The Gambia livestock sector strategy

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Contents

Tables

Figures

Abbreviations and acronyms

AnGRs	Animal Genetic Resources
BAU	Business as usual
BQ	black quarter
CBPP	contagious bovine pleuropneumomia
DLS	Department of Livestock Services
FAO	Food and Agriculture Organization of the United Nations
GBA	Greater Banjul Area
GCCI	the Gambia Chamber of Commerce and Industry
GDP	gross domestic product
GLMA	Gambia Livestock Marketing Agency
GMD	Gambian dalasi
GoTG	Government of the Gambia
HESM	Herd and Economic Sector Model
HS	haemorrhagic septicaemia
IHS	Integrated Household Survey
LSD	lumpy skin disease
LSS	livestock sector strategy
LVC	Livestock value chain
MIS	Market information system
MoFEA	Ministry of Finance and Economic Affairs
NaLOA	National Livestock Owners' Association
NARI	National Agricultural Research Institute
NCD	Newcastle disease
NSAP	National Strategy and Action Plan
PPP	Public Private Partnership
PROGEBE	Regional Project on Sustainable Management of Endemic Ruminant Livestock in West Africa
SDCs	Sanitary Defence Committees
WAD	West African dwarf (goats)
WALIC	West African Livestock Innovation Centre (WALIC)
WALIC	West African Livestock Inovation Center
WI	with investment
WID	Women In Development

1 Introduction

The livestock sector in the Gambia contributes 20% of the agricultural gross domestic product or GDP (equivalent to 8% of the national GDP) (Rich et al. 2020). It is a key driver of socio-economic development, providing food, income, and employment. Nearly 75% of the population relies on the agricultural sector for employment, with the majority engaged in mixed crop-livestock systems. Livestock plays a role in both income generation and savings for rural inhabitants. The Gambia relies predominately on traditional cattle breeds for beef and milk production and small ruminants for meat, and both are produced through extensive, free-range systems. Local production is currently insufficient to meet domestic demand. Production is constrained by the low productivity of traditional breeds, poor feeding resources, limited processing infrastructure, limited capacity and access to veterinary resources, and a lack of coordinated value chains (FAO 2016).

The development of a livestock master plan (LMP) for the Gambia is aimed at enhancing the performance of the livestock sector through increased and better-targeted investments by the government, development partners, and the private sector having first identified the priority areas where the investments are needed to be informed by knowledge of existent challenges and potential for boosting the sector's contribution to the economy and livelihoods if interventions were instituted.

1.1 The Livestock Sector Analysis (LSA) summary

As a first step in the development of the LMP, a livestock sector analysis (LSA) was conducted (Bahta et al. 2022a). For this analysis, a livestock herd and economic sector model (HESM) for the Gambia was developed and used to carry out a 15-year foresight analysis of the performance of the livestock sector under the current level of investment (business as usual (BAU) scenario) with 2020/21 as the base year.

Applying the HESM requires characterizing a country's livestock production systems and zones. In the Gambia, following Seré and Steinfeld (1996) and recommendations from a team of livestock experts, three geographical zones/regions where livestock production occurs were identified, including (i) the Western Region comprising KMC[1] and West Coast Regions (WCR)[2]; (ii) the Central Region comprising North Bank Region (NBR) and the Lower River Region (LRR); and (iii) the Eastern Region including the Central River Region North (CRR/N), Central River Region South (CRR/S) and Upper River Region (URR).

The LMP in the Gambia focuses on four priority livestock species: cattle, sheep, goats, and poultry. Cattle are reared in all the administrative regions, but production is concentrated in the rural areas. The systems of cattle production include (i) the extensive system, which is the most predominant and involves mixed crop-livestock farming, usage of indigenous breeds of low productivity (N'Dama and Gobra/zebu), and transhumance and internal migration in search of pastures and water during the dry season); (ii) the semi-intensive system where selected animals (including

1. KMC Kanifing Municipal Council is an urban/peri-urban area with minimal potential for agricultural production, although urban agriculture is gradual.

2. Western, Central, and Eastern are livestock production zones identified by the LSA, whereas West Coast Region is the official nomenclature for the administrative area. Kanifing Municipal Council (KMC) is a local government area located within the West Coast Region.

draught animals) are given supplementary feeds using agro-industrial by-products and crop residues to increase meat, milk, manure, and draught power; and (iii) the intensive system practiced mainly in the urban and peri-urban areas using purebreds (mostly European breeds) and crosses of N'Dama and European breeds to increase productivity (both milk and meat); and poultry production using commercial breeds. Rearing of small ruminants and traditional poultry is widespread in all regions under an extensive and subsistence-oriented production system. Recently, intensive small ruminant and poultry production systems have evolved and are proliferating in the peri-urban areas and around the growth centres.

The Gambian livestock subsector faces a plethora of challenges. The major constraints for ruminants species include:

- Lack of access to feed associated with:
    - severe rangeland degradation due to overgrazing, climate change, recurrent bushfires, and the absence of improvement strategies;
    - acute scarcity of feed and water during the dry season;
    - dwindling rangeland resources due to demographic pressure together with a high cost of concentrates in the western region; and
    - lack of policy and legal frameworks for the protection and sustainable management of grazing lands and cattle tracks; and for enhancing the adaptive capacities of women livestock farmers.
- Frequent occurrence of disease resulting in economic losses exacerbated by a critical shortage of veterinarians in both the private and public sectors and a significant lack of favorable policy for the promotion and support of private veterinary services for the delivery of animal health care services (Rich et al. 2020).
- Low current productivity of local breeds that have evolved partly/most likely because of/in response to nutritional and disease stress and the potential for erosion of animal genetic resources.
- Poor market infrastructure (most livestock markets need more basic facilities like fencing, running water, office space for the management committees and livestock assistants, weighing scales, and loading ramps) and market imperfections that stifle performance and growth.

The major challenges affecting the poultry subsector include:

- Dependence on imported feeds whose prices are affected by currency fluctuations and lack of quality assurance. Often the supply chain for feed and day-old chicks is disrupted because farmers and the private sector have limited access to foreign exchange, compounded sometimes by restrictions placed by the neighboring countries on the exportation of agricultural products and produce.
- The non-availability of day-old chicks, as there is only one known breeder, which results in dependence on imports from Senegal.
- Recurrent disease outbreaks, particularly Newcastle disease (NCD) and the occurrence of emerging diseases such as H5N1 highly pathogenic avian influenza (HPAI).
- Inefficient marketing system due to reasons including poor linkages of producers to the markets; flooding of the local markets with cheap imports; poor infrastructure, including lack of storage facilities which causes significant post-harvest losses through spoilage.
- Numerous policies and strategies were identified to address the policy and institutional constraints. Actions to improve animal health delivery and reduce the negative impact of animal diseases should focus on the development and strengthening of institutional structures (public and private) and delivery systems for animal health, the development of human resources to fill the acute shortage of veterinarians and laboratory scientists and technicians and to strengthen the epidemic surveillance system and establish an early warning system and emergency preparedness and contingency plans. For animal genetic resources, where the government policy is to progressively diversify the livestock sector by broadening the number of species, breeds, products, and by-

products, the proposed strategy to achieve this includes continuous exploitation of indigenous species, which are well adapted (to the livestock production system being practiced) and the introduction of exotic breeds to ensure diversification of the agricultural production base and the satisfaction of the needs of the country. Despite their apparent low productivity, the indigenous breeds thrive in the extensive low input traditional livestock production system that most farmers predominantly practice. For instance, the overwhelming majority of all cattle (98%) in the Gambia are indigenous and belong to the N'Dama breed. The remaining 2% comprises Zebus, 'Gobras' (crosses of N'Dama and Zebu cattle), and crossbreds of N'Dama with Jersey, Holstein-Friesian and other European breeds (National Livestock Census 2016). The N'Dama cattle breed is known for its innate tolerance to trypanosomosis (Murray et al. 1982; Paling et al. 1992); resistance to dermatophilosis, heartwater, anaplasmosis, and babesiosis (Murray et al. 1981); and relative resistance to helminths (Claxton and Laperre 1991). Their physiological adaptation to harsh environmental elements makes them more resistant to heat, drought, and feed scarcity than other breeds. (For references, please refer to the LSA). The breed also provides the draught power requirements for farm operations of crop farmers for the production of 73.4% of all field crops in the Gambia. Draught power requirements for most farm operations (from planting to the evacuation of produce) are met largely through the usage of animal traction. Draught power is also useful in the rural socio-economy as a means of transport for serving the weekly markets, 'lumoos', and providing transportation networks and (ambulance services) for remote rural communities (Loum 2019).

Specific activities under this strategy include genetic improvement for the indigenous breeds; genetic upgrading through crossbreeding using AI aimed at providing genetically superior crossbred cows; introduction of exotic pure dairy breeds for increased milk supply together with adequate and timely financial support, including credit, to develop sustainable cattle production and encourage private sector participation; promotion of the sustainable use of Djallonke and West African dwarf goats and facilitatation of their conservation; and adoption of productivity-enhancing technologies, including climate change adaptation measures, strengthening animal breeders' capacity; reinforcing the genetic improvement programs and encouraging public private partnerships (PPPs).

The traditional tenure system is strained by population growth and cropland expansion at the expense of grazing. In most parts of the country, cattle tracks have been encroached on, limiting access to grazing and watering points and resulting in user conflicts between herders and crop farmers. There is also urban sprawl into valuable agricultural land and uncontrolled land encroachment, including encroachment into wetlands. To address these problems, the government should revisit and modify the land tenure system in a socially acceptable manner and provide efficient management of rangeland resources. The government also has an active role in making land available for feed production and grazing, establishing feed quality standards and monitoring, establishing policy instruments, regulations, and incentives to define the rights to grazing and watering, controlling resources, and supporting the private sector investment in animal feeding.

Results from the analysis of the baseline situation (BAU scenario) indicated that:

- Between 2020/21 and 2035/36 under the BAU scenario, the cattle population is projected to grow by less than 3% (from 296,265 to 304,437), although, in the commercial dairy, a higher increase of 30% is anticipated. The population of sheep is expected to increase by 28% (from 188,256 to 240,734), and that of goats to rise by 34% (from 360,357 to 483,690). A large increase (40%) is projected for the poultry population (from 1,053,356 to 1,476,299 birds).
- Milk production under the BAU scenario is expected to grow by 5.5% during 2035/36 compared to the base year, whereas meat production will grow by about 14%. Egg production, influenced mainly by the population change of layer chicken, is expected to increase by 40% in the coming 15 years.
- Under the BAU scenario, the total value of livestock products is projected to increase by about 7% between 2020/21 and 2035. The increase in contribution to GDP by each species is projected to be highest for chicken (37%), followed by goats (34%) and sheep (29%). The contribution of cattle to GDP in the coming 15 years will increase minimally by about 3.7%, which suggests the need to consider additional investments in all livestock subsectors.

1.2 A livestock sector strategy for the Gambia

The development of a livestock sector strategy (LSS), that is, a series of foresight analyses to explore alternative paths forward in terms of sector policies and investments (e.g. in technology), derives from the information in the Gambia LSA. This component of the work includes the development of scenarios and policy options to analyse impacts, benefits, costs, and trade-offs associated with jointly defined objectives and investments. The LSS helps identify priorities for investment in livestock at the state level.

Despite the challenges of achieving growth in domestic production to meet projected future consumption, livestock in the Gambia holds much potential as a pathway for meeting development objectives, including poverty reduction, gender equality, and women's empowerment. The projected rise in demand for livestock products will offer increased market opportunities to local producers. However, its share of the total agriculture budget has been declining. A major challenge is that the budget allocated to the livestock sector has not been coupled with evidence of livestock's contributions to the economy, and, as such, it does not constitute a commensurate fraction of the whole state agricultural budget. (Bahta et al. 2022a). In addition, budgetary allocation to the livestock sector (and indeed to other sectors) does not necessarily guarantee access to the allocated funds. Access to the resource envelope is strictly dependent on the revenues collected by the government during a particular period in the year, and allocations are made monthly or quarterly.

The LSS employs a livestock herd and economic sector model (HESM) applied to the Gambia context. This model provides a quantitative analysis of the technical performance of the sector and the potential economic contributions of alternative intervention options to households, value chains, the livestock subsector, the agricultural sector, and the national economy. Quantitative tools from the livestock sector investment and policy toolkit were used in the analysis, which was based on data obtained from field surveys, published literature, and expert opinion and evaluated using consistency tests. For the gender analysis, literature reviews and consultations with experts were undertaken, along with key informant interviews with stakeholders involved in key livestock value chains (LVCs).

This report is organized as follows: section 2 briefly discusses livestock improvement strategies; section 3 discusses the projections of production and consumption; sections 4–5 consider improvement intervention targets and impacts for the dairy cattle, small ruminant, and poultry sectors, respectively; and, finally, section 7 presents conclusions and recommendations.

2 Livestock sector improvement strategies

2.1 Cattle value chain improvement strategies

To improve the cattle production system as well as the income of small and marginal farmers, different activities need to be implemented. An effort has been made to identify the interventions based on the challenges and constraints faced by the sector, as presented in Table 1.

Table 1: Interventions in cattle production in different production zones

Category	Production system 1 (Western Region)	Production system 2 (Middle Region)	Production system[3] (Eastern Region)
Feed and fodder[3]	• Broaden and update the inventory to cover all production zones, feed, and fodder resources, including available range resources, crop residues, oil seed cakes (groundnut, sesame, and cotton seed cakes), and other by-products and watering facilities. • Building on the experiences from the implementation of the Regional Project on Sustainable Management of Endemic Ruminant Livestock in West Africa (PROGEBE), give priority to the collection, storage and utilization of groundnut hay, maize, millet stovers, and rice straw for livestock feeding during the latter part of the dry season. • Promote the production of climate-resilient forages (drought-tolerant and deeper-rooted fodder grasses and/or legumes) to enhance feed availability. • Encourage the utilization of by-products such as groundnut cake, cotton seed cake, sesame cake, rice, and millet brans, particularly in Zone 1, for the enhancement of milk production. • Strengthen the program of promoting the utilization of compost pens and other stabling techniques. In 2019, 52 marginalized households were supported to construct compost pens and each was given two cows to stall-feed to produce milk for domestic consumption and sales to the existing mini-dairies (source: DLS, 2020).		

3. Thorough comprehensive/systematic monitoring and inventory of the available range resources and carrying capacity of the rangelands was conducted in 1986 by the USAID - funded Mixed Farming and Resource Management Project for the CRR/N, CRR/S and URR only (Production Zone 3).

Category	Production system 1 (Western Region)	Production system 2 (Middle Region)	Production system[3] (Eastern Region)
Breeding	• For the sustainable conservation, utilization, and development of the indigenous breed, broaden, strengthen and sustain the three-tier national breeding program (nucleus, multiplier, village/farmer) being implemented by the Department of Livestock Services (DLS) and West African Livestock Innovation Centre (WALIC). The development of a long-term planning and strategic breeding program should be initiated and implemented. • Reverse the trend of erosion of cattle genetic resources; use the Government of the Gambia (GoTG) to promote sustainable use, development and conservation of indigenous Animal Genetic Resources (AnGRs) as stated in the National Development Plan (MoFEA 2018). • For the conservation of the indigenous breed, conduct bio-morphometric and molecular characterization of the N'Dama breed. The phenotypic characterization should also be conducted. • Initiate a National Artificial Insemination Program both for indigenous breeds and pure-bred European breeds being used in the dairy industry, particularly in Production Zone 1. • Put in place a cadre of well-trained geneticists and technicians.		
	• Urgently provide refresher courses on AI for technicians and para-vets and the provision of requisite equipment and supplies to the trained AI technicians.		
Animal Health	• Initiate long-term and short-term programs to address the critical issue of the shortage of veterinarians. In the short-term, the GoTG should seek technical assistance from Commonwealth member countries (as was the case in the past) and explore the possibility of employing retired Gambian vets on contract. In the long-term, the training of vets must be given priority. • Enhance private participation in the delivery of veterinary healthcare through the engagement of vets in private practice. • Establish/strengthen regional diagnostic laboratories and the Central Veterinary Laboratory to facilitate effective disease surveillance and the monitoring of vaccinations against contagious bovine pleuropneumonia (CBPP) and other transboundary animal diseases (TADs). • Enhance cold chain maintenance for proper storage of vaccines, reagents, and laboratory samples collected for confirmatory diagnosis.		
Marketing	• Develop improved market infrastructure and facilities for the collection, storage, processing, and transportation of milk in the production zone, given the high demand in this area. • Prioritize the construction of a modern abattoir and meat processing plants in the area.	• Support women engaged in the informal marketing of milk and milk products and in forming cooperative societies and working closely with the mini dairies. • Initiate a program for the building of modern slaughterhouses and slabs in rural areas.	• Support women engaged in the informal marketing of milk and milk products and in forming cooperative societies and working closely with mini dairies. • Initiate a program for the building of modern slaughterhouses and slabs in rural areas.
	• Promote and further encourage private sector involvement in the marketing of milk and meat. • Provide marketing incentive packages for the private sector to help in this regard.		

2.2 Small ruminant value chain improvement strategies

2.2.1 Goat value chain improvement strategies

To address the low productivity of goats as well as significantly enhance the increment in the income of small, middle-income, and commercial farmers, different strategies/interventions are proposed based on the challenges, opportunities, and constraints identified earlier (Table 2).

Table 2: Interventions in goat production in different production zones

Category	Production system 1 (Western Region)	Production system 2 (Central Region)	Production system 3 (Eastern Region)
Feed and fodder	• Broaden and update the inventory to cover all production zones, feed and fodder resources, including available range resources, crop residues, oil seed cakes (groundnut, sesame and cotton seed cakes), and other by-products and watering facilities. • Building on the experiences from the implementation of PROGEBE, prioritize the collection, storage and utilization of groundnut hay, maize and millet stovers, and rice straw for livestock feeding during the latter part of the dry season. • Promote the production of climate-resilient forages (drought-tolerant and deeper-rooted fodder grasses and/or legumes) to enhance feed availability. • Encourage the utilization of by-products such as groundnut cake, cotton seed cake, sesame cake, rice, and millet brans, particularly in Zone 1, for the enhancement of commercialization and intensification of the goat dairy industry, particularly in Zone 1.		
Breeding	• Reverse the trend of erosion of indigenous goat genetic resources; GoTG promotes sustainable use, development and conservation of indigenous Animal Genetic Resources (AnGRs) as stated in the National Development Plan (MoFEA 2018). • For the sustainable conservation, utilization and development of WAD goats (the indigenous breed), broaden, strengthen and sustain the three-tier national breeding program (nucleus, multiplier, village/farmer) being implemented by DLS and WALIC . The development of a long-term planning and strategic breeding program should be initiated and implemented. • For the conservation of the indigenous breed of goats, the WAD goats, conduct bio-morphometric and molecular characterization of the breed. The phenotypic characterization should also be conducted. • Put in place a well-trained cadre of geneticists and technicians.		
Animal health	• Mobilize resources to enable the implementation of the National Strategy for the Control and Eradication of PPR in the Gambia, formulated in 2017 by the Ministry of Agriculture. • To address the critical issue of the shortage of Veterinarians, initiate long-term and short-term programs. In the short-term, the GoTG should seek technical assistance from Commonwealth member countries (as was the case in the past) and explore the possibility of employing retired Gambian vets on contract. In the long-term, the training of vets must be given priority. • Enhance private sector participation in the delivery of veterinary healthcare through the engagement of vets in private practice. • Establish/strengthen regional diagnostic laboratories and the Central Veterinary Laboratory to facilitate effective disease surveillance and the monitoring of vaccinations against PPR and other TADs. • Enhance cold chain maintenance for proper storage of vaccines, reagents and laboratory samples collected for confirmatory diagnosis.		

Category	Production system 1 (Western Region)	Production system 2 (Central Region)	Production system 3 (Eastern Region)
Marketing	• Promote the development of improved market infrastructure for goats and other livestock. • Prioritize the construction of a modern abattoir and meat processing plants in the area.	• Support women engaged in goat production and encouraged them to form producer associations/ marketing cooperative societies and work closely with the National Livestock Owners' Association (NaLOA). • Initiate a program for the building of modern slaughterhouses and slabs in rural areas.	• Support women engaged in goat production and encourage them to form producer associations/ marketing cooperative societies and work closely with NaLOA. • Initiate a program for the building of modern slaughterhouses and slabs in rural areas.

2.2.2 Sheep value chain improvement strategies

To improve the sheep production system as well as substantially increase the income of small and marginal farmers and commercial farmers, different activities need to be implemented. An effort has been made to identify the interventions based on the challenges and constraints faced by the sector, which are presented in Table 3 below.

Table 3: Interventions in sheep production in different production zones

Category	Production system 1 (Western Region)	Production system 2 (Central Region)	Production system 3 (Eastern Region)
Feed and fodder	• Thorough comprehensive/systematic monitoring and inventory of the available range resources and carrying capacity of the rangelands was conducted in 1986 by the USAID - funded Mixed Farming and Resource Management Project for the CRR/N, CRR/S, and URR only (Production Zone 3). • Broaden and update the inventory to cover all production zones, feed and fodder resources, including available range resources, crop residues, oil seed cakes (groundnut, sesame and cotton seed cakes) and other by-products and watering facilities. • Building on the experiences from the implementation of PROGEBE, prioritize the collection, storage and utilization of groundnut hay, maize and millet stovers, and rice straw for livestock feed during the latter part of the dry season. • Promote the production of climate-resilient forages (drought-tolerant and deeper-rooted fodder grasses and/or legumes) to enhance feed availability. • Encourage the utilization of by-products such as groundnut cake, cotton seed cake, sesame cake, rice and millet brans, particularly in Zone 1, for the enhancement of commercialization and intensification of the production of crossbreeds such as Ladoum, Touabire and Peul-Puel for the 'Tobaski' market.		
Breeding	• Reverse the trend of erosion of indigenous sheep genetic resources; GoTG promotes sustainable use, development and conservation of indigenous Animal Genetic Resources (AnGRs) as stated in the National Development Plan (MoFEA 2018). • For the sustainable conservation, utilization and development of Djallonke (the indigenous breed), broaden, strengthen and sustain the three-tier national breeding program (nucleus, multiplier, village/farmer) being implemented by DLS and WALIC. The development of a long-term planning and strategic breeding program should be initiated and implemented. • For the conservation of the indigenous breed of sheep, the Djallonke, conduct bio-morphometric and molecular characterization of the breed. The phenotypic characterization should also be conducted. • Encompass the provision of technical guidance for the Sheep Cross Breeding Program and facilitate access to elite cross breeds to more small- and middle-income farmers so that they can also benefit more from the niche 'Tobaski' market for crossbreeds. • Put in place a well-trained cadre of geneticists and technicians.		

Category	Production system 1 (Western Region)	Production system 2 (Central Region)	Production system 3 (Eastern Region)
Animal health	• Mobilize resources to enable the implementation of the National Strategy for the Control and Eradication of PPR in the Gambia, formulated in 2017 by the Ministry of Agriculture. • To address the critical issue of the shortage of veterinarians, initiate long-term and short-term programs. In the short-term, the GoTG should seek technical assistance from Commonwealth member countries (as was the case in the past) and explore the possibility of employing retired Gambian vets on contract. In the long-term, the training of vets must be given priority. • Enhance private sector participation in the delivery of veterinary healthcare through the engagement of vets in the private practice. • Establish/strengthen regional diagnostic laboratories and the Central Veterinary Laboratory to facilitate effective disease surveillance and the monitoring of vaccinations against PPR and other TADs. • Enhance cold chain maintenance for proper storage of vaccines, reagents and laboratory samples collected for confirmatory diagnosis.		
Marketing	• Promote the development of improved market infrastructure for goats and other livestock. • Prioritize the construction of a modern abattoir and meat processing plants in the area.	• Support women engaged in sheep production and encourage them to form producer associations/ marketing cooperative societies and work closely with the National Livestock Owners' Association (NaLOA). • Initiate a program for the building of modern slaughterhouses and slabs in rural areas.	• Support women engaged in sheep production and encourage them to form producer associations/ marketing cooperative societies and work closely with NaLOA. • Initiate a program for the building of modern slaughterhouses and slabs in rural areas.

2.3 Chicken value chain improvement strategies

In the Gambia, traditional/backyard poultry production predominates in all production zones, with most households in rural and peri-urban areas keeping some birds both for domestic consumption and for sale at the village level and weekly markets. The production system practised is mainly extensive, and birds (flocks of 10–15) are poorly housed and fed and have minimal access to veterinary healthcare. Small flocks that are, in most cases, owned and managed by women and children are kept in the backyard. The birds are confined during the night in kitchens or locally made shelters to minimize predation, whilst during the daytime, birds are left on a free range to scavenge in the backyards, and supplementary feeds such as millet, brans and household food leftovers are provided.

The poultry flocks are made up of local breeds that have low productivity both in terms of meat and eggs in comparison with exotic breeds. Due to their relative ease of convertibility to cash, they serve as a ready source of household income and are often utilized for satisfying various needs and sociocultural exigencies. They are also slaughtered for domestic consumption to serve as an important source of protein for the rural and peri-urban populations.

The proposed strategic interventions (Table 4), among other things, are premised on the training of extension workers and farmers on improved management practices and feed formulation and utilization, control of NCD and other endemic poultry diseases and improvements in the storage, processing, and marketing of poultry and poultry products.

Table 4: Strategic interventions for backyard poultry production in the Gambia

Category	Western Region	Middle Region	Eastern Region
Feed	• Extension workers and farmer resource persons trained by past projects in the agricultural sector should continue to train more women and youth farmers to formulate simple feed rations using locally available feed resources. This will supplement scavenging and increase the body weight of birds and heavier eggs. The increase in production and productivity will enhance increased income-generating capacity and improve the nutritional status of women and youth farmers. • Encourage trained poultry farmers to train other farmers in their areas on feed supplementation and simple management practices, e.g. the building of low-cost houses using locally available materials. • Train poultry farmers on crop residue conservation techniques for feed use.		
Breed	• Interviews with women poultry farmers indicated they never sell certain types of female birds due to their good mothering ability and the number of chicks hatched. The information should be shared with relevant research stations (Gambia College, the University of the Gambia and the National Agricultural Research Institute) for possible breed improvement. • Make concerted efforts to conserve indigenous local chicken breeds such as 'Firgi' and 'Tunguneh' (that are on the brink of extinction) in consonance with the provisions of the National Strategy and Action Plan (NSAP) for animal genetic resources (Loum 2019). • The Department of Livestock Services should collect data on traditional backyard poultry production and assist farmers in breeding and supplying other farmers with good breeding stock with established records on performance. • Re-introduce affordable[4] local incubators and the cockerel exchange program at the community level.		
Health	• Include backyard poultry farmers in vaccination campaigns against NCD to prevent and reduce both mortality and morbidity during outbreaks. • Provide better management practices (housing, health, and feed packages) • Train female farmers and youths on poultry vaccination and deworming for wider and better coverage. • Introduce housing made with locally available materials. • Sensitize poultry farmers about disease outbreak reporting, emergency preparedness and control measures when outbreaks occur.		
Marketing	• With feed supplementation and improved housing, farmers may be in a position to produce greater numbers of chicks and eggs for sale during sociocultural and religious festivities and maximize their profit. • Carry out sensitization campaigns and promote marketing of poultry and poultry products during livestock shows and fairs. • Reintroduce and organize poultry field and market dDays to coincide with sociocultural events/celebrations. • Use other market outlets such as 'loumos' (weekly markets) to emphasize and also encourage marketing at the village level. • Target linking farmers directly with the consumers.		
Other	• Develop training materials in the form of posters, songs, and theatres to relay messages to poultry farmers in the field. • Make use of available raw materials in the Gambia such as fish meal, maize bran, yellow maize, sorghum grain, cotton seed cake, groundnut cake, sesame cake, oyster shell, cassava meal, rice bran, palm kernel, Leucaena, millet and bone. • Promote record keeping by farmers.		

4. Affordable local incubators that could hatch between 12 to 36 eggs and the cockerel exchange programme was implemented with success under the UNDP Women In Development (WID) project 1992 to 1997. After the phasing out of the project progressive farmers continue.

Strategic interventions for the development of commercial poultry production in the Gambia will, among other things, focus on addressing key constraints facing the subsector, such as the acute dependence on the importation of expensive layer and broiler feeds (sometimes of doubtful qualities), day-old chicks and other production inputs and the absence of storage and processing facilities for poultry and poultry products (Table 5). Emphasis should be placed on veterinary healthcare delivery/disease prevention and control, quality control, and assurance to improve access to the niche markets of the tourist/hotel industry.

Table 5: Strategic interventions for the development of commercial poultry production in the Gambia

Category	Western Region	Central Region	Eastern Region
Feed	• Conduct quality control and assurance of feeds to ascertain expected output for production and productivity of commercial poultry farms. Quality control of feeds and other products is a regulatory function of the public sector to ensure adherence to acceptable standards and safety of the products being imported. • Improve the capacity the existing mills and millers to establish well-designed and produce by designing appropriate feed mills to produce the required quality and quantity of feeds. This will thus reduce forex expenditure on feed importation. • Encourage public private partnership (PPP) in commercial feed production. • Support capacity strengthening of already established feed mills in the country to increase production and productivity.		
Breed	• Selection should be based on performance and genetic potential. • Increase the number of breeder farmers/hatcheries to establish a reliable source of supply for day-old chicks at affordable prices.		
Health	• Conduct mass NCD vaccination and re-vaccination programs. • Conduct sero-surveillance, when necessary, • Sensitize farmers on record keeping and disease outbreak surveillance and reporting.		
Marketing	• Link farmers directly to consumers. • Provide appropriate storage facilities for poultry and poultry products.		
Others	• Extension agents should train farmers on basic health and management practices using locally available technologies. • Farmers should ensure quality assurance of egg sizes and weights to gain market confidence • The Department of Livestock Services in collaboration with the Planning Services Unit of the Ministry of Agriculture should mobilise efforts to collect relevant data pertinent to the Commercial Poultry subsector in the Gambia. Currently, there is a paucity of information about the subsector given that data is not routinely collected from commercial poultry farmers. The Planning Services Unit of the Ministry of Agriculture has the mandate to collect all relevant information pertinent to the agricultural sector. However, there is a significant bias towards collecting crop-related data.		

2.4 Post-production improvement strategies

Livestock production constitutes an important complimentary attribute of the Gambia's farming system and agricultural economy, contributing to food and nutrition security and providing sustenance and livelihood support proportion of rural households. However, to ensure that livestock farmers derive maximum benefits as a result of the improvement interventions, it is necessary to put in place appropriate planning for post-production management. In this regard, a series of interventions are proposed and discussed in tables 6, 7 and 8:

Table 6: Post-production in dairying

Category	Western Region	Central Region	Eastern Region
Milk collection	• Improve market infrastructure and collection, storage, processing, and transportation of milk in the Western Region, given that this is the Region with the highest number of Dairy Farms using pure breed dairy cattle.	• Encourage the formation of milk collection centres by women engaged in the trade.	
Milk processing	• Encourage the establishment of more mini dairies at the regional level and give support to the women involved in the processing of milk.		
Sales and retailing (marketing)	• Encourage women engaged in the informal marketing of milk and milk products to form cooperative societies and work closely with the mini dairies. • Encourage private sector involvement in the marketing of milk and milk products. • Engage the dairy farmers (particularly in the Western Region) to improve the hygienic processing and packaging of milk and milk products, thereby making it possible to penetrate the supply chain for the niche market of the tourist industry in the country.		

Table 7: Post-production in red meat (cattle, goat and sheep)

Category	All Production Zones
Collection system	• Strengthen the National Livestock Owners' Association (NaLOA) to enhance the bargaining power of livestock producers and encourage Gambia Livestock Marketing Agency (GLMA) to work closely with producer associations to ensure that livestock owners get fair prices for their animals.
Processing	• Promote value addition to increase the competitiveness of livestock products. Value addition certainly increases the chances of the local producers accessing the niche market of the hotel industry that largely depend on inputs for supplies. • Prioritize the construction of a modern abattoir and meat processing plant (in the Western Region) and slaughterhouses and slabs in rural areas (Central and Eastern regions). • Promote the construction of modern sales outlets for beef, mutton, and chevron and train butchers and other stakeholders in the value chain in hygienic processing, storage, and marketing of red meat. • Train master butchers in the production of specialized cuts, particularly for the hotel industry. • Encourage the re-establishment of the tannery for value addition to hides and skins for export, job creation, and enhancement of foreign exchange earnings.
Sales and Retailing	• Broaden the market information system (MIS) being used by departments under the Ministry of Agriculture to cover the major livestock weekly markets (Fass Njaga Choi, Ndungu Kebbeh, Farafenni, Wassu, Brikama Baa, Wassu and Sare Bojo) and facilitate the provision of real-time market information to stakeholders in the livestock value chains.

Table 8: Post-production in poultry

Management category	All production zones
Backyard poultry	• Encourage women farmers to improve on management practices (biosecurity measures, disease control, housing, and supplementary feeding through the provision of technical training). • Enhance the development of input and output markets to increase the sale and consumption of local poultry products. • Carry out sensitization campaigns and promote marketing of local poultry and poultry products during livestock shows. • Reintroduce and organize field and market days to coincide with celebrations when chickens are slaughtered. Promote poultry fairs and sales field days to coincide with major cultural events. • Use other market outlets such as 'loumos' (weekly market) to enhance the marketing of poultry and poultry products.
Layer and broiler production	• Promote and encourage PPP along the entire commercial poultry value chain, particularly in feed milling, the hatchery industry, cold storage, processing and product development.

2.5 Recommendations for interventions in all LVCs to mainstream and improve gender and social inclusion

Livestock marketing and processing can serve as platforms from which to initiate equitable gender-responsive actions to ensure women and youth can increase their incomes, food security and wellbeing and to improve intrahousehold decision-making. Extension and training activity would be cross-cutting in all three LVCs and crucial for the successful implementation of the recommended interventions as significant gender inequalities exist in access to technologies, technical information, and knowledge. Table 9 sets out recommended activities and actions to overcome gender-related barriers to successful livestock production.

Table 9: Gender considerations and recommended activities in livestock production

Gender considerations and recommended activities	
Livestock production	
• Limited access to veterinary services for the species women own; goats, sheep and poultry. • Inadequate market information and limited access to markets. • Women's workloads, particularly household chores, are a challenge for women's participation in animal health and production training and skills development.	• Encourage, train, support and mentor women in the importance of participating in livestock production and productivity learning, skills development, and enhancement. • Use women leaders to participate in the decision-making process to address social and cultural barriers that limit their engagement in livestock activities. • Conduct routine mass vaccinations against PPR and pasteurellosis and routine deworming campaigns. • All community members should understand, appreciate, and, where possible, represent women because of the roles they play in socioeconomic and sociocultural activities.[5] • Develop and distribute labour-saving, environmentally friendly, and locally accepted devices and technologies. • Develop and reproduce coloured simplified brochures/leaflets with key extension messages (related to feed, animal health etc.) in local languages where feasible. • Initiate and build strategically located modern slaughterhouses and slabs in rural areas.

5. In a situation where females are not able to attend due to household chores ; meetings/trainings or any other useful interventions that affect them, women farmers should be encouraged to attend additional feedback or training meetings.

Gender considerations and recommended activities	
Livestock production	
• Women leave their animals in the mornings to scavenge and return on their own in the evenings. However, pregnant and lactating females are tied and supplemented with household food remains and or whatever grains are available. Insufficient financial resources constrain women, due to their numerous commitments, from purchasing feed and feed by-products.	• Build livestock extension and animal health systems that are sensitive to the needs of women and youths by circumventing gender norms and challenges, particularly women receiving and benefiting from extension and animal health services. Sensitize women farmers on the market potential of backyard poultry meat and eggs, as well as support, encourage and educate farmers on the nutritional benefits of consuming eggs • Provide information on food safety control systems for foods of animal origin and feeds. • Reintroduce training women and youth farmers to formulate simple feed rations using locally available feed resources to supplement their animals to increase body weight and egg weights. Increase income-generating capacity and improve the nutritional status of women and youth farmers. • Train women and youth in crop residue conservation techniques to use as feed, such as groundnut hay, maize stovers, rice, millet bran, groundnut, sesame cake, and cotton seeds. • Sensitize and reintroduce training on backyard leguminous fodder trees establishment e.g. *Pterocarpus erinaceus, Leucocephala, Acacia albida, Leucaena leucocephela, Cajanus cajan, Moringa oleifera, Gliricidia sepium* and other palatable species in community forest parks, range lands and around boreholes and slipways as well as fences and hedges. • Support and introduce farmer associations and cooperatives to produce various feeds e.g. groundnut and sesame cake-making techniques • Support and introduce and or re-establish small feed mills • Prepare feed supplements using locally available raw materials such as fish meal, maize bran, yellow maize, sorghum grain, cotton seed cake, groundnut cake, sesame cake, oyster shell, cassava meal, rice bran, palm kernel, Leucaena, millet bran, bone meal, etc. • Personnel trained in the International Animal Feed program abroad should train farmers. • Promote simple management practices e.g. building low-cost houses using locally available materials.
• Limited access to breeding services	• Put in place progressive diversity of the livestock sector by broadening the number of species, breeds, products, and by-products, therefore continuous exploitation of indigenous species. • Reverse the trend of erosion of indigenous genetic resources; GoTG to promote sustainable use, development, and conservation of indigenous Animal Genetic Resources (AnGRs).
Livestock management and food safety	
• Limited access to animal health and veterinary services • Due to cultural reasons, women lack mobility, time, or money to access private veterinary services.	• Train women farmers in simple and timely vaccination techniques that do not require syringes and needles and train youths in basic techniques of vaccinations as well as skills and knowledge to identify, recognize and on preventive measures of diseases and consequently report symptoms and signs observed. Sensitize farmers on record keeping and disease outbreak surveillance and reporting. • Re-introduce timely and inclusive ambulatory services to communities in collaboration with women farmers associations/organizations; including timely vaccinations and re-vaccination schedules. • Women should have access to Information, knowledge, and skills related to livestock production, food safety, nutrition, biosecurity and zoonosis.

Gender considerations and recommended activities	
Livestock production	
• Women are more exposed to zoonotic diseases (like TB and brucellosis) through their close association with livestock and handling of raw animal products. • Men involved in slaughtering are exposed to anthrax, brucellosis etc.	• Develop women and youth's capacity to fill the acute shortage of veterinarians and laboratory scientists and technicians. • Introduce and or strengthen women and youth auxiliaries in the epidemic-surveillance system. • Build the capacity of community-based sanitary defence committees, including women. • Enhance capacities of both men and women as well as youths on how to detect and control zoonosis, emerging and other re-emerging diseases in animals and animal by-products.
Livestock marketing and processing	
• Subsistence women farmers depend more on sales at the farm gate. • Payment is based on visual examination and not on body weight. • Women's cows are kept and managed by male herders.	• Build and further strengthen the capacity of women and youths to understand and participate in livestock and livestock products markets. • Reintroduce, sensitize and support campaigns, and organize field and market days to coincide with sociocultural and religious celebrations. • Organize and strengthen women farmers in marketing activities within their villages and communities as well as neighbouring communities. • Promote marketing of women's livestock and livestock products, including using other market outlets such as 'loumos' (weekly markets), and emphasize and encourage marketing within village and community levels. • Re-introduce economic record keeping by farmers using different colours of paper and felt pen colours as representative of different colours of money denominations. • Provide training and sensitization on the importance and possible profits of the relationship between weight and payment. • Provide marketing infrastructure in (Sare Ngai, Sare Bojo, Brikamaba, Wasu, Jareng, Samitenda, Farafeni, Bureng, Kerr pateh, Ndugukebbeh, Fass Njaga Choi and Panchang) and terminal markets (Abuko and Brikama) and provide watering facilitates, animal sheds, toilets facilities, loading ramps, slaughter slabs, meat stalls, cold storage facilities and weighing bascules. • Encourage and support cow owners to provide a backyard shed for the management of both cows and milk. • Support and assisit women engaged in the informal marketing of milk and milk products in forming cooperative societies and working closely with consumers.
• Women lack of market information and understanding of the dynamics market. • Women have reduced bargaining capacity with retailers, traders or milk collectors.	• Educate, train and provide information on the market information. • Strengthen existing marketing strategies using mobile phones and public transporters by traditional poultry and small ruminant farmers. • Develop skills and knowledge of women and youth farmers on bargaining capacity by conducting in-country and out-of-country study tours with more experienced entrepreneurs. • Identify institutions specialized in basic business management and link them with women farmers
• Self-employment in the livestock sector can be a feasible livelihood strategy for women.	• Link women and youth farmers to the Gambia Chamber of Commerce and Industry (GCCI). • Support, introduce and encourage women farmers to study and engage with small and medium size entrepreneurs (SMEs) on the benefits of successful business avenues.

3 Projections of production and consumption: the business-as-usual scenario

3.1 Projected consumption of livestock products to 2035/36

To estimate the future levels of consumption of livestock commodities, we use annual compounding (Sarma 1986), where the projected level of per capita consumption of a given livestock product in year t (LCt) is calculated as:

$$LC_t = LC_o{}^*(1 + \eta * \gamma)^t LC_t = LC_o{}^*(1 + \eta * \gamma)^t$$ (formula*) (1)

LC0 is the base year (2022) level of per capita consumption, η is the income elasticity of demand, and γ is the annual growth rate of the real per capita income. Subsequently, the projected national level of consumption in year t is calculated by multiplying the estimated level of per capita consumption with the projected population (POPt) in that year (formula *).

$$LC_t = LC_o{}^*(1 + \eta * \gamma)^t * POP_t LC_t = LC_o{}^*(1 + \eta * \gamma)^t * POP_t$$ (formula*) (2)

The values of the parameters used in the projection were obtained from various sources. The levels of per capita consumption were projected using FAO (2019) data. Table 10 shows the estimated levels of per capita consumption in the base year for the LMP (2022) and 2019, which form the basis of the base year projections. On average, a Gambian consumes about 50 litres of milk, 33 eggs, 14 kg of chicken, 4 kg of beef, and 0.5 kg of sheep and goat (shoat) meat.

Table 10: Levels of per capita consumption of various livestock products

Year	Milk (litres/year)	Beef (kg/year)	Poultry (kg/year)	Eggs (number/year)	Shoat meat (kg/year)
2019	40.4	3.4	11.1	26.0	0.4
2022 (base year)	50.4	4.0	13.9	33.0	0.5

Due to a dearth of demand studies for livestock products in the Gambia, estimates of the income elasticities of demand were generated using the country's 2015 Integrated Household Survey (IHS) data (The World Bank Microdata Library 2018). However, due to measurement problems in the data, the estimates for milk and eggs seemed implausible when triangulation was done against findings from food demand studies in other countries in Africa. For the problematic commodities, moderation was done informed by findings from other countries to make these parameters more realistic. Table 11 shows the levels of elasticity of demand in the rural and urban areas used in

the projection of the future level of consumption. A value of income elasticity presents the percentage change in the level of demand for a one percent change in the level of income. The income elasticity of demand for beef which is based on the HIS data, is rather low (0.1) compared to the values of all the other commodities (0.9 to 2).

Table 11: Income elasticity of demand for livestock food commodities

	Milk	Beef	Poultry	Eggs	Shoat meat
Urban	1.0	0.1	1.1	2.0	1.24
Rural	0.9	0.1	1.1	2.0	1.43

Population projections were made based on historical population data obtained from the World Bank portal ('Macrotrends | The Long Term Perspective on Markets'). Although the level of economic growth exhibits some wide variations over the last 15 years (2006–2021), it averages about 2% per annum.

Table 12: Population, real GDP and annual growth rates in the Gambia

Parameter	Year	
	2022	2037
Population	2,494,805	3,336,437
Annual population growth rate (%)	3.0	3.0
Growth in the proportion of people living in urban areas	2.8	2.8
Per capita income growth rate (%)	2	2

Table 13 shows the changes in levels of per capita consumption of various livestock products over the 15 years projection period. The per capita consumption increase is highest for eggs (80%). Conversely, per capita beef consumption is projected to rise by only 3% (from 4.0 to 4.1 kg) owing to the relatively small income elasticity of demand (0.1) compared to other commodities.

Table 13: Projected per capita and percentage change by 2022 by livestock product

Livestock product	Units	Estimated consumption 2022	Projected consumption 2037	Percentage increase in per capita consumption
Milk	Litres	50.40	67.11	33.15%
Beef	Kg	4.00	4.12	3.04%
Poultry	Kg	13.90	19.41	39.67%
Eggs	Kg	1.70	3.06	80.09%
Shoat meat	Kg	0.50	0.74	47.44%

Projections indicate that the rise in consumption will be huge compared to the growth in local production (Table 14). The highest level of increase in consumption is projected for shoat meat (255%) and eggs (141%) compared to a modest rise in production of just 32% and 40%, respectively, over the 15 years. Likewise, the quantities of beef and milk produced are projected to rise by only 3% and 5%, respectively, compared to an increase in the level of consumption of 38% and 78%, respectively. Following this trend, the percentage share of domestic production to total consumption is projected to fall for all of the commodities.

Table 14: Projected production and consumption under the BAU scenario

Livestock product	Consumption		% increase inconsumption	Production		% increase in production	Projected production as % of consumption	
	Estimated 2022	Projected 2037		Estimated 2022	Projected 2037		Estimated 2022	Projected 2037
Milk (million litres)	44	79	78%	22	23	5%	49%	29%
Beef (MT)	5	7	38%	4.1	4.2	3%	77%	57%
Poultry ('000 tones)	9	16	87%	0.6	1	40%	7%	5%
Eggs (millions)	3	8	141%	0.47	1	40%	13%	8%
Shoat meat ('000 tones)	1.3	4.7	255%	1.66	2.2	32%	126%	47%

4 Cattle value chain improvement intervention targets and impact

4.1 List of interventions and targets at state and production zone levels

4.1.1 Feed interventions

According to the 2019 National Feed Balance Sheet study of FAO and DLS, the nationally available and required feed balance in the Gambia shows significant disparity between different seasons (Annex, Table 38). According to the study, surplus feed production is observed in the rainy and cold dry seasons. The surplus feed produced in these seasons usually get burned instead of conserving it for the harsher hot dry season (DLS and FAO 2022). The following interventions are proposed to improve feed production in the Gambia.

- Although the Forest Act 1998 (in accordance with Section 68 of this Law) allows for forest grazing in designated community's forests, it is necessary for the DLS to collaborate with the Department of Forestry to ensure sustainable exploitation of range resources within the designated areas.
- The last comprehensive Land Use Plan for the Gambia was developed in 1985, and it was followed by the preparation of the Physical Development Plan for the GBA (Greater Banjul Area) in 2000. The Ministry of Agriculture should engage other relevant stakeholders (such as the ministries of Local Government and Lands, Justice, Forestry and the Environment and Parks and Wildlife, civil society and community leaders to update the Land Use Plan taking into consideration the urgent needs of the agriculture/livestock sector in the country.
- To decrease conflicts between farmers and transhumant livestock herders, demarcate, map, and Gazette grazing areas and stock routes within the first four years of the LSS.
- Sensitize and train farmers on the prevention and control of bushfires. Experience has shown that in a predominantly extensive livestock production system as practiced in the Gambia, where the rangelands are communally owned and managed, large-scale improvement efforts will be difficult to sustain over time. Hence the DLS's approach of promoting Intensive Feed Gardens and other stabling technics and the provision of support to owners of private pastures (where enrichment planting with palatable species is being conducted) should be enhanced/supported and replicated countrywide.
- Develop a community-based grazing area and a rangeland (pasture plots) management and improvement system to regenerate degraded plots.
    - Over-sowing of palatable grass and legume species, including *Andropogon gayanus, Panicum, Brachiaria* species, and *Stylosanthes* species.

- Construction of access/slipways to rivers. It is targeted that about 20%, 40%, and 65% of the areas with low access will have access/slipways to rivers by the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Construction of boreholes with the contribution of herd owners. It is targeted to construct 80, 110, and 150 boreholes in the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Develop low-lying areas and improve water harvesting. It is targeted to develop 40, 80, and 100 low-laying areas in the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS duration, respectively

- Sensitize farmers and provide incentives to grow fodder and fodder trees as fences and hedges in the backyard and other areas to supplement cattle and enhance feed availability during the dry season. It is targeted that about 5%, 10%, and 35% of cattle farmers will practice this by the end of the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Increase the use of leguminous plants, e.g. *Pterocarpus erinaceous, Acacia albida (Faidherbia albida), Cajanus cajan,* etc.
- Encourage farmers to harvest green feeds during the wet season and conserve them for use in the dry season.
- Encourage the establishment of a Central Animal Feed Quality Control Laboratory.
- Educate farmers in collecting, preserving, and utilizing locally produced crop resides. The current level of crop residue utilization is depicted in the table below.

Table 15: Current level of crop residue utilization in livestock feeding

Crop	Baseline*
Maize	37
Early millet	35
Late millet	35
Sorghum	36
Upland rice	56
Swamp rice	56
Fonio/Findo	56
Groundnuts	90
Cowpea	87

*Source: DLS and FAO (2021)

- Improve the availability of dairy farming and milk processing professionals by increasing the accessibility of long-term training on animal nutrition, breeding, health, and milk processing (see extension and research intervention).
- Improve the availability and access to agricultural by-products (cakes, bran, etc.) to the small livestock holders in the village by studying the sector and providing the means that can protect the cottage edible oil and grain processors. The importance of the by-products of cottage edible oil and food grain processing factories for the livestock sector shouldn't be overlooked.
- Reinforce the porous border control and limit the export of processed feed ingredients and have a concessional supply for local livestock producers.
- Encourage commercial dairy farms by facilitating and supporting financial acquisition and long-term loan payment schemes for farmers that want to establish and/or operate commercial dairy farms.

- Encourage the establishment of a fodder and fodder seed producers' association within three years.
- Improve the linkages with associations in other countries like Mali and Senegal.

4.1.2 Health interventions

- Cattle will be vaccinated against priority diseases like contagious bovine pleuropneumonia (CBPP), haemorrhagic septicaemia (HS), black quarter (BQ) and lumpy skin disease (LSD). The vaccine coverage of CBPP is targeted to increase from the current coverage of about 75% to about 80% in the coming five years and to keep it constant till the end of 2037. The percent of cattle vaccinated against HS, BQ and LSD is targeted to increase from current coverage of about null to 30% by the end of the first five years of the LSS period (2027/28) and 50% by the end of the second five year (2032/33) and to keep constant through the third five years (2033/34–2037/38).
- In commercial farms, vaccination of cattle against CBPP, HS, BQ, LSD and anthrax and chemoprophylaxis against tick-borne and blood parasitic infectious diseases is expected to continue with the current rate of about full coverage.
- Currently, about 15% and 25% of local cattle (N'Dama) owners practice external and internal parasite treatments, respectively, using anti-parasite chemicals and anthelmintic[6]. It is targeted to increase the rate of anti-parasite treatment to 30%, 50%, and 75% and anthelmintic use to 40%, 60% and 75% by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Strengthen the Veterinary Council within four years to effectively monitor and regulate the importation, distribution, and use of veterinary drugs.
- Ensure the availability of sufficient vaccines and medicines in the country.
- Strengthen Livestock Training School of the Gambia College of Agriculture through capacity building of trainers, provision of teaching materials, equipment, and protective clothing for trainees, and provide laboratories and practical facilities and equipment throughout the LSS duration.
- Revise the current curriculum used to train livestock technicians to enhance their performance (within a year).[7]
- Train veterinarians and livestock technicians to scale up their capacity and increase their contribution to the improvement of extension and veterinary service delivery.
- Establish additional veterinary pharmacies and drug outlets in the regions; 5 in the first (2023/24–2027/28) and 15 in the second (2028/29–2032/33) five years of the LSS duration.
- To strengthen the existing six regional veterinary stations, improve the infrastructures and provide equipment within five years.
- Improve infrastructure, provide equipment and hire experts on open positions for the existing 53 veterinary sub-stations.
- Establish 53 new veterinary sub-stations (one more for every district) in the first five years (2023/24–2027/28).
- Strengthen the disease surveillance system by improving staff capacity with training and the monitoring system.

6. Source: Consultation with animal health experts

7. The need for the revision of the current curriculum is concurred by the experts. The detail will be done during the production of the detail implementation plan and during the revision of the curriculum.

- Currently, there are 82 farmer sanitary defence committees (SDCs). It is recommended to build the capacity of existing sanitary defence committees and raise their number to 120, 150, and 200 by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Improve the capacity of the existing six regional veterinary laboratories in the coming five years by improving infrastructure, equipment, staffing and staff capacity.
- Improve the facilities and train laboratory technologists and technicians of the Central Veterinary Laboratory at Abuko.

4.1.3 Genetic improvement interventions

- Produce a national cattle breeding policy within two years.
- Sensitize herd owners on the selection and retention of good breeding bulls and heifers in the local herd. The target is to sensitize 60, 75 and 90% of livestock farmers by the end of the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS period, respectively.
- The N'Dama breeding program being conducted by West African Livestock Inovation Center (WALIC) should be expanded and elite breeding bulls should be produced and distributed to farmers through Gambia Indigenous Livestock Multipliers Association (GILMA). The target is that 5%, 20% and 75% of cattle farmers in the country will have access to elite N'Dama breeding bulls/semen by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively.
- Strengthen the capacity of WALIC by coordinating and facilitating funds for the construction of more barns, the purchase of more animals, and improved research and training facilities. Also, it is equally essential to provide enhanced laboratory and storage facilities and equipment to expand the laboratories' capacity to include handling of breeding materials and activities.
- Construct one AI centre within the first five years of the LSS period and an additional one during the second five years. The AI centres will produce semen straws from elite N'Dama bulls and exotic/exotic-cross/ breed bulls.
- Construct one liquid nitrogen storage facility within five years.
- Train AI technicians. The target is to train 150, 50 and 50 AI technicians in the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Subsidize private AI service providers to help them expand their AI service to more livestock producers.

4.1.4 Extension and research interventions

- Develop livestock extension policy, guidelines and legal framework for extension services within three years. There is a validated Agricultural Extension Policy for the Gambia developed with support from FAO. The formulation of the legal framework and guidelines are expected to follow.
- Strengthen the capacities of the livestock research section of the NARI (National Agricultural Research Institute) by improving the research facilities and staffing with livestock researchers and scientists to make it able to conduct livestock research. The research institute must also collaborate with other research institutions like WALIC and others in the sub-region.
- Coordinate and facilitate the provision of financial support, the necessary equipment, and training opportunities to the staff of WALIC to expand its local cattle improvement program and other research.
- Strengthen the public extension in terms of mobility to reach more areas.

- Strengthen DLS and other stakeholders' livestock data collection tasks by providing appliances and gadgets (computers, tablets etc.) in addition to capacity building and training on data collection (methods and tools) and analysis.
- NARI (which has the mandate for livestock research), WALIC and DLS need to improve staff retention through incentives, career progression opportunities, and scholarships.
- The existing four training centres and four demonstration units cater to all species in the country. It is recommended that the training centres and demonstration units be upgraded and utilized to full capacity.
- Veterinary sub-stations serve as veterinary and extension service delivery stations. The target is to improve the infrastructure, equipping and staffing of the existing 53 veterinary sub-stations and construct additional 53 new veterinary sub-stations with farmer demonstration units (one for every district) within the first five years (2023/24–2027/28) of the LSS period.
- Promote private veterinary and extension service providers by subsidizing veterinary and livestock experts to establish veterinary pharmacies and input shops that can provide farmers with veterinary and extension services.
- Support the emergence of private extension service providers by subsidizing the private extension service providers.
- The public sector will regulate the private veterinarians and extension service providers and continue researching and providing public veterinary and extension services.
- NARI must collaborate with the University of the Gambia and other stakeholders in the livestock sector to ensure that training at the faculty of science produces graduates with skills that NARI and the country need.
- Promote adaptive research on the exotic breed and milk improvement along the value chain.
- Currently, very few farmers get intensive and continuous cattle improvement training. The target is to increase the number of farmers that receive intensive cattle improvement training (training, exchange visits, farmer advisory services and practical demonstrations) to 50%, 75% and 90% by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS duration, respectively.

4.1.5 Marketing and processing improvement interventions

- Marketing infrastructure in primary markets and terminal markets such as fencing of holding ground, provision of watering facilitates, sheds, office, and toilets, and loading ramps, slaughter slabs, meat stalls, and cold storage facilities, weighing scale will be improved for 2 terminal and 10 primary markets in the first five years (2023/24–2027/28) and 2 primary markets in the second (2028/29–2032/33) five years of the LSS period.
- Strengthen the newly established livestock market information system and sensitize users about it (GLMA has established MIS).
- Subsidize cooperatives to introduce specialized vehicles for the transportation of live animals and animal products.
- Perform capacity building for market management committees of cooperatives.
- Support the establishment of at least one marketing cooperative for each of the different commodities (dairy, live animal and meat, layers, broilers and free-range chicken) within five years.
- Support cooperatives to improve the system of collection, transportation, and processing of livestock products.

- Encourage and subsidize private actors ready to establish small-scale milk processing plants. The target is to launch 5 small-scale milk processing plants in each of the first (2023/24–2027/28) and second (2028/29–2032/33) five years of the LSS period, with a total of 10 plants in the country.
- Encourage private actors to set up milk collection centres. The target is to set up 10 small-scale milk collection centres in each of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period.
- Encourage private actors to establish two modern abattoirs within five years.
- Support commercial dairy farms to increase the number of commercial dairy in the Gambia. The target is to establish an additional about 40, 100 and 180 commercial dairy farms (with the current farm size of about 65 animals) by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Modernize the 12 (10 in 2023/24–2027/28 and 2 in 2028/29–2032/33) existing slaughterhouses.
- Renovate and establish the existing non-functional tannery by encouraging private sectors to join a PPP and strengthening the capacities of stakeholders, including technical personnel.

4.2 Cattle production improvement scenario—impact of interventions

4.2.1 Impact of interventions at animal and farm level

The following assumption were made in the model analysis regarding the impact of the above proposed interventions on farmers adopting them. Farmers adopting the proposed interventions will get the following benefits and incur the following costs at animal and farm level.

- Parturition rate of cows will increase to 0.60 per year from 0.48 at the BAU scenario (Dwinger et al. 1994).
- Mortality rate of cattle is anticipated to decrease by 30% (Dwinger et al. 1994).
- Average live weight of cattle is expected to increase by about 10 to 15%. The dressing percentage is also expected to increase to 50% from the current 47%.
- Milk production of cows is projected to increase to 2.5 lt/day from the current about 1.1 lt/day.
- Due to the proposed interventions, the farmer will also incur additional costs for feeds to purchase of concentrate feeds and other roughages. Farmers will buy an additional about 500 gm/day/animal concentrate feeds for adult cows during the five-month very dry period and/or when lactating. Farmers also are expected to increase the daily mineral and salt provision to cattle to 50 gm/day from the current about 20 gm/day.
- Farmers will also incur additional veterinary costs. The veterinary cost of farmers will increase to 700 GMD/year/animal due to the additional vaccination schemes and internal and external parasite control and treatment applications.

4.2.2 Impact of interventions at production zone and country level

4.2.2.1 Projected livestock population in 15 years

The projected impact of the cattle value chain improvement interventions (see section 4.1) on the size of the population of the national cattle herd by 2037/2038 is presented in Table 16. The results indicate that overall, under the with investment (WI) scenario, the population of both the indigenous N'Dama breed and crossbreeds (Zebu/

Gobra) is projected to increase equally by 34.6%[8]. Under the BAU scenario, the population of the indigenous N'Dama breed and crossbreeds are projected to increase by 2.7% and 2.6%, respectively. This might be indicative of the fact that the available range of resources cannot continue to support significant numerical increases in cattle populations without improvements in livestock husbandry practices.

Table 16: Comparison of current (2022/23) and BAU and WI projected (2037/38) livestock numbers

Production zone	Breed	Livestock population				
		Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Western	N'Dama	37,363	38,041	1.8%	50,285	34.6%
	Zebu/Gobra	764	793	3.8%	1,028	34.6%
	Total	38,126	38,834	1.9%	51,313	34.6%
Central	N'Dama	89,366	93,894	5.1%	120,275	34.6%
	Zebu/Gobra	2,642	2,694	2.0%	3,556	34.6%
	Total	92,009	96,588	5.0%	123,831	34.6%
Eastern	N'Dama	163,128	165,840	1.7%	219,548	34.6%
	Zebu/Gobra	3,295	3,385	2.7%	4,435	34.6%
	Total	166,423	169,226	1.7%	223,983	34.6%
Commercial dairy		332	432	30.3%	11,886	3485.3%
Total population	N'Dama	289,857	297,775	2.7%	390,109	34.6%
	Zebu/Gobra	6,701	6,872	2.6%	9,019	34.6%
Grand total population		296,889	305,079	2.8%	411,013	38.4%

4.2.2.2 Projected production in 15 years

Beef production from the base year (2022/2023) to 2037/38 with the WI and BAU scenarios is projected to increase by 105.4% and 2.8%, respectively. With the BAU scenario, the increment is minimal because a significant proportion of the slaughter stock will continue to be imported from neighbouring countries. The WI scenario takes into account the likely improvements in productivity and off-take rate and increased population growth rate as a result of investments that will improve management practices.

Table 17: Beef production in the base year and projected for 2037/38 under BAU and WI scenarios

Production zone	Breed	Beef production (tonnes)				
		Base year 2022/23	BAU 2037/38	% change Base year to BAU 2037/38	WI scenario 2037/38	% change Base year to WI 2037/38
Western	N'Dama	516	525	1.7%	1,021	97.8%
	Zebu/Gobra	12	12	3.8%	18	49.5%
	Total	528	537	1.8%	1,038	96.7%
Central	N'Dama	1,235	1,299	5.2%	2,329	88.6%
	Zebu/Gobra	25	26	1.9%	41	59.5%
	Total	1,260	1,325	5.1%	2,370	88.0%

8. A 2% growth rate was used for cattle, both N'Dama and Zebu/Gobra.

Production zone	Breed	Beef production (tonnes)				
		Base year 2022/23	BAU 2037/38	% change Base year to BAU 2037/38	WI scenario 2037/38	% change Base year to WI 2037/38
Eastern	N'Dama	2,243	2,277	1.5%	4,456	98.7%
	Zebu/Gobra	33	34	2.7%	52	58.0%
	Total	2,275	2,311	1.6%	4,507	98.1%
Commercial dairy		10	13	32.2%	451	4490.5%
Total production	N'Dama	3,993	4,101	2.7%	7,806	95.5%
	Zebu/Gobra	70	72	2.6%	110	57.1%
Grand total production		4,073	4,186	2.8%	8,367	105.4%

Milk production in the Gambia from 2022/2023 to 2037/38 is projected to increase by 3.1% in the BAU and by 336.2% under the WI scenario. This is expected given that N'Dama cattle make up the overwhelming majority of the cattle population and they are generally poor milkers with an average daily production of 1.5 litres. However, significant improvement in yields will be registered in the WI scenario.

Table 18: Milk production in the base year and projected for 2037/38 under BAU and WI scenarios

Production zone	Breed	Milk production (thousand litres)				
		Base year 2022/23	BAU 2037/38	% change Base year to BAU 2037/38	WI scenario 2037/38	% change Base year to WI 2037/38
Western	N'Dama	2,472	2,515	1.7%	7,972	222.4%
	Zebu/Gobra	95	99	3.8%	153	60.4%
	Total	2,567	2,613	1.8%	8,124	216.4%
Central	N'Dama	6,112	6,428	5.2%	19,604	220.8%
	Zebu/Gobra	255	260	1.9%	415	62.8%
	Total	6,366	6,688	5.0%	20,019	214.4%
Eastern	N'Dama	10,648	10,812	1.5%	34,333	222.4%
	Zebu/Gobra	345	354	2.7%	559	62.0%
	Total	10,993	11,167	1.6%	34,892	217.4%
Commercial dairy		246	325	32.2%	24,967	10042.4%
Total production	N'Dama	19,232	19,755	2.7%	61,908	221.9%
	Zebu/Gobra	695	713	2.5%	1,127	62.1%
Grand total production		20,173	20,793	3.1%	88,002	336.2%

Total cumulative production of beef, milk, manure and draught power from the national cattle herd under the BAU and WI scenarios from the base year to 2037/38 are shown in Table 19. With the WI scenario, beef milk and manure production in the coming 15 years will increase by 105%, 336% and 36%, respectively.

Table 19: Total cattle produce in the base year and 2037/38 under BAU and WI scenarios

Products		Base year 2022/23	Production in 2037/38 under BAU scenario	% change base year to BAU 2037/38	Production in 2037/38 under WI scenario	% change base year to WI 2037/38
Beef (tonnes)	N'Dama	3,993	4,101	2.7%	7,806	95%
	Zebu/Gobra	70	72	2.6%	110	57%
	Commercial	10	13	32.2%	451	4491%
	Total	4,073	4,186	2.8%	8,367	105%

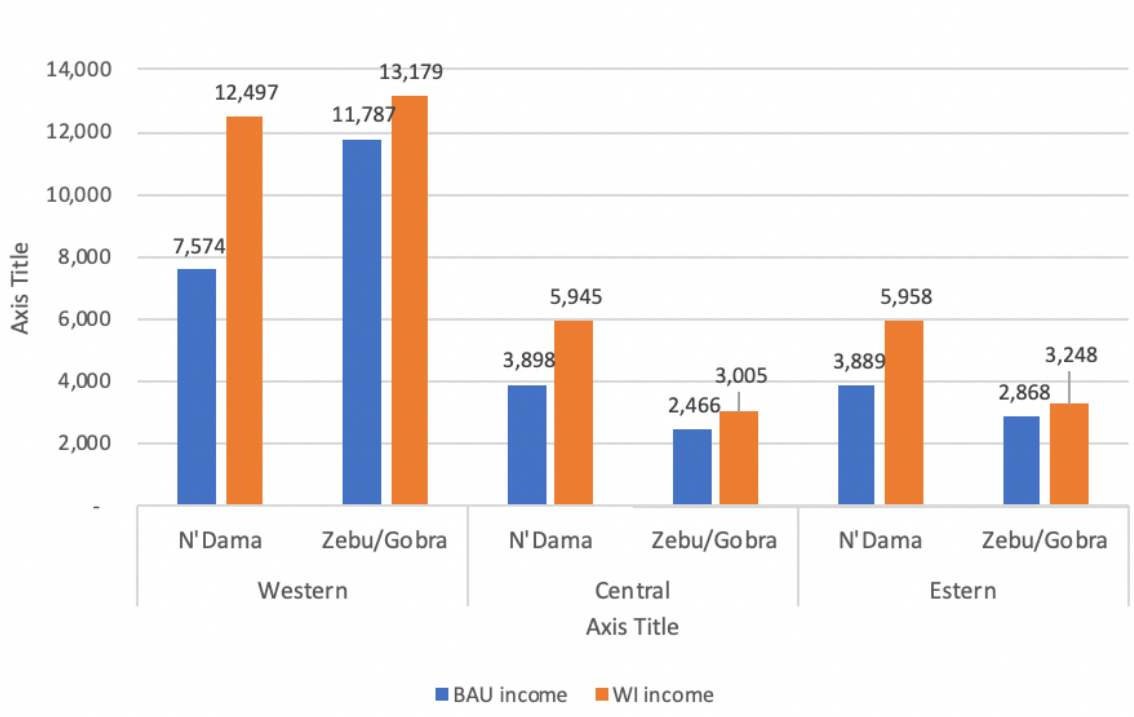
Products		Base year 2022/23	Production in 2037/38 under BAU scenario	% change base year to BAU 2037/38	Production in 2037/38 under WI scenario	% change base year to WI 2037/38
Milk (thousand litres)	N'Dama	19,232	19,755	2.7%	61,908	222%
	Zebu/Gobra	695	713	2.5%	1,127	62%
	Commercial	46	325	32.2%	24,967	10042%
	Total	20,173	20,793	3.1%	88,002	336%
Hides (tonnes)		-	-	NA		NA
Manure (tonnes)		160,106	164,402	2.7%	218,090	36%
Traction power (thousand days)		5,603	5,826	4.0%	7,270	30%

4.2.2.3 Projected income per animal in 15 years (2037/38)

Figure 1 shows the projected annual income per animal in 2037/38 under the BAU and WI scenarios. With both scenarios, livestock farmers in the Western Region are projected to have significantly higher income per animal, given the fact that the area has a comparative advantage in terms of a mild climate that support the production of crossbreeds and European breeds, easy access to basic livestock infrastructure including markets, abattoir, feed mills and veterinary clinics and more urbanized population with higher income levels. Most of the country's thriving tourism industry is also domiciled in this region.

Across the Central and Eastern production zones, the income per animal in BAU and WI is projected to be significantly lower due to the higher cost of the interventions and the difficulties in accessing livestock infrastructure, veterinary healthcare, feed and nutrition stress, and higher disease incidence, which makes it difficult to keep the more productive (but more susceptible) crossbreeds.

Figure 1: Annual income per animal for BAU and WI scenarios in 15 years (in GMD by 2037/38)



In the WI scenario, the annual household income per animal for farmers owning N'Dama Cattle in the Western Region is projected to increase significantly from 7,574 (GMD)[9] to GMD 12,497 (i.e. by about 40%). However, across the Central and Eastern regions, annual household income per animal for the indigenous breed is significantly lower (D 3,898 and GMD 3,889, respectively. Similarly, in the WI scenario for N'Dama Cattle, the projected increment is from GMD 3,898 to GMD 5,945 and GMD 3,889 to GMD 5,958 in the Central and Eastern regions, respectively.

4.2.2.4 GDP contribution for all cattle products

The GDP contribution of all cattle products is projected to grow from 3.8% under BAU to 66.1% with the WI scenario (Table 20). Most of the gain in GDP contribution is due to the projected increase in milk production from N'Dama cattle in the WI scenario.

Apart from milk, manure is the most important contributor to the agricultural GDP of the country. Past studies have not highlighted the important contribution of manure to soil fertility maintenance and the agricultural GDP of the Gambia. However, livestock farmers understand the important role that manure plays in crop production in the Gambia. According to data from the National Livestock Census of 2016, the majority of livestock farmers stated that their main purpose for keeping cattle was for manure (22.3%) and milk (22.2%).

For the 2021/2022 cropping season, a 50 kg bag of fertilizer cost GMD 2,500 and most farmers complain that they couldn't afford to buy enough to cover the acreage they cultivate. This resulted in a greater dependence on manure.

Table 20: GDP contribution for the base year and projected for 2037/38 under BAU and WI scenarios (10^6 GMD)

Products	Base year 2022/23	Production in 2037/38 under BAU scenario	% change under BAU	Production in 2037/38 under WI-1 scenario	% change under WI-1
Beef	689	711	3.3%	1,209	75.5%
Milk	545	578	6.0%	3,195	486.3%
Hides	-	-	NA	1	1
Manure	31	31	1.9%	45	44.9%
Traction power	2,917	3,018	3.5%	2,495	-14.5%
Total	4,182	4,339	3.8%	6,945	66.1%

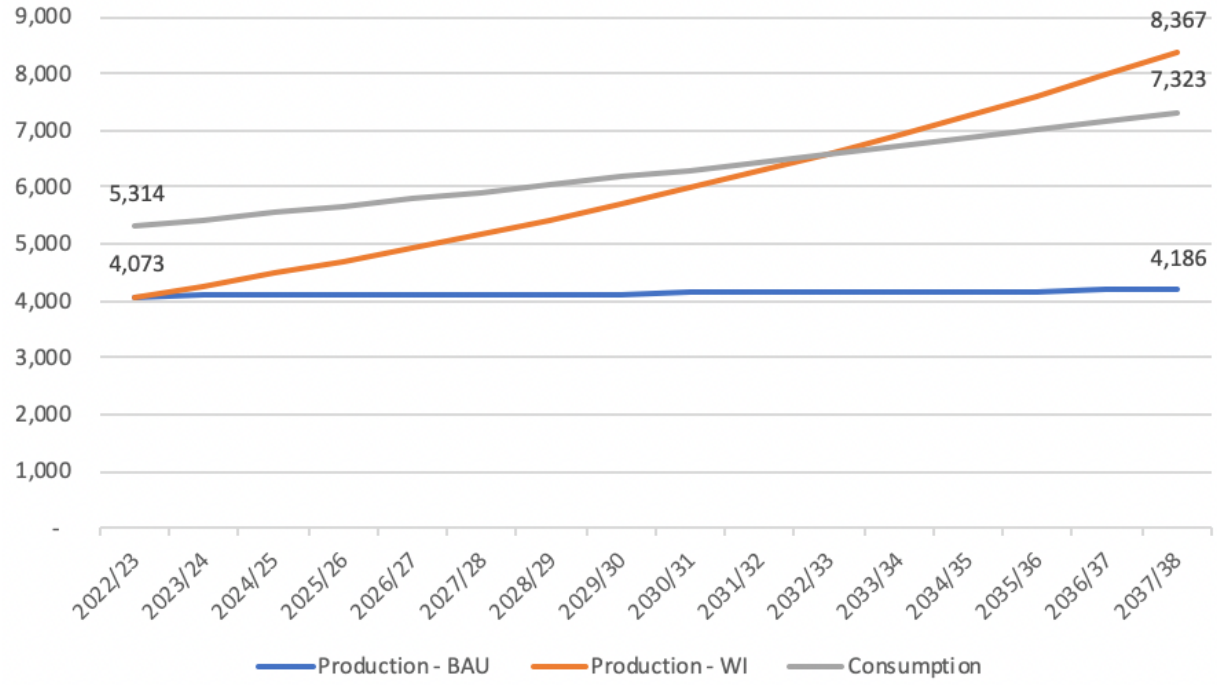
4.3 Production-consumption balance

4.3.1 Future beef production-consumption balance

Between 2022/23 and 2037/38, beef production is projected to remain almost stagnant under the BAU scenario, whereas consumption is projected to almost double. Under this scenario, the majority of the slaughter stock for the country will continue to be imported from the neighbouring countries to satisfy demands. However, with the WI scenario, projected beef production will more than double and surpsass projected consumption between the base year and 2037/38.

9. Current exchange of the Gambian Dalasi (GMD) to the USD is 1 USD = 60 GMD (2022).

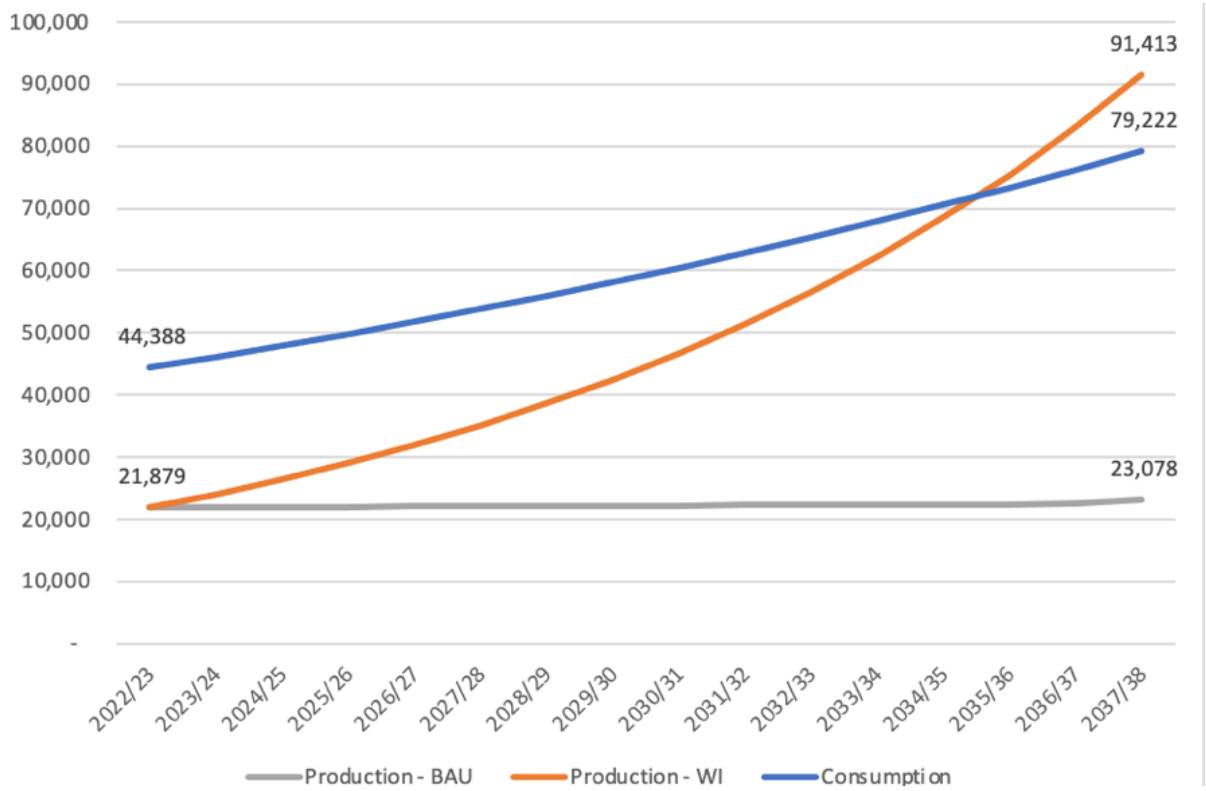
Figure 2: Future production-consumption balance of beef under BAU and WI scenarios



4.3.2 Future milk production-consumption balance

Milk production in the BAU scenario is projected to be significantly below the consumption level (satisfying about 50% of the consumption requirement of the country). Between 2022/23 and 2037/38, under the BAU scenario, production is projected to increase only by about 5%. During the same period, consumption is projected increase by about 44%. With the WI scenario, milk production is projected to increase by 76% from the base year to 2037/38 and close the milk deficit by 2034.

Figure 3: Future production-consumption balance in milk under BAU and WI scenarios



5 Small ruminant value chain improvement intervention targets and impacts

5.1 List of interventions and targets at state and production zone levels

5.1.1 Feed improvement interventions

- The feed improvement interventions for cattle meat and dairy also cater to sheep and goats.
- Plant fodder tree species such as *Pterocarpus erinaceus, Leucocephala, Acacia albida,* and *Leucaena* in community forest parks, range lands, and around boreholes and slipways.
- Promote the construction of small houses for small ruminants. Currently, it is estimated that 30% of farmers have small houses for sheep and goats. It is targeted to increase this number to 40%, 50%, and 70% by the end of the first (2023/24–2027/28), second (2027–203), and third (2033/34–2037/38) five years of the LSS period, respectively.
- Sensitize farmers to grow fodders and fodder trees as fences and hedges in the backyard and other areas to supplement cattle and enhance feed availability during the dry season.
- Promote and train farmers in the collection, preservation, and enhancement of crop residues such as groundnut hay, maize stovers, rice, millet bran, groundnut, sesame cake and cotton seeds. Encourage intensive sheep and goat farms to establish intensive feed gardens (starting from 625 m^2) through the use of fodder legumes such as *Cajanus cajan*, *Leucaena*, Moringa and other palatable species in the forested areas.
- Encourage commercial sheep and goat farms that practice zero-grazing schemes by providing a 40% subsidy.
- Improve availability and access to agricultural by-products (cakes, bran etc.) and raise awareness of the importance of the by-products of cottage edible oil industries for the livestock sector.

5.1.2 Health improvement interventions

- The health service improvement interventions for cattle meat and dairy also cater to sheep and goats.
- Conduct routine mass vaccinations against PPR and pasteurellosis. It is targeted to raise the percentage of sheep and goats vaccinated to 80% by the end of the first five years of the LSS period (2026/27) and to 90% by the end of the 15th year (2036/37).

- Conduct routine deworming campaigns. It is targeted to raise the per cent of sheep and goats covered under the routine deworming campaign to 60%, 70% and 80% by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34-2037/38) five years of the LSS periods, respectively.

5.1.3 Genetic improvement interventions

- Develop a breeding policy for sheep and goats in the coming three years.
- Encourage private practitioners to be involved in the multiplication and distribution of existing breeds, developing new and improving existing ones by providing a 40% subsidy. These farms can serve as a source of breeds for commercial sheep and goat farms in the Gambia and abroad.
- Encourage commercial sheep and goat farms that practice zero-grazing schemes by providing a 40% subsidy.
- Promote community-based local sheep and goat breed improvement schemes.
- Sensitize small ruminant owners on the culling of unproductive animals, selection and retaining good breeding rams and bucks in the flock.
- Strengthen the existing local breed improvement research being carried out by WALIC by providing adequate resources for purchasing additional rams/ewes, and training livestock technicians, geneticists, and equipment.
- Strengthen livestock farmers' associations such as GILMA.

5.1.4 Research and extension improvement interventions

- The research and extension service improvement interventions listed under the cattle meat and milk improvement section also cater to sheep and goats.
- Coordinate and facilitate the provision of financial support, training opportunities, and the necessary equipment for WALIC to expand its local sheep and goat improvement program.
- Provide farmers with intensive and consistent training on improved sheep and goat management practices. The proportion of farmers getting intensive and consistent training will reach 50%, 75% and 85% by the end of the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS period, respectively.

5.1.5 Marketing and processing improvement interventions

- Construct adequate marketing facilities like fencing livestock holding ground, watering facilities, sheds, toilets and loading rams at the level of the weekly market at Sare Ngaingai, Sare Bojo, Brikamaba, Wasu, Jareng, Samitenda, Farafeni, Bureng, Kerr pateh, Ndugukebbeh, Fass Njaga Choi and Panchang.
- Form small ruminant owners' cooperatives and introduce weighing scales to facilitate marketing of sheep and goats.
- Improve the infrastructure at the veterinary stations in Yorro Beri Kunda (YBK), Sololo and Basse.
- Encourage online marketing to facilitate the marketing of sheep and goats and their products. Online marketing will require improved internet networking, faster internet, and reduced cost of data bundles.
- Construct two more terminal markets in the coming five years.
- Promote the use of appropriate transportation facilities for animals from primary to terminal markets and enforce the use of refrigerated transport facilities for meat transportation.
- Rehabilitate laughter slabs and cold storage facilities, and the non-functional tannery.

5.2 Goat and sheep production improvement interventions—impact of interventions

5.2.1 Impact of interventions at animal and farm level

The following assumptions were made in the model analysis regarding the impact of the above proposed interventions on farmers adopting the interventions. Farmers adopting the proposed interventions will get the following benefits and incur the following costs at the animal and farm levels.

- Parturition rate of ewes and doe will increase to 1.5 per year from 1.25 at the BAU scenario for goats and 0.95 for sheep.
- Mortality rate of sheep and goats is anticipated to decrease to 15% for kids, 9% for sub-adults and 5% for adults.
- Average live weight of sheep and goats is expected to increase by 20% for kids and sub-adults and by 15% for adults.
- Due to the proposed interventions, the farmer will also incur additional costs for feeds to purchase concentrate feeds and other roughages. Farmers will buy additional 100 gm/day/animal concentrate feeds for adults and sub-adults in the four months of the very dry periods of the year. In the same period, kids will also be supplemented with 50 gm/day/animal concentrate feeds.
- Farmers adopting health interventions will also incur additional veterinary costs. The veterinary cost of farmers adopting the health interventions will increase to 400 GMD/year/animal due to the additional vaccination schemes and internal and external parasite control and treatment applications.

5.2.2 Impact of interventions at production zone and country level

5.2.2.1Projected population in 15 years

The goat population is projected to increase by 2037/38 under both BAU and the WI scenarios for the different production zones when the above interventions are implemented. The goat population in 2037/38 is projected to increase by 34.2% and 107.9% from 2022/23 under BAU and WI scenarios, respectively (Table 21). Under a WI scenario, all three production zones are projected to witness the same increase in goat population (107.9%), while the Eastern zone is projected to witness the highest increase in goat population (35.2%) under a BAU scenario. Under each production zone, the goat population is projected to increase by the same margin under both the BAU and WI scenarios for small and female-owned systems. However, the magnitude of female-owned goat numbers is higher. The Western zone is projected to have the smallest goat numbers in 2037/38 under both BAU and WI scenarios (Table 21).

Table 21: Comparison of current (2022/23) and BAU and WI projected (2037/38) goat population

Production zone	Production sub-system	Goats population (in number)				
		Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Western	Small (1–10)	38,765	51,714	33.4%	80,589	107.9%
	Female-owned	40,347	53,825	33.4%	83,878	107.9%
	Total	79,112	105,538	33.4%	164,467	107.9%
Central	Small (1–10)	47,539	63,233	33.0%	98,831	107.9%
	Female-owned	49,480	65,814	33.0%	102,865	107.9%
	Total	97,019	129,047	33.0%	201,696	107.9%

Production zone	Production sub-system	Goats population (in number)				
		Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Eastern	Small (1–10)	93,588	126,514	35.2%	194,562	107.9%
	Female-owned	97,408	131,677	35.2%	202,503	107.9%
	Total	190,995	258,191	35.2%	397,066	107.9%
Grand total population		367,126	492,777	34.2%	763,229	107.9%

Source: LSIPT results

On the other hand, the total sheep population is projected to increase by 27.9% and 107.9% under the BAU and WI scenarios by 2037/38 (Table 22). Like goats, the population of sheep is projected to increase by 107.9% under a WI scenario for the three production zones, whilst it will be highest in the Central zone (28.2%) under a BAU scenario. The Djallonke and the Female Owned systems are projected to record the highest increase under a BAU scenario for the three production zones than the Sahelian system. The Western production zone will have the least sheep numbers compared to the Central and the Eastern, which are projected to have the highest sheep population numbers.

Table 22: Comparison of current (2022/23) and BAU and WI projected (2037/38) sheep population

Production zone	Production sub-system	Sheep population (numbers)				
		Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Western	Djallonke	14,138	18,206	28.8%	29,392	107.9%
	Sahelian	2,786	2,849	2.3%	5,791	107.9%
	Female-owned (Djallonke)	14,865	19,142	28.8%	30,904	107.9%
	Total	31,789	40,197	26.4%	66,087	107.9%
Central	Djallonke	17,722	22,820	28.8%	36,843	107.9%
	Sahelian	944	1,007	6.6%	1,963	107.9%
	Female-owned	18,633	23,994	28.8%	38,737	107.9%
	Total	37,299	47,821	28.2%	77,542	107.9%
Eastern	Djallonke	58,159	74,891	28.8%	120,908	107.9%
	Sahelian	3,143	3,282	4.4%	6,534	107.9%
	Female-owned (Djallonke)	61,150	78,742	28.8%	127,126	107.9%
	Total	122,452	156,916	28.1%	254,568	107.9%
Grand total population		191,540	244,934	27.9%	398,198	107.9%

Source: LSIPT results

An increase in sheep and goat populations would mean an increase in women and youth financial resources since women and youths are the currently the major keepers of sheep and goats, particularly goats[10]. Women make decisions where goats are concerned. The nutritional status of the household will improve since there would be more animal protein intake for the most vulnerable, pregnant women, children, and the elderly. Women's spending capacity on goods and services would be favourable from the sales of more animals, thereby lifting some of the burdens of buying uniforms, paying school fees where applicable and other necessities under the responsibility of women.

10. The assumption is that the stracture of ownership will remain the same or no changes in the structure of ownership with large increases in animal numbers.

5.2.2.2 Projected production in 15 years

Implementing the various interventions outlined in the previous section under sheep and goats is expected to increase the production of sheep and goat meat in the Gambia. The production of goat meat is projected to increase from 1,125 tonnes to 1,483 and 3,581 tonnes under BAU and WI scenarios, respectively, representing 31.8% and 218.3%. Goat meat production is projected to be highest in the Eastern zone, increasing from 620 tonnes in 2022/23 to 1,880 tonnes representing 208% under a WI scenario. Goat meat production will be more in the Central production zone (946 tonnes) in 2037/38 with additional investments compared to 371 tonnes under a BAU scenario. Female-owned systems will produce more goat meat in 2037/38 than small systems, as shown in Table 23.

Table 23: Goat meat production in the base year and projected for 2037/38 under BAU and WI scenarios

Production zone	Production sub-system	Average number of heads per farm	Goat meat production (tonnes)				
			Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Western	Small (1–10)	5	113	148	30.9%	370	227.2%
	Female-owned	5	118	154	30.9%	385	227.2%
	Total		231	302	30.9%	755	227.2%
Central	Small (1–10)	5	139	182	30.6%	464	233.2%
	Female-owned	5	145	189	30.6%	483	233.2%
	Total		284	371	30.6%	946	233.2%
Eastern	Small (1–10)	5	299	397	32.7%	921	208.0%
	Female-owned	5	311	413	32.7%	959	208.0%
	Total		610	810	32.7%	1,880	208.0%
Grand total production			1,125	1,483	31.8%	3,581	218.3%

Source: LSIPT results

Compared to goat meat, the projected increase in total sheep meat production between 2022/23 and 2037/38 is 246.7% (from 504 tonnes in 2022/23 to 1,748 tonnes in 2037/38) with additional investments through the quantity of goat meat will be more compared to sheep meat (Table 23 and Table 24). The Eastern production zone is projected to contribute more to total sheep meat production under both BAU and WI scenarios compared to the other two production zones. As with goat meat, the Western production zone is projected to contribute less to the total sheep meat production in 2037/38 under both BAU and WI scenarios.

Table 24: Mutton production in the base year and projected for 2037/38 under BAU and WI scenarios

Production zone	Production sub-system	Mutton production (tonnes)				
		Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Western	Djallonke	33	42	28.6%	120	264.6%
	Sahelian	14	14	0.6%	43	215.2%
	Female-owned (Djallonke)	35	45	28.7%	127	264.6%
	Total	81	101	23.9%	290	256.3%
Central	Djallonke	35	45	28.6%	160	355.4%
	Sahelian	3	3	5.1%	13	302.6%
	Female-owned (Djallonke)	37	47	28.6%	168	355.4%
	Total	75	96	27.5%	341	353.1%

Production zone	Production sub-system	Mutton production (tonnes)				
		Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Eastern	Djallonke	162	208	28.6%	519	220.7%
	Sahelian	16	16	2.8%	53	236.8%
	Female-owned (Djallonke)	170	219	28.6%	546	220.7%
	Total	348	443	27.4%	1,118	221.5%
Grand total production		504	640	26.9%	1,748	246.7%

Source: LSIPT results

The projected total produced from goat meat in 2037/38 under BAU and WI scenarios is shown in Table 25. As already discussed, while goat meat will increase from 1,125 to 3,581 tonnes under a WI scenario of additional investments representing a 218% increase, goat milk, on the other hand, will record a 100% increase under a WI scenario, increasing from 1,706 litres in 2022/23 to 3,411 litres in 2037/38. On the other hand, manure from goats is projected to increase by 100% from 39,276 tonnes in 2022/23 to 82,453 tonnes in 2037/38 (Table 25).

Table 25: Total goat products in the base year and projected for 2037/38 under BAU and WI scenarios

Products	Base year 2022/23	Production in 2037/38 under BAU scenario	% change under BAU	Production in 2037/38 under WI-1 scenario	% change under WI-1
Goat meat (tonnes)	1,125	1,483	31.8%	3,581	218%
Milk (thousand litres)	1,706	2,248	31.8%	3,411	100%
Skin (tonnes)	-	-	NA	-	NA
Manure (tonnes)	39,276	51,745	31.7%	82,453	110%

Source: LSIPT results

While sheep meat production, as discussed, is projected to increase by 247% from 504 tonnes in 2027/28 to 1,748 tonnes in 2037/38, sheep manure will record an increase of 100% from 13,199 tonnes in 2022/23 to 27,748 tonnes in 2037/38 (Table 26).

Table 26: Total sheep products in the base year and 2037/38 under BAU and WI scenarios

Products	Base year 2022/23	Production in 2037/38 under BAU scenario	% change under BAU	Production in 2037/38 under WI-1 scenario	% change under WI-1
Mutton (tonnes)	504	640	26.9%	1,748	247%
Skin (tonnes)	-	-	NA	-	NA
Manure (tonnes)	13,199	16,738	26.8%	27,748	110%

Source: LSIPT results

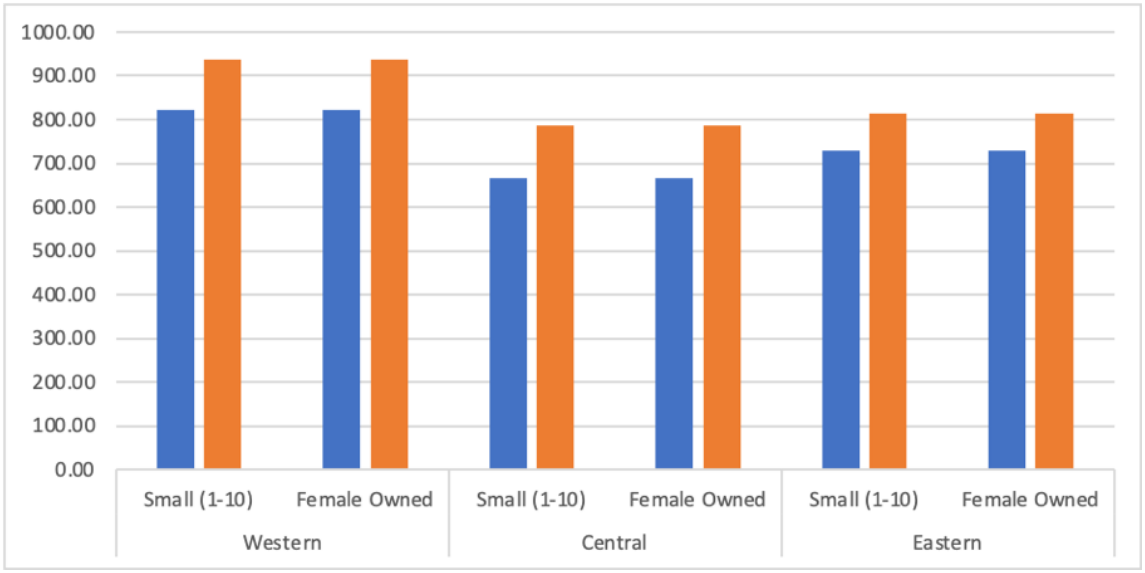
Both goat meat and mutton, including manure and goat milk production, increase with intervention. Manure production is, therefore, an opportunity for female farmers to use in their vegetable gardens and/or sell to other farmers. Female farmers need to be encouraged and supported to keep milking goats. Goat milk consumption will increase protein intake as well as improve the nutrition status of the house. Extra milk produced will be sold, thereby ready cash will be available to farmers.

5.2.2.3 Projected income per animal in 15 years (2037/38)

Figure 4 shows the projected income per goat after 15 years under both BAU and WI scenarios. The Western production zone is projected to have the highest income per animal, followed by the Eastern production zone and the least by the Central production zone. The income per animal for both female-owned and small farms with fewer than 10 goats is GMD 937.14 under a WI scenario and GMD 821.16 under a BAU scenario. Likewise, the income

per animal for both female-owned and small farms with fewer than 10 goats is GMD 814.29 under a WI scenario and GMD 728.42 under the BAU scenario in the Eastern production zone. In the Central production zone, income per animal is projected at GMD 786.27 under a WI scenario, which is GMD 150.87 less than that of the Western production zone and GMD 28.02 less than the income per animal in the Eastern production zone (Figure 4).

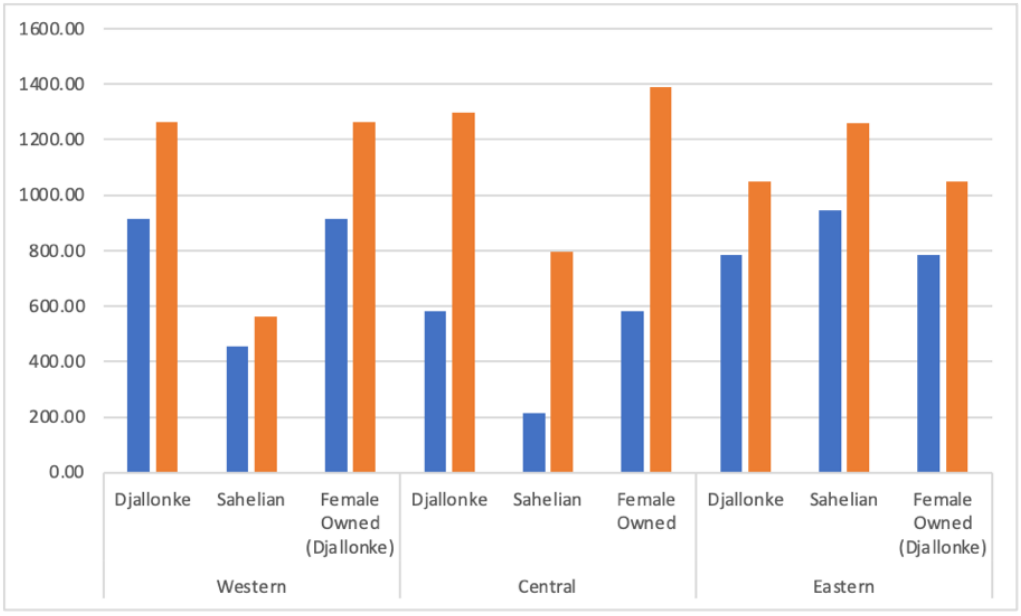
Figure 4: Annual income per goat in GMD for BAU and WI scenarios in 15 years (by 2037/38)



Source: LSIPT results

Compared to goats, the annual income per sheep under both BAU and Wi scenarios is projected to be higher for the three production zones. The Central production zone will record the highest annual income per sheep for female-owned (GMD 1,387.53) and Djallonke (GMD 1,295.33) systems under a WI scenario compared to the Western zone's GMD 1,261.51 for both female-owned and Djallonke systems under the same investment scenario (Figure 5). Interestingly, the income per sheep in a WI scenario is more than twice that under a BAU scenario for female-owned (GMD 1,387.53 as against GMD 582.19) and Djallonke systems (GMD 1,295.33 against GMD 582.19). Additional investment in the identified intervention area will result in a slight increase in income per sheep (GMD 561.88 for WI and GMD 454.29 for BAU) under a Sahelian system in the Western production zone (Figure 5).

Figure 5: Annual income per sheep in GMD for BAU and WI scenarios in 15 years (by 2037/38)



Source: LSIPT results

5.2.2.4 GDP contribution for all small ruminant products

The projected contribution of the goat and sheep sector to GDP is shown in tables 27 and 28. The analysis shows that goat meat GDP contribution is projected to increase from GMD 264 Million in 2022/23 to GMD 697 Million in 2037/38 under a WI scenario, representing a 164% increase within the period (Table 27). This contrasts with the BAU scenario, where a 36.9% increase in GDP is projected. On the other hand, the contribution of manure to GDP under an investment WI scenario is projected to increase by 113% from the base year, from GMD 25 Million to GMD 53 million, compared to GMD 34 million under a BAU scenario with a projected 36% increase (Table 27).

Table 27: Goat GDP contribution for the base year and 2037/38 under BAU and WI scenarios (10^6 GMD)

Products	GDP (10^6 GMD)				
	Base year 2022/23	GDP in 2037/38 under BAU scenario	% change under BAU	GDP in 2037/38 under WI scenario	% change under WI
Goat meat	264	362	36.9%	697	164%
Milk	-	-	NA	-	NA
Skin	-	-	NA	3	3
Manure	25	34	36.0%	53	113%

Source: LSIPT results

Sheep meat GDP contribution is projected to increase by 192% under an investment scenario, increasing from GMD 164 million in 2022/23 to GMD 480 million in 2037/38 compared to a 30.8% increase under a BAU scenario (Table 28). GDP contribution from manure production by sheep is projected to increase by 114% between the two periods (from GMD 19 million to GMD 42 mMillion under an investment WI scenario compared to the BAU scenario's 29.2%.

Table 28: Sheep GDP contribution for the base year and 2037/38 under BAU and WI scenarios (10^6 GMD)

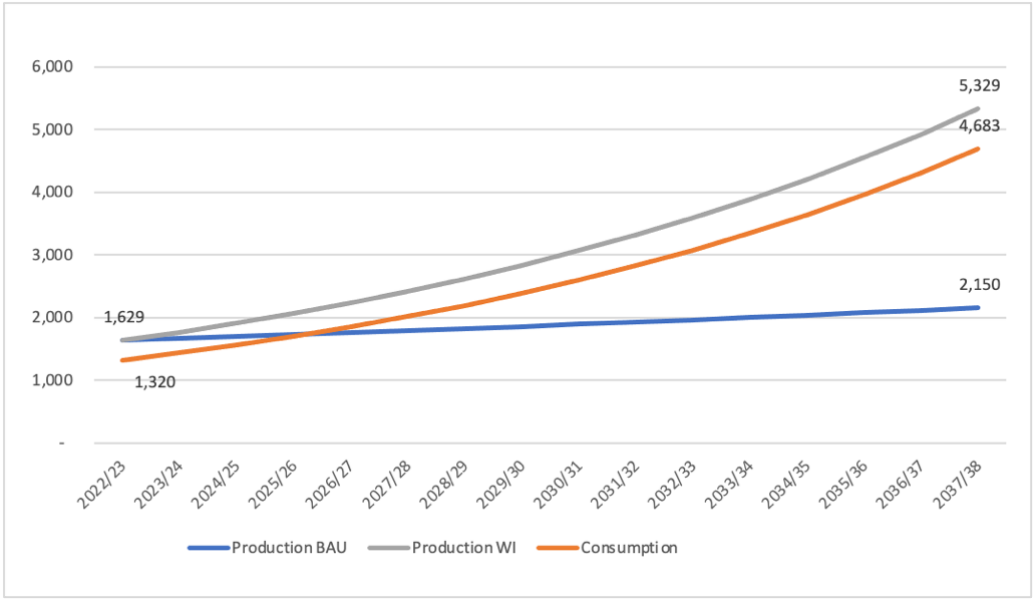
Products	GDP (10^6 GMD)				
	Base year 2022/23	GDP in 2037/38 under BAU scenario	% change under BAU	GDP in 2037/38 under WI scenario	% change under WI
Mutton	164	215	30.8%	480	192%
Skin	-	-	NA	0.4	0.4
Manure	19	25	29.2%	42	114%

Source: LSIPT results

5.2.3 Production-consumption balance

Figure 6 shows the future production-consumption balance for goat and sheep meat under BAU and WI scenarios. Like many other countries, the Gambia is projected to record an increase in demand for animal products such as sheep and goat meat due to factors such as rising income levels, population growth, and urbanization. The consumption of sheep and goat meat is projected to increase from 1,320 in 2022/23 to 4,683 tonnes in 2037/38, representing a 254.78% increase under a WI scenario. This demand increase in goat and sheep meat needs to be met by local production for self-sufficiency. The analysis shows that in the absence of any intervention (BAU scenario) under goats and sheep production, the country may not be able to meet the demand for meat from sheep and goats because production in 2037/38 under a BAU is only projected to be 2,150 tonnes, which is far below the projected demand, 4,683 tonnes in 2037/38. However, if the interventions proposed are adopted, the country may be able to meet the demand for sheep and goat's meat in 2037/38 with an projected 5,329 tonnes, which is an excess of 464 tonnes. Therefore, interventions in sheep and goat production appear to be necessary to meet the projected demand for shoat meat in 2037/38.

Figure 6: Projected production-consumption balance in sheep and goat meat under BAU and WI scenarios in metric tonnes



Source: LSIPT results and own calculation

6 Chicken value chain production improvement interventions, targets and impact

6.1 List of interventions and targets

6.1.1 Feed and feeding intervention

6.1.1.1 Backyard local chicken

- Establish small feed milling centres that process grains or oil seeds in rural areas to improve the availability of processed grains and cooking oil and the by-products (bran/oil seed cake) in the village. The target is to establish 20, 10 and 10 feed milling centres in the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS duration, respectively.
- Enact regulations and acts that limit the export of brans and oil seed cakes outside the country within two years.[11]
- Sensitize and train farmers on the utilization of bran and oil seed cakes for the backyard chicken. It is targeted that about 15%, 25% and 60% of the backyard chicken farmers will supplement their birds with brans and oil seed cakes in the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively.
- Advise farmers on the different possible ration formulas, which can constantly evolve with the dynamic nature of the locally available feed base. Backyard chicken ration formulas will be produced using locally available feed bases and farmers will be sensitized.

6.1.1.2 Commercial chicken

- Encourage contract farming with cereal farmers to produce feed ingredients for feed millers and processors.
- Encourage farmers to grow soybean for use as a chicken feed ingredient.
- Strengthen the Food Safety and Quality Authority (FSQA) to increase its capacity to regulate the quality of imported feeds and feed ingredients. The FSQA can closely work with locally available feed quality laboratories.

11. There is just one main crushing plant near Banjul at Denton Bridge producing groundnut oil and cake. The plant is owned by the government. For the parastatal to survive financially, it needs forex that it can only generate through exports. However, a quota is set for some of the cake to be sold locally to livestock farmers. The production capacity and quota needs regular improvement to match domestic demand and growth of the livestock sector.

- Establish new certified feed quality testing laboratories with a PPP approach. One feed quality testing laboratory will be established in each of the first (2023/24–2027/28), second (2028/29–2032/33), and third (2033/34–2037/38) five years of the LSS period.
- Prepare commercial chicken feed quality standards within two years.
- Encourage the importation of maize to decrease pressure on local maize production used for human consumption. Also, encourage the importation of other poultry feed ingredients such as soybean, minerals, vitamins, and pre-mixes. Additionally, promote and support irrigated maize and soybean production.
- The total commercial feed required for the commercial layer and broiler systems is expected to grow from about 5.1 thousand tonnes at the base year (2022/23) to about 20 thousand tonnes by the 5th year and 48 and 98 thousand tonnes by the 10th year and 15th year (Table 29).
- Establishment of silos for both imported and locally produced chicken feed raw materials and processed chicken feeds is important given that it is anticipated that the demand for feed will increase substantially for the next 15 years (from 5,000 to almost 100,000mts). To meet this demand, it will be necessary to increase the importation of bulk feeds (mostly maize and other grains) and store them in silos prior to formulation and packaging for the domestic market[12]. The building of two silos each with a capacity of 20, 000mts could be adequate for the needs of the country. First silo could be built in 2024/25 and the second in 2027/2028.
- Increase the capacity of the existing five commercial chicken feed processing plants in the coming three years and establish new 5–10 chicken feed processing plants with ranging capacities in each of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively.
- Train and empower farmer organizations to be aware of the indicators of feed quality.
- Additional research should be done on alternative feed ingredients available in the Gambia that can replace maize, soybean and other ingredients.

Table 29: Projected estimate of annual feed requirements for commercial chicken in the Gambia in the coming 15 years[13]

	Farming systems	Commercial chicken indicative annual feed requirement (in tonnes)			
		2022/23 (base year)	2027/28	2032/33	2037/38
Annual feed requirements	Layers	3,270	10,385	19,133	25,604
	Broilers	1,787	9,609	29,325	72,359
	Total	5,057	19,994	48,458	97,963

Source: LSIPT results and own calculation

6.1.2 Health interventions

Many of the health service improvement interventions listed under the cattle meat and milk improvement intervention sections also cater to other livestock species, including chicken. The following interventions are specific to the chicken sector.

12. To cut costs, importers can form syndicates and purchase whole shipments mainly from South America (Argentina and Brazil) or elsewhere. Experience in Senegal has shown this strategy to be feasible.

13. Annual feed requirement for a single layer and broiler bird is assumed to be 29 kg/year and 15 kg/year, respectively.

6.1.2.1 Backyard local chicken

- By 2022/23 the total number of backyard local chicken vaccinated against the priority diseases (Newcastle disease, NCD, and fowl pox) is about 86,500, i.e. about 8.6%. The target is to increase the number of vaccinated backyard chickens against Newcastle and fowl pox to 65%, 75% and 90% by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively.
- Currently, the practice of applying internal and external parasite treatments to chickens is very low. The target is to increase the percentage of farmers applying internal and external parasite treatments to reach 65%, 75% and 90% by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively.
- Facilitate easy access to medication for animals by the creation of veterinary outlets (pharmacies) and cold storage facilities for vaccines.
- Train farmers on biosecurity measures.

6.1.2.2 Commercial chicken

- Sensitize local and commercial chicken farmers to vaccinate all their birds against NCD, Gumboro disease, fowl pox and Marek's disease to mitigate the risk of cross-infection.
- Train farmers and traders on biosecurity measures.

6.1.3 Genetic improvement

6.1.3.1 Backyard local chicken

- Develop a local chicken breeding policy in the coming two years.
- Start a local chicken breed improvement program in the coming three years and start distribution of improved local cocks. In the first five years of the LSS period, the target is to start the pilot phase and distribute improved local cocks to farmers for pilot research work, while in the second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, the target is to increase the number of improved local cocks distributed to farmers to 5,000 and 20,000, respectively. In the Gambia, there are about 40,000 households that keep local chicken.
- The backyard local chicken population is expected to increase from the base year (2022/23) population of about 1.1 million to 1.4, 1.7 and 2.2 million by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively (Table 30).
- The annual population growth rate of the backyard local chicken population is projected to increase from the base year (2022/23) population growth rate of about 2.28% to about 4.5% in the coming 15 years (Table 31).

Table 30: Projected increase in the number of backyard chickens under the additional investment scenario

Scenarios	Backyard chicken number in different target years and scenarios			
	2022/23 (base year)	2027/28	2032/33	2037/38
Business as usual (BAU)	1,117,173	1,250,222	1,399,115	1,565,740
With additional investment (WI)	1,117,173	1,392,202	1,734,937	2,162,047

Source: LSIPT results

Table 31: Percentage increase in the number of backyard chickens under the additional investment scenario

Scenarios	Backyard chicken number growth rate in different target years and scenarios		
	First five years (2022/23–2027/28)	Second five years (2028/29–2032/33)	Third five years (2032/33–2037/38)
Business as usual (BAU)	2.28%	2.28%	2.28%
With additional investment (WI)	4.5%	4.5%	4.5%

Source: LSIPT results

6.1.3.2 Commercial chicken (layers and broilers)

- Establish one commercial chicken parent stock farm with subsidies from the government within three years.
- Increase the number of hatcheries. Currently, there is a demand for about 0.8 million day-old chicks (DOC) per year. The number of hatcheries needs to be increased to meet the expected DOC demand increase to about 4 million (about 3.8 million broiler and 0.2 million layer DOC) by the end of the first five years (2023/24–2027/28), 12.2 million (about 11.7 million broiler and 0.5 million layer DOC) by the end of the second five year (2028/29–2032/33) and 15.6 million (about 15 million broiler and 0.6 million layer DOC) by the end of the third (2033/34–2037/38) five years.
- Promote contracts between hatcheries and parent stock farmers.

Table 32: Projected indicative increase in the number of commercial farms and chicken per farm size under the additional investment scenario

Outcome	Farming systems	2022/23 (Bas year)	2027/28	2032/33	2037/38
Commercial chicken farm sizes (in birds)	Layer	1,000	2,000	2,000	2,000
	Broiler (per cycle)	500	1,000	1,250	2,000
Number of commercial chicken farms (in number)	Layer	113	179	330	441
	Broiler	238	641	1,564	1,248

Source: LSIPT results and own calculation

Table 33: Projected increase in the number of commercial chickens in the BAU and WI scenarios

Scenarios	Farming systems	Commercial chickens in different target years and scenarios			
		2022/23 (base year)	2027/28	2032/33	2037/38
Business as usual (BAU)	Layer	112,755	126,183	141,211	158,028
	Broiler	119,113	133,298	149,173	166,938
Total		231,868	259,481	290,384	324,966
With additional investment (WI)	Layer	112,755	358,087	659,751	882,896
	Broiler	119,113	640,616	1,955,005	2,495,136
Total		231,868	998,703	2,614,756	3,378,032

Source: LSIPT results

Table 34: Percentage increase in the number of commercial chickens in the BAU and WI scenarios

Scenarios	Farming systems	Commercial chickens in different target years and scenarios		
		First five years (2022/23–2027/28)	Second five years (2028/29–2032/33)	Third five years (2032/33–2037/38)
Business as usual (BAU)	Layer	2.28%	2.28%	2.28%
	Broiler	2.28%	2.28%	2.28%
With additional investment (WI)	Layer	26.00%	13.00%	6.00%
	Broiler	40.00%	25.00%	5.00%

Source: Own calculations

6.1.4 Extension and research interventions

The extension and research improvement interventions listed under the cattle meat and milk improvement section also support other livestock species, including chickens. Additional extension-related specific interventions are listed below.

6.1.4.1 Backyard local chicken

- Currently, very few farmers get backyard local chicken improvement training. The target is to increase the number of farmers that receive intensive and continuous chicken improvement training (training, exchange visits, farmer advisory services and practical demonstrations) to 50%, 75% and 90% by the end of the first (2023/24–2027/28), second (2028/29–2032/33) and third (2033/34–2037/38) five years of the LSS period, respectively.
- Develop training manuals in the coming two years and encourage farmers to engage in the commercial production of local chicken.

6.1.4.2 Commercial chicken

- Support private extension service providers by encouraging veterinary and livestock experts and subsidizing the establishment cost of veterinary pharmacies and input shops which can serve as veterinary and extension service provision posts.

6.1.5 Marketing and processing interventions

- Address the problem of unfair competition from imported eggs by developing the appropriate acts and regulations in the coming two years.
- Promote the establishment of cold storage and purchase of cold transportation facilities by subsidizing the private sector. Solar cold storage and transportation facilities are preferred due to the electricity situation in the country.
- Promote and support the formation of commercial chicken producer groups/ associations. Strengthen the existing commercial feed producer's association.
- Support contracts between groups of producers and buyers.
- Create platforms for chicken, egg, and chicken input producers and buyers to improve the chicken value chain.

6.2 Chicken production improvement interventions—impact of interventions

6.2.1 Projected population in 15 years

Table 35 shows the projected flock size nationally in the with and without (BAU) investment scenarios between 2022/23 and 2037/38. If the BAU scenario prevails, a growth in flock size of only 40% is expected during the projection years for backyard chickens, layers and broilers. However, in the WI scenario, the population of broilers is expected to rise by 1,995% (from 119,113 in 2022/23 to 2,495,136 birds in 2037/38). Likewise, for layers, the population is projected to grow by 683% (from 112,755 in 2022/23 to 882,896 birds in 2037/38) WI, while that for backyard chickens would rise by 94% (from 1,117,173 in 2022/23 to 2,162,047 birds in 2037/38).

Table 35: Comparison of current (2022/23) and projected (2037/38) chicken population under BAU and WI scenarios

Production sub-system	Chicken population (in number)				
	Base year 2022/23	BAU 2037/38	% change base year to BAU 2037/38	WI scenario 2037/38	% change base year to WI 2037/38
Backyard (female-owned)	1,117,173	1,565,740	40.2%	2,162,047	93.5%
Layers	112,755	158,028	40.2%	882,896	683%
Broilers	119,113	166,938	40.2%	2,495,136	1995%
Grand total population	319,975	448,451	40.2%	3,548,546	1009%

Source: LSIPT results

6.2.2 Projected production in 15 years

With additional investments, total chicken meat production is projected to rise considerably from 1,229 tonnes in 2022/23 to 17,068 tonnes in 2037/38. Most of the projected increase in chicken meat production in the WI scenario derives from expansion in the rearing of broilers and layers. This increase in the quantity of chicken meat produced that is postulated for the WI scenario contrasts sharply with the low level of increase of only 43% (to 1,761 tonnes) for the BAU scenario. Likewise, in the WI scenario, a 621% increase in the number of eggs produced is projected (from about 25 million to about 180 million) compared to only 71% for the BAU scenario. Layer production is projected to account for most of the increase in egg production in the WI scenario.

Table 36: Chicken meat and egg production in the base year and projected for 2037/38 under BAU and WI scenarios

Products	Production sub-system	Production				
		Base year 2022/23	BAU 2037/38	% change	WI scenario 2037/38	% change
Chicken meat (in tonnes)	Backyard (female-owned)	455	652	43.3%	1,662	265.3%
	Layers	61	87	43.3%	475	683.0%
	Broilers	713	1,022	43.3%	14,931	1994.8%
	Total	1,229	1,761	43.3%	17,068	1289.3%
Eggs (in thousands)	Backyard (female-owned)	2,643	3,789	43.3%	5,115	93.5%
	Layers	22,421	38,276	70.7%	175,563	683.0%
	Total	25,064	42,065	67.8%	180,678	620.9%
Manure (tons)	Total	2,106	3,229	53.3%	16,173	667.9%

Source: LSIPT results

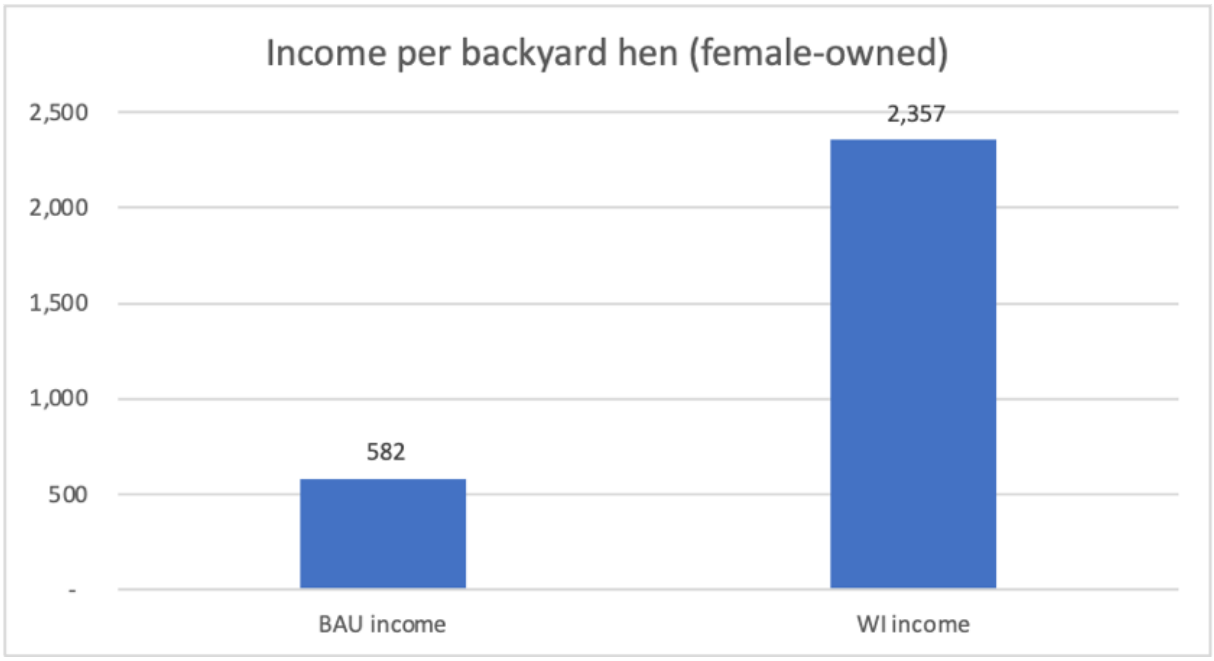
WI female farmers will be in a position to have financial gains, more intake of eggs and poultry meat leading to improved nutritional and health status of family members, particularly children, pregnant women and the elderly. Consequently, less time and resources will be spent on medication and more time will be available for women to take care of their household chores.

6.2.3 Projected income per animal in 15 years (2037/38)

With investments, the level of earnings per hen in the backyard system is projected to be GMD 2,357 compared to only GMD 582 for the BAU scenario (Figure 7). The predicted level of earnings per bird in the WI scenario is, therefore, more than 4 times higher than the anticipated level for the BAU scenario.

Annual income per bird (GMD) will increase from 582 from BAU to 2,357 with interventions. Increased/improved financial status of backyard female-owned flocks has the potential to boost income-generating capacity and improve social status.

Figure 7: Annual income per animal in GMD for BAU and WI scenarios in 15 years (by 2037/38)



Source: LSIPT results

6.2.4 GDP contribution for all chicken products

With investments, the contribution of chicken meat production to GDP is projected to increase by 1,067% (from GMD 61.26 million to 714.66 million) compared to only 43% (to GMD 87.8 million) for the BAU scenario (Table 37). The increase in contribution to the GDP under the WI scenario is proejcted to be highest in broiler production (1,994%) compared to backyard chicken (833%) and layers production (683%). Again, lots of numbers, not much discussion.

By the same token, with investments, a 583% increase in the contribution of eggs production to GDP is projected from GMD 21.45 million to 375.9 million compared to a projected rise of only 43% (to GMD 30.75 million) for the BAU scenario. Layer production is projected to experience the highest level of increase in the contribution of egg production to GDP (639%) for the WI scenario. Overall WI, the contribution of the chicken sector (chicken meat, eggs, and manure production) to the GDP is projected to increase by 879% (from GMD 85.18 million to 878.7 million) compared to only about 44% (to GMD 122.3 million) for the BAU scenario.

Table 37: Chicken production GDP contribution for the base year and projected for 2037/38 under BAU and WI scenarios (10^6 GMD)

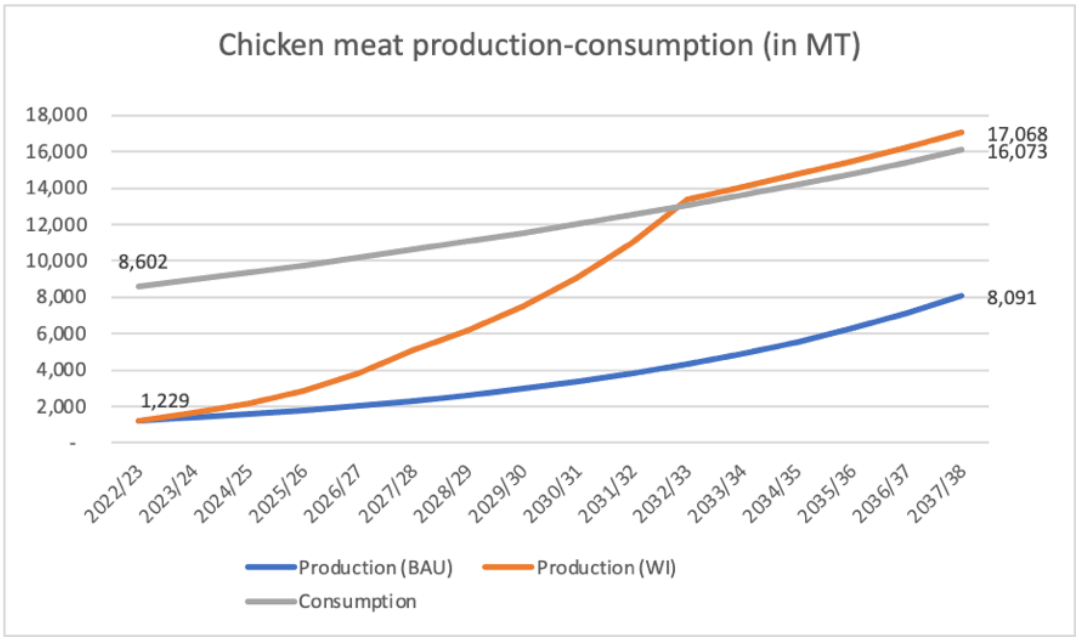
Products	Production sub-system	Chicken GDP contribution (in million GMD)				
		Base year 2022/23	BAU 2037/38	% change	WI scenario 2037/38	% change
Chicken meat	Backyard (female-owned)	40.78	58.45	43.3%	380.46	833.1%
	Layers	7.23	10.36	43.3%	56.60	683.0%
	Broilers	13.25	19.00	43.3%	277.60	1994.8%
	Total	61.26	87.80	43.3%	714.66	1066.7%
Eggs	Backyard (female-owned)	10.43	14.95	43.3%	21.32	104.4%
	Layers	11.02	15.79	43.3%	80.76	632.9%
	Total	21.45	30.75	43.3%	102.07	375.9%
Manure	Total	2.47	3.75	51.8%	16.88	583.1%
Grand Total		85.18	122.30	43.6%	833.61	878.7%

Source: LSIPT results

6.2.5 Production-consumption balance

The prevailing gap (7,373 tonne/year) between aggregate demand (8,602 tonne/year) and supply (1,229 tonne/year) for chicken meat is projected to persist and widen to 7,982 tonne/year (demand=16,073 and supply=8,091 tonne/year) under the BAU scenario (Figures 8a and 8b).

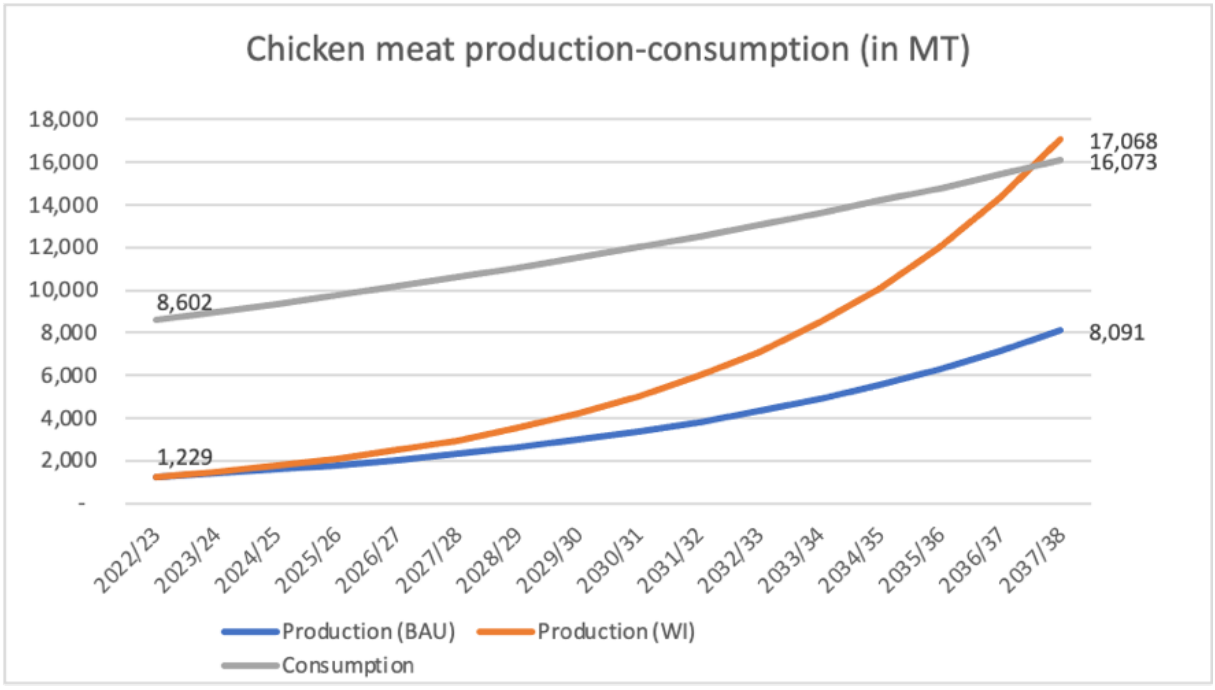
Figure 8a: Projected production-consumption balance for chicken meat in metric tonnes under BAU and WI scenarios with increasing chicken growth rate



Source: LSIPT results and own calculations

However, in the WI scenario, the shortage gap is expected, depending on the timing of the level of investments, to become narrower and be fully bridged by 2032/33 if the growth rate of chickens is not constant and the population of chickens changes at an increasing rate (Figure 8a), and by 2037/38, if the growth rate of chickens is remained constant throughout the 15 years (Figure 8b).

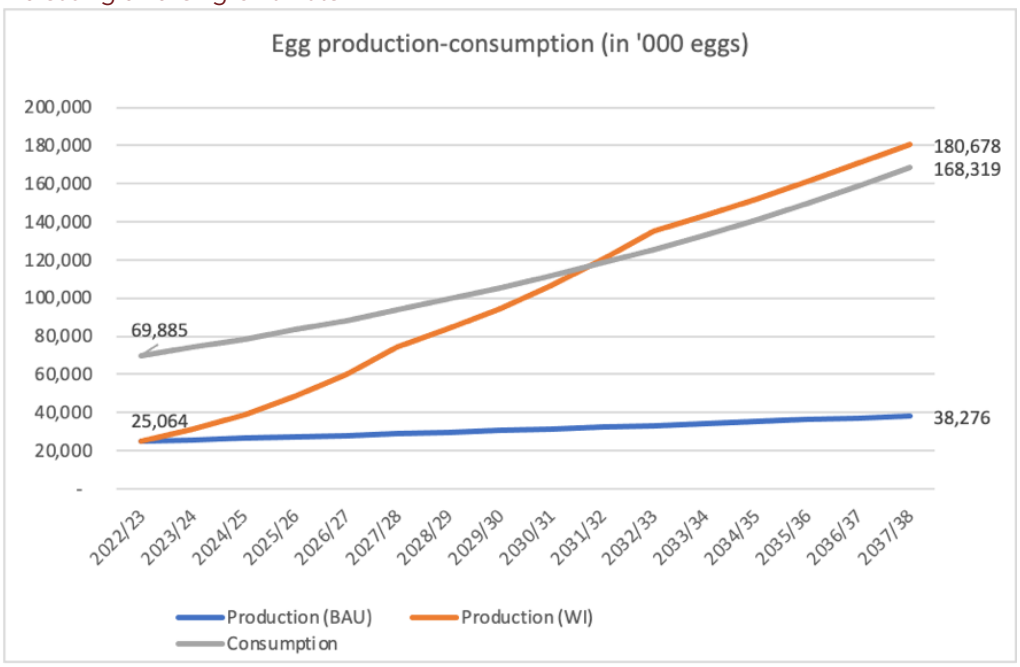
Figure 8b: Projected production-consumption balance for chicken meat in metric tonnes under BAU and WI scenarios with constant chicken growth rate



Source: LSIPT results and own calculations

Likewise, for eggs, a shortage gap between national demand (69.9 million eggs/year) and supply (25.1 million eggs/year) of 44.8 million eggs per year in 2022/23 is projected to grow to 130 million eggs in 2037/38 under the BAU scenario (Figures 9a and 9b).

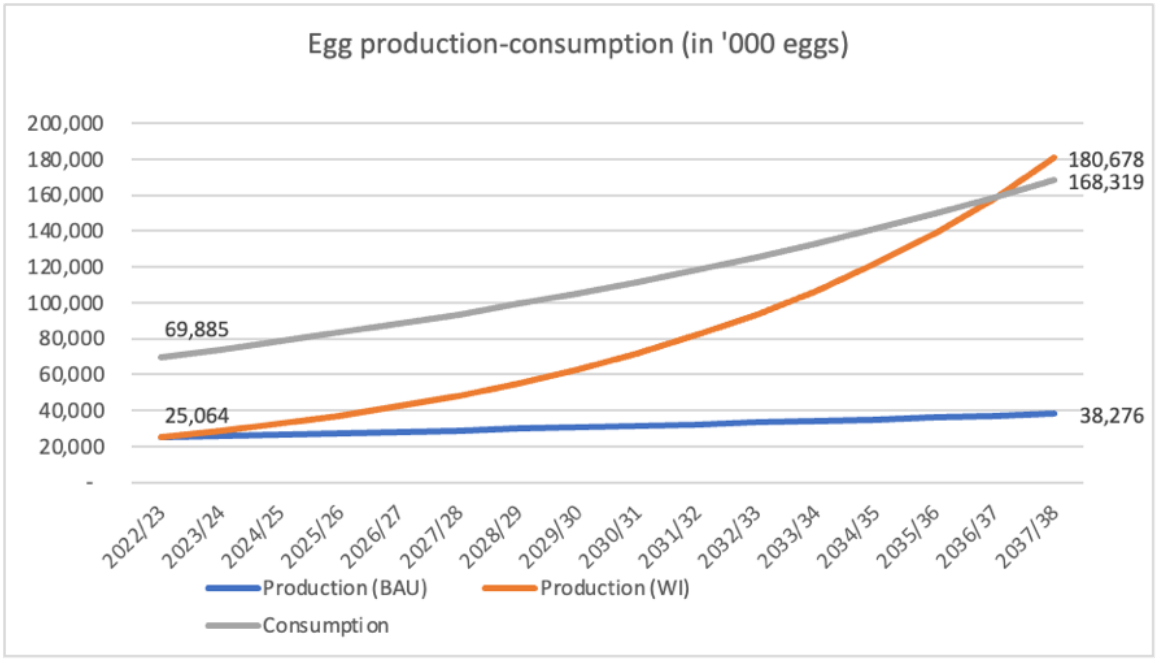
Figure 9a: Projected production-consumption balance for eggs in thousand eggs under BAU and WI scenarios with increasing chicken growth rate



(Source: LSIPT results and own calculations)

In comparison to WI, the gap is projected to narrow and completely disappear between 2031/32 (with increasing chicken growth rate) and 2036/37 (with constant chicken growth rate), subject to the timing of the level of investments.

Figure 9b: Projected production-consumption balance for eggs in thousand eggs under BAU and WI scenarios with constant chicken growth rate



Source: LSIPT results and own calculations

7 Conclusion

The livestock sector is very significant to the socioeconomic development of Gambia, serving as a source of employment for many, particularly in rural areas, and contributing significantly to the GDP of the Gambia. A significant number of farmers depend on the sector as a source of livelihood, contributing to the incomes of farmers and food and nutrition security. It also holds a lot of potential to meet the country's development objectives, such as poverty reduction, gender equality and women's empowerment. Despite the importance to the Gambian economy, the sector faces challenges that limit the achievement of sufficient growth in domestic production to meet the rising future demand for animal-sourced foods. Inadequate funding both from the private and public sector makes it difficult for local producers to tap the many opportunities in the sector as demand for livestock products increases.

This livestock sector strategy (LSS) is a quantitative analysis of the technical performance of the livestock sector in the Gambia and the potential economic contributions of the BAU and WI alternative intervention options to households, value chains, the livestock subsector, the agricultural sector, and the national economy, presents a plan to guide investments in the livestock sector through foresight analysis. It presents interventions in the areas of genetics, animal feed, animal health and extension service delivery, marketing and processing, and livestock research improvements. The adoption of this strategy will help in the modernization of the country's livestock sector and guide the achievement of state development goals as contained in the country's development priorities. In addition to these, the strategy provides measurable evidence that justifies the investments required to meet future potential demand for livestock products in the Gambia.

7.1 Livestock production systems

Livestock in the Gambia is kept under three main production zones: the Western, Middle, and Eastern regions. The cattle sector, which is predominately smallholder based, is raised under extensive, semi-intensive, and intensive systems. The extensive system is mainly characterized by the raising of traditional N'Dama breeds under a transhumance approach; the semi-intensive is characterized by supplementary feeding of selected animals, and the intensive system is characterized using improved breeds and improved technologies like artificial insemination techniques.

Unlike cattle, small ruminants (sheep and goats) are kept mainly under the extensive system and are smallholder based. Most farmers keep sheep and goats under the traditional mixed farming system where local breeds move in flocks and graze on grasses in the locality, whilst just a handful of farmers practice a market-oriented system (mainly for sheep). Only a few practices supplementary feeding, which is particularly for lactating ewes and fattened stock.

Poultry production in the Gambia is practised under communal/backyard production, small-to-medium-scale, and commercial farm production. Poultry in the backyard system, mainly small flock sizes of 10–15 birds, rely on scavenging for feeding, and marketing is predominantly for urgent cash needs. The small-to-medium-scale system, with flock sizes between 50–500 birds, is dominant in urban and peri-urban areas, whilst commercial poultry production serves high-end markets such as restaurants and hotels.

7.2 Cattle value chain improvement strategies

Improvements in cattle production and the incomes of small and marginal farmers can be achieved through substantial investments in feed and fodders, breeding, animal health, and marketing. One major intervention identified to improve feed and fodder is the development and broadening of available feed and fodder resources inventory in all production zones. The development and implementation of a long-term planning and strategic breeding program and enhanced private participation in the delivery of veterinary healthcare will help improve cattle breeding and animal health. The marketing of milk and meat needs to be promoted by encouraging private-sector investment.

7.3 Small ruminant value chain improvement strategies

Small ruminant production can be improved by broadening and updating the inventory of feed and fodder resources to cover all production zones. Since PPR is a major constraint to small ruminant production, the provision of adequate resources for the implementation of the National Strategy for the Control and Eradication of PPR in the Gambia will help improve animal health. The marketing of small ruminants can be improved through the promotion and development of improved market infrastructure, as well as supporting the engagement of women. Extension service delivery and research need to be strengthened to improve the value chain.

7.4 Chicken value chain improvement strategies

Since the major challenges facing the poultry value chain are disease threats and adequate feeding, the poultry value chain can be improved by creating the necessary awareness in the adoption of improved management practices, proper feed formulation and utilization, promoting supplementation in feeds and supplement scavenging chickens, promoting vaccination campaigns against NCD and other endemic poultry diseases and improvements in the storage, processing and marketing of poultry and poultry products. Proper training on poultry vaccination and deworming for wider and better coverage amongst female farmers and youths need to be implemented.

7.5 Post-production improvement strategies

Several interventions are also proposed after implementing productivity improvement strategies across the value chains to ensure that livestock farmers derive the maximum benefits from the interventions. Improvement in market infrastructure and collection, storage, processing, and transportation of milk in the Western Region and encouraging the formation of milk collection centres by women engaged in the trade in the Central and Eastern regions needs to be implemented. Encouraging private sector involvement in the marketing of milk and milk products is also necessary to enhance the sales and marketing of milk in the Gambia. Value addition needs to be promoted to increase the competitiveness of red meat products, and broadening market information systems is crucial to developing the red meat value chains. Since poultry production is a predominant activity of women, they need to be encouraged to improve management practices (biosecurity measures, disease control, housing, and supplementary feeding through technical training).

7.6 Mainstreaming and improving gender and social inclusion

The development of the livestock sector in the Gambia cannot be improved without mainstreaming gender in all the livestock value chains. Women contribute immensely to livestock production, yet many social and cultural

barriers limit them from tapping opportunities presented by the livestock sector. Challenges such as limited access to veterinary and breeding services, inadequate market information and market access, lack of access to financial resources, and cultural barriers impede their involvement in the value chain. There is an urgent need to ensure that gender is mainstreamed through the adoption of interventions that will ensure their participation is enhanced and their skill developed. Women's access to animal health and veterinary services needs to be improved, and sensitization carried out to ensure they have the right knowledge, information and skills related to livestock production, nutrition, biosecurity, and zoonosis. Building the capacity of women and youths will strengthen women's participation in livestock marketing.

7.7 Impact of livestock interventions

7.7.1 Impact of no intervention (BAU scenario)

Analysis carried out in the BAU scenario, which is an absence of major interventions in the livestock sector, over 15 years, the per capita consumption of dairy and milk is projected to increase by 33% and 3%, respectively, compared to 40% for poultry. It is projected that this rise in consumption will be met by an increase in local production. However, in the BAU scenario, the projected increase in consumption will be higher than the projected increase in local production. While dairy consumption is projected to increase by 78% (from 44 to 79 thousand tonnes between 2022 and 2017), production is projected to increase by just 5% (from 22 to 23 thousand tonnes) during the same period. Beef production in 2037 will be 57% of consumption, while poultry production will be 5% of consumption. Egg production under a BAU is projected to meet just 8% of the national poultry demand. The BAU scenario means that the domestic production share to total consumption will fall for all livestock commodities.

7.7.2 Impact of intervention (with-intervention scenario)

7.7.2.1 Cattle

The impact of interventions in the cattle value chain is projected to increase the population of the national cattle herd for all cattle breeds under the three production zones. The population of the indigenous N'Dama breed and crossbreeds (Zebu/Gobra) will increase equally by 34.6% compared to the indigenous N'Dama breed's 2.7% and crossbreeds 2.6% under the BAU scenario. Most of the population of cattle herds will be in the Eastern production zone.

Total beef production under a WI scenario is projected to increase by 105.4% compared to 2.8% under a BAU scenario, with most production coming from the indigenous N'Dama breeds and the Eastern Production Zone. The production of beef from the indigenous N'Dama breed is projected to increase more (95.5%) than for crossbreeds (Zebu/Gobra) (57%) under a WI scenario with investments in productivity improvements and management practices. Milk production will increase by 336.2% under a WI scenario compared to 3.1% in the BAU scenario.

7.7.2.2 Small ruminants

Like the cattle value chain, implementing the proposed interventions in small ruminant production is projected to result in an increased animal population and the production of meat, milk, and hides. Small ruminants, which serve as one of the main value chains for employment and income generation for most smallholder farmers in the Gambia, are projected to benefit when investments are targeted at improved feeding and management practices, animal health, breeding, extension services, research and development, among others. These are projected to enhance the productivity of the herd, which will subsequently result in increased production of products from small ruminants and the incomes of farmers.

In all three production zones, the goat population is projected to increase under the BAU and WI scenarios but by a larger amount for the WI scenario. The goat population is projected to increase by 107.9% under a WI scenario compared to 34.2% under a BAU scenario. It is projected to increase by the same margin under both the BAU and WI scenarios for small and female-owned systems under each production. The Eastern production zone is projected to have more animals than the other two zones, like the situation under the cattle value chain.

Sheep population is projected to increase 107.9% (from 191,540 in 2022 to 244,934 in 2037) under WI scenarios compared to 27.9% for a BAU scenario. Though the Djallonke, female-owned, and Sahelian systems will record similar increases in 2037 under WI scenarios (107.9%), under a BAU scenario, the increase in the population of sheep will be highest for Djallonke and the female-owned systems than Sahelian systems for the three production zones. This situation will likely result in an improved livelihood for women and youth who are major keepers of small ruminants.

In terms of the production of meat and milk from small ruminants, increased investments in the small ruminant value chain are projected to lead to a substantial increase in the production of meat from sheep and goats. While goat meat production is projected to increase by 218% (from 1,125 tonnes in 2022 to 3,581 tonnes in 2037) under a WI scenario, milk and manure from goats will increase by 100%, respectively. On the other hand, sheep meat will increase by 247% from 504 to 1,748 tonnes under a WI scenario compared to 26.9% under a BAU scenario. The projected manure increase under a WI scenario is 110% compared to 26.8% under a BAU scenario.

7.7.2.3 Poultry

The analysis indicates that increased investment in the poultry value chain, particularly in improving animal health and feeding, could benefit women and other vulnerable groups who mostly engage in traditional backyard chicken production.

The LSS results project that the national population of chickens in the Gambia will increase by 1009% between 2022 and 2037 with increased investments in the chicken value chain compared to a BAU scenario of only 40.2%. Though backyard chicken production is predominant compared to layers and broilers, the estimated increase in broiler production by 1995% under a WI scenario is projected to overtake the backyard chicken population. The layer population is projected to increase by 683% under a WI scenario in 2037. Broiler meat is projected to dominate the total meat production in the Gambia with a projected 1994.8% increase in 2037 compared to 265% and 683% for backyard chicken and layers in a WI scenario. On the other hand, national egg production will increase by 620% under a WI scenario compared to 67.8% under a BAU. This increase in broiler production, therefore, calls for more attention to the production of day-old chicks to meet the national demand and poultry breeds that can withstand disease threats. It also means that there is a need to put in more resources that will improve the feeding practices adopted by farmers and strengthen poultry associations to foster greater markets for poultry inputs and products.

7.8 Profitability impacts and GSDP

7.8.1 Income per animal

The projected income per animal in 15 years in the dairy sector indicates significantly more income per animal under the WI scenario than the BAU scenario for all two types of animals. Cattle farmers in the Western Region are projected to have significantly higher income per animal (GMD 13,179 and GMD 12,497 for Zebu and N'Dama cattle breeds, respectively, under a WI scenario compared to GMD 11,787 and GMD 7,574, respectively under a BAU scenario. The income per animal is projected to be lower across the Central and Eastern production zones because of the higher cost of the interventions and the difficulties in accessing livestock infrastructure, veterinary healthcare, feed and nutrition stress, and higher disease incidence.

Goat production in the Western production zone is projected to have the highest income per animal for both female-owned and small farms, followed by the Eastern production zone and the least by the Central production zone. Under a WI scenario, income per animal in the Western zone will be GMD 937.14 for both small and female-owned farms compared to GMD 821.63 under BAU for the same farm types. In the case of sheep, the income per animal is projected to be highest for female-owned (GMD 1,387.53) and Djallonke (1,295.33) systems under a WI scenario in the Central zone compared to the Western zone's GMD 1,261.51 for both female-owned and Djallonke systems under the same investment scenario. Similarly, when investments are made to implement the proposed interventions, earnings per hen in the backyard system are projected to be GMD 2,357, which is four times the earnings on a hen under a BAU scenario (GMD 582).

7.8.2 GDP contribution

The GDP contribution of all cattle products is projected to grow from a % change of 3.8% under BAU to 66.1 % with the WI scenario. Most of the projected gain in GDP contribution is due to the increase in milk production (486.3%) from N'Dama cattle in the WI scenario compared to 75.5% for beef. Goat meat is projected to increase by 164% compared to sheep meat by 192%. The monetary contribution is projected to be higher for goats (GMD 697 million) than sheep (GMD 480 million) with the same investment compared to GMD 362 million and GMD 215 million under a BAU scenario.

With much attention paid to the chicken value chain investment, chicken contribution to GDP is projected to increase from GMD 85.18 million in 2022 to GMD 833.61 million in 2037, representing an 878.7% increment. Chicken meat production is projected to contribute more to GDP with an increase of 1,067% (from GMD 61.26 million to 714.66 million) when the proposed interventions in the chicken value chain are implemented compared to only 43% (GMD 61.26 million to GMD 87.8 million) for the BAU scenario. Although broilers are projected to increase more as a percentage, the monetary contribution of meat from the backyard is projected to be about 1.4 times more than broilers under a WI scenario and more than three times under a BAU scenario. On the other hand, egg contribution will increase by 375.9% under WI, with the most significant increase in layers (632.9%) compared to backyard (104.4%).

7.8.3 Investment impacts on future production and potential consumption

A major priority of most governments is to meet the domestic demand for animal-source foods through increased production. As population, urbanization, and incomes increase, there will most likely be a corresponding change in the preference for consumer products, resulting in an increase in the consumption of high-source animal products. Meeting this increased demand requires substantial investment in every aspect of the livestock sector, from production to marketing. Lack of investment in the livestock value chain will result in supply gaps, which could be filled with imports. This suggests the need for a conscientious effort from value chain actors to implement the necessary interventions.

Though beef consumption presently is more than production, analysis suggests that with increased investment in the cattle value chain, the production of beef (8,367 tonnes) will surpass the demand (7,323 tonnes), enabling the country to meet its beef needs compared to a more constant production of 4,186 tonnes under BAU in 2037. A similar situation will be recorded for milk, where production in 2037 (91,413 tonnes) will outweigh demand (79,222 tonnes). The country also may be able to meet the projected goat and sheep meat deficit in 2037 with additional investments made in the sector, with production in 2037 (5,329 tonnes) surpassing the future demand of 4,683 tonnes compared to 2,150 under a BAU scenario. Finally, investments in the chicken value chain are projected to narrow the gap between demand for chicken meat and production. With the current demand at 8,602 tonnes/year and supply at 1,229 tonnes/year, increasing demand in 2037 of 16,073 tonnes will be met with production of 17,068 tonnes with increased investments. A similar situation will be recorded for egg production.

It can be concluded, based on the analysis from the LSS, that the projected gaps between the demand for the various animal-sourced foods (meat and eggs) can be narrowed and perhaps made positive if the public and private sector invest appropriately in value chains to realize the goals in the livestock sector and improve the livelihood of farmers.

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9 Appendixes

Table 38: Feed balance on DM, protein and energy bases

	DM (t) RS	CDS	HDS	Protein t PDI RS	CDS	HDS	Energy Mcal RS	CDS	HDS
Total biomass available, usable and accessible	766,909	664,671	158,882	4,266	61,498	1,130	740,187	527,406	51,009
Total animal requirements	241,585	232,189	180,634	108,762	112,924	95,418	555,822	559,655	492,347
Balance	525,324	432,482	-21,752	-104,496	-51,426	-94,288	184,365	-32,249	-441,338
% of feed requirements covered	317%	286%	88%	4%	54%	1%	133%	94%	10%

Source: DLS&FAO, 2022

Lists of participants for LSS workshops

Table 39: List of cattle workshop participants: 25–26 May 2022 and 1 June 2022

Participants/experts	Expertise
Dr Sulayman Sonko	Livestock production and health
Mr Joseph Faye	Cattle breeder
Dr Pa Ousman Ceesay	Livestock production and health
Mr Jerreh Ceesay	Dairy farmer
Dr Duto Sainey Fofana	Livestock production and health
Mr Ebou Jobe	Livestock production
Dr Sirak Bahta	Project leader, ILRI
Dr Badara Loum	Lead national consultant, ILRI
Ms Fatou Ndeye Gaye	Gender expert/consultant, ILRI
Mr Kidus Nigussie	Animal science and LSIPT expert/consultant, ILRI
Mr Francis Wanyoike	Agricultural economist, ILRI
SRPEP staff	Project experts

Table 40: List of small ruminant workshop participants: 27–28 May 2022

Participants/experts	Expertise
Dr Famara Sanyang	Livestock production and health
Ms Isatou Savage	Livestock production
Mr Ebrima Jallow	Sheep breeder/farmer
Dr Sulayman Sonko	Livestock production and health
Mr Nerry Corr	Small ruminant production and health
Dr Duto Sainey Fofana	Livestock production and health
Dr Badara Loum	Lead national consultant, ILRI
Ms Fatou Ndeye Gaye	Gender expert/consultant, ILRI
Mr Kidus Nigussie	Animal science and LSIPT expert/consultant, ILRI
Mr Francis Wanyoike	Agricultural economist, ILRI
SRPEP staff	Project experts

Table 41: List of poultry workshop participants: 30–31 May 2022

Participants/Experts:	Expertise
Mr Basirou Jatta	Poultry expert
Mr Ousman Sanyang	Poultry expert
Mr Momodou Mass Jobe	Poultry expert/farmer
Mrs Tida Ceesay Bojang	Poultry farmer
Dr Badara Loum	Lead national consultant, ILRI
Ms Fatou Gaye	Gender expert/consultant, ILRI
Mr Kidus Nigussie	Animal science and LSIPT expert/consultant, ILRI
Mr Francis Wanyoike	Agricultural economist, ILRI
SRPEP[14] staff	Project experts

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