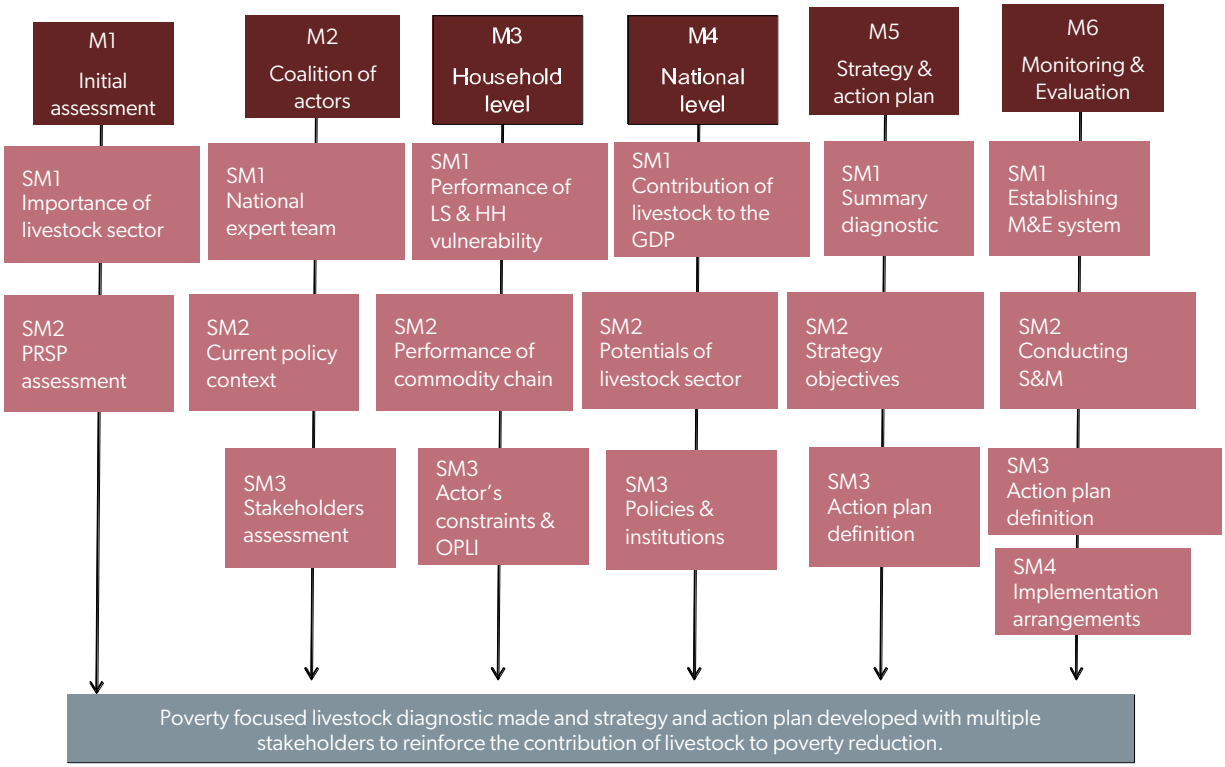
LSIPT integrates micro, meso and macro analysis for quantitative and qualitative assessment of household vulnerability, the role of livestock in strategy for reducing poverty and the contribution of livestock to the overall economy. It accounts for the multiple functions of livestock, including those of cultural importance; the contribution to food security and nutrition and draught power and manure supply for soil fertility.

LSIPT provides a systematic framework for organizing accessible quantitative data (mostly from secondary sources) and includes tools to carry out analyses that help to understand the production potential of the sector and its contribution to agricultural and overall economic growth (GDP), as well as a reduction in rural poverty and food insecurity. Furthermore, LSIPT enables the running of alternative technology and policy scenarios to gauge the

supply response of potential government investments in research and extension (such as technologies that impact feed availability, animal health, etc.), as well as private sector investments 5-year projection period. The scenario analysis is transparent and readily understandable and thus useful to policymakers and development investors. Moreover, analysis of potential impacts from changes in key aspects of policy, such as the enactment of food quality standards and regulations required to compete in formal markets (including export markets), can also be evaluated with the ALive toolkit. Further description of the LSIPT methodology is given in figure 2 below.

The core elements of LSIPT are modules 3, 4 and 5. Module 3 assesses the productivity at household, value chain and production systems level. These micro and meso data figures are then consolidated and extrapolated to the national or state level in module 4. Once this database is established, the participatory tools of module 5 can be used to identify, with all stakeholders, the priority sectors, target groups, and the most effective technology and policy interventions to ensure optimal use of scarce human and financial resources. Once the interventions are identified, financial, economic, social and environmental impacts can be rapidly assessed using the database established in modules 3 and 4. Finally, using the tools, the implementation arrangements can be established on a mutually agreed upon basis.

Figure 2: Diagram showing the different modules and sub-modules of LSIPT.



2 Livestock systems and production

2.1 Livestock systems and production typology zone—rationale, criteria and classification

Livestock production systems which exist in different agro-ecological and socio-economic settings are diverse and thus complex to analyse and understand their performance overtime, including the potential productivity and production responses to different technology and policy interventions. To conduct a broad national LSA, there is a need to simplify the system diversity systematically so one can overcome the system complexities and establish a clear pattern to visualize and comprehend the system similarities. This can be accomplished by creating a typology or classification of the livestock production systems according to the common traits of the systems.

A typology of livestock production systems or classification system according to common features can be defined for a group of farm/herd operations under similar characteristics of climatic conditions and husbandry practices or herd and feeding management methods. Building a typology involves defining similar (relatively homogenous) representative groups of livestock farms and farming practices with similarity in terms of performance and constraints and opportunities faced and which require a similar set of interventions to improve the system.

A system classification or typology facilitates the analysis of systems to be able to:

- capture and understand the diversity of production systems in the country
- set up a framework to customize and target interventions appropriate for different types of production systems and producers
- simplify the planning of development options/interventions so that interventions appropriate for different production systems and producers can be targeted (because interventions and improvements are strongly livestock typology specific)
- conduct sector analysis at different levels.

A systems classification thus will facilitate testing alternative technical and financial livestock production technologies with a model like the HESM, which is the objective of the LSA and the LSA baseline analysis.

In the widely used production system classification of Sere et al. (1995), they propose the use of a three-level livestock system classification. The first level of classification is 'based on agro-ecology' altitude, topography and rainfall. This first level of classification is labelled as the 'Main Production Zones (MPZs)'. One can often find the same type of production systems being practised in different zones or MPZs. The second level of classification of livestock production systems is 'species-based systems' i.e. cattle, sheep, goats, etc. and can be mixed herds or limited to only one species. The third level is the 'subsystem level' which is 'based on household assets' such as land size, herd size, etc. and farming practices. 'Specialized production systems (SP)' or commercial, market-oriented systems are not agro-ecologically determined and they are not limited to any one zone, but are usually limited to one livestock species which produces one or two products like milk, or chicken and/or eggs.

The first step in producing the LSA/LMP is to define and classify the first level of the typology of production systems, or the Main (livestock) Production Zones (MPZs) in the country based on identified common features. A combination of methods has been used here to build a typology of livestock systems, including:

- Literature review of the existing systems in the country,
- Stakeholders consultations involving local experts who understand the systems and
- Based on the general principles of global classification of livestock production systems by Sere et al. (1995).

The available literature and Uzbek livestock experts informed us that in Uzbekistan, the MPZs or first level classification could be divided into desert and steppe, piedmont and highland agroclimatic zones. In local dialect, the desert and steppe belt is '***chul***', foothills '***adyr***' and average high mountains '***tau***' and high mountains '***yaylau***' (highland). With increasing altitude, the climate, soil type and vegetation that determine the livestock production possibilities change significantly.

Livestock production in Uzbekistan is diverse and practised in all these agroclimatic zones. For example:

- beef cattle are mainly found in highland and mid altitude zone pasture areas,
- milk cattle are mainly found in irrigated croplands near urban industrial centres,
- Karakul sheep production systems are found mainly in desert and steppes,
- meat wool and ram production systems are concentrated in the highland zone of the Fergana valley and
- Specialized (SP) industrial-scale chicken production is found near large cities and industrial centres in all zones (FAO 2006).

To facilitate the use of the analytical model HESM created to carry out this LSA baseline assessment, a typology or classification of the livestock production systems in Uzbekistan was developed based on Uzbekistan consolidated agro-ecological zonation (World Bank 2010) which organizes Uzbekistan into three major altitude and rainfall regimes. This classification was presented and agreed upon in a consultative workshop of Uzbek livestock experts held in Tashkent in June 2017 (World Bank 2017).

In Uzbekistan, the three main livestock production zones (MPZs) used here are (see Figure 2):

- Desert and steppe zone: Lowland and low plateaus in the western areas of the country, with vast valleys in the central part of the zone. Elevation ranges from 60 to 150 metres above sea level (masl), with smaller areas in eastern districts with an elevation greater than 400 masl. Annual mean temperature ranges from 10 to 15°C and rainfall 100 to 200 mm. Crop production is possible only with irrigation. The vast rangeland is used for livestock production.
- Piedmont zone: Undulating terrain intermixed with open plains and elevation ranging from 400 to 1,000 masl; precipitation is below 400 mm; and both irrigated and rainfed crop production is practised. Extensive areas of pasture are used for livestock production.
- Highland zone: Steep and mountainous with an elevation greater than 1,000 masl; an annual mean temperature of –5 to 5°C; rainfall exceeds 600 mm, but the area is not suitable for crop production. The area is the source of summer grazing for livestock.

Moisture, temperature and altitude are closely linked with the quantity and type (and quality) of forage produced and the availability of crop residues and other feed supplements, which would impact the performance of livestock and delimit the kind of production practices. Hence, the above broader classification or the main livestock production zonation (MPZ) helps to have a focused and targeted analysis to capture any variability in the productivity performance of the different livestock species, as well as opportunities and constraints which exist across the

production zones. Depending on the availability and type of animal feed and climatic conditions, the suitability of each one of the three MPZs/systems for different livestock species varies. For example, Karakul sheep and camels perform better in the desert and steppe and dairy cattle in the piedmont zone.

Figure 3: Geographic distribution of the major livestock production zones (MPZs) in Uzbekistan.

The livestock keeping households in all three zones that also cultivate crops use crop residues to feed their livestock. Those with larger land sizes could also grow forage crops for feeding their livestock, as well as for markets. In the desert and steppe zone, except those who have access to irrigation, all households depend on livestock to make a living. In all production zones, it is a common practice to purchase and conserve feed to supplement the herd particularly, during the winter season.

The livestock production practices whose production methods are modern and which depend mainly on the procurement of feed from outside the farm operation for livestock feeding and which are to a certain extent independent of the broader zonation are classified as the 4th category or are defined as specialized production (SP) systems and analysed independently due to their unique modern production characteristics and commercial market orientation.

The specialized livestock production (SP) in Uzbekistan include:

- Dairy systems with dairy grade cows
- Cattle fattening operations
- Sheep fattening operations
- Chicken systems—differentiated into commercial broiler and layer operations using high yielding breeds, purchased feed and high levels of animal health services and inputs.

Under the broader first level classification (highland, piedmont, desert and steppe and SP), further classification was done based on the main or priority livestock systems or value chains (cattle, sheep, goats, camel, horses and chicken). This further classification by livestock systems (species) is critical because interventions (i.e. improvements in genetics, animal health, feeding, dairy, meat, etc.) are strongly livestock system and value chain specific. For example, the required type and scope of policy support or technology investment interventions differ significantly between a commercial market oriented specialized (SP) dairy system and a dehkan low input and low output milk–meat system, or interventions for the development of goats meat or village chicken meat are not expected to be the same as the development of beef or broilers and layers.

The livestock systems based on species or the value chain level classifications were further stratified by subsystems based on the major types of agricultural entities and assets and types of agricultural practices. The legislation of Uzbekistan provides for three types of agricultural entities or three major types of agricultural producers: agricultural cooperatives or Shirkats, private farms and dehkan.

The Shirkats, which were established through conversing collective farms and distributing their shares among the members, have been restructured into private farms and they almost do not exist anymore. Currently, the livestock and agricultural sector is dominated by dehkan and private farms or fermers, accounting for more than 97% of gross agricultural output. All the prioritized livestock value chains are practised by either the dehkan or private livestock farm subsystems.

Dehkan farms are small household farms engaged in the small production of livestock and other agricultural products for own consumption and marketing, mainly using household labour and household land plot. The dehkan farms are lifelong leaseholders with inheritable ownership rights. They are low input and low-cost systems. The leaseholds are small and do not enable them to produce enough feed to support their animals. Owners are employees of agricultural enterprises, rural civil servants and retired people.

Private farms (fermer) are independent legal entities with long-term land leases. They hire external labour and also use household labour. They produce mainly for the market. At present, livestock breeding farms with at least 30 nominal livestock heads get at least 0.3 ha of land per animal head; while a minimum size of land plot for crop production (cotton and grain crops) is at least 10 ha. These farms produce feed for their livestock, but if they have larger herds, they have to buy more feed.

The following priority livestock systems and subsystems (Table 1) were identified for the purpose of assessing the sector and recommending potential system and subsystem specific technology and policy interventions to modernize and transform the sector.

Table 1. Uzbekistan livestock systems and subsystems and specialized systems

Livestock systems by species	Subsystems in the highland	Subsystems in piedmont	Subsystems in the desert and steppe
Cattle system	Dehkan	Dehkan	Dehkan
	Fermer	Fermer	Fermer
Sheep system	Dehkan	Dehkan	Dehkan
	Fermer	Fermer	Fermer
Goats systems	Dehkan	Dehkan	Dehkan
	Fermer	Fermer	Fermer
Chicken systems	Dehkan	Dehkan	Dehkan
Camel systems	Dehkan	Dehkan	Dehkan

2.2 Livestock resources and distribution over the three MPZs

To conduct the sector baseline analysis, the Uzbekistan livestock master plan (U-LMP) team used the 2017 national livestock population of Uzbekistan, which was obtained from the Uzbekistan Statistics Committee (UzStat 2017b), as shown in Table 2.

Table 2. Livestock population in Uzbekistan (2016)

Livestock species	Number of livestock in 2016
Cattle	12,103,865
Sheep	15,525,795
Goats	3,736,277
Camels	15,557
Horses	221,190
Chicken	65,758,900

Source: UzStat 2017b.

Livestock production in Uzbekistan is dominated by cattle and sheep. Chicken production is also important and growing through very strong government investment support. Camels and horses are not important species in meat production currently, but due to growing demand, they could have the potential to significantly help increase meat and milk production in the future, with additional technology and policy interventions since there is reported to be rapidly increasing domestic demand, as well as potential to export to the Middle East (camel meat and milk) and Europe (horse meat).

Tables 3 to 8 show the distribution of the Uzbekistan national livestock herd over the three MPZs by species.

Table 3. Cattle population distribution in the three MPZs

	Subsystem	Desert and steppe	Piedmont	Highland	National	% total
Cattle	Dehkan	5,092,096	3,588,796	1,106,293	9,787,185	94
	Fermer	344,960	197,293	78,675	620,928	6
	Total	5,437,056	3,786,089	1,184,968	10,408,113	

Source: Adapted from UzStat (2017b).

Table 4. Sheep population distribution in the three MPZs

	Subsystem	Desert and steppe	Piedmont	Highland	National	% total
Sheep	Dehkan	5,252,972	5,843,543	1,398,720	12,495,235	82
	Fermer	1,398,720	885,856	497,323	2,781,899	18
	Total	6,651,692	6,729,399	1,896,043	15,277,134	

Source: Adapted from UzStat (2017b).

Table 5. Goat population distribution in the three MPZs

	Subsystem	Desert	Piedmont	Highland	National	% total
Goats	Dehkan	1,442,203	1,072,311	825,717	3,340,232	89
	Fermer	127,033	138,242	130,770	396,045	11
	Total	1,569,236	1,210,554	956,487	3,736,277	

Source: Adapted from UzStat (2017b).

Table 6. Camel population distribution in the three MPZs

	Subsystem	Desert and steppe	Piedmont	Highland	National
Camels	Dehkan	15,557			15,557

Source: Adapted from UzStat (2017b).

Table 7. Horse population in the three MPZs

	Subsystem	National	% Total
Horses	Dehkan	188,167	85
	Fermer	33,023	15
	Total	221,190	

Source: Adapted from UzStat (2017b).

Table 8. Backyard chicken population in the three MPZs

	All MPZ	National
Backyard chicken hens only	Dehkan and fermer	18,914,487

Source: Adapted from UzStat (2017b).

All of the three main livestock production zones support a large number of cattle. The desert and steppe and the piedmont support 42 and 31% of the national cattle population, respectively. Sheep and goats are also important in all zones. Eighty-six per cent of the sheep and 75% of the goats are found in the desert and steppe and piedmont.

Taking all ruminant livestock species together, the desert and steppe zone support the largest proportion, followed by piedmont. this is an indication of how critically important livestock is for the livelihood of the households in the desert and steppe zone and piedmont. The dehkan subsystem (farm groups), which are low input and land constrained (for feed and crop production) subsystem supports 95% of the national cattle population, 82% of the sheep and 89% of the goats' populations.

Except for specialized chicken, the SP and feedlot systems account for very few animals (and production). SP dairy accounts for only 1% of the national cattle population. Both the specialized dairy and beef fattening, however, have the potential to grow, given the growing demand and could gain much through appropriate policy and technology interventions. Sheep fattening is also at a very early stage of development. It constitutes only 2% of the total sheep population. Specialized layers and broilers systems, however, constitute 56% of the chicken population. Forty-four per cent are backyard or village chicken kept by the dehkan farming group. Table 9 shows the livestock population in the feedlot, specialized dairy and specialized chicken production systems.

Table 9. Livestock population in the feedlot, specialized dairy and specialized chicken production systems

	Average herd/ flock size	Number of farms/ herds/flocks	Total
Specialized cow dairy	1,500	50	75,044
Cattle feedlots—dehkan	4	400,000	1,600,131
Cattle feedlots—fermer	100	200	20,577
Sheep feedlots—dehkan	8	31,928	248,661
Specialized chicken layers	150,000	125	18,742,145
Specialized chicken broilers	20,000	272	5,428,759

Source: Adapted from UzStat (2017b).

Conclusion

Overall, the livestock system in Uzbekistan is dominated by the low input and low output dehkan subsystem. The private farm group (fermer) and the specialized livestock subsectors are in the infant stage of development. There seems to exist ample potential to modernize and transform the sector through policy and technology investment interventions in the specialized and private subsectors and in transforming the dehkan subsystem through enhanced and sustainable intensification and more aggregation through better marketing to achieve benefits of economies of scale. However, analysis of how the demand side of the demand–supply equation will change over time has to be analysed to ensure increased production will make consumers and rural producers better off in the years to come.

2.3 Trends in livestock population and production

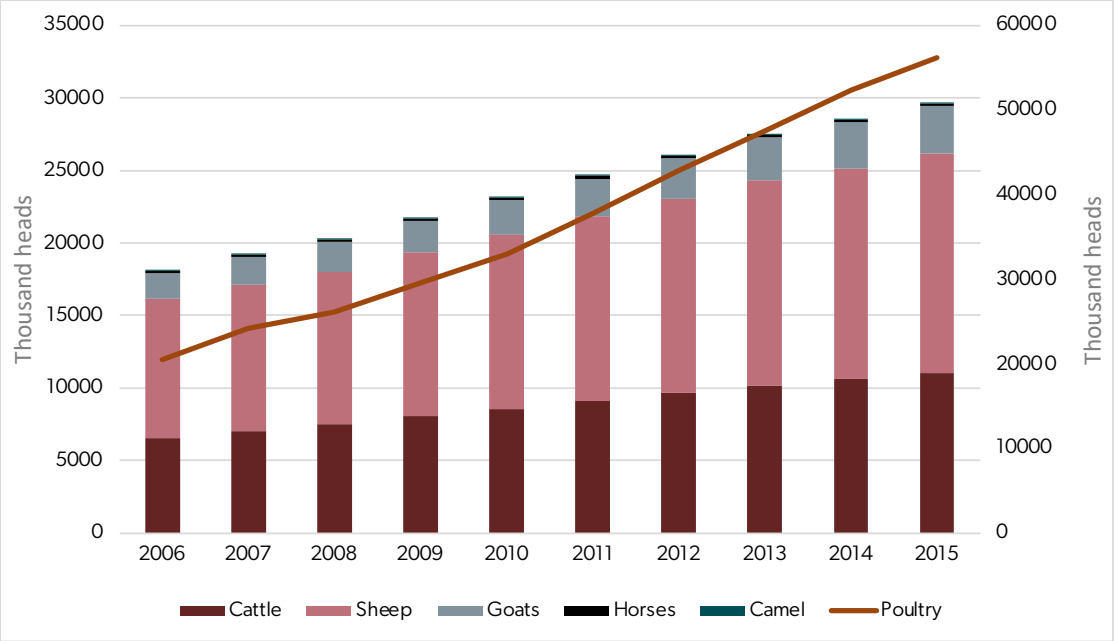
The livestock sector is the leading branch of agriculture in Uzbekistan. It is characterized as dual nature, with most of the livestock production falls on household plots and dehkan farms that own about 0.15 ha of land and 93% of cattle. The dehkan farm is a family small-scale farm that produces and sells agricultural products on the basis of the personal labour of family members on the personal plot of land given to the head of the family with the right to inherit it.

Unlike other countries of the former Soviet Union, the transition period in Uzbekistan was not accompanied by a drastic decrease in livestock herd numbers (Iñiguez et al. 2004). The livestock population gradually increased and reflected in increased livestock output share in the gross national agricultural product (see Figure 3).

The ownership of livestock species, particularly sheep, camels and horses, by dehkan farmers has steadily increased from 2006 to 2017 (Figure 4). For example, during the years 2006 to 2015, the share of sheep owned by dehkan

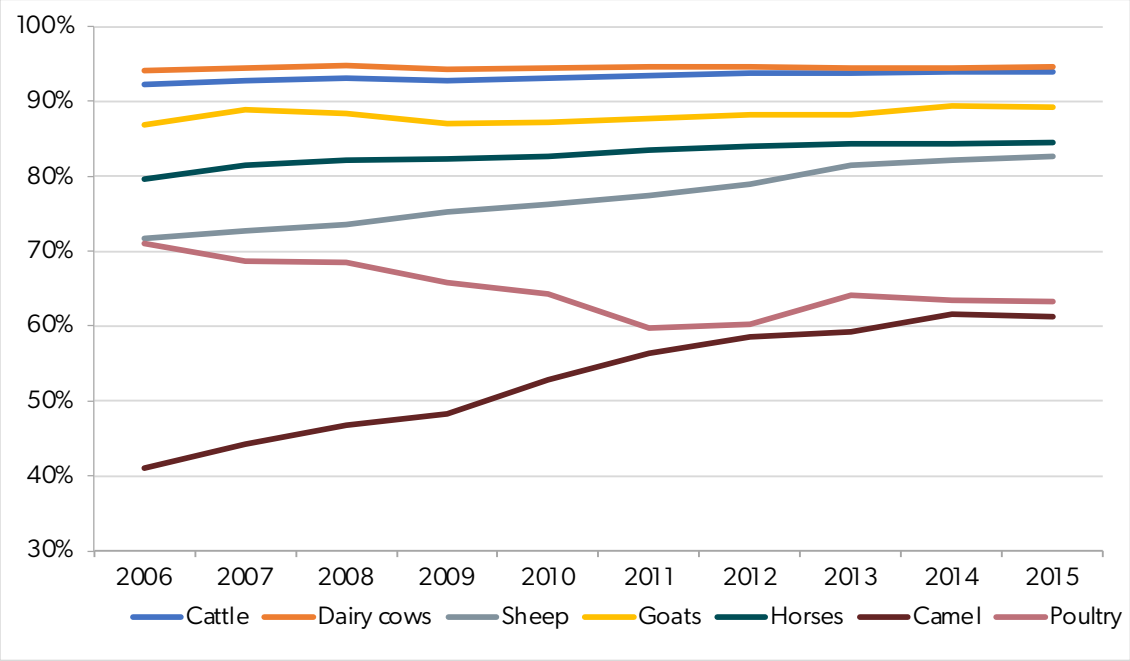
farms has increased from 72%to 83%. Similarly, the ownership of cattle, goats, horses and camels by dehkan farmers has slowly increased. However, the proportion of the chicken population owned by dehkan farms has decreased to 63% in the year 2015, a 7.7% decrease from 2006.

Figure 4: Livestock population in thousand heads (2006–2015).



Data source: UzStat (2015).

Figure 5: Proportion of livestock species owned by the dehkans (2006–2015).



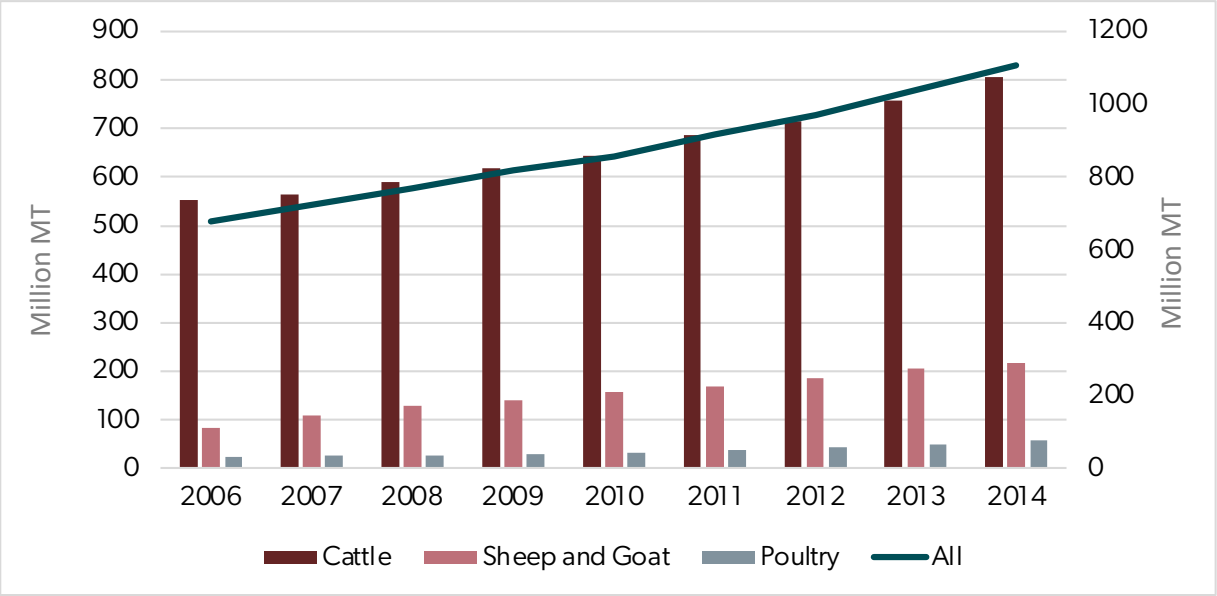
Data source: UzStat (2015).

Production growth of meat, the main livestock output, is of high social and economic importance for the farm community development, considering that it is one of the basic food products and also represents a significant part of revenues in rural areas.

The meat and milk production trend in Uzbekistan during the period 2006 to 2014 is shown in Figures 5 and 6. According to Figure 5, all sources of meat products have shown an increasing trend of production from 2006 to

2015. In terms of volume of production, cattle meat, sheep and goat and chicken meat are the major meat products. Beef meat production from cattle has increased by about 46% during the entire period. Similarly, sheep and goat (or shoats) and chicken meat production had on average increased by 159% and 147% from 2006 to 2014, respectively.

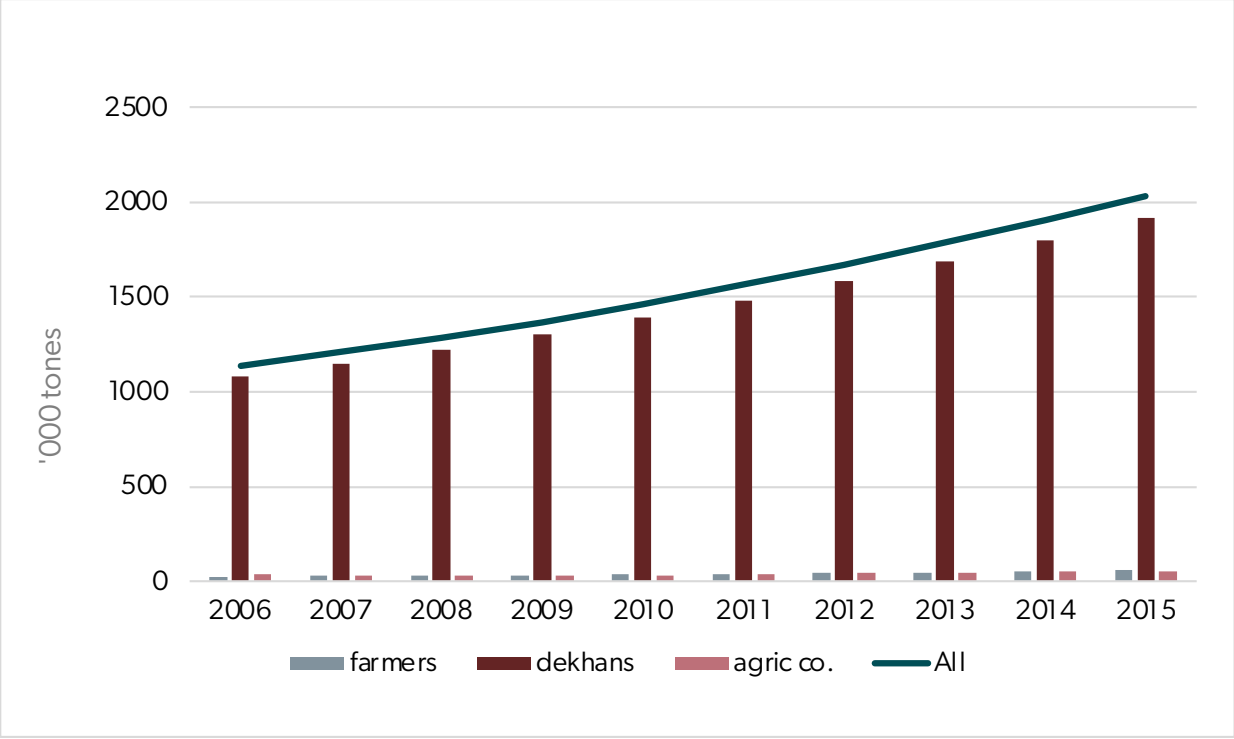
Figure 6: Meat production in million t (2006–2014).



Data source: UzStat (2015).

Most of the meat in Uzbekistan is produced by dehkan farmers. For example, Figure 6 shows about 94–95% of all the meat production from 2006 to 2015 is produced by dehkan farms.

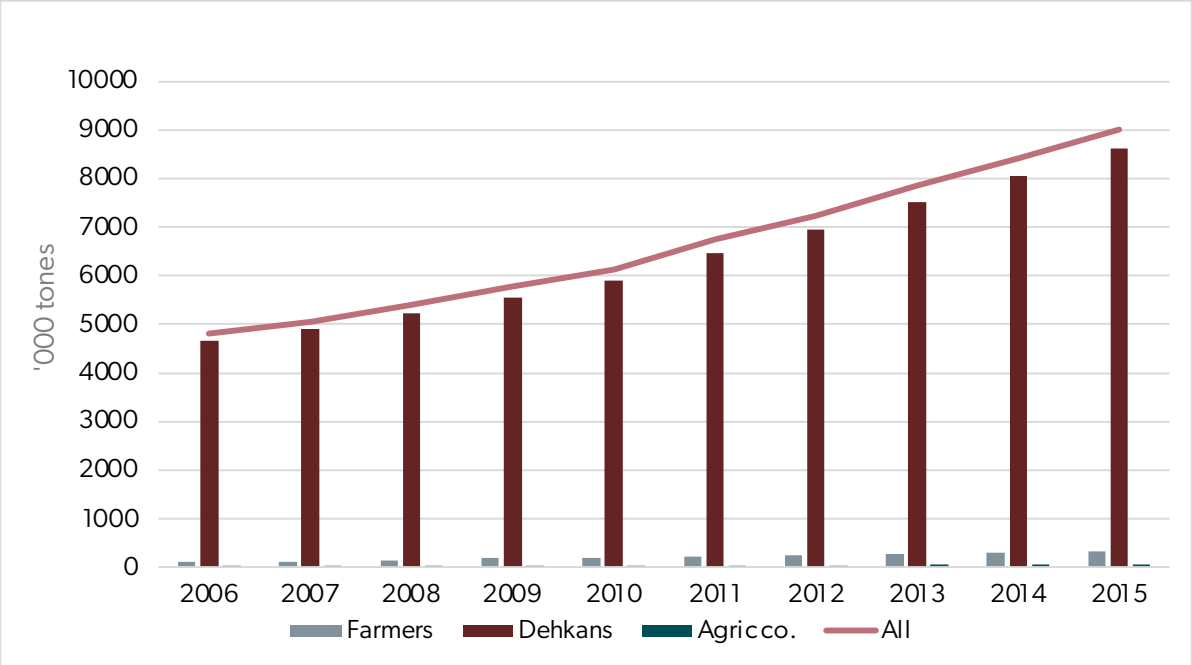
Figure 7: Meat production by farming systems in thousand t (2006–2015).



Data source: UzStat (2015).

Figure 7 shows cow milk production increased from 4.8 million t in 2006 to 8.9 million t in 2015, an 87% growth. Despite the increase in the proportion of milk produced by private farmers, about 96–97% of the milk produced during the entire period originated from dehkan farms.

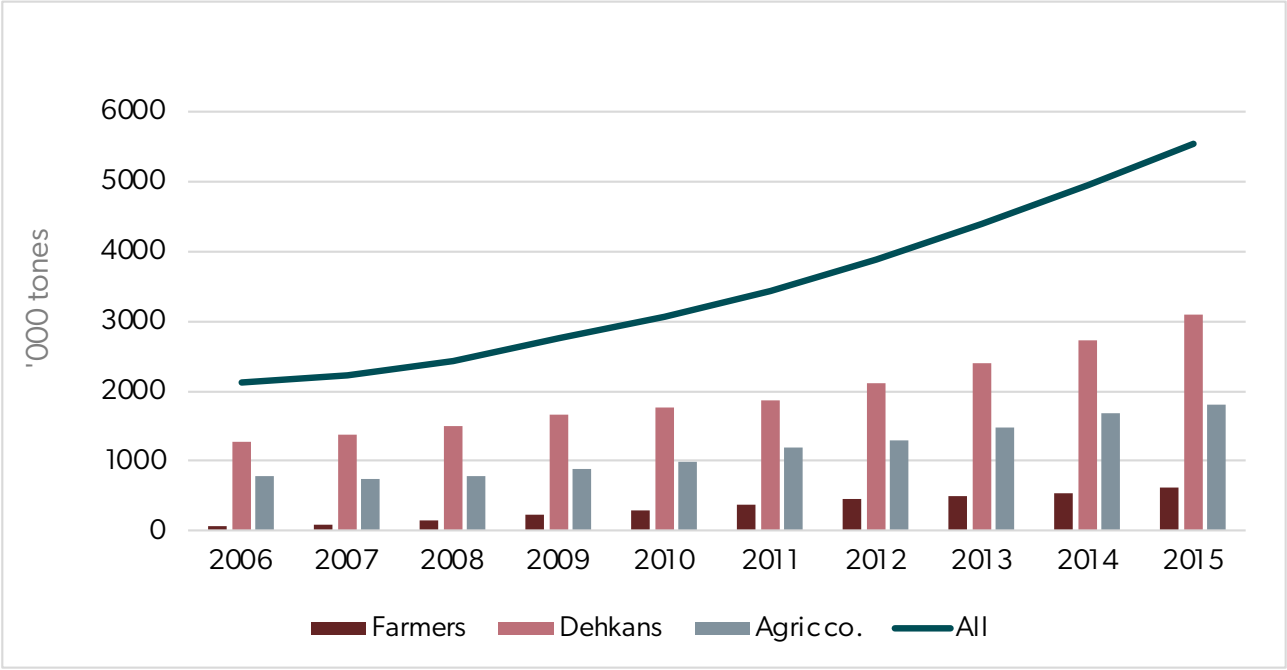
Figure 8: Milk production by farming systems in thousand t (2006–2015).



Data source: UzStat (2015).

In line with the far-reaching increase in chicken population that happened from 2006 to 2015 (see Figure 8), egg production also increased from 2.1 million t in 2006 to 5.5 million t in 2015, a growth of about 160%. Unlike in meat and milk production, agricultural firms or AgriFirms (SP) have a fair share in total egg production. While the majority (about 55%) of all eggs is produced by dehkan farms, the SPs have produced on average about 33% of the total eggs produced during the entire period.

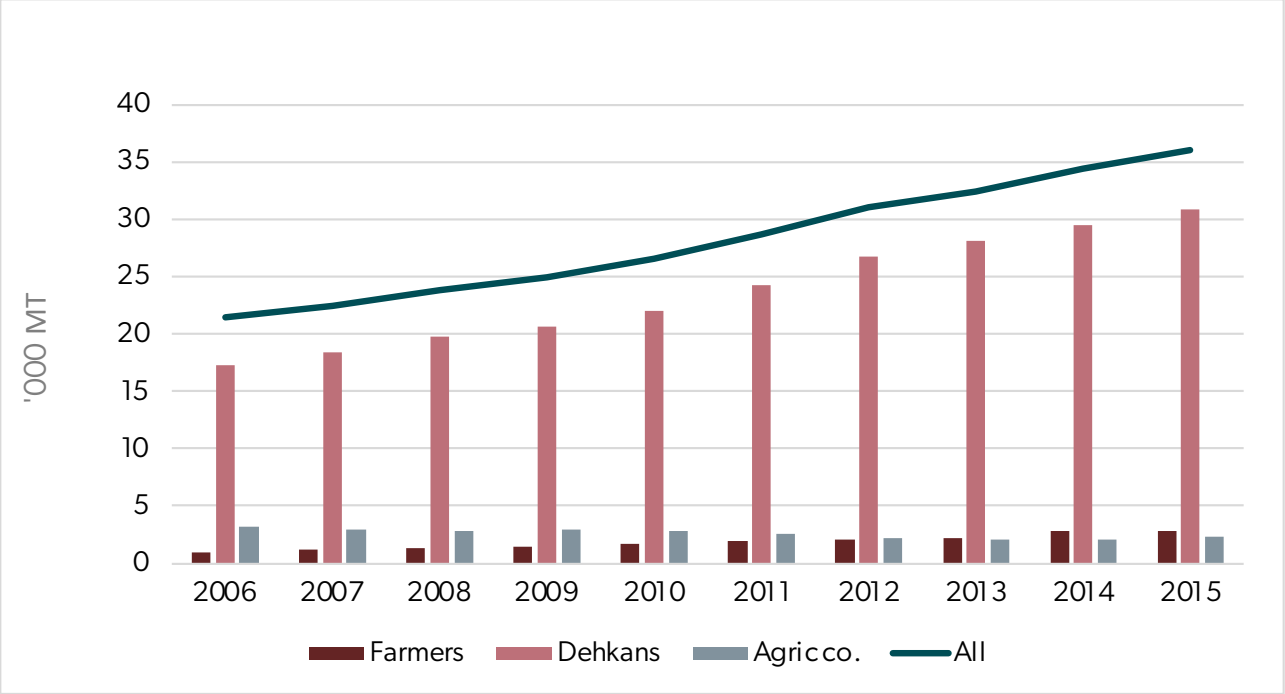
Figure 9: Egg production in thousand t (2006–2015).



Data source: UzStat (2015).

Figures 9 and 10 show that wool, including Karakul skins production in Uzbekistan, has continuously increased during the period between 2006 and 2015. Wool production increased from 21.4 thousand t in 2006 to 36 thousand t in 2015 (Figure 9).

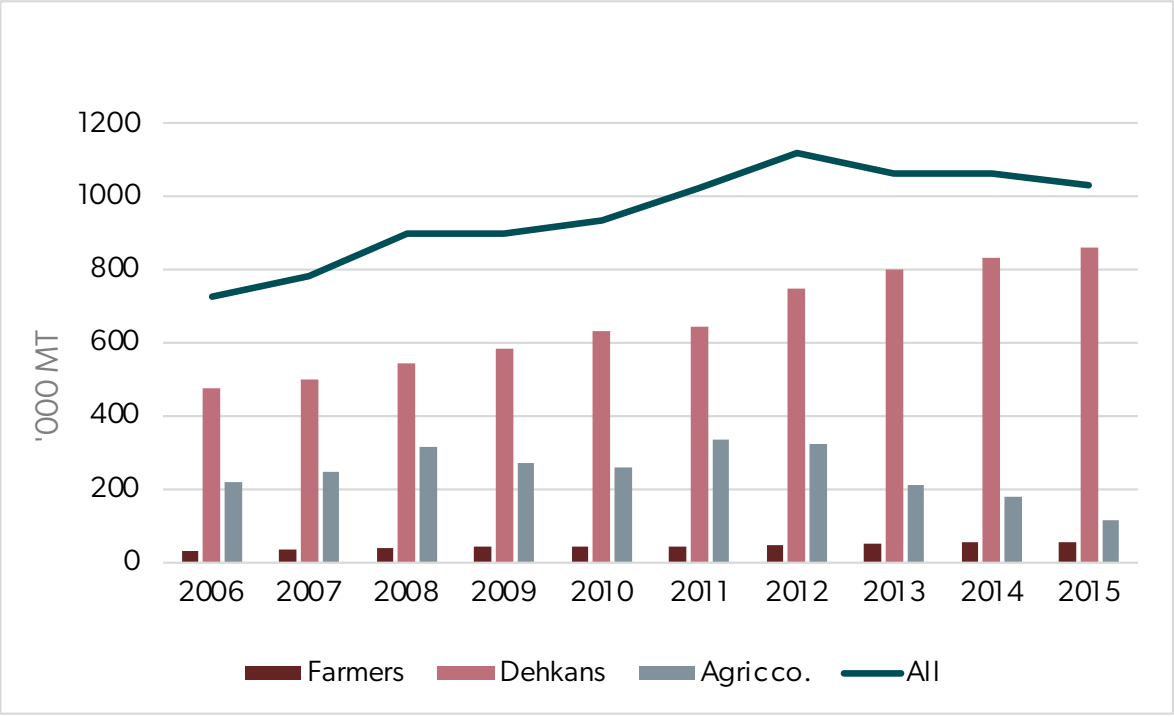
Figure 10: Wool production in thousand t (2006–2015).



Data source: UzStat (2015).

Similarly, Karakul sheep skin production has gradually increased from 726 thousand t in 2006 to 1.03 million t in 2015. Most of the growth in wool and Karakul skin production from 2006 to 2015 is due to the continuous increase in production from the dehkan farming system.

Figure 11: Karakul skin production in thousand t (2006–2015).



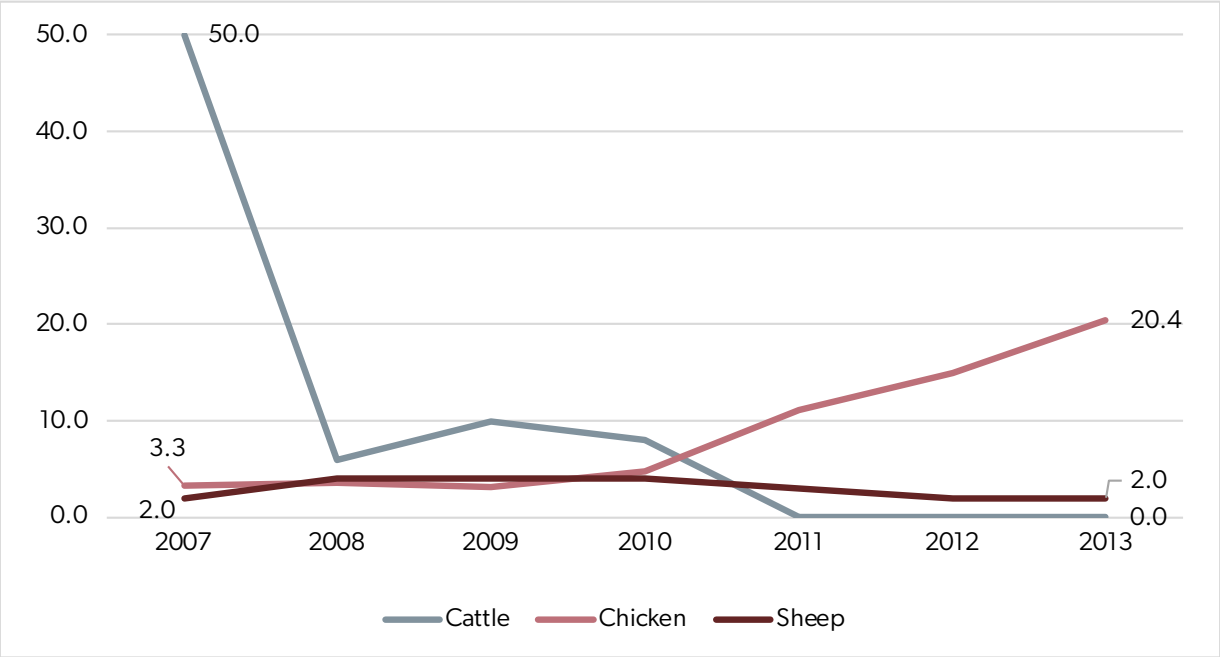
Data source: UzStat (2015).

Livestock products trade

Uzbekistan is a net importer of meat and dairy products. According to the FAOSTAT database, there was no livestock product export originated from Uzbekistan from 2007 to 2014. Until early 2017 the country had a list of goods for which export was banned. The list, among others, had included cattle, meat and edible meat by-products, chicken and sugar. The country, however, imported a wide range of meat and dairy products.

Despite the fact that domestic chicken production has doubled from 2006 to 2015 (Figure 5), Uzbekistan remained a net importer of chicken meat from 2007 to 2013 (Figure 11). Chicken meat import was relatively steady in the range of 3.3 to 4.4 thousand t until 2010, when imports drastically started to increase. During the year 2013, Uzbekistan imported about 20.4 thousand t, which is equal to about 45% of domestic chicken production for the same year.

Figure 12: Meat imports in thousand t (2007–2014).



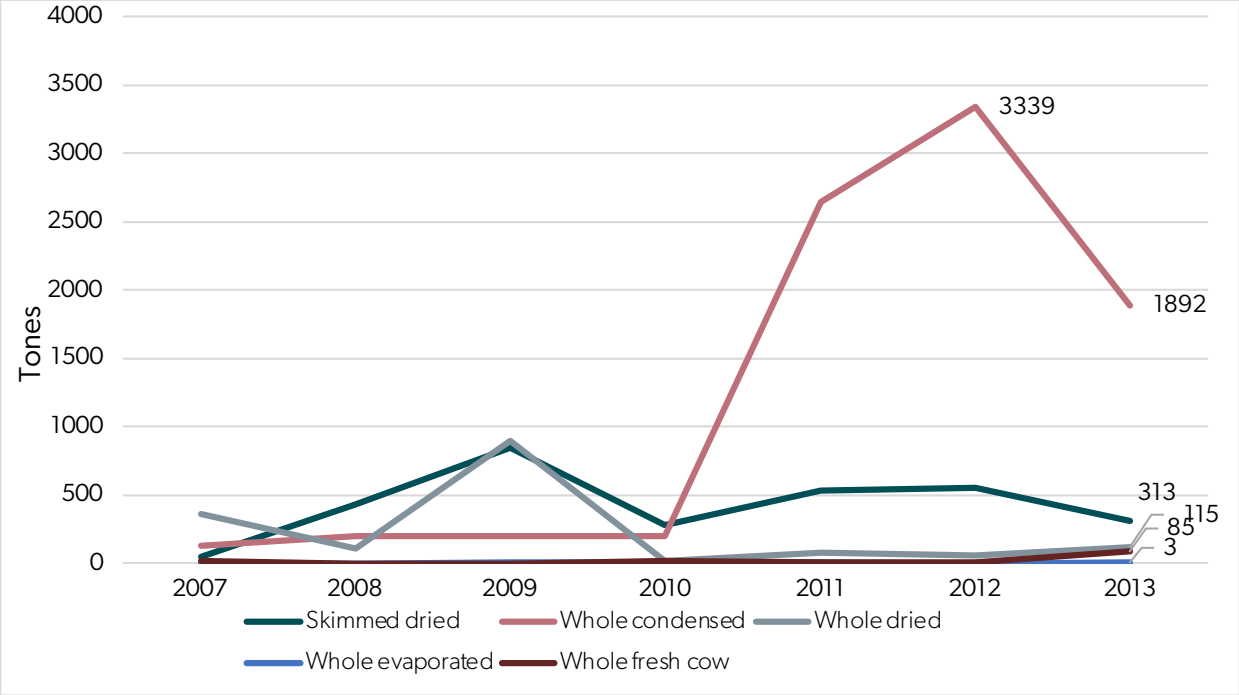
Data source: FAOStat (FAO 2014).

Contrary, Uzbekistan was a net importer of cattle meat only during the years 2007 to 2011. In 2007, Uzbekistan imported about 50 thousand t of cattle meat. The following year cattle meat imports decreased abruptly to reach about 6 thousand t, a decrease of 88%. Imports of cattle meat were in the range of 8 to 10 thousand t from 2009 to 2010. There was no import of cattle meat in 2011 and afterwards, which is consistent with the drastic increase in domestic cattle meat production from 2011 to 2014 (Figure 11). The import of sheep meat was relatively constant at 2 thousand t from 2007 to 2013.

Uzbekistan also imports prepared beef which is prepared beef and veal meat and offal that are boiled, steamed, grilled, fried, roasted, or otherwise cooked. It contains more than 20% of meat and offal by weight. The imported amount of prepared beef was 231 t in 2007 and sharply decreased in 2008 and 2009 (31 and 1 t, respectively). Once again, it started to increase in 2010 (reached about 293 t in 2011), before it gradually decreased in 2012 and 2013 (195 and 112 t, respectively).

Figure 12 shows the imports of different milk types from 2007 to 2014. During this period, Uzbekistan imported skimmed dried, whole condensed, whole dried, whole evaporated and whole fresh cow milk. The import of condensed milk was relatively steady until 2010. Between the years 2010 to 2012, there was a sharp increase in condensed milk imports and reached 3,339 t in 2012 and decreased by 47% in 2013. Skimmed dried, whole dried and whole fresh milk were other important milk types imported during the period between 2007 and 2013. During the final year, the total import of skimmed dried, whole dried and whole fresh was 85 t, 115t and 313 t, respectively.

Figure13: Milk imports in thousand t (2007–2014).



Data source: FAOStat (FAO 2014).

2.4 Current production technologies and management practices

The current livestock production technologies and management practices are explained for the different livestock production systems found in Uzbekistan. The major livestock production systems found in Uzbekistan are smallholder private farms (dehkan), large (larger) private farms (fermer) and specialized commercial production systems (SP). Each production system behaves differently in the three main livestock production zones (desert and steppe, piedmont and highland) and for different species.

The explanation is given focusing on the production zones and species under the same production system where significant variation is observed in production zones and species. However, as the cattle production system is the overwhelmingly dominant system, the production systems technology and management practices are explained, emphasizing the cattle production.

Dehkan—Smallholder private livestock production system

The dehkan livestock production system exists in all the three livestock production (agro-ecological) zones of the country (piedmont, highland and desert and steppe). Dehkans have very limited land to produce forage; only up to 0.3 ha and have no grazing land of their own (Sigmund-Shultze et al. 2013). Due to this land shortage, dehkan farmers need to buy up to 30% of their forage demand and concentrate feeds as the need arises. Concentrate feeds are usually given to lactating adult cows. However, during the winter period, most of the animals get concentrates as supplement to minimize the adverse effect of the feed shortage in this season. This explains why feed takes 86–88% of the total production costs and general expense in cattle production in the LSIPT Ecorum and 60–66% of the total production costs and general expenses of small ruminants. In addition, dehkan farmers in the piedmont and highland zones graze their animals on stubble from cropped fields, grazing vegetation along canals and other borders. However, dehkans in the desert and steppe production zone can graze their animals in communal pasture lands all year round.

Veterinary service is a crucial component of livestock production. The veterinary services in Uzbekistan are considered as the most developed subsector of the livestock infrastructure, considering its regional and district branches and set of services provided. This is backed up by the low mortality rate of up to 2–3% reported for juveniles and an even lower rate observed in adult animals. At the lower level, the veterinary services are represented by the public and private Zoo-Vet stations (ZVS). The public ZVS provides animal vaccination, treatment and AI services to farmers, while private ZVSs mostly deal with general animal health issues and also, upon agreements with the state veterinary services, make animal vaccination and AI. This increases access to both veterinary services and AI.

According to the 2016 report and six-month 2017 report from the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan (Government of the Republic of Uzbekistan 2017 http://agro.uz/uz/), the AI service coverage in Uzbekistan is encouraging. In 2016, about 2,465 thousand cows were inseminated and in the six months of 2017, 375 thousand cows were able to be inseminated, with over 565 thousand doses of pedigree bull semen produced and distributed locally (Government of the Republic of Uzbekistan 2016). The total breeding farms also increased to 640 and the import of high producing animals, though the number is not so significant, continues. These efforts are contributing to the envisaged increase in the number of improved dairy and meat, particularly dairy animals. The past 25 years average annual population growth rate trend shows that the cattle population is growing by 3.8%. However, in the last 10 years, the average population growth rate of cattle is about 6%, though it needs further study to conclude if this increase is in the number of crossbred cattle (crossbreed of exotic with local) or pure genetically improved animals (UzStat 2015). A similar growth rate is observed in other species like sheep and goats.

Animals in the dehkan production system are kept in separate barns and shelters which have ventilation, flooring, roof, feed troughs and watering facilities. The barns/shelters can be located either in the yard or outside. Milking dairy cows is usually done manually and consumed or sold to neighbouring markets and intermediaries. Many dehkans are involved in the milk collection system of larger dairy processors such as 'Nestle' in Fergana Valley, 'Pure Milky' in Samarkand, 'Musaffo' in Tashkent region and others. Dehkans are price-takers. Dehkan farmers need to be organized into cooperatives to have bargaining power on the price of their produce and to market and process their products. Live animals are traded at farm gate or transported in trucks to sell in district livestock markets. Also, animal slaughtering is organized mostly in backyards by the household members for sheep/goats, or by invited butchers for bulls. There is not much processing of their products in the household except making yogurt from milk.

The livestock production technologies and management practices applied currently are summarized below:

Animal feeding:

- Mixed feed from concentrates purchased from local markets;
- Cut-and-carry from communal areas to feed sheep/goats;
- Limited grazing around irrigation canals and roadsides, or in the cropping fields after harvest;
- Crop residues after harvest of cereals and legumes;
- Pastoral grazing in communal areas both for cattle and small ruminants (applied by dehkans in desert and steppe areas);
- Kitchen waste is used to feed chicken, sheep and goats.

Animal health:

- Farmer-treatment is used mostly when diseases occur;

- Veterinarians provide planned vaccinations for dairy cattle and bulls against serious infectious diseases, but very limited for the chicken, sheep and goats;
- Some dehkans use veterinary services regularly to vaccinate and to prevent animal diseases (only dehkans involved in the fattening of sheep and bulls apply);
- Chicken are not vaccinated regularly, but only by a minority of dehkans;
- Shearing is applied to sheep/goats twice per year to eliminate ticks;
- Animal bathing applied to sheep/goats for sanitary purposes twice a year;
- The veterinary certificate must be received for marketing of live animals, milk, eggs and meat;
- Animal shelter and watering points are not disinfected regularly.

Genetics:

- The government distributes offspring of imported highly productive cows and goats to dehkan households;
- Limited use of breeding record books for planning reproduction of cattle and fattening animals;
- Limited application of AI for dairy cows and fattening cattle;
- Most of the dehkans apply natural mating for sheep and goats;
- Almost no reproduction planning for sheep and goats;
- No AI is used for sheep and goats;
- Male goats are castrated in most of the goat flocks owned by dehkans;
- Crossbreeding program in place for the production of goats' milk and fine wool.

Managing practices:

- Animals are kept in separate barns and shelters located in the yard or outside;
- Livestock barns have ventilation, flooring, roof, feedlots and watering facilities;
- Dairy cows are milked manually when animal numbers are less than 5;
- Goat milk is mostly consumed fresh by household children, not for marketing;
- Animal slaughtering takes place in backyards by the household members for sheep/goats, or by invited butchers for bulls;
- Meat, eggs and milk are usually stored in refrigerators before using or marketing;
- Dehkans are poorly organized as cooperatives in production, processing and marketing of milk/meat and eggs products;
- Live animals are traded at the gate or transported in trucks to sell in district livestock markets;
- Many dehkans are involved in the milk collection system of larger dairy processors such as 'Nestle' in Fergana Valley, 'Pure Milky' in Samarkand, 'Musaffo' in Tashkent region and others, in most of the cases dehkans are price-takers;
- In desert and steppe areas dehkan animals graze all year round on local community pastures.

Fermer or private livestock production system

Like dehkans, the private farms or 'fermer' livestock production system prevail in all the three livestock production zones of the country (piedmont, highland and desert and steppe). However, unlike dehkans, fermers have a significant amount of land to produce forage; about 0.3 ha irrigated forage production land per cattle unit and grazing land of about two ha per cattle unit. Due to this, fermer farms do not need to buy forage feeds though they buy concentrate feeds. Concentrate feeds are usually provided to lactating adult cows. Other animals are also provided with concentrate as supplements during the winter period to minimize the adverse effect of the feed shortage in the season. Though fermers usually do not buy forage feeds, the share of feed in the total production costs and general expense is within the range of 71–77% for cattle and between 15–22% for sheep and goats (LSIPT result).

Private farmers (fermers) also enjoy similar veterinary and AI services as dehkans and have even better access due to their financial capabilities. Therefore, unlike in dehkan , the mortality rate in fermer farm type is very low and does not exceed 2–3% with even a rate as low as 0.5% mortality for adult animals. The AI service, presence of pedigree farms and import of high productive animals are also benefiting fermer as much as the dehkan farms. However, as the AI service is predominantly for the cattle dairy system, breed improvement for cattle meat is not moving at the same rate as the dairy. Also, breed improvement attempts in sheep and goats are highly constrained by the lack of sufficient improved sheep and goat breeding farms and breeding rams/bucks.

Animals in the fermer production system are kept in separate barns/shelters which have ventilation, flooring, roof, feed troughs and watering facilities. Animals may also spend most of their time grazing on pasture. In the case of the desert and steppe production zones, sheep and goats can be herded very far from their barn and could spend days/nights in the grazing field. In the fermer production system, milking dairy cows is usually done both manually and using machines and the milk produced is consumed or sold to neighbouring markets and intermediaries. Many fermers supply their produce to large milk and meat processing/slaughtering facilities and some can also have their small processing operations.

The production technologies and managing practices applied by private livestock farmers in desert and steppe, piedmont and highland areas are summarized below:

Feeding:

- Stall feeding (for cattle in the piedmont and highlands) and pasture grazing (for drylands);
- Silage and hay from own maize, lucerne, legumes produced in allocated arable areas;
- Purchasing and preparing mixed concentrated feed;
- Grazing in the cropping fields after harvest of cereals and legumes;
- For winter feeding collecting crop residues after harvesting cereals and legumes;
- Pastoral grazing in communal areas both for cattle and small ruminants (applied in desert and steppe areas).

Animal health:

- Veterinary services are used as planned to vaccinate all livestock (all ruminants and chicken) and to prevent most of the animal diseases;
- A veterinary certificate must be received for marketing of live animals, eggs, milk and meat;
- Animal bathing is applied twice a year to control external parasites;
- Shearing used for sheep and goats to eliminate ticks;

- Disinfecting barns and shelters organized annually to eliminate all parasites and ticks;
- Watering points disinfected, but not regularly.

Genetics:

- Crossbreeding program in place for dairy cows;
- AI applied to most of the cattle in piedmont and highlands, but limited in the desert and steppe areas;
- AI not used for sheep, very limited to graded breeding goats;
- Must use breeding record books to monitor reproduction of dairy cows and fattening bulls;
- Most farmers apply natural mating for sheep and goats;
- Almost no reproduction records are kept for sheep and goats;
- Male goats are castrated in most of the goat flocks.

Managing practices:

- Dairy cows are milked manually in drylands and highlands and mechanically in piedmont;
- Animals are kept in separate roofed barns and winter shelters;
- Livestock shelters have ventilation, flooring, roof, feedlots and watering facilities;
- Animal slaughtering are organized mostly in butcheries or at district slaughtering houses;
- Meat, eggs and milk are usually stored in cooling containers/tanks before marketing;
- Produced milk are supplied to processors, meat are traded in farm markets or supermarkets;
- Live animals are traded at the farm gate to wholesalers.

Specialized commercial production systems (SP)

The major SP systems found in Uzbekistan are dairy and chicken (layer and broiler) production systems. Each system has its own peculiar as well as similar properties. The specialized commercial dairy production system is characterized by its high input–high output nature. Modern livestock production technologies, high value feeds and pure dairy breeds are used, along with the processing of value-added products. The number of animals per farm in this system can be 500 or more. Due to the use of pure dairy breeds and improved feeding, the average milk productivity of cows can reach up to 30 litres per day with an overall average of about 20 litres per day. Though this production can further be increased, it is the highest compared to what is produced by fermer and dehkan production systems. Breeding is done predominantly using AI. The average parturition rate of 85% reported shows there is still a need to improve the efficiency of the AI service. The most common types of breeds used for dairying are pure breeds of Schwyer and Holistein. In terms of feeding, farmers in this system produce their forage feeds and mix their own concentrate feeds. The health service in the farms is conducted by a hired veterinarian of the farm and veterinary service provided by the government. Due to the high volume of production, many can have their milk cooling and processing facilities which can also be used for the milk collected from neighbouring farms. This production system is more common in Samarkand, Nawayi, Fergana valley and Tashkent areas.

Specialized commercial chicken production, like the dairy, is common in Samarkand, Nawayi, Fergana valley and Tashkent areas. It consists of layer and broiler production systems. The average number of chicken per farm in both layer and broiler production systems of Uzbekistan can be estimated to be 150 thousand layers/farm and 20

thousand broilers/cycle per farm. Advanced technologies and operations are used starting from high producing crossbreed chicken breeds, carefully prepared ration and improved veterinary services.

The chicken breeds used in this system are crossbred commercial layer and broiler chicken imported as parent stock or commercial breed either as live or egg. As feeding is critical in this system, most of the big farms carefully prepare their feed and make sure that they have sufficient and nutritionally up to the standard ration. Small layer and broiler farmers, on the other hand, either purchase processed feeds or make their ration. These farms are also known for properly following up vaccinations and they use either family labour, hired or private veterinarians. In terms of the outputs, the majority of the outputs (about 95%) from these systems go to supermarkets, shops and other outlets through intermediaries while the remaining (about 5%) go directly to consumers.

Most of the production technologies listed above apply to the specialized commercial systems also, but resource use is more adapted towards the economy of scale, as listed below:

Feeding:

- Only stall feeding is applied for cattle and chicken;
- Only silage with balanced animal rations are prepared from own maize, lucerne and legumes produced in allocated arable areas;
- Mixed concentrates are prepared for chicken on the farm from own maize and cereals;
- Concentrates and multivitamins are bought to mix with silage;
- No grazing in the cropping fields after harvest.

Animal health:

- Employ veterinarians for planned vaccination of all livestock (all cattle and chicken) to prevent most of the animal diseases;
- A veterinary certificate must be received for marketing of all livestock products;
- Animal bathing is applied for sanitary purposes regularly;
- Disinfecting barns and shelters are organized annually to eliminate all parasites and ticks;
- Watering points are disinfected regularly.

Genetics:

- Reproduction planning and monitoring are in place for all cattle;
- Employing AI specialist (Zoo-technologist) and only AI is applied to reproduce all cattle;
- Have breeding record books to monitor reproduction of dairy cows and fattening bulls;
- New layer and broiler chicken are reproduced in automatic incubators on the farms.

Managing practices:

- Not involved in sheep/goat production;
- Dairy cows are milked only mechanically;
- Animals are kept in automated barns and winter shelters;

- Livestock shelters have ventilation, flooring, roof, automatic feedlots and watering facilities;
- Animal slaughtering are organized mostly at farm butchery by employed staff;
- Meat, eggs and milk are usually stored in cooling containers/tanks before processing and marketing;
- Milk produced and collected from smaller farms;
- Dairy, eggs and meat produced are mostly supplied to supermarkets.

2.5 Major technical parameters defining productivity by species, system and zone

A combination of methods was used to collect the technical and financial parameters needed to build the model and carry out the LSA baseline analysis. This includes expert opinion, farmer consultations, field visits and literature reviews. First, a data sheet was prepared for each of the species and commodity value chains that are covered in the study and a list of experts and areas to be visited was prepared. The list of experts included specialists in different livestock species (cattle, sheep, goats, camels, horses, chicken) and commodity value chains (dairy, beef, mutton and goat meat, camel and horse meat, chicken meat and egg) and the main livestock production zones (desert and steppe, piedmont and highland). In individual and group meetings, data sheets were presented and discussed with the selected experts and filled based on the knowledge and the literature they reviewed.

The next stage was to make field visits to the three main livestock production zones and to fill data sheets by interviewing farmers (dekhan, fermer and specialized) in these zones. After data collection, the team took time to study the convergence of the data collected in the two approaches and with the literature reviewed. For this purpose, a detailed review of the literature was conducted. After studying the data collected and literature reports, reliable parameters were obtained and the HESM model was specified and the baseline analysis was conducted. A second verification of the parameters was also done with more experts after making the first model runs.

In this section, the most critical parameters for cattle and sheep are presented (in Tables 10–15). Please see Annex 1 for the detailed technical and financial parameters for all the species studied.

As shown in Table 10, as expected, the specialized (SP) dairy production system shows higher performance than both fermer and dehkan farms. This is particularly significant in terms of milk production. When comparing fermer and dehkan farms, meanwhile, fermer has a higher parturition rate and higher milk production and also shows a lower juvenile mortality rate than dehkan. In terms of the MPZs, both highland and piedmont have more or less similar productivity, but both have higher performance compared to the desert and steppe production zones.

Table 10. Demography, reproduction and production parameters of cattle under the three MPZs and subsystems

Parameters		Cattle							
		Sex and age category/units Dehkan	Desert and steppe		Piedmont		Highland		Specialized dairy
			Fermer	Dehkan	Fermer	Dehkan	Fermer		
Demography	Average no. of heads	Number	5	120	3	200	5	100	1500
	Parturition rate		0.70	0.70	0.73	0.78	0.73	0.78	0.85
	Prolificacy rate		1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Mortality rate	F–J	2.3%	2.0%	2.3%	1.5%	2.3%	1.5%	2.0%
		F–S	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
		F–A	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
		M–J	2.5%	2.0%	2.5%	2.0%	2.5%	2.0%	2.0%
		M–S	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
		M–A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Production	National average offtake rate	%	28%	33%	29%	34%	28%	34%	37%
	Average live weight at marketing	Kg	385	326	419	350	418	350	381
	Dressing percentage		52%	52%	52%	52%	52%	52%	56%
	Milk	Duration of lactation (days)	285	285	295	295	305	305	305
		Milking (litres)	7.0	9.0	9.5	12.0	9.5	12.0	20.0

According to Table 11 sheep in the steppe and steppe livestock production zone have lower performance in terms of parturition rate and live weight compared to both the piedmont and highland zones. It is also noticeable that milking sheep is not common in many areas of Uzbekistan.

Table 11. Demography, reproduction and production parameters of sheep under the three MPZs and subsystems

Parameters		Sheep						
		Sex and age category/units Dehkan	Desert and steppe		Piedmont		Highland	
			Fermer	Dehkan	Fermer	Dehkan	Fermer	
Demography	Average no. of heads	Number	30	300	15	300	20	300
	Parturition rate		0.95	0.95	1.00	1.00	1.00	1.00
	Prolificacy rate		1.10	1.10	1.10	1.10	1.10	1.10
	Mortality rate	F–J	3%	3%	3%	3%	3%	3%
		F–S	2%	2%	2%	2%	2%	2%
		F–A	2%	2%	2%	2%	2%	2%
		M–J	3%	3%	3%	3%	3%	3%
		M–S	2%	2%	2%	2%	2%	2%
		M–A	2%	2%	2%	2%	2%	2%
Production	National average offtake rate	%	39%	38%	38%	38%	38%	39%
	Average live weight at marketing	Kg	35	37	39	41	39	41
	Dressing percentage	%	48%	48%	50%	50%	50%	50%
	Milk	Duration of lactation (days)	0	0	0	0	0	0
		Milking (litre)	0.0	0.0	0.0	0.0	0.0	0.0

As shown in the Tables 12–15, dehkan farms buy a significant proportion of their forage feed requirements, in addition to concentrate feed, while the fermer system does not need to buy forage feeds but will buy supplements and concentrate feeds. This finding should be due to the fact that fermer has more land for both forage production and grazing land compared to dehkan. Fermer households are provided with irrigated land for forage production and rainfed grazing land based on their livestock number.

Table 12. Financial parameters of cattle under the steppe, steppe and piedmont production zones and subsystems (dehkan and fermer)

Parameters	Unit	Cattle							
		Desert and steppe				Piedmont			
		Dehkan		Fermer		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	5		120		3		200	
Forage land production area	Ha	0.35		36		0.04		60	
Grazing land area	Ha	0		240		0		400	
% of forage feed purchased	%	30%	600	0.0%	600	30%	600	0.0%	600
Veterinary costs and medicines	Cost/animal		150,000		200,000		150,000		200,000
AI	Cost/ reprod female		60,000		60,000		60,000		60,000
Products price	Unit								
Meat	Price/kg		20,352		19,864		19,796		19,468
Milk	Price/litre		2,355		2,355		2,250		2,250
Hides and skins	Price/kg		10,366		10,366		11,333		11,333
Wool	Price/kg								
Organic matter	Price/kg		68		68		112		112
Animal draught	Price/day		0		0		0		0

Table 13. Financial parameters of cattle in the highland production zone and its subsystems and specialized dairy system

Parameters	Unit	Cattle					
		Highland				Specialized dairy	
		Dehkan		Fermer			
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	5		100		1,500	
% of forage feed purchased	%	30%	600	0.0%	600	0.0%	600
Forage land production area	Ha	0.04		30		480	
Grazing land area	Ha	0		200		0	
Veterinary costs and medicines	Cost/animal		150,000		200,000		250,000
AI	Cost/reprod. female		60,000		60,000		60,000
Family labour	People/year	1		1.5		0	
Cost of loan for working capital							
% of production costs and general expenses financed by a loan	%	0%		0%		50%	
Annual interest rate on loan	%	12%		12%		12%	
Duration of loan	Month	24		24		24	

Parameters	Unit	Cattle					
		Highland				Specialized dairy	
		Dehkan		Fermer			
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Products price							
Meat	Price/kg		20,113		19,468		21,812
Milk	Price/litre		2,303		2,303		2,276
Hides and skins	Price/kg		10,850		10,850		11,092
Wool	Price/kg						
Organic matter	Price/kg		90		90		101
Animal draught	Price/day		0		0		0

Table 14. Financial parameters of sheep under the desert, steppe and piedmont production zones and subsystems

Parameters	Unit	Sheep							
		Desert and steppe				Piedmont			
		Dehkan		Fermer		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	30		300		15		300	
% of forage feed purchased	%	10%	600	0%	300	10%	571	0%	571
Grazing land area	Ha	0		200		0		200	
Veterinary costs and medicines	Cost/animal		15,000		15,000		15,000		15,000
AI	Cost/ reproductive female		0		0		0		0
Family labour	People/year	1		2		1		2	
Products price									
Meat	Price/kg		23,237		21,993		20,083		19,073
Milk	Price/litre		0		0		0		0
Hides and skins	Price/kg		2,190		2,190		3,333		3,333
Wool	Price/kg		1,500		1,500		1,500		1,500
Organic matter	Price/kg		0		0		0		0
Animal draught	Price/day								

Table 15. Financial parameters of sheep in the highland production zone and subsystems

Parameters	Unit	Sheep			
		Highland			
		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	20		300	
% of forage feed purchased	%	10%	571	0%	571
Grazing land area	Ha	0		200	
Veterinary costs and medicines	Cost/animal		15,000		15,000
AI	Cost/reprod. female		0		0
Family labour	People/year	2		2	

3 Baseline analysis of livestock contributions to the Uzbek economy

The LSIPT Ecorum was the tool used to create the Uzbekistan livestock HESM. It was then used to carry out the LSA baseline assessment to validate that the HESM represents the present livestock sector. The baseline analysis assesses the animal population, production and GDP from the Uzbek national herd in the base year 2016, given the BAU or business-as-usual level of investment, the level of investment existing in 2016. The next 3 sections provide the overall baseline analysis results for livestock population, production and GDP contribution for the baseline year, 2016, by species, and then for the main subsystems, as well as the projected results for 2031 (in 15 years), by the MPZs (desert and steppe, piedmont and highland) and for all the species.

3.1 Livestock population, production and GDP contributions in 2016

Livestock population in 2016

Table 16 shows the baseline population of livestock by major species in the 2016 base year, according to the model results, as well as the proportion of total LSU. The LSU is used to convert different species into comparable units by weight and feed requirements. The cattle and sheep population account for the most significant proportion (93%) of the national livestock herd.

Table 16. Livestock population by species in Uzbekistan in 2016

Species	Base year population (2016)	Base year population in LSUs (2016)	Proportion of total LSUs (%)
Cattle	12,176,365	13,796,365	79
Sheep	15,892,124	2,422,133	14
Goats	3,736,277	560,442	3.5
Camels	18,557	25,980	0
Chicken	43,084,591	430,846	2.5
Horses	221,190	176,952	1
Total LSU		17,412,717	100

Source: LSIPT Ecorum results.

LSUs are used to convert different species into comparable units. Cattle = 1.0 LSU, small ruminant = 0.15 LSU, 1 chicken = 0.01 LSU, 1 horse = 0.8 LSU and 1 camel = 1.4 LSU (Eurostat 2013. http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary: Livestock Standard Unit (LSU))

Livestock production output in the base year 2016

The livestock production (meat, milk, eggs, wool, hides and skins, organic matter and energy) estimates for the base year are described in this section. The computations were made based on the technical parameters and productivity indicators presented in the section above and Annex 1 and the base year livestock population. Table 17 presents the quantity of dressed carcass meat; Tables 18–21 present cow milk, eggs, hides and skins and organic matter. Figure 13 illustrates the share of total LSUs for meat coming from various species and total milk production in litres by species (2016).

Table 17. Volume of dressed carcass meat

Product/species	Production (t) Base year (2016)	% Contribution to total meat production
Meat		
Cattle	857,964	79
Sheep	117,580	11
Goats	22,563	2
Chicken	79,629	7
Camels	547	0
Horses	7,223	1
Total	1,085,506	100

Source: LSIPT Ecorum results.

Dressed carcass meat refers to the weight of an animal after being partially butchered, removing all the internal organs, the head and inedible (or less desirable) portions of the tail and legs. The value for the hides and skins represents hides and skins produced from livestock slaughtered and consumed at the household level. The value added of hides and skins from traded animals are not considered here.

At present, 1.1 million tonnes of meat production comes primarily from cattle (79%). The contribution of other species is low, with meat from chicken and sheep amounting to only 7 and 11%, respectively.

Production of 6.65 billion eggs is the current estimate based on the LSIPT Ecorum results.

Table 18. Current egg production

	Production in 2016
Eggs (number in million)	6,647

Source: LSIPT Ecorum results.

Milk comes from cattle and horses, although cattle contribute 99% of the milk produced. Significant increases in cow milk production can be expected, given the current scenario. At present, a total volume of 10.1 billion litres of milk is produced in Uzbekistan. Table 19 shows the milk produced by species.

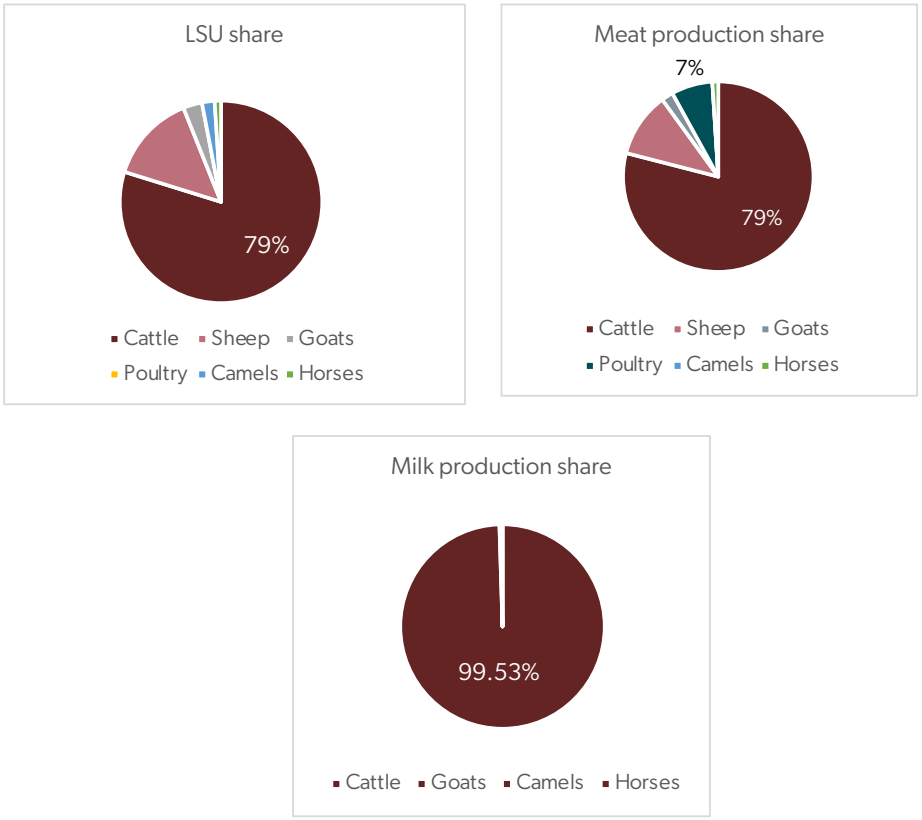
Table 19. Milk produced by species (cattle, goats, horses and camels)

Milk (litres)	2016	% contribution to national production
Cattle	10,063,492,800	99.53
Goats	22,033,800	0.22
Horses	24,808,379	0.25
Camels	979,700	0.01
Total	10,111,314,679	100.00

Source: LSIPT Ecorum results.

As shown in Figure 13, cattle are dominant in all respects. In both livestock population measured in LSUs and meat produced cattle take up to 79% share of the total. Sheep follows cattle in the LSU share, at 14%. Chicken, on the other hand, are insignificant in relative importance in terms of LSUs, but their importance in the meat production share is comparable to other species, like sheep.

Figure 14: Shares of LSU and meat and milk produced by species (2016).



Organic matter, wool, hides and skins outputs are shown in Tables 20 and 21.

Table 20. Production (t) of hides and skins, wool, organic matter and energy

Products	Units	Production in 2016
Hides and skins	Number	13,174,382
Wool	In tonnes	41,825
Organic matter	In tonnes	44,857,417
Energy		
Horses	In days	19,937,027

Source: LSIPT Ecorum results.

Table 21. Hides and skins production by species

	Livestock number	Offtake rate (%)	Hides and skins production
Cattle	12,176,365	44	5,357,601
Sheep	15,892,124	40	6,356,850
Goats	3,736,277	39	1,457,148
Camels	18,557	15	2,784
			13,174,382

Source: LSIPT Ecorum results.

Livestock contribution to GDP in the 2016 base year

The livestock GDP is defined as a monetary measure of the market value of all final livestock goods and services produced in a year (milk, meat, eggs, manure and energy). The contribution of livestock to the national GDP is an essential way to measure the economic performance of the subsector and its relative importance in the national economy. GDP can be generated at the production stage and also can include value added from the value chains by aggregating the margins from the various sub chains. In the sector model used, the livestock GDP is computed at the production stage by aggregating the gross value of the livestock output (milk, meat, eggs, manure and energy) and subtracting the intermediate consumption or costs to obtain the total value added. Tables 20 and 21 show the production of hides and skins, wool, organic matter and energy.

GDP or total value added = gross value of output—value of intermediate consumption/costs

Table 22 provides the value added of the various livestock commodities. According to the results from the herd and sector model (HESM), the total value added from the livestock sector in 2016 amounts to UZS 31,759 billion. It is observed that the largest livestock value added is generated by cow milk produced, which accounts for about 42%, followed by meat which accounts for 37%. Eggs contribute about 8% to the livestock GDP. The contribution of organic matter in value terms to livestock GDP, and hence to crop agricultural GDP and the overall economy is often overlooked since it is an intermediate good, but it is measured by the LSIPT Ecorum and is included here in the baseline assessment of livestock GDP.

Table 22. Livestock contribution to GDP to Uzbekistan economy (base year 2016) by species or product

Products	Units (t)	LSIPT value added/GDP results (2016) (in million UZS)	% contribution to total GDP
Meat			
Cattle		9,240,842	29.1
Sheep		1,761,050	5.5
Goats		151,746	0.5
Chicken		615,468	1.9
Camels		17,591	0.1
Horses		59,525	0.2
Total meat		11,846,224	37.3
Milk	Litres		
Cattle		13,296,589	41.9
Goats		85,748	0.3
Horses		26,289	0.1
Camels		8,205	0.0
Total milk		13,416,832	42.2
Eggs	Number	2,460,339	7.7
Hides and skins	Number	85,780	0.3
Wool	t	113,007	0.4
Organic matter	t	3,837,089	12.1
Energy			
Horse transport	in days	–	–
Total		31,759,273	100

Source: LSIPT Ecorum results.

3.2 Future contribution of the sector to national economic development under the BAU scenario

Projected livestock population by 2031 under the BAU scenario

The herd and sector model was used to project livestock population, livestock products and livestock GDP in 15 years. The 2031 projected livestock population figures for different livestock species are given in Table 23. These values are based on the baseline model productivity parameters and the BAU scenario, i.e. no additional investments in interventions made to raise the productivity of the livestock population over the coming 15 years and thus no changes in productivity parameters over time.

Table 23. Comparison of baseline and projected livestock populations, 2016–2031

Species	Base year (2016)	2031	Per cent change (%)
Cattle	12,176,365	19,757,654	62
Sheep	15,892,124	24,741,943	56
Goats	3,736,277	7,056,725	89
Camels	18,557	19,294	4
Chicken	43,084,591	134,903,755	213
Horses	221,190	334,469	51

Source: LSIPT Ecorum results.

Under the BAU scenario in 2031 and given current animal productivity parameters and recent growth rates in numbers, there is significant growth expected in the population of all livestock species, except camels, due to their current low numbers and low growth rate. This does not mean the camel population of Uzbekistan could not grow significantly if there is a higher level of investment over the coming 15 years. As mentioned before, there is said to be a growing demand for horse meat for export to the rest of Central Asia and Europe (Lerman 2008b).

Livestock production by 2031, under the BAU scenario

To estimate the quantities of future production of livestock products in 2031, under the BAU scenario, the baseline livestock productivity parameters are applied to the projected livestock population. The volume of the main livestock products, meat, milk, eggs, manure and skins and hides, are thus projected and valued at current products to estimate their contributions to the national economy or GDP of the country.

The results of the production projection (for 2031) are presented in Tables 24–27 and compared with the 2016 baseline situation. For example, under the BAU scenario, the production of dressed beef carcass is expected to grow from 857,964 t in 2016 to 1,214,392 t in 2031, a significant increase of 42%. Total milk production increases from 10,111,315 to 14,971,204 t or a growth of about 48%. Egg production increases by 233% over the same period.

Table 24. Comparison of the baseline 2016 and projected 2031 BAU meat production by species

Product/ species	Production (t)		% contribution to the national production		2016 vs. 2031 % change
Meat	2016	2031	2016	2031	
Cattle	857,964	1,214,392	79	74	42
Sheep	117,580	179,404	11	11	53
Goats	22,563	42,526	2	3	88

Product/ species	Production (t)		% contribution to the national production		2016 vs. 2031 % change
Chicken	79,629	200,619	7	12	152
Camels	547	569	0.1	0.0	4
Horses	7,223	10,890	1	1	51
Total	1,085,506	1,648,400	100	100	52

Source: LSIPT Ecorum results.

Table 24 shows that cattle will remain the dominant source of meat in 2031, 74%, given the BAU level of investment. Chicken and sheep production follows with 12% and 11%, respectively. Chicken production shows the most significant change over 15 years, with an increase of 152% compared to the baseline production of 2016.

Table 25 shows milk from cattle, goats, horses and camels, although cattle contribute 99.5% of the milk produced. Significant increases in milk production are expected, given the current scenario, and there will be close to a 50% increase in milk production in 2031, given the BAU scenario compared to the base year.

Table 25. Comparison of the baseline 2016 and projected 2031 BAU milk produced by species (cattle, goats, horses and camels)

Product/species	Production (t)		Share (%) of national production		2016 vs. 2031 % change in production
Milk	2016	2031	2016	2031	
Cattle	10,063,493	14,891,031	99.53	99.46	48
Goats	22,034	41,611	0.22	0.28	89
Horses	24,808	37,544	0.25	0.25	51
Camels	980	1,018	0.01	0.01	4
Total	10,111,315	14,971,204	100.00	100.00	48

Source: LSIPT Ecorum results.

Production of 6.6 billion eggs is the current estimate based on the LSIPT. It is expected that with the current level of investment, egg production will reach 22 billion, which is a 233% increase by year 2031 as shown in Table 26. The potential contributions of organic matter, wool, hides and skins and energy under the BAU scenario are important outputs in 2031 as shown in Table 27.

Table 26. Current egg production and projection for 2031

	Production in 2016	Production in 2031	% change in production
Eggs (number in million)	6,647	22,145	233%

Source: LSIPT Ecorum results.

Table 27. Production (t) of hides and skins, wool, organic matter and energy

Products	Units	Production in 2016	Production in 2031	% change in production
Hides and skins	Number	13,174,382	21,345,162	62
Wool	t	41,825	67,194	61
Organic matter	t	44,857,417	61,110,189	36

Products	Units	Production in 2016	Production in 2031	% change in production
Energy				
Horse transport	In days	19,937,027	29,912,344	50

Source: LSIPT Ecorum results.

Tables 28 and 29 show the contribution of meat and milk from the MPZs (desert and steppe, piedmont and highland) and the SPs or specialized systems to national meat and milk production in 2031 (under the BAU investment). Desert and steppe and piedmont contribute about three times higher than the highland zone in importance in total meat production. Specialized systems, chicken and horses contribute about 22% to the national meat production in both 2016 and 2031. The per cent contributions for the various species to meat and milk production change very little from 2016 to 2031. The specialized systems, chicken and horses were not analysed by MPZ. This was due to the assumption that they have more or less similar production systems and management across the different MPZ.

Table 28. Meat production by production typology

Production typologies/zones	Production (t)		% contribution		2016 vs. 2031 % change
	2016	2031	2016	2031	
Desert and steppe	367,055	536,349	34	33	46
Piedmont	369,366	567,148	34	34	54
Highland	115,619	185,530	11	11	60
SP or specialized systems; chicken and horses	233,466	359,373	22	22	54
Total	1,085,506	1,648,400	100	100	52

Source: LSIPT Ecorum results.

Table 29. Milk produced by production typology/MPZs

Production typologies/MPZs	Milk produced (10 × 3 litres)		% contribution		2016 vs. 2031
	2016	2031	2016	2031	% change
Desert and steppe	3,649,081	5,305,827	36	35	45
Piedmont	4,607,746	6,907,683	46	46	50
Highland	1,477,245	2,330,585	15	16	58
Specialized systems; horses	377,243	427,108	4	3	13
Total	10,111,315	14,971,203	100	100	48

Source: LSIPT Ecorum results.

Livestock GDP contribution by 2031, under the BAU scenario

The total livestock value added or livestock GDP at the production stage in 2031 is projected to reach UZS 49,833 billion, which is about 57% growth over the 2016 value. The per cent change in GDP contribution changes most for chicken. Table 30 shows the distribution and change of the livestock GDP across the different species and Table 31 across different production systems/MPZs. Cattle remains the dominant contributor to the GDP, followed by chicken.

Table 30. GDP contributed by species for 2016 and 2031

Production typologies/zones	GDP contributed in million UZS		% contribution		2016 vs. 2031 % change
	2016	2031	2016	2031	
Cattle	26,453,632	38,041,128	83	76	44
Sheep	1,817,887	2,797,352	6	6	54
Goats	300,331	567,290	1	1	89
Camels	25,801	26,825	0.1	0.1	4
Horses	85,952	132,043	0	0	54
Chicken	3,075,808	8,268,628	10	17	169
Total	31,759,410	49,833,266	100	100	57

Source: LSIPT Ecorum results.

As shown in Table 31, in terms of GDP contribution in 2016 and 2031, piedmont has the lead, followed by the desert and steppe zones. All the MPZs and SP production systems show significant increases in their contribution to livestock GDP in 2031, compared to the base year, 2016, with the share from SP chicken and horse changing the most.

Table 31. GDP contributed by production typology/MPZs

Production typologies/MPZs	GDP contributed in million UZS		% contribution		2016 vs. 2031 % change
	2016	2031	2016	2031	
Desert and steppe	9,755,630	14,179,321	31	28	45
Piedmont	12,084,851	18,295,344	38	37	51
Highland	3,605,664	5,719,358	11	11	59
Specialized systems (SP), chicken and horse	6,313,265	11,639,243	20	23	84
Total	31,759,410	49,833,266	100	100	57

Source: LSIPT Ecorum results.

The livestock contribution by commodity to GDP in Uzbekistan in 2031 BAU comes mainly from the milk (and more specifically cow milk) and beef value chains. Cow milk and beef production are expected to contribute together about 77% of the total livestock GDP in 2031. Table 32 shows the GDP contributed by commodity.

Table 32. GDP contributed by commodity

Commodity	GDP contributed in million UZS		% contribution		2016 vs. 2031 % change
	2016	2031	2016	2031	
Milk	13,416,832	19,808,434	42.2	39.7	48
Meat	11,846,224	17,871,795	37.3	35.9	51
Eggs	2,460,339	6,769,074	7.7	13.6	175
Hides and skins*	85,917	128,392	0.3	0.3	49
Wool	113,007	196,369	0.4	0.4	74
Manure	3,837,090	5,059,201	12.1	10.2	32
Total	31,759,410	49,833,266	100	100	57

*This value is not representative of all the hides and skins GDP contributed as it only includes the hides and skins produced from animals slaughtered by the livestock farm owner and not animals sold for slaughter off the farm.

Source: LSIPT Ecorum results.

Conclusion

The projected volume of livestock products over the next 15 years is based on the BAU scenario. The LSA baseline assessment shows the total contribution of the livestock sector to national GDP will increase by 57% under the BAU scenario. This could be taken to be a very high increase but has to be compared to the expected increase in demand over this same period. If the recent high current human population growth rate (2.5%) and income growth increase at around 6% per year, as expected in Uzbekistan, this can be expected to lead to a simultaneous increase in demand for animal source foods. Thus, attention needs to be given to whether the existing levels of animal productivity and production and investment will meet the consumption requirements of the rapidly growing population. This scenario analysis is the objective of the next phase of the sector analysis using the now validated HESM.

It needs to be investigated if there is the need to invest more in the sector to increase the productivity performance of the priority livestock species and to test which combination of technological investments and policy interventions breeding, health and feed and marketing could increase production enough to meet the growing domestic consumption requirements, or more than enough and thus to enable exports of livestock products from Uzbekistan, to help meet the government objective to raise foreign exchange earnings. The possible interventions (technological and policy) recommended to be tested will be discussed in the subsequent sections of this report.

3.3 Livestock population, production and GDP contributions by subsystem

In this section, we analyse the HESM baseline results for livestock numbers by species, as well as products and GDP, by subsystems—dehkan, fermer and SP. An important validation of the HESM results is whether these livestock numbers, production and GDP results match or nearly match the findings coming from analysis done with the 2016 data from the UzStat (2017b). Table 33 shows the livestock numbers by livestock production in the year 2016.

Table 33. Livestock numbers by livestock production subsystems in the base year 2016

	Livestock number by type of production system			Livestock under fattening by production systems	
	Dehkan	Fermer	Specialized (SP)	Dehkan	Specialized
Cattle	11,387,691	638,674	150,000	1,600,000	20,000
Sheep	13,108,263	278,3861	–	255,425	–
Goats	3,340,784	395,493	–	–	–
Camels	18,557	–	–	–	–
Chicken	41,568,100	–	24,190,000	–	–
Horses	188,167	33,023		–	–

Source: LSIPT Ecorum results.

Part of the results on the Uzbekistan livestock sector show that the dehkans (the smallholder livestock keeping households) own more than 90% of the cattle (11 million heads), 83% of the sheep and goats (16 million heads), 85% of horses and 63% of chicken. The dairy sector is the major livestock subsector in Uzbekistan, contributing about 45% to livestock GDP during 2016. It is stated in the literature that dehkans produce over 60% of all the animal source foods (ASFs—meat, milk and eggs) and 91% of the milk produced during 2016 came from the smallholder dehkan farms.

Table 34 and Figure 14 show the livestock number in LSUs by types of production subsystems.

Table 34. Livestock numbers in LSUs by subsystems

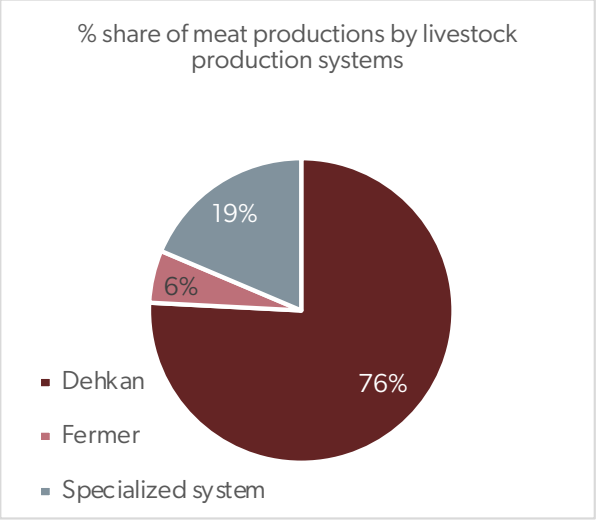
	Livestock number in LSUs by types of production subsystems*		
	Dehkan	Fermer	Specialized
Cattle	11,756,922	638,674	155,128
Sheep	1,991,782	417,579	–
Goats	501,118	59,324	–
Camels	25,980	–	–
Chicken	415,681	–	241,900
Horses	150,534	26,418	–
Total	14,615,281	1,141,996	397,028
% share	91%	7%	2%

*LSU conversion factor: cattle = 1.0 LSU, small ruminant = 0.15 LSU, 1 chicken = 0.01 LSU, 1 horse = 0.8 LSU and 1 camel = 1.4 LSU. For feedlot production, the additional weight gained during fattening is used (e.g. for cattle (livestock number *cattle LSU conversion *weight gained during fattening average live weight cattle).

Source: LSIPT Ecorum results.

As shown in Table 35 and Figure 15, the dehkan farms (subsystem) presently produce 76% of the meat and 90% of the milk, which are conducive to small-scale production systems. This does not mean, however, that no economics of scale are possible in meat and milk production and the investment returns in larger scale units need to be assessed in the LSA scenario analyses to be done in Phase 2 of the project. dehkans also currently produce 48% of the eggs coming from the sector. As expected, the SP or industrial scale chicken units produce a large share of the eggs or 52% and the relative profitability and ways to scale up dehkan chicken need to be assessed in the LSA work in Phase 2.

Figure 15: Per cent share of livestock number (in LSU) by livestock production subsystems.



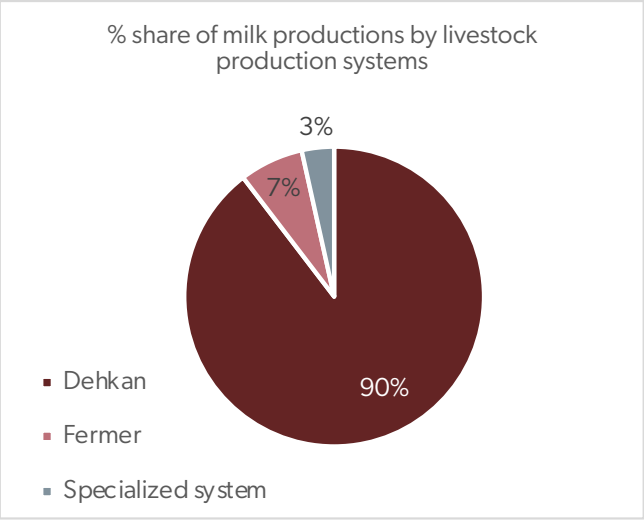


Table 35. Major livestock products by production subsystems in 2016

Production subsystems	Meat		Milk		Egg	
	Production	% share	Production	% share	Production	% share
Dehkan	823,000	76	9,060,607	90	3,157,526	48
Fermer	60,470	6	698,273	7	NA*	NA
Specialized system (SP)	202,037	19	352,434	3	3,489,843	52
Total	1,085,507	100	10,111,315	100	6,647,368	100

*Farmer keeping chicken will keep highly productive layers and broilers and are counted with the specialized chicken production systems.

Source: LSIPT Ecorum results.

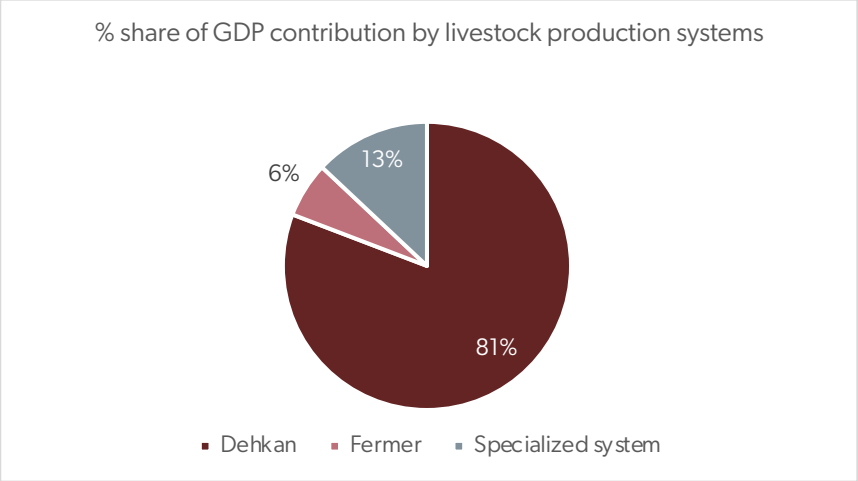
Table 36. Total GDP contribution and per cent share of GDP contribution by production systems

Production subsystems	GDP contribution	% share of GDP contribution
Dehkan	25,665,219	81
Fermer	1,967,870	6
Specialized (SP) systems	4,126,321	13
Total	31,759,410	100

Source: LSIPT Ecorum results.

Dehkans presently produce 81% of the GDP contribution coming from the livestock sector. Ways to scale up the number of dehkan units, as well as the larger scale fermer units and SP farm units, need to be assessed. The LSA scenario analyses are to be done in Phase 2 of the project.

Figure 16: Per cent share of major livestock productions and total livestock GDP by production systems.



An important validation of the HESM results is whether these livestock numbers, production, the HESM baseline results for livestock numbers by species, as well as products and GDP, by subsystems—dehkan, fermer and SP match or nearly match the findings coming from analysis done with the 2016 data from the UzStat (2017b).

3.4 Production constraints and challenges for identifying future interventions

This section highlights the current production constraints and challenges to help identify the interventions to be assessed in the future scenario analysis to be done in Phase 2 of the Uzbek LSA analysis. The priority feed resource, animal health, animal breeding and processing and marketing challenges are highlighted.

Insufficient feed resources

Almost half of the dehkan family smallholders and private livestock farms suffer from insufficient feed supplies (IFAD 2015), especially during cold winter seasons. The key reasons for insufficient feed production are lack of land and low feed crop yields (ICARDA 2015). Although the recent state policy prescribed increasing arable land allocations under animal feeding crops, the important factor is yet existing administrative restrictions leading to insufficient feed crop cultivation, whose strategic objective is to grow cotton and wheat (IFAD 2015). This leads to no access for family and private livestock to graze farmer's crop fields. Therefore, most of them are feeding their livestock inside the canal and drainage edges. This, at the same time, increases animal diseases and destroys irrigation and drainage network.

The dehkan smallholders, who own the bulk of the livestock in the country, do not have sufficient land area for fodder crops production, as do the larger livestock farmers. This is a critical limiting factor for developing and expanding livestock business for the dehkan smallholders. There have to be at least 30 heads of LSU—equals to one adult cattle or 10 heads of sheep to register livestock farm and to receive state leased land plots of 0.3–0.6 ha per LSU (Government of the Republic of Uzbekistan 1998a; Government of the Republic of Uzbekistan 1998b).

Most of the dehkan households cannot buy sufficient feed due to the high cost (especially industrial by-products) as well as due to shortage of high-quality concentrated feeds. Currently, low nutritious feeds such as straw, bran and maize are the main animal feeding ingredients. Therefore, there is a shortage of animal feed during the winter and early spring seasons in rural areas, when the animals experience the weakest body weight conditions. During longer periods of cold winter, smallholder animal producers have to sell their livestock at low prices due to a shortage of winter feed stocks and an excessive supply of live animals in the market. This also leads to poor animal productivity and poor investment in improved feedlot and breeding practices.

Harvesting natural grass for cattle is associated with some difficulties and higher transaction costs. Cattle farms are usually located in the irrigated zone and haymaking is carried out in steppe and foothill areas and involves the departure, harvesting of fodder and transporting over considerable distances, which distracts labour resources, requires transport equipment and significantly increases the cost of feed. Harvesting of hay by special foraging teams in the foothill and steppe regions does not have a systematic organization and does not guarantee the required volume.

In the regions, there is an acute shortage of pastures—existing pastures are depleted, including on farm plots. More than half of the livestock farmers in the desert and steppe areas are experiencing a shortage of productive pastures for grazing. The lack of own fodder and pastures forces livestock owners to buy fodder, especially for the winter season.

Gaining mixed fodder is a problem, since this resource is produced and sold under strict state control and production plants do not have the right to sell their products on the market or directly to farmers (ICARDA 2015). Concentrated fodders are sold mainly through the commodity exchange and their offer is extremely limited. The farmer needs to submit many documents to the commodity exchange for the purchase of feeds (but not necessarily satisfied). In principle, concentrated fodder can be purchased for cash on the market or from other farmers, but its price is significantly higher than on the exchange.

Many farmers cannot get enough feed. The main reason is their high cost. In addition, the cottonseed cake and cereal husks are often not available for sale. According to experts, one of the key problems of poor fodder supply is the extremely unsatisfactory state of the production system and sale of mixed fodder. The quality of mixed fodder is low and they often contain mechanical impurities and foreign matter.

A summarized list of constraints that livestock producers experience in providing animal feeding is given below:

- shortage of feed and administrative restrictions on feed crop cultivation;
- seasonal high cost of animal feeding in district markets;
- almost half of the family and private livestock farms suffer from insufficient feed supplies;
- scarcity of land for forage production and competition with crop production;
- straw, bran and corn are the main feed ingredients in the animal diet, which is not optimal because of their low nutrition value;
- the unsatisfactory state of the system of production and sale of mixed fodder and its poor quality;
- purchased feed often contains mechanical impurities and foreign matters.

Animal health challenges

At the village level, veterinary services are used at the minimum level, only when diseases occur. Preventive measures are not practised widely. Weak demand for animal disease prevention causes poor provision of veterinary services in remote rural areas. Some householders buy animal medications at veterinary stations and treat animals by themselves against parasites and intestine worms, which otherwise significantly deteriorate animal productivity.

There is one veterinary station available in each district, but there is almost no diagnostic equipment. Veterinarians cannot work effectively due to resource limitations such as lack of human resources, equipment to store and transport vaccines. There are not enough animal health extension workers to serve the farming community as well. Vaccine is one of the most important activities of the district veterinary station in terms of providing free vaccination for some of the epizootic animal diseases, including anthrax, foot-and-mouth, plague (Pasteurella pestis), sheep/goat pox and pasteurellosis.

However, the vaccines allocated for the district do not cover the entire animals and some are not available, possibly because of the insufficient number of vaccines produced at the national level or problems in the distribution system, but mostly due to the limited demand for the veterinary services from rural households and dehkans. This is mostly due to lack of awareness of rural households on serious animal diseases and their implications on human health, as well as poor services provided by the veterinarians to the rural population. This is why most of the smallholder livestock keepers try to treat animals by themselves, or at least they slaughter sick animals before they die, but not by spending funds on veterinary services and vaccinations to prevent the diseases.

A summarized list of challenges in animal healthcare is provided below:

- limited use of public and private veterinary services, including for surveillance and control of animal diseases;
- poor body condition of most of the animals due to lack of nutritious feeding and because of limited land availability for fodder and limited availability of concentrate and supplementary feed;
- feeding livestock inside the canal and drainage edges are causing as eruption places for parasites;
- absence or weak capacity of veterinary institutions at the district level and their technical infrastructure such as lab facilities do not meet quality standards;
- limited capacity to disseminate information on disease prevalence;
- limited capacity of veterinary service that distinguishes the importance of improving disease prevention and control and prioritizes the control of several zoonotic and transboundary diseases (including brucellosis, echinococcosis, foot-and-mouth disease, tuberculosis, peste des petits ruminants, rabies, anthrax and others).

Obstacles in animal breeding

There is still a lack of access for the smallholder livestock producers to get high breed cattle breeds. It has been noted that most of the rural households keep cattle, sheep and goats as liquid assets that can easily be sold to access cash. Therefore, the householders believe that it is more important for them to keep a higher number of animals in stock rather than their higher productivity (ICARDA 2015). Due to this fact, for example, the rural smallholders continue keeping cattle or sheep with poor reproduction potential. Moreover, due to high market prices, the rural households supply a minimum amount of feed to their animals and apply almost no preventive measures against diseases to minimize input costs.

Animal genetic improvement practices that can very well enhance animal productivity and provide higher incomes, such as AI, controlled reproduction and pedigree selection practices, are not widely practised. This is due to a lack of necessary skills and awareness in animal breeding. Therefore, the household strategies of livestock breeding management can be considered to be in chaos. There is a lack of an animal identification system (the government

starts to implement the ID system during 2018–2021), rearing of breeder animals and their distribution. The producers do not have the necessary knowledge to correctly assess the quality of reproducing animals—whether the number of males in the herd is in excess or shortage (ICARDA 2015). There is no special attention given to dehkans for highly productive animals and no follow-up of animal reproduction in pedigree records. This is partly due to the lack of access to rams/bucks of highly productive pedigrees in the regional animal markets (ICARDA 2015). However, those private livestock farms with knowledge of animal genetics apply advanced breeding practices such as AI and import high grade cattle pedigree from European farmers. The introduction of a well-maintained animal identification system with track records of animal breeding origins on the national level can well serve to effectively address all the challenges.

A summary list of challenges in animal genetics is as follows:

- weak selection and breeding control at farm level, AI infrastructure;
- lack of knowledge on benefits of the AI and keeping animal reproduction records;
- loss of local genetics adapted to Uzbekistan's climate and a knowledge deficit in breeding institutions;
- lack of understanding among the population of the importance of veterinary service, low level of solvent demand for veterinary services, primarily by dehkans;
- shortage of vaccines and low quality of available veterinary drugs and materials for vaccinating and insemination;
- weak development of private entrepreneurship in veterinary service subsector;
- insufficient advocacy among the population about the necessity of vaccination and lack of qualified specialists and their low motivation.

Processing and marketing challenges

The most needed service, which is not fully available, is the storage and processing of agricultural outputs. The situation is aggravated by a lack of competitive input and service supply markets. In addition, farm machinery and equipment are, in most cases, outdated, have exhausted their operating life and require replacement or frequent repair (IFAD 2015). Lack of processing equipment is also related to an unsatisfactory power supply. Even those farms, which are connected to power supply, sometimes face power cut-offs and voltage drops in the power network.

With regards to marketing, rural households, who are willing to specialize in and commercialize beef/mutton production, especially in remote districts, have weak bargaining power and they use resellers' services to sell their animals as transportation service is poorly available for the livestock farmers and smallholders in rural areas to provide better access to district markets. In better cases, animal keepers sell their animals at slaughterhouses or to market intermediaries at better prices than to wholesale resellers. Mid-size livestock farms and smallholders require better market access as they are more vulnerable to environmental and economic shocks than larger scale specialized livestock farmers.

Below is a summarized list of processing and marketing challenges in livestock production:

- absence of processing and marketing infrastructure for small producers;
- weak networks or absence of mutually beneficial contractual relationships between farmers, farmer groups and agro-processors;
- weak compliance with principles of hazard analysis and critical control point (HACCP);
- small size of the overwhelming majority of livestock producers pose significant challenges for applying modern mini-technologies and limits potential economies of scale effects, resulting in relatively low levels of the sector's efficiency.

3.5 Livestock sector development strategies

An experts' consultation was conducted on 19 September 2017 to provide input on the key strategic areas and strategies that are critical for the future development of the livestock sector in Uzbekistan. The key strategic areas identified are feeds and feeding, genetics, health and extension services, marketing, processing of livestock products and policy. These strategic areas and strategies will be used to craft the detailed interventions needed to improve the livestock sector of Uzbekistan and which will be tested in the next LSA phase of this work.

Feeds and feeding

- promoting local feed production to have country-level feed self-sufficiency;
- providing optimal water supply for animals and forage production;
- improving the productivity of pastures;
- promoting rotational grazing of pastures and application of conservation technologies for use during winter;
- preventing overgrazing, soil degradation and erosion;
- promoting inter/rotational cropping of leguminous fodder with food and other industrial crops;
- effective use of crop residues;
- mechanizing labour-intensive feed production operations;
- supporting forage seed production and marketing;
- promoting production and use of forage crops in Piedmont and irrigated areas;
- creating year round and stable fodder and reserves for the winter period;
- promoting use of high yielding varieties of fodder crops and hybrids;
- making land available for soya bean and maize production—the main inputs for chicken feed;
- promoting semi-scavenging village chicken in fenced areas.

Health care and services

- implementing and improving the animal identification system
- improving the provision of veterinary services
- enhancing planning of disease preventive measures and timely vaccination of animals
- complying with international sanitary and phytosanitary standards (SPS) to promote exports through identifying traceability, disease surveillance and quarantine facilities
- attracting private investments to improve the provision of veterinary services
- financing technologies that enhance early detection of animal diseases and increase disease prevention
- improving the logistics for the provision of veterinary services and vaccinations in remote desert areas
- allocating budget to conduct regular monitoring of vaccination and veterinary services in the areas where the services are poorly covered
- vaccinating all chicken and disinfecting chicken houses and utensils.

Genetic improvement

- using selection and crossbreeding methods to improve the productivity of existing animals
- conducting AI for improving cattle breed
- attracting the private sector to the animal breeding business and training them
- improving the certification process for pedigree farms through closer follow up and support and encouraging the improvement of record-keeping on farms
- strengthening immunogenetic and genomic evaluation of animals
- organizing a system of incentives and training for successful animal selection
- promoting the establishment of day-old chick production and distribution farms/centres.

Extension services

- strengthening the capacity of the farmers' union that provide extension services
- training farmers on livestock production technologies and best practices (feeding, management, disease control and livestock products harvest, marketing and processing)
- creating a database on innovative technologies (with mobile applications and websites)
- improving qualification of specialists through intensive training and study tours at home and abroad
- equipping extension centres with necessary tools and transport services
- financing farmer-to-farmer schools to organize field training and seminars
- integrating value chain activities among farms and processing enterprises on production of Karakul skins (for desert areas).

Marketing livestock products

- supporting farmers to organize marketing cooperatives
- Assisting in the primary milk cooling, storage and selling centres, including special milk transporting vehicles
- conducting market research (private and public) and sharing information on market prices for inputs and livestock products
- investing in establishing certification of livestock products before exporting
- procuring lab equipment necessary for testing and certifying livestock products
- conducting slaughtering animals at certified slaughter places to ensure the quality and safety of meat products
- setting up a system to improve the quality and safety of livestock products storage, transporting and marketing.

Processing livestock products

- encouraging the existing processing facilities to modernize and promote the establishment of new livestock products processing facilities (milk, meat, wool, hide and skin)
- following up and supporting livestock products processing facilities to ensure compliance with state standards

- introducing the wide distribution of affordable mini technologies for processing, packaging, labelling and storage of livestock products
- developing a cooperative system for processing and marketing of finished and semi-finished chicken products.

Policy

- assisting dairy producers by providing land necessary for the production of feed, in accordance with their number of cattle, as well as training on the productivity of the land and fodder crops
- creating incentives for specialized fattening farms, including helping to create a system for the systematic supply of feed, especially concentrate feeds
- creating a policy environment that can attract private sector investment in livestock production and input supply
- creating the legal framework to establish independent testing services that can allow farmers to check the nutritional quality of processed fodder before buying it
- enforcing contractual obligations between farmers and feed producers in terms of price and quality of fodder
- promoting investments in pasture rehabilitation and improved forage production
- supporting the production of chicken meat through organizing a targeted credit system and providing land for growing feed (1 ha per 40 chicken)
- increasing funding for procuring scientific equipment and research projects to develop new and well-adapted technologies.

4 Conclusions

In this baseline report, we have analysed the HESM baseline results for livestock population, as well as production and GDP, according to the Uzbekistan MPZs, species and subsystems. We have done this assessment to validate the HESM baseline results so we can carry out the LSA foresight scenario analysis in Phase 2 with confidence that the model represents the current state of the sector.

Table 37 demonstrates the baseline population, production and GDP findings of the HESM compare well with the 2016 data from the UzStat (2017b). The results match or nearly match the data coming from the Uzbekistan State Committee on Statistics.

Table 37. Production and GDP results based on comparison of LSIPT produced results with Uzbek State Statistics Committee and FAO results

Products	Units	Production			Value added/GDP
		Baseline LSIPT results (2016)	The State Committee on Statistics (2016)	FAOSTAT (2014)	LSIPT results (2016) (in million UZS)
Meat					
Cattle	In tonnes	857,964	906,000	800,000	9,240,842
Sheep	In tonnes	117,580		177,000	1,761,050
Goats	In tonnes	22,563	128,500	–	151,746
Chicken	In tonnes	79,629	78,000	48,100	615,468
Camels	In tonnes	547		1,000	17,591
Horses	In tonnes	7,223	7,300	4,000	59,525
Total meat	In tonnes	1,085,506	1,119,800	1,030,100	11,846,224
Milk					
Cattle	In litres	10,063,492,800	9,703,253,000	8,404,235,000	13,296,589
Goats	In litres	22,033,800		26,500,000	85,748
Horses	In litres	24,808,379		–	26,289
Camels	In litres	979,700		800,000	8,205
Total milk	In litres	10,111,314,679	9,703,253,000	8,431,535,000	13,416,832
Eggs	Number	6,647,368,323	6,111,734,000	4,370,300,000 (2013)	2,460,339
Hides and skins	Number	13,174,382	–		85,780
Wool	In tonnes	41,825	37,053	–	113,007
Organic matter	In tonnes	44,857,417	–	–	3,837,089
Horse transport (energy)	Number of days	19,937,027	–	–	–
Total livestock GDP					31,759,273

In Uzbekistan, all the three MPZs (desert and steppe, piedmont and highland) are important for producing livestock, however, based on the current technologies and perhaps policies, as well as the current level of investment, the piedmont and desert and steppe zones stand out. The highlands have a comparative advantage mainly for sheep production, but it was found an important amount of milk is currently produced in the highlands. Thus, there may also be potential to expand smallholder and large-scale dairy production and this needs to be tested in the LSA scenario analyses to be done in Phase 2 of the project.

Species wise, cattle dominate in the Uzbek livestock sector, as it contributes 79% of meat and 99% of milk. Naturally, given the agro-ecology of Uzbekistan, which does not favour goats (as indicated in the relatively low goat population numbers), the volume of hides and skins produced mainly come from sheep (48%) and cattle (41%). Meanwhile, even given the BAU investment scenario, or continuing the current level and type of investment, a projected increase to meat production of 233% is anticipated to come from egg production, which will reach 22.1 billion by 2031 (in 15 years).

Lastly, the fact that the dehkan farms (or subsystem) presently produce 76% of the meat and 90% of the milk demonstrate that these income-earning activities are conducive to small-scale production. This does not mean, however, that no economies of scale are possible in meat and milk production and the investment returns in larger scale units also need to be assessed in the LSA scenario analyses to be done in Phase 2 of the project.

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Annex 1. Baseline data tables—Parameters

Table 38. Demography, reproduction and production parameters of cattle under the three MPZs and subsystems

	Parameters	Sex and age category/units	Cattle						
			Desert and steppe		Piedmont		Highland		SP-dairy
			Dehkan	Fermer	Dehkan	Fermer	Dehkan	Fermer	SP-dairy
Demography	Average no. of heads	Number	5	120	3	200	5	100	1500
	Duration of age groups (in months)	F–J	12	12	12	12	12	12	12
		F–S	14	14	14	14	14	14	13
		F–A	54	54	54	54	54	54	36
		M–J	12	12	12	12	12	12	12
		M–S	6	6	6	6	6	6	6
		M–A	12	12	12	12	12	12	2
	Age/sex structure	F–J	15%	17%	16%	18%	16%	18%	19%
		F–S	17%	19%	17%	19%	17%	19%	20%
		F–A	46%	50%	45%	47%	45%	47%	45%
		M–J	15%	12%	15%	12%	15%	12%	13%
		M–S	5%	2%	5%	2%	5%	2%	2%
		M–A	2%	1%	2%	1%	2%	1%	1%
	Parturition rate		0.70	0.70	0.73	0.78	0.73	0.78	0.85
	Prolificacy rate		1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Mortality rate	F–J	2.3%	2.0%	2.3%	1.5%	2.3%	1.5%	2.0%
		F–S	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
		F–A	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
		M–J	2.5%	2.0%	2.5%	2.0%	2.5%	2.0%	2.0%
		M–S	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.0%
		M–A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Production	Offtake rate (%)	F–J	0%	1%	1%	2%	1%	2%	1%
		F–S	1%	5%	3%	7%	3%	7%	3%
		F–A	11%	13%	11%	16%	10%	16%	10%
		M–J	5%	60%	5%	60%	5%	60%	60%
		M–S	70%	70%	70%	70%	70%	70%	70%
		M–A	80%	80%	80%	80%	80%	80%	80%
	National average offtake rate	%	28%	33%	29%	34%	28%	34%	37%
	Live weight (kg)	F–J	130	130	150	150	150	150	160
		F–S	250	250	290	290	290	290	350
		F–A	430	450	480	490	480	490	510
		M–J	140	140	150	150	150	150	150
		M–S	300	300	330	330	330	330	400
		M–A	500	500	530	540	530	540	550
	Average live weight at marketing	Kg	385	326	419	350	418	350	381
	Dressing percentage		52%	52%	52%	52%	52%	52%	56%
	Financial price	F–J	1,344,000	1,344,000	1,568,000	1,568,000	750,000	1,568,000	2,000,000
		F–S	2,800,000	2,800,000	3,248,000	3,248,000	3,500,000	3,248,000	3,000,000
		F–A	4,480,000	4,480,000	4,704,000	4,704,000	4,500,000	4,704,000	6,000,000
		M–J	1,568,000	1,568,000	1,680,000	1,680,000	1,900	1,680,000	2,400,000
		M–S	3,360,000	3,360,000	3,696,000	3,696,000	4,000,000	3,696,000	4,000,000
		M–A	5,040,000	5,040,000	5,376,000	5,376,000	6,000,000	5,376,000	8,000,000
	Milk	Duration of lactation (days)	285	285	295	295	305	305	305
		Milking (litres)	7.0	9.0	9.5	12.0	9.5	12.0	20.0

Table 39. Demography, reproduction and production parameters of sheep under the three MPZs and subsystems

	Sheep							
	Parameters	Sex and age category/units	Desert and steppe		Piedmont		Highland	
			Dehkan	Fermer	Dehkan	Fermer	Dehkan	Fermer
Demography	Average no. of heads	Number	30	300	15	300	20	300
	Duration of age groups (in months)	F–J	6	6	6	6	6	6
		F–S	18	18	18	18	18	18
		F–A	48	48	42	42	42	42
		M–J	6	6	6	6	6	6
		M–S	13	13	13	13	13	13
		M–A	12	12	12	12	12	12
	Age/sex structure	F–J	10%	10%	11%	10%	10%	10%
		F–S	26%	26%	26%	26%	26%	27%
		F–A	41%	41%	40%	40%	40%	40%
		M–J	10%	10%	10%	10%	10%	10%
		M–S	11%	11%	11%	11%	11%	11%
		M–A	2%	2%	2%	2%	2%	2%
	Parturition rate		0.95	0.95	1.00	1.00	1.00	1.00
	Prolificacy rate		1.10	1.10	1.10	1.10	1.10	1.10
	Mortality rate	F–J	3%	3%	3%	3%	3%	3%
		F–S	2%	2%	2%	2%	2%	2%
		F–A	2%	2%	2%	2%	2%	2%
		M–J	3%	3%	3%	3%	3%	3%
		M–S	2%	2%	2%	2%	2%	2%
		M–A	2%	2%	2%	2%	2%	2%
	Offtake rate (%)	F–J	7%	7%	6%	6%	6%	6%
		F–S	10%	10%	8%	8%	8%	8%
		F–A	16%	15%	13%	14%	14%	15%
		M–J	15%	15%	15%	15%	15%	15%
		M–S	70%	70%	70%	70%	70%	70%
		M–A	90%	90%	90%	90%	90%	90%
	National average offtake rate	%	39%	38%	38%	38%	38%	39%
Production	Live weight (kg)	F–J	19	20	22	23	22	23
		F–S	30	32	33	35	33	35
		F–A	40	42	45	47	45	47
		M–J	20	21	23	25	23	25
		M–S	33	35	36	38	36	38
		M–A	45	48	50	53	50	53
	Average live weight at marketing	Kg	35	37	39	41	39	41
	Dressing percentage	%	48%	48%	50%	50%	50%	50%
	Financial price	F–J	150,000	150,000	150,000	150,000	150,000	150,000
		F–S	300,000	300,000	300,000	300,000	300,000	300,000
		F–A	450,000	450,000	450,000	450,000	450,000	450,000
		M–J	200,000	200,000	200,000	200,000	200,000	200,000
		M–S	350,000	350,000	350,000	350,000	350,000	350,000
		M–A	600,000	600,000	600,000	600,000	600,000	600,000
	Milk	Duration of lactation (days)	0	0	0	0	0	0
		Milking (litre)	0.0	0.0	0.0	0.0	0.0	0.0

Table 40. Demography, reproduction and production parameters of goats under the three MPZs and subsystems

	Parameters	Sex and age category/units	Goats					
			Desert and steppe		Piedmont		Highland	
			Dehkan	Fermer	Dehkan	Fermer	Dehkan	Fermer
Demography	Average no. of heads	Number	25	100	12	60	15	60
	Duration of age groups (in months)	F–J	6	6	6	6	6	6
		F–S	18	18	18	18	18	18
		F–A	48	48	48	48	48	48
		M–J	6	6	6	6	6	6
		M–S	12	12	12	12	12	12
		M–A	12	12	12	12	12	12
	Age/sex structure	F–J	11%	11%	11%	11%	11%	12%
		F–S	27%	27%	27%	27%	27%	27%
		F–A	38%	37%	38%	37%	38%	42%
		M–J	11%	11%	10%	11%	11%	11%
		M–S	11%	11%	11%	11%	11%	7%
		M–A	2%	2%	2%	2%	2%	1%
	Parturition rate		1.00	1.00	1.00	1.00	1.00	1.00
	Prolificacy rate		1.20	1.25	1.20	1.25	1.20	1.25
	Mortality rate	F–J	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
		F–S	3.0%	2.0%	3.0%	2.0%	3.0%	2.0%
		F–A	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
		M–J	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
		M–S	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
		M–A	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Production	Offtake rate (%)	F–J	5%	6%	5%	6%	5%	7%
		F–S	10%	11%	9%	12%	9%	12%
		F–A	19%	23%	19%	23%	19%	23%
		M–J	15%	15%	15%	15%	15%	15%
		M–S	70%	70%	70%	70%	70%	70%
		M–A	90%	90%	90%	90%	90%	90%
	National average offtake rate	%	39%	41%	39%	41%	39%	42%
	Live weight (kg)	F–J	17	18	17	18	17	18
		F–S	28	29	28	29	28	29
		F–A	37	38	37	38	37	38
		M–J	18	19	18	19	18	19
		M–S	29	30	29	30	29	30
		M–A	40	42	40	42	40	42
	Average live weight at marketing	Kg	32	33	32	33	32	33
	Dressing percentage	%	48%	48%	48%	48%	48%	48%
	Financial price	F–J	50,000	50,000	50,000	50,000	50,000	50,000
		F–S	120,000	120,000	120,000	120,000	120,000	120,000
		F–A	160,000	160,000	160,000	160,000	160,000	160,000
		M–J	50,000	50,000	50,000	50,000	50,000	50,000
		M–S	150,000	150,000	150,000	150,000	150,000	150,000
		M–A	250,000	250,000	250,000	250,000	250,000	250,000
	Milk	Duration of lactation (days)	145	145	145	145	145	145
		Milking (litres)	0.11	0.11	0.11	0.11	0.11	0.11

Table 41. Demography, reproduction and production parameters of camels and horses under the three MPZs and subsystems

	Parameters	Sex and age category/units	Camels		Horses	
			Dehkan		Dehkan	Dehkan
Demography	Average no. of heads	Number	2		3	40
	Duration of age groups (in months)	F–J	12		18	18
		F–S	48		18	18
		F–A	72		84	84
		M–J	12		18	18
		M–S	48		18	18
		M–A	72		48	48
	Age/sex structure	F–J	8%		13%	13%
		F–S	29%		12%	11%
		F–A	40%		33%	33%
		M–J	8%		12%	12%
		M–S	13%		10%	10%
		M–A	1%		19%	20%
	Parturition rate		0.40		0.56	0.56
	Prolificacy rate		1.00		1.00	1.00
	Mortality rate	F–J	2%		1%	1%
		F–S	1%		0%	0%
		F–A	1%		0%	0%
		M–J	2%		1%	1%
		M–S	1%		0%	0%
		M–A	1%		0%	0%
Production	Offtake rate (%)	F–J	3%		1%	5%
		F–S	1%		5%	10%
		F–A	1%		10%	10%
		M–J	1%		10%	10%
		M–S	40%		10%	10%
		M–A	60%		10%	10%
	National average offtake rate	%	16%		15%	17%
	Live weight (kg)	F–J	110		40	40
		F–S	225		270	270
		F–A	488		450	450
		M–J	137		45	45
		M–S	281		300	300
		M–A	650		500	500
	Average live weight at marketing	Kg	371		413	398
	Dressing percentage		50%		52%	52%
	Financial price	F–J	2,000,000		1,000,000	1,000,000
		F–S	4,500,000		3,500,000	3,500,000
		F–A	12,000,000		5,400,000	5,400,000
		M–J	2,000,000		1,100,000	1,100,000
		M–S	4,500,000		4,000,000	4,000,000
		M–A	12,000,000		6,000,000	6,000,000
	Milk	Duration of lactation (day)	365		250	250
		Milking (litres)	0.9		2.4	2.4

Table 42. Financial parameters of cattle under the desert and steppe and piedmont production zones and subsystems

Parameters	Unit	Cattle							
		Desert and steppe				Piedmont			
		Dehkan		Fermer		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	5		120		3		200	
% of forage feed purchased	%	30%	600	0.0%	600	30%	600	0.0%	600
Concentrate feed for female adults	Kg/day	1.4	1,920	1.5	1,920	2.92	1,190	3.2	1,190
Forage production									
Area	Ha	0.35		36		0.04		60	
Casual workers	Days/ha	0	30,000	7.67	30,000	0	35,000	7.67	35,000
Seed	Kg/ha	25	13,288	25	13,288	25	13,133	25	13,133
Fertilizers	Kg/ha	150	3,082	150	3,082	150	2,520	150	2,520
Other (Tractor rental)	Number/ha	1	1,350,000	1	1,350,000	1	1,350,000	1	1,350,000
Grazing land									
Area	Ha	0		240		0		400	
Salaried labour	Days/ha	0	30,000	0	30,000	0	35,000	0	35,000
Fertilizers	Kg/ha	0	3,082	0	3,082	0	2,520	0	2,520
Veterinary costs and medicines	Cost/animal		150,000		200,000		150,000		200,000
AI	Cost/ reprod. fem.		60,000		60,000		60,000		60,000
Herder	Months/ year	0	650,000	12	650,000	0	800,000	12	800,000
Casual workers	Days/year	0	30,000	90	30,000	0	35,000	90	35,000
Taxes and contributions									
Access to grazing	Ha	0	900	240	900	0	900	400	900
Agricultural taxes	Ha	0.35	15,000	36	15,000	0.04	18,000	60	18,000
Access to water (electricity)	Month	12	1,666.67	12	1,666.667	12	1,666.67	12	1,666.67
Family labour	People/ Year	1		1.5		1		1.5	
Cost of loan for working capital									

Parameters	Unit	Cattle							
		Desert and steppe				Piedmont			
		Dehkan		Fermer		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
% of production costs and general expenses financed by a loan	%	0%		0%		0%		0%	
Annual interest rate on loan	%	12%		12%		12%		12%	
Duration of loan	Month	24		24		24		24	
Products price	Unit								
Meat	Price/kg		20,352		19,864		19.796		19,468
Milk	Price/litre		2,355		2,355		2,250		2,250
Hides and skins	Price/kg		10,366		10,366		11,333		11,333
Wool	Price/kg								
Organic matter	Price/kg		68		68		112		112
Animal draught	Price/day		0		0		0		0

Table 43. Financial parameters of cattle under the highland production zone and its subsystems and specialized dairy system

Parameters	Unit	Cattle					
		Highland				Specialized dairy	
		Dehkan		Fermer			
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	5		100		1,500	
% of forage feed purchased	%	30%	600	0.0%	600	0.0%	600
Concentrate feed for female adults	Kg/day	3.00	1,555	3.32	1,555	4.25	1,372.5
Forage production							
Area	Ha	0.04		30		480	
Casual workers	Days/ha	0	40,000	7.67	40,000	23	40,000
Seed	Kg/ha	25	13,211	25	13,210.5	25	13,172
Fertilizers	Kg/ha	150	2,081	150	2,081	150	2,660
Other (tractor rental)	Number/ha	1	1,350,000	1	1,350,000	1	1,350,000
Grazing land							
Area	Ha	0		200		0	
Casual workers	Days/ha	0	30,000	0	40,000	0	40,000
Fertilizers	Kg/ha	0	2,081	0	2,081	0	2,660
Veterinary costs and medicines	Cost/animal		150,000		200,000		250,000
AI	Cost/reprod. fem.		60,000		60,000		60,000
Herder	Months/year	0	800,000	12	800,000	120	900,000
Casual workers	Days/year	0		90	30,000	0	40,000
Taxes and contributions							
Access to grazing	Ha	0	900	200	900	0	900
Agricultural taxes	Ha	0.04	18,000	30	18,000	480	18,000
Access to water (electricity)	Month	9	1,666.67	12	1,666.67	9	1,666.667
Family labour	People/ year	1		1.5		0	
Cost of loan for working capital							
% of production costs and general expenses financed by a loan	%	0%		0%		50%	
Annual interest rate on loan	%	12%		12%		12%	
Duration of loan	Month	24		24		24	
Products price							
Meat	Price/kg		20,113		19,468		21,812
Milk	Price/litre		2,303		2,303		2,276
Hides and skins	Price/kg		10,850		10,850		11,092
Wool	Price/kg						
Organic matter	Price/kg		90		90		101
Animal draught	Price/day		0		0		0

Table 44. Financial parameters of sheep under the desert and steppe and piedmont production zones and subsystems

Parameters	Unit	Sheep							
		Desert and steppe				Piedmont			
		Dehkan		Fermer		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	30		300		15		300	
% of forage feed purchased	%	10%	600	0%	300	10%	571	0%	571
Concentrate feed for female adults	Kg/day	0.04	1,920	0.04	1,920	0.05	1,190	0.06	1,190
Forage production									
Area	Ha	0		0		0		0	
Casual workers	Days/ha	0	30,000	0	30,000	0	35,000	0	35,000
Seed	Kg/ha	0	0	0	13,288	0	13,133	0	13,133
Fertilizers	Kg/ha	0	3,082	0	3,082	0	2,520	0	2,520
Other (Tractor rental)	Kg/ha	1	1,350,000	1	1,350,000	1	1,350,000	1	1,350,000
Grazing land									
Area	Ha	0		200		0		200	
Casual workers	Days/ha	0	30,000	0	30,000	0	35,000	0	35,000
Fertilizers	Kg/ha	0	3,082	0	3,082	0	2,520	0	2,520
Veterinary costs and medicines	Cost/animal		15,000		15,000		15,000		15,000.00
AI	Cost/ reprod. fem.		0		0		0		0
Herder	Months/ year	0	650,000	12	650,000	0	800,000	12	800,000
Casual workers	Days/year	0	30,000	0	30,000	0	25,000	0	25,000
Taxes and contributions									
Cost of access to grazing	Ha	0	900	200	900	0	900	200	900
Agricultural taxes	Ha	0	15,000	0	15,000	0	18,000	0	18,000
Cost of access to water	Month	0	1,667	9	1,667	0	1,667	0	1,667
Family labour	People/ year	1		2		1		2	
Cost of loan for working capital									
% of production costs and general expenses financed by a loan	%	0%		0%		0%		0%	
Annual interest rate on loan	%	12%		12%		12%		12%	
Duration of loan	Month	24		24		24		24	
Products price									
Meat	Price/kg		23,237		21,993		20,084		19,073
Milk	Price/litre		0		0		0		0
Hides and skins	Price/kg		2,190		2,190		3,333		3,333
Wool	Price/kg		1,500		1,500		1,500		1,500
Organic matter	Price/kg		0		0		0		0
Animal draught	Price/day								
Net income (financial)	UZS								

Table 45. Financial parameters of sheep under the highland production zone and subsystems

Parameters	Unit	Sheep Highland Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads	Number	20		300	
% of forage feed purchased	%	10%	571	0%	571
Concentrate feed for female adults	Kg/day	0.05	1,555	0.06	1,555
Forage production					
Area	Ha	0		0	
Casual workers	Days/ha	0	40,000	0	40,000
Seed	Kg/ha	0	13,211	0	13,210.5
Fertilizers	Kg/ha	0	2,081	0	2,081
Other (Tractor rental)	Kg/ha	0		1	1,350,000
Grazing land					
Area	Ha	0		200	
Casual workers	Days/ha	0	40,000	0	40,000
Fertilizers	Kg/ha	0	2,081	0	2,081
Veterinary costs and medicines	Cost/animal		15,000		15,000
AI	Cost/reprod. fem.		0		0
Herder	Months/year	0	800,000	12	800,000
Casual workers	Days/year	0	40,000	0	40,000
Taxes and contributions					
Cost of access to grazing	Ha	0	900	200	900
Agricultural taxes	Ha	0	18,000	0	18,000
Cost of access to water	Month	0	1,667	0	1,667
Family labour	People/year	2		2	
Cost of loan for working capital					
% of production costs and general expenses financed by a loan	%			0%	
Annual interest rate on loan	%	18%		12%	
Duration of loan	Month	24		24	
Products price					
Meat	Price/kg		20,084		19,074
Milk	Price/litre		0		0
Hides and skins	Price/kg		2,762		2,762
Wool	Price/kg		1,500		1,500
Organic matter	Price/kg		0		0
Animal draught	Price/day				

Table 46. Financial parameters of goats under the desert and steppe and piedmont production zones and subsystems

Parameters	Unit	Goats							
		Desert and steppe				Piedmont			
		Dehkan		Fermer		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads		25		100		12		60	
% of forage feed purchased	%	10%	500	0%	500	10%	500	0%	500
Concentrate feed for female adults	Kg/day	0.04	1.920	0.06	1,190	0.05	1,190	0.06	1,190
Forage production									
Area	Ha	0		0		0		0	
Casual workers	Days/ha	0	30.000	0	35,000	0	35,000	0	35,000
Seed	Kg/ha	0	13,288	0	0	0	0	0	0
Fertilizers	Kg/ha	0	3,082	0	0	0	0	0	0
Other (Tractor rental)	Kg/ha	1	1,350,000	1	1,350,000	1	1,350,000	1	1,350,000
Grazing land									
Area	Ha	0		67		0		40	
Casual workers	Days/ha	0	30,000	0	35,000	0	35,000	0	35,000
Fertilizers	Kg/ha	0	3,082	0	0	0	0	0	0
Veterinary costs and medicines	Cost/ animal		15,000		15,000		15,000		15,000
AI	Cost/ reprod. fem.		0		0		0		0
Herder	Months/ year	0	650,000	4.5	800,000	0	800,000	2.4	800,000
Casual workers	Days/ year	0	30,000	6	35,000	0	35,000	3.5	35,000
Taxes and contributions									
Cost of access to grazing	Ha	0	900	67	900	0	900	40	900
Agricultural taxes	Ha	0	15,000	0	15,000	0	18,000	0	18,000
Cost of access to water	Month		1,667	0	1,667	0	1,667	0	1,667
Family labour	People/ year	1.00		2		1		2	
Cost of loan for working capital									
% of production costs and general expenses financed by a loan	%	0%		0%		0%		0%	
Annual interest rate on loan	%	12%		18%		18%		18%	
Duration of loan	Month	24		24		24		24	
Products price	Unit								
Meat	Price/kg		9,982		9,613		9,985		9,610
Milk	Price/ litre		6,000		6,000		6,000		6,000
Hides and skins	Price/kg		1,712		1,762		1,762		1,762
Wool	Price/kg		8,000		8,000		8,000		8,000
Organic matter	Price/kg		0.00		0.00		0.00		0.00
Animal draught	Price/ day								

Table 47. Financial parameters of goats under the highland production zone and subsystems

Parameters	Unit	Goats			
		Highland			
		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads		15		60	
% of forage feed purchased	%	10%	500	0%	500
Concentrate feed for female adults	Kg/day	0.05	1,555	0.06	1,555
Forage production					
Area	Ha	0		0	
Casual workers	Days/ha	0	0	0	40,000
Seed	Kg/ha	0	0	0	13,210.5
Fertilizers	Kg/ha	0	0	0	2,081
Other (Tractor rental)	Kg/ha	1	1,350,000	1	1,350,000
Grazing land					
Area	Ha	0		40	
Casual workers	Days/ha	0	0	0	40,000
Fertilizers	Kg/ha	0	0	0	2,081
Veterinary costs and medicines	Cost/animal		15,000		15,000
AI	Cost/reprod. fem.		0		0
Herder	Months/year	0	0	2.2	800,000
Casual workers	Days/year	0	0	4.4	40,000
Taxes and contributions					
Cost of access to grazing	Ha	0	900	40	900
Agricultural taxes	Ha	0	18,000	0	18,000
Cost of access to water	Month	0	1,666.667	0	1,666.6667
Family labour	People/year	1		2	
Cost of loan for working capital					
% of production costs and general expenses financed by a loan	%	0%		0%	
Annual interest rate on loan	%	18%		18%	
Duration of loan	Month	24		24	
Products price					
Meat	Price/kg		9,986		9,335
Milk	Price/litre		6,000		6,000
Hides and skins	Price/kg		1,737		1,737
Wool	Price/kg		8,000		8,000
Organic matter	Price/kg		0		0
Animal draught	Price/day				

Table 48. Financial parameters of camel under the desert and steppe production zone and subsystems and horse production systems

Parameters	Unit	Camels		Horses			
		Desert and steppe		National			
		Dehkan		Dehkan		Fermer	
		Number of units	Unit cost (financial)	Number of units	Unit cost (financial)	Number of units	Unit cost (financial)
Average no. of heads		2		3		40	
% of forage feed purchased	%	10%	300	15%	600	0%	600
Concentrate feed for female adults	Kg/day	0.07	1,920	1	1,190	0.5	1,190
Forage production							
Area	Ha	0.6		0		12.0	
Casual workers	Days/ha	0	30,000		35,000	7.67	30,000
Seed	Kg/ha	25	13,288		13,133	25	13,133
Fertilizers	Kg/ha	150	3,082		2,520	150	2,520
Other (Tractor rental)	Kg/ha			1	1,350,000	1	1,350,000
Grazing land							
Area	Ha			0		0	
Casual workers	Days/ha	0	30,000		35,000	0	30,000
Fertilizers	Kg/ha	0	3,082		2,520	0	2,520
Veterinary costs and medicines	Cost/animal		100,000		275,000		275,000
AI	Cost/reprod. fem.		0		0		0
Herder	Months/year	0	650,000	0	800,000	4	800,000
Casual workers	Days/year	0	30,000	0	30,000	0	30,000
Taxes and contribution							
Cost of access to grazing	Ha		900	0	900	0	900
Agricultural taxes	Ha	0.6	15,000	0	18,000	12	18,000
Cost of access to water	Month	9	1,667	12	1,667	12	1,667
Family labour	People/year	1		0.75		1	
Cost of loan for working capital							
% of production costs and general expenses financed by a loan	%	0%		0%		0%	
Annual interest rate on loan	%	12%		12%		12%	
Duration of loan	Month	24		24		24	
Products price							
Meat	Price/kg		42,240		23,496		23,596
Milk	Price/litre		11,000		3,000		3,000
Hides and skins	Price/kg		2,000		6,000		6,000
Wool	Price/kg		0		0		0
Organic matter	Price/kg		0		0		0
Animal draught	Price/day		0		0		0

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