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MINISTRY OF AGRICULTURE

Ethiopian Livestock and Fisheries Investment Handbook





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Ethiopian Livestock and Fisheries Investment Handbook

Kedir Lubango¹, Dejene Takele¹, Temesgen Jembere², Addis Sime³, Mohamud Mekonnen¹, Fekadu Getachew¹, Berhanu Tassew⁴, Aschalew Lakew⁵, Adefris Kasaye¹, Desalegn Begna⁶, Yeshitilla Eshete⁷, Alemu Wolde¹, Fekadu Tilahun¹, Yonatan Zewedu¹, Welela Seyum¹, Neway Lachebo¹, Muluken Teferi¹, Gifawosen Tessema¹ and Getachew Legese⁸

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Foreword

Ethiopia boasts diverse agro-ecological settings suitable for production of a wide range of livestock and fish species. Dairy, beef, poultry, sheep, goat, camel, equine, swine, apiculture, fishery and silviculture production are practiced in the different agro-ecologies of the country. There is also an ever-growing demand for these products because of a very fast-growing population of the country and increasing demand for animal source foods both in Ethiopia and the world. However, despite the existence of huge production potential and demand for livestock products, Ethiopia is not adequately benefiting from its livestock and fishery resources.

Taking the potential in its livestock and fishery industry into account, the Ethiopian government has set clear milestones targeting transformation of the sector in its 10-year perspective plan and is implementing different initiatives including *Yelemat Tirufat* targeting transformation of dairy, poultry, fishery and apiculture. These interventions have resulted in significant achievements, but, sustaining these gains and accelerating progress requires well-structured private and public investment in the sector.

The purpose of this handbook is to provide evidence on feasible investment opportunities in the Ethiopian livestock and fisheries industry. The Handbook embraces the viable business venture of livestock and fishery sectors along their value chain for private sector engagement and enabling environment to encourage increased investments for transforming the livestock sector by energizing its under-utilized potential. The handbook presents investment options and the existing incentive packages for realizing the potential of the sector as a major contributor to socio-economic development. The document is prepared in an innovative way, combining the skills and experiences of scientists, extension personnel, and agribusiness development specialists.

On behalf of the Ministry of Agriculture, we would like to thank all the institutions and capable individuals who have been involved in the preparation of this handbook. The funding for development of the handbook was provided by Livestock and Fishery Development Sector Project (LFSDP), Food System Resilience Program (FSRP), and De-Risking, Inclusion and Value Enhancement of Pastoral Economies in the Horn of Africa Project (DRIVE).

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Eshete from Global Alliance for Improved Nutrition (GAIN) for their invaluable contributions in developing this handbook. We also extend our special thanks to Dr. Fekede Feyissa of EIAR; Dr. Gebregziabher Gebreyohannes, Dr. Kebede Amenu, Dr. Rahel Abiy, Dr. Melkamu Derseh, Dr. Million Getnet and Dr. Selam Meseret from ILRI for their critical reviews, which have contributed immensely to the quality of this document.

Finally, we call upon able private sector actors to engage in the investment options identified in the handbook, and all actors to be transparently focused, accountable and innovative in providing the support service to implement the activities outlined in this document. We urge government staff from central to local government, private sector and other stakeholders to fully commit themselves to fostering investment in the Ethiopian livestock and fisheries sector.



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Section I: Introduction

1.1 Background Information

Livestock is the major source of animal protein, power for crop cultivation, transportation, export commodities, manure for farmland and household energy, security during crop failures, and a means of wealth accumulation (Management Entity, 2021). For instance, small-scale farmers, who contribute about 90% of the total agricultural output, cultivate approximately 95% of the agricultural land using animal power.

The livestock and fisheries sectors are crucial for meeting Ethiopia's demand for livestock products. Despite their high investment potential, these sectors remain underutilized in the country. These sectors have the potential to boost the economy, create jobs, enhance food and nutrition security, and increase export earnings. According to CSA (2021), Ethiopia has the largest livestock population in Africa, with 70.2 million cattle, 42.9 million sheep, 52.5 million goats, and 8.1 million camels. However, in terms of productivity, these resources have not reached their full potential. Milk and its products, meat, and egg are expected to improve in Ethiopia through the adoption of available livestock technologies which requires contributions from all stakeholders, including the private sector.

In its 10 years Agricultural Transformation Plan, Ethiopia has set clear milestones for transforming its livestock and fisheries sector. The plan aims to increase milk production to 28.4 billion liters, meat production to 1.7 million tons, egg production to 5.5 billion units, chicken meat production to 106 thousand tons, honey production to 152,000 tons, and fish production to 260,000 tones over its 10 years implementation period. The private sector is expected to play a significant role in achieving these targets.

Considering the potential Ethiopia's livestock and fish resources, investment options have been identified to encourage the engagement of local and foreign investors in the sector. To achieve this, the government has made efforts to improve infrastructure to attract investors who can boost the country's economy by promoting investment in the livestock and fisheries sub-sector. The government has also reformed investment incentives to attract private sector investment to the livestock and fisheries industry.

Therefore, this investment Handbook is prepared to serve as reference for potential livestock and fishery investment options and to indicate related standards and criteria within existing enabling environments.

1.2 Objectives of the Handbook

1. To unveil a spectrum of investment options related to livestock and fisheries development under Ethiopian conditions.
2. To provide highlights of innovative investment approaches.
3. To define viable investment options to be promoted for private sector engagement, government organizations, and enhance readiness of stakeholders for required support services.

4. To synthesize the precondition and enabling environment to start and expand livestock and fishery investments.
5. To outline the required quality standards of products from livestock and fishery investments.
6. To map the institutional arrangements to support livestock, fisheries, animal feed production, and product processing investments in Ethiopia.

1.3 Importance of the Handbook

To achieve the development goals of livestock and fisheries sub-sector outlined in the 10-year Agricultural Perspective Plan, various efforts are being made to enhance their contribution to national economic growth. This Handbook focuses on livestock and fisheries by addressing several key issues to enhance investment in the sector:

- Identifying and promoting viable livestock and fishery investment options across different agro-ecological zones for both domestic and international investors.
- Attracting foreign investment by expanding opportunities within the sub-sector, both in scale and scope, to contribute to economic growth and facilitate the transfer of knowledge, skills, and technology.
- Enhancing the competitiveness of local investors by fostering partnerships with international counterparts and leveraging foreign capital.

1.4 SWOT Analysis of Livestock and Fisheries Investment

This section identifies internal strengths and weaknesses, as well as external opportunities and threats for livestock and fisheries investment in Ethiopia. By understanding these factors, investors can leverage existing strengths, address weaknesses, and capitalize on opportunities. Additionally, they can prepare for external threats that could hinder the success of their investments.

Strengths (S):

- **Diverse livestock and fisheries resources:** Ethiopia boasts an extensive inventory of diverse livestock and fish species, including cattle, sheep, goats, camels, and various fish species. This diversity provides a robust foundation for both domestic and international investments aimed at sustainable production and value addition.
- **Natural resources:** Abundant water bodies, fertile land to grow a variety of forage crops, suitable climatic conditions, and diverse agro-ecologies support the production of various livestock and fish species.
- **Growing demand:** Rising population, income, and urbanization drive high demand for animal source foods in Ethiopia and beyond.
- **Feed inputs available:** There are prospects for growing agro-industries, with increasing availability of raw materials for concentrate feed production. However, animal feed availability in Ethiopia is seasonal, with sufficient quantities available during certain parts of the year and shortages during others. This indicates that one can harvest and store livestock feeds when it is available in sufficient quantity to be used when shortages occur.
- **Diverse vegetation/flora for honeybee development:** The diverse agro-ecological environments and the availability of varied honeybee flora offer significant potential to increase honey production and productivity through targeted investments.

- **Suitable water body for fishery development:** Successful fishery farming is dependent upon use of a good site that has controlled access to suitable water resources. Ethiopia has numerous water bodies with large surface areas, offering significant potential for annual fish production. Capture fisheries could also be geared to investment.
- **Availability of vaccines:** Different types of livestock vaccines are locally produced for major livestock diseases by National Veterinary Institute here in Ethiopia.
- **Trained workforces:** Adequate number of trained workforce in animal science and health in Ethiopia
- **Government support:** Government initiatives like the Livestock and Fisheries Sector Development Project, *Yelemat Tirufat*, Food Systems Resilience Program, etc. will help to enhance productivity and commercialization. These initiatives and projects are indications for government commitment to transform the livestock sector in Ethiopia.

Weaknesses (W):

- **Infrastructure challenges:** Limited infrastructures (roads, cold storage, processing facilities) may limit efficient supply chain management.
- **Smallholder dominance:** The sector is dominated by smallholder farmers. These producers lack access to modern technologies and face challenges in scaling up.
- **Weak implementation of policies:** Despite attractive incentives for agricultural investment, including livestock and fisheries sectors, the implementation of these policies on the ground remains weak.
- **Less focus for production:** It seems that the focus is on the higher ends of the value chain, with little attention to the production end from most of the private sector investments in the livestock sector. Most investors are working on the higher ends of the value chain such as processing and marketing. The production aspect is left for small-scale producers. This attitude must transform.
- **Shortage of livestock technology multiplication centers:** Despite very huge demand for livestock technologies such as improved heifers, day old chicks, and similar technologies, centers dedicated to respond for these demands are missing. Privatization of state-owned centers in the last three decades has severely affected the livestock sector.
- **Quality control:** Ensuring consistent quality standards remains a challenge in the sector. The weakness in this aspect is associated with the regulatory bodies and in milk and milk products marketing.
- **Reliance on livestock for farm power:** As indicated above, the livestock industry is dominated by smallholder farmers who rely on animals for crop farm traction, threshing, and transportation. As a result, the primary objective of cattle production among smallholder farmers is draft power which limited the contribution of cattle to meat and milk production.
- **Poor entrepreneurship skills among livestock producers:** Equipping the producers with skills in analysing the strong and weak points of their enterprises as well as the threats and opportunities in the business is crucial. Livestock producers lack the attitude, aptitude, and ability to discover and exploit available opportunities to establish a new agribusiness venture in a particular environment.

Opportunities (O):

- **Incentive packages:** Conducive investment policies with competitive incentive packages such as access to land, tax holidays, duty free import permits, access to finance.

Implantations of home-grown economic reform policy to liberalize the economy with stable macroeconomic environment may support livestock investment.

- **Massive investment in basic infrastructure:** Ethiopia has made significant progress in infrastructure development, with indicators that compare favourably to those of other low-income countries. The country developed Ethiopia Airlines and associated regional air transport hubs. It launched an ambitious investment program to upgrade its network of trunk roads and is establishing a modern funding mechanism for road maintenance. Access to water and sanitation is expanding rapidly.
- **Potential to generate and adopt improved livestock technologies:** Research institutes, universities, and colleges have made significant progress. They are focused on generating, improving, and adapting technologies to meet the country's livestock needs. These institutions also coordinate, encourage, and support research activities to address current and long-term requirements.
- **Capacity building:** The human capacity building of Federal and Regional governments to coordinate and implement livestock development is in good progress. This may create a good opportunity for any investor to acquire the required workforce.
- **Access to international market and export potential:** Ethiopia can tap into international markets for meat, dairy, and fish products. There is also an initiation by the government to identify potential export markets in addition to the traditional destinations for Ethiopian livestock products.
- **Value addition:** Value addition was not common with most livestock products in Ethiopia. Investment in processing, packaging, and value-added products can boost investors' profitability.
- **Access to international market:** The country is at strategic location to access the export markets in the neighbouring and middle East Countries
- **Expansion of agro-processing industries:** The growing demand of agro-processing industries, including industrial parks, for livestock product inputs is another opportunity for investment in the livestock sector.

Threats (T):

- **Disease outbreaks:** Disease outbreak could lead to bans on the export of livestock and livestock products to the target countries.
- **Market volatility:** Price fluctuations and market uncertainties may impact profitability of a particular investment.
- **Environmental concerns linked to climate change:** Overgrazing, water pollution, and habitat loss, pose challenges to sustainable livestock investment. Recurrent droughts in pastoral areas may impact the availability of source animals, feed, and water required for these investments. Effective planning and early action are essential to address these issues.

Strategic investments in Ethiopia's livestock and fishery sector must leverage strengths, address weaknesses, seize opportunities, and mitigate threats. A holistic approach that includes technology adoption, capacity building, and policy support is key to fostering sustainable growth and economic development in the sector.

1.5 Beneficiaries of the Handbook

This Handbook is designed to serve as a reference for private sector actors interested in participating in livestock and fisheries investments, policymakers, implementing institutions at all levels, development partners, and other stakeholders supporting the development of livestock and fishery investment.

Section II: Enabling Conditions for Investment in Livestock and Fisheries

The following enabling conditions are in place to facilitate the entry of foreign investors into Ethiopia and encourage their participation in livestock and fishery investment activities. These conditions also enhance the engagement of new local and foreign investors to explore opportunities within the livestock sector.

2.1 Livestock and Fisheries Enabling Environment

The enabling environment for livestock and fisheries investment includes formal elements such as public policies, governance structures, regulatory frameworks, and investment programs. Informal elements, such as social, cultural, and economic norms, rules, and practices also play a crucial role in shaping the functioning of innovation actors, networks, and systems.

a. **Legal framework:** Livestock and fisheries-related investment policies, decrees, rules, and regulations are well-defined. The Ethiopian Investment Proclamation 1180/2020 outlines:

- Areas of investment,
- Enterprise types for investments,
- Minimum capital requirements for foreign investors,
- Investment permits (including issuance, renewal, transfer, suspension, and revocation),
- Reporting and cooperation duties for investors,
- Technology transfer agreements with domestic partners,
- Eligible areas for investment incentives,
- Investment guarantees and protections,
- Rights for fund remittance and external loans,
- Foreign currency account access,
- Employment of expatriates, work permits, and visa services,
- One-stop service provision,
- Grievance procedures and settlements, and
- Administrative powers and duties for investment bodies.

- b. **Ease of doing business:** A one-stop service delivery system has been established for the livestock and fisheries sector. It includes a streamlined investment application process that provides detailed information on requirements and procedures for investors. The roles and responsibilities of relevant institutions are also clearly outlined. Detailed guidelines for livestock investment processes are accessible on the Ethiopian Investment Commission website.
- c. **Feasibility analysis services:** Initiatives have been implemented to support investors by providing feasibility studies, helping them better understand their investment options and make informed decisions. These initiatives include regional efforts to document and promote potential livestock investment opportunities.
- d. **Sustainable and viable market linkage service:** There is a market linkage services that facilitate trade relationships between market actors, creating a sustainable and viable system for livestock and fishery investments..
- e. **Mapping of available resources**
 - **Mapping of livestock resources:** This involves ensuring the availability of animal species in the required quantity and quality, conducting feasibility studies, identifying relevant stakeholders, and establishing systems for managing market linkages and establishing accountability.
 - **Identify land resource:** The regional governments provide rules that empowers investors to access land resource in a way it could mitigate the future risk of the investment in livestock and fishery.
- f. **Contract farming and its enforcement:** Out-growers schemes and other innovative methods are designed to encourage producers to adopt market-oriented production. An effective contract enforcement system is crucial for sustainable linkages and economic growth. Existing contract agriculture regulations are being promoted for broader implementation.
- g. **Livestock market information system:** A central Market Information Platform (MIP) for livestock products is being developed to provide comprehensive information to buyers, from production to processing. This system aims to benefit investors by improving market transparency and accessibility.
- h. **Advisory services:** Business development advisory services are being provided for investment, production, and marketing, analysing the viability of agricultural products in the market, management of production costs and production volume data, and supporting business planning.
- i. **Community consultation:** To address ownership issues and avoid conflicts, government bodies at all levels conduct community consultations. These consultations aim to foster transparency and collaboration between stakeholders.
- j. **Availability of monitoring and support by institutions:** Given the nature of the investments, progress is monitored and ranked, with dedicated support units coordinated through relevant institutions to ensure smooth operations.
- k. **Finance provisions**
 - A legal framework is being developed to allow investors engaged in livestock to use their land-use rights as collateral for loans and shares.
 - There are encouraging moves towards establishing agricultural banking and insurance as rural financing options that provide services to investors engaged in livestock investment.

A financial service/loan system is being developed that allows small credit and saving institutions to provide better credit and allow investors to obtain loans for non-agricultural activities and develop their knowledge and skills in financial planning and use.

I. Investment guarantees and protections

- The Constitution of the Federal Democratic Republic of Ethiopia protects private property. In addition, the Investment Proclamation provides an investment guarantee against possible diversification and nationalization measures.
- In the event of damage, the government will provide adequate compensation, as specified by the decree, equivalent to the market value. Foreign investors are permitted to own immovable property (excluding land) for investment purposes. Additionally, a senior foreign investor or a foreign national classified as a domestic investor is allowed to own one residential property.
- In addition, the Proclamation provides for certain guarantees, protections, and obligations to investors.

2.2 Incentives for Livestock and Fisheries Investment

Investment incentives are essential for encouraging responsible private investment in the livestock and fishery sectors. These incentives are specific measures offered by the government to attract and guide investors toward desired behaviors, such as focusing on particular locations or adopting more responsible investment practices.



Figure 1: Different forms of fiscal investment incentives

1. **Income tax exemption:** The private sector involved in livestock investment can create enough capacity to start working and fulfil the responsibilities required for the development of the country's economy, job creation, and foreign exchange. The income tax incentives include provisions indicated in Table 1.

Table 1: Income tax exemption packages of livestock and fisheries investment

Livestock investment types	Income tax exemption packages	
	Addis Ababa and Shager City Administration	Other Areas
Milk production	3 years	5 years
Animal feed growing	2 years	3 years
Animal feed processing	2 years	4 years
Animal production	3 years	4 years
Farming chicken	1 years	2 years
Beekeeping	2 years	4 years
Production of silkworm	3 years	4 years
Aquaculture	3 years	4 years
Mixed crop and livestock farming	3 years	4 years
Export-linked business income tax exemption	Additional two years for at least 60% export or supply to exporter of each investment type	Additional two years for at least 60% export or supply to exporter of each investment type

- Loss carry forward:** Loss incurred during the income tax exemption period can be carried forward for half of the exemption period after expiry, the maximum limit being five income tax period.
- Imported vehicles:** Directive No. 942/2023 outlines the types and quantities of vehicles eligible for duty-free import for development projects. This directive offers various privileges to investors establishing new livestock and fishery ventures, as well as those expanding or upgrading existing investments. Specific details regarding these duty-free privileges are provided in Table 2.

Table 2: Land and vehicles incentive packages of livestock and fisheries investment

Type of livestock investment	Areas of land (Hectares)	Addis Ababa and Shager City Administration		Other areas	
		Motor Bicycles	Truck	Motor Bicycles	Truck
Animal feed production	10–30	Not permitted	Not permitted	Not permitted	Notpermitted
	30 and above	Not permitted	1	1	2
Animal production	200–500	Not permitted	1	Not permitted	1
	500 and above	Not permitted	1	Not permitted	2
Poultry production	2000–10000	Not permitted	1	Not permitted	1
	10000–50000	Not allowed	1	Not allowed	2
	50000 and above	Not allowed	2	Not allowed	3
Beekeeping	1000 Hives and above	Not allowed	1	Not allowed	1
Silkworm production	1 and above	Not allowed	1	Not allowed	1
Aquaculture	1250 m ²	Not allowed	1	Not allowed	1

Type of livestock investment	Areas of land (Hectares)	Addis Ababa and Shager City Administration		Other areas	
		Motor Bicycles	Truck	Motor Bicycles	Truck
Mixed crop-livestock farming	300–1000	1	4	2	3
	1000–2000	2	5	3	4
	2000–3000	2	6	4	5
	3000–4000	2	7	5	6
	5000 and above	3	8	6	7

4. **Customs duty exemption for imported capital goods:** The investment proclamation No. 769/2012 defines the exemption from customs duties and other taxes like VAT, sur tax, withholding taxes and excise taxes on imported capital goods and construction materials for the investment of livestock and fisheries.

Table 3: Customs duties and other taxes exemptions of imported capital good and construction materials

Investment name	Brief description
Exemption from customs duties and other taxes on imported capital good	Note 1: Capital goods are defined as machinery equipment and the accessories needed to produce goods or render services in livestock and fisheries
	Note 2: Time limits for enjoying this right differ based on sector, size, and employment potential of investment
Exemption from customs duties and other taxes on imported construction materials	Note 1: Construction materials are defined as basic inputs necessary for the construction of investment in livestock and fisheries
	Note 2: This right can be exercised up on establishment of a new enterprise (before commissioning) and for expansion/upgrading of an existing one as defined under the investment proclamation
Exemption from customs duties and other taxes on imported spare parts	Note 1: For livestock and fishery investment with 100% export, there is no time or value limitation
	Note 2: For livestock and fishery investment, there is no time limit, but the value should not be more than 15% of the total value of the capital goods
Exemption from customs duties and other taxes on imported vehicles	Note 1: The type and number of vehicles that can be imported duty free varies depending on investment sector, size, nature, and location of investment. Type of vehicles include pickups minibuses, cargo trucks, ISUZs, Hybrid ISUZs
	Note 2: Agricultural investors which invest ETB 200 million and above, and export for three consecutive years more than 60% of their product quality for 1–2 station wagons

5. **Incentives for land acquisition and compensation:** Land acquisition procedures: Investors in Ethiopia can lease land for investment purposes. Investors cannot, however, buy land for an indefinite period as land is owned by the state and the people. The procedure for acquiring land varies based on several factors, including the project location, the type of investment activities, the administrative status of the land, and the specific region or sector within the livestock investment industry. A foreign investor must approach the federal Ethiopian Investment Commission (EIC) to set-up a business. The EIC provides investment licenses and additional guidance on how to acquire land. Legislative changes have however mandated Regional Administration to provide investment land. The regional representative body manages a database of available investment land and works closely with the regional investment bureau. The actual procedures to lease land varies across regions and depends on land availability and economic priorities. Investors are generally encouraged to identify plots suitable for their investment and subsequently contact the regional authorities to understand the exact land acquisition procedures.

Table 4: Steps for investors to acquire new land

Step 1: Investment license	Investors must obtain an investment license from the Federal Ethiopian Investment Commission for foreign investors or the Regional Investment Bureau for domestic Investors before submitting a land request.
Step 2: Identify the project area	Investors must consult with relevant Woreda or Zone authorities to assess the availability and suitability of land for their investment project.
Step 3: Request for land	Investors must submit a formal land request to the Regional Investment Bureau. Relevant documents include a completed land request form, investment license, TIN certificate, Federal EIC support letter, project proposal, ID (resident ID for foreigners), bank account, passport, and passport photos.
Step 4: Evaluation of the investment project	The respective investment bureau evaluates land requests during board or committee meeting. In some regions, investors may be required to present their project proposal during the evaluation process.
Step 5: Land request approval	The land bureau verifies the availability of land locally. If land is available, the application is forwarded to the Regional President for approval or rejection. In some cases, the President delegates this decision to a committee or board. Conclusive meetings are typically held bi-monthly but may occur quarterly, depending on the volume of applications.
Step 6: Land preparation process	During the approval process, the land bureau collaborates with the investor to assess land availability. If the land bank lacks suitable land, the process shifts to compensation-based land acquisition, which typically takes around six months.
Step 7: Contract signing	The land lease contract is signed between the investor and the responsible authority.
Step 8: Payment for the land	Investors pay the amount specified in the lease contract. If compensation is involved, the regional administration is responsible for making payments. However, if resources are unavailable, the administration may request the investor to cover the compensation costs. The Woreda administration must deposit these funds into the resettled individuals' bank accounts, and the amount is deducted from the lease payment.
Step 9: Land bank reservation and site mapping	After compensation is paid, the compensated individuals vacate the plots, and the land is transferred to the land bank. Professionals then visit the site to take GPS coordinates and measure the exact property boundaries.
Step 10: Confirmation and handover	The authorized administration sends the necessary documentation to the regional administration bureau to finalize the land acquisition process. The investor then officially receives the land from the relevant regional officials.

Table 5: Steps for investors that renew their land leases

Step 1: Check the expiry of land lease	The lease period may be renewed upon expiration, with a new lease price determined at the time of renewal.
Step 2: Application for renewal	The leasee must apply to the appropriate authority for renewal before the lease expires. Early application is encouraged to secure renewal rights.
Step 3: The appropriate body notifies the applicant	The responsible authority provides written notification of their decision within one year of the application's submission. If no communication is received within this timeframe, the lease renewal is considered automatically approved.
Step 4: Lease renewal	The National Bank of Ethiopia issued the "Operationalization of Movable Collateral Registry (Directive No. MCR/01/2020)," requiring banks to allocate at least 5% of their annual credit disbursements to individuals, cooperatives, unions, and Micro, Small, and Medium Enterprises (MSMEs) in the agricultural sector. This directive, effective July 1, 2020, allows the use of movable property as collateral.

Table 6: Steps for investors that want to expand their land

Step 1: Request for land	Investors can request for additional land through a land request application form and other relevant documents.
Step 2: Evaluation of the investment expansion project	The investment bureau and land board evaluate the request and assess the historic investment activities of the applicant.
Step 3: Land request approval and land acquisition	This process is similar to the sections 'for investors acquiring land, steps 5–12'. The time to receive expansion land could occur faster if the adjacent land is not used effectively.

- **Land leasing and compensation:** Holding rights and leasing conditions are regulated in the Federal Rural Land Administration and Use proclamation No. 1324/2016. Leasing rates differ per region, zone, cities, and towns. This information is accessible from the detailed regional legal framework. The difference is based on factors such as land productivity, water availability, remoteness, land use, and the presence of infrastructure. Regions, cities, and towns generally use classifications to determine price levels of land. Prices per square meter are determined on a case-by-case basis once the plot is identified. Prices are not fixed and change frequently. Ethiopian law stipulates lease prices to be revised every two years. Investors should check the updated price ranges during their due diligence.

6 Financial support: Financial services are critical enablers in the agricultural sector investment, including livestock and fishery sub-sector.

- **The National Bank of Ethiopia:** The Bank issued the directive titled "Operationalization of Movable Collateral Registry (Directive No. MCR/01/2020)," requiring all banks to allocate at least 5% of their annual credit disbursement to individuals and organizations in the agricultural sector. This includes cooperatives, unions, and Micro, Small, and Medium Enterprises (MSMEs) using movable property as collateral. This directive has been in effect since July 1, 2020. Non-compliance with this requirement is subject to a penalty of Birr 10,000.

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- **The Development Bank of Ethiopia:** The Development Bank of Ethiopia provides credit to eligible borrowers engaged in livestock and fishery projects that are appraised as financially and economically viable. Projects must also demonstrate social desirability, such as environmental protection, job creation, and other benefits aligned with the government's development regulation framework. The Bank provides loan services as outlined in "The Short Guide to Access the Loan," which details the economic sectors eligible for financing, types of loans offered, loan terms, lending conditions, equity contribution requirements, and a checklist of documents needed for all loans. It also specifies the required documents for applicants seeking to expand existing projects, repayment periods, collateral requirements, interest rates, fees, charges, and incentives for investors, including export, import substitution, and joint venture incentives. Additionally, it outlines the grace period during which borrowers are not required to make principal loan repayments.

Section III: Livestock and Fisheries Investment Options and Requirements

The livestock and fisheries sub-sector are a key source of food, nutrition, income, and agricultural power for millions of rural households in Ethiopia. Investing in these sectors presents a rewarding business opportunity, as it can offer the following benefits:

- **Profitability and sustainability:** The growing demand for animal products, driven by population growth, urbanization, and rising incomes, highlights the untapped profitability and sustainability of the livestock sector as a business venture.
- **Employment and income generation:** Livestock goods and services provide significant economic benefits. These include quick employment opportunities, household-level income generation for those involved in the business, and the raw materials for agro-processing industries which in turn contribute to national economic growth.
- **Foreign currency earnings:** Although current export earnings from livestock underperform relative to Ethiopia's livestock population potential, there is significant promise for generating foreign currency through the export of live animals and livestock products (Shapiro, et al, 2017).
- **Food and nutrition security:** Livestock make substantial contributions to food and nutrition security by providing high-value, palatable, and nutrient-dense foods such as milk, meat, and eggs. Additionally, manure enhances soil fertility, and draft power supports stable food cultivation.
- **Animal health and welfare:** Investments in livestock and fisheries can enhance animal health and welfare while improving food safety and quality. This is achieved through better management, feeding practices, and veterinary services.
- **Environmental impact:** Investments in livestock and fisheries can mitigate the environmental impact of production by adopting advanced practices and technologies that can enhance the productivity, efficiency, and resilience of the livestock systems.

3.1 Livestock Ranch Investment Options and Requirements

3.1.1 Ranch-based Beef Cattle Breeding and Fattening Investment

Ranch-based beef cattle breeding and fattening involves raising cattle from birth to slaughter on a ranch, utilizing natural or improved pastures supplemented with feed and minerals. The main goal of this business is to produce high-quality beef that meets the domestic and international market demand and standards. It involves pasture-based beef cattle breeding, raising calves in a modern way, and deliver them to the market or to other parties

who use them as stalk or inputs for the fattening operation. Ranch-based cattle breeding investments enhance the performance and competitiveness of the meat sector by improving grazing land productivity and optimizing cattle management through age, gender, and productivity-based segregation.



Figure 2: Ranch-based Calves Production for Beefing

On the other hand, Alternatively, investors can purchase young bulls from the pastoral community, document essential animal information, and market the bulls after keeping them on a cattle farm or in a feedlot for a minimum of six months. This is an investment option that ensures a mutual benefit for pastoralist and potential investors.

3.1.2 Ranch-based Heifer Production Investment

Ranch-based heifer production involves raising female calves (heifers) from birth to breeding age on a ranch, using natural or improved pastures, supplemented with concentrates and minerals. The primary objective is to produce high-quality heifers for sale as replacements for cow-calf operations or for herd expansion. This investment can be implemented through two main modalities in Ethiopia.

- **Heifer production from parent stock:** Heifers are produced on the ranch using artificial or sexed semen or natural breeding methods. The focus is on raising high-quality female calves while minimizing the number of unwanted male calves. These heifers can then be sold or retained for herd expansion.
- **Cow rental model:** Pastoralists and agro-pastoralists can rent cows to investors, creating a mutually beneficial business arrangement. This model requires a clear contractual agreement specifying the rental duration, cost, and conditions. The renting pastoralist ensures the investor's facilities are suitable for the calving process, including barn inspections, proper care, and necessary veterinary assistance.
 - **Benefits for the pastoralist:** Financial gains through rental agreements, providing an additional income source.
 - **Benefits for the investor:** The investor gains a new calf without incurring breeding or pregnant cow purchase costs. If the rented cow has desirable traits, such as high milk production or strong genetics, these traits can enhance the investor's herd.
 - Both parties must prioritize the well-being of the cow and calf during the calving process, ensuring proper nutrition, veterinary care, and a stress-free environment. Legal agreements should address liability, insurance, and any unforeseen circumstances. While not yet a widespread investment model, this system has been successfully implemented in the Borena area, contributing to the improvement of Ethiopian Borena cattle breeds and community-oriented breed enhancement.

3.1.3 Ranch-based Breeding Bull Production Investment

The private sectors can be engaged in ranch-based breeding bull production, which involves collecting weaned male calves identified for their meat characteristics, raising them for one to two years, and marketing them. Subsequently, these bulls are used by various stakeholders for natural breeding purposes and to improve foreign breeds and other local breeds required for meat production.

For natural breeding bulls, comprehensive veterinary health care is crucial to ensure successful reproduction and maintain herd health. Regular vaccinations are very important to protect bulls from common diseases. Reproductive health consideration such as regular evaluation of semen quality ensures that the bull is capable of effective natural breeding. If there is a possibility of venereal disease transmission due to the introduction of non-virgin mature bulls to a herd, the bulls must undergo testing for venereal diseases and receive appropriate treatments.

It should be noted that livestock ranch sizes and its categories are generic which has not been well defined contextually. The specific classification of a cattle ranch may vary depending on national or local conditions. Generally, the size of a ranch does not determine its profitability or success. Factors such as leadership and management practices, market conditions, and operational efficiency play a vital role in the success of a cattle ranch business.

Box 1: Ranch standards and sizes for cattle

a. Small ranch

- Land size: as large as 40 hectares.
- Cattle population size: Most of time it may have up to 50 cattle.
- Purpose of investment: Usually focused on selling to a local market, it can be established as a self-sustaining or hobbyist objective.

b. Medium size ranch

- Land size: Between 40 to 200 hectares of land.
- Cattle population size: Between 50 to 200 cattle.
- Purpose of investment: It may include supply to local markets, breeding of purebred cattle and production of specific breeds for breeding purposes.

c. Large size ranch

- Land size: Between 100 and 2000 hectare of land
- Cattle population size: Between 2000 and 5000 Cattle
- Purpose of investment: Mainly focused for high business or for profit for the country international or for the section continental markets When which the world Access to the international market outside to send capacity which has is it.

d. Industrial ranch

- Land size: 1,000 between 15,000 hectares of land
- Cattle population size: 5000 between 30,000 cattle
- Purpose of investment: It is mainly focused on high profit for national or sub- continental markets, which has the potential to export with international market access.

3.1.4 Ranch-based Sheep and Goat Production and Fattening

Ethiopia possesses abundant sheep and goat resources along with favorable natural climate for production. However, despite numerous efforts to enhance the benefits derived from small ruminants, the sub-sector has not yet reached its full potential. This is evident in the current supply of sheep and goat products, which has neither significantly contributed to food security nor adequately supported the country's export demands. For instance, export slaughterhouses often fail to acquire animals of the appropriate age and size needed for meat production, leading to underutilization of their capacity. Additionally, livestock exports remain minimal in terms of foreign exchange earnings, highlighting the challenges within the sector. Sheep and goat production is highly desirable for both domestic consumption and export trade, offering significant potential for foreign currency earnings through ranch-based investments.

3.1.5 Investing in Multipurpose Sheep Production Ranches

Ethiopia hosts various indigenous sheep breeds across its diverse ecosystems, offering significant potential for meat production. Major breeds include *Afar*, *Arsi Bale*, *Black head or Somali*, *Horo*, *Menz*, *Washara*, *Bonga*, *Gumuz*, etc. sheep breeds.



Figure 3: Multipurpose Ranch-based Sheep Production

The following two options could be considered for ranch-based sheep investment:

- **Investing in a sheep fattening ranch:** Ranch based raising of selected or improved sheep breeds for meat production enhances the supply of meat and meat products for domestic and export market. One of the investment options is for the investor to purchase male sheep from the local farmer/pastoral breeder at a young age, then fatten them in the pasture and offer them to the market.
- **Investing in indigenous sheep breed improvement ranches:** This involves improving sheep breeds through selection and breeding, programs supplying improved rams to the community.

3.1.6 Investing in Multipurpose Goats Ranches

Ethiopia is home to various indigenous goat breeds used for meat production, including *Abergele*, *Afar*, *Arsi-Bale*, *Begait*, *Kefa*, *Weytto-Guji*, *Somali*, *Central Highlands*, *Hararge Highlands*, *Western Lowlands* are the main breeds of goats known in the country.

Unlike sheep, goats are natural browsers in their feeding habits. It is worth noting that, like sheep, goats can thrive under extensive ranching systems. Goats are more drought-tolerant than both sheep and cattle. Additionally, their high productivity and prolific reproductive rates enable their population to grow significantly within a single production season. Moreover, mutton and goat meat are often preferred over beef in many markets.



Figure 4: Ranch Based Goat Production

Goat milk is a valuable product with medicinal benefits. To increase goat milk production in the lowland areas, one option is to invest in high milk yielding goat breeds. Another strategy is to improve the nutrition of exotic goat breeds and rear them in ranches with suitable climates for crossbreeding. Goat ranch investment can have the following investment modalities:

- a. Increasing the supply of meat and meat products for the local and export market by ranch-based investment of raising and breeding of selected and improved goat breeds. One investment option involves purchasing young male goats from local farmer, pastoralist, or agro-pastoralists for ranch-based fattening and finishing to supply meat and meat products.
- b. Providing marketable does (breeding female goats) to the community through ranch-based selection and crossbreeding program aimed at improving the productivity of indigenous goat species is another viable investment option.

It should be noted that these are general guidelines for size categories for sheep and goat ranches and the specific classification may vary depending on national or local conditions. Also, the size of a ranch does not determine its profitability or success. Factors such as management practices, market conditions, and operational efficiency play a critical role in the success of a sheep or goat ranch.

Box 2: Recommended types and sizes of investment ranches for sheep and goats

a. Small size ranch

- Land size: up to 40 hectares,
- Livestock population: up to 500 sheep/goats
- Purpose of investment: usually focused to a local market, it can be set up as a self-sustaining or hobby purpose.

Box 2: ctd.**b. Medium size ranch**

- Land size: between 40 to 200 hectares.
- Livestock population: between 50 and 2,000 head of sheep/goats
- Purpose of investment: it may include supplying local markets, breeding of breeds for wild goats and production of specific breeds for breeding purposes.

c. Large ranch

- Land size: 100 to 2000 hectares can be covered,
- Livestock population: between 20,000 to 50,000 thousand sheep/goats
- Purpose of investment: It is mainly focused on high turnover or profit for national or sub-continental markets, which has the potential to export with international market access.

d. Industrial level ranch:

- Land size: 1,000 to 15,000 thousand hectares
- Livestock population: 50,000 as long as 300,000 sheep/goats
- Purpose of investment: It involves large-scale investment activities, particularly in terms of extensive infrastructure, advanced technology and significant market access.

3.1.7 Investing in Camel Breeding Ranches

Camels are typically raised in pastoral and semi-pastoral environments on expansive pasturelands, making camel ranching is not very common in the world a relatively uncommon practice globally.

Countries such as Ethiopia, Australia, and Saudi Arabia have established camel ranches for purposes including research, conservation, and commercial ventures. Ranch-based camel breeding offers advantages over traditional systems such as improved animal health, enhanced productivity, and better marketing opportunities. However, these systems face challenges including high initial investment costs, land tenure issues, and environmental impacts. In Ethiopia, camel ranch investments can yield significant economic benefits through the production of camel heifers, camel milk, or camels for export markets. Ranches of varying sizes, from small scale to large industrial operations, represent viable business opportunities. The size of a camel ranch depends on factors such as available resources (land, capital, and herd capacity), the business objectives, and the operational management capacity. Some common categories used to describe different ranch sizes for camels are listed below.

It is important to note that camel ranch size categories are general guidelines, and specific classifications may vary based on national or local conditions. Moreover, the size of a ranch does not determine its profitability or success. Factors such as management level and practices, market conditions and operational efficiency play a vital role in the success of a camel ranch.

Box 3: Recommended types and sizes of ranches for camel

a. Small ranch

- Land size: up to 40 hectares.
- Livestock population: up to 50 head of camels.
- Purpose of investment: usually focused on to provide camels to a local market, and it can be established a self-sustaining or hobby purpose.

b. Medium ranch

- Land area: Up to 40 to 200 hectares.
- Livestock population: Between 50 to 200 camels.
- Purpose of investment: It may include supplying local markets, breeding camels and producing specific breeds for breeding purposes.

c. Large ranch

- Land size: 100 to 2000 hectares
- Livestock population: usually 2000 to 5000 camels
- Purpose of Investment: it is mainly focused on high turnover or profit for national or sub-continental markets, which has the potential to export camels to international market.

d. Industrial ranch

- Land size: 1,000 to 15,000 thousand hectares) can be included.
- Stock Size : 5000 to 30,000 head of camels
- Purpose of Investment: - considering extensive infrastructure, advanced technology and significant market access and size.

Ranch infrastructure, housing, and machinery: Ranch infrastructure varies based on size, location, climate, and objectives. Common infrastructure includes housing, barns, corrals, water systems, power systems, communication systems, waste management systems, and security systems. Cattle ranch infrastructure is the set of buildings, facilities, equipment, and roads that support the operation and management of a cattle ranch. Some examples of cattle ranch infrastructure are:

- **Housing:** This includes the main house, guest houses, cabins and bunkhouses for the ranch owner, family, guests, and workers.
- **Barns and sheds:** These are used for storing hay, feed, tools, machinery, and vehicles, as well as sheltering animals.
- **Corrals and pens:** These are fenced areas for holding, sorting, and loading livestock, as well as providing water and feed.
- **Water systems:** These include wells, pumps, tanks, pipelines, troughs, and sprinklers for providing water to the ranch, the livestock, and the crops/forages.

- **Power systems:** These include generators, solar panels, batteries, inverters, and wiring for providing electricity to the ranch, especially in remote areas.
- **Communication systems:** These include phones, radios, internet, and satellite for staying connected and informed, as well as for emergency and security purposes.
- **Waste management systems:** These include septic tanks, compost bins, and manure spreaders for disposing human and animal wastes, as well as recycling and reducing environmental impact.
- **Security systems:** These include gates, locks, cameras, alarms, and dogs for protecting the ranch, the people, and the animals from intruders, predators, and thieves.
- **Human and animal health care centres:** Health care centres seek to effectively manage or eliminate livestock, zoonotic and food-borne diseases.

Recommended ranch machineries

- **Tractor:** A multipurpose tractor for ploughing, mowing, raking, harvesting, and baling
- **Pickup truck and a livestock trailer:** A vehicle like pickup truck and livestock trailer are required for transporting animals, feed, and materials.
- **Firefighting equipment:** A firefighting equipment such as a skid unit or fire extinguishers for preventing and controlling fires.
- **Power tools:** A power tools such as an auger, a post driver, a drill, a circular saw, a brush cutter, and a chainsaw for fencing, building, and clearing.
- **Toolbox:** A toolbox with basic tools such as pliers, hammers, wrenches, and screwdrivers for repairs and maintenance.
- **Livestock handling facilities:** Livestock handling facilities such as chutes, alleys, and crowding tubs for moving and sorting animals.
- **Livestock scales:** Scales for weighing animals and monitoring their health and growth.
- **Portable corrals and panels:** The facilities are required for creating temporary enclosures and pens.
- **Loading chutes and ramps:** The facilities are required for loading and unloading animals from trailers.
- **Livestock prods and electric/non-electric fencing:** The facilities are required for controlling and containing animals.
- **Head gates and head holders:** The facilities are required for restraining animals during examinations and treatments.
- **Squeeze chutes and palpation cages:** The infrastructures are required for performing procedures such as vaccinations, castrations, and pregnancy checks.

Recommended human resources, skills and profession for livestock ranch

Any livestock ranch requires various human resources, skills, and professions to run smoothly and efficiently. These are some of the common human resources, skills and professions needed for livestock ranches, but there may be others depending on the size, location, and goals of the ranch. Some of the required personnel to run an effective ranch include:

- **Rancher:** The owner or manager of the ranch, who oversees the overall operation and makes strategic decisions. *A rancher typically needs a university degree in animal science. A rancher also needs animal care, business, and leadership skills.*

- **Ranch hand:** A ranch hand refers to a worker who performs various tasks on the ranch, such as feeding, watering, herding, branding, and vaccinating animals. A ranch hand usually needs university degree, typically receives on-the-job training from the rancher or experienced workers and benefits from skills such as physical stamina, mechanical aptitude, and teamwork. A ranch hand also needs physical stamina, mechanical aptitude, and teamwork skills.
- **Veterinarian:** A professional who provides medical care and treatment to cattle and other livestock. A veterinarian needs a degree in veterinary medicine and a license to practice. A veterinarian also needs diagnostic, surgical, and communication skills.
- **Livestock inspector:** A professional who monitors the health and welfare of cattle and other livestock and ensures compliance with animal health and safety regulations. A livestock inspector needs a bachelor's degree in animal science, biology, or a related field, and may need certification from the National Animal Health Laboratory Network. A livestock inspector also needs analytical, observational, and problem-solving skills.
- **Agronomist:** A professional who inspects and improves the quality and productivity of pastures and crops on the ranch. An agronomist needs a bachelor's degree in plant science, soil science, or a related field, and need a certificate of competency from Ministry of Agriculture.
- **Driver:** Someone who drives a vehicle, such as a car, bus, or truck
- **Farm machinery operator:** Farm machinery operator is someone who drives and controls farm equipment to perform various tasks on a farm, such as tilling soil, planting, cultivating, and harvesting crops. A farm machinery operator may also operate stationary equipment to perform post-harvest tasks, such as husking, shelling, threshing, and ginning.

Factors to be considered for ranch investment business appraisal

a. Land and facilities

- **Area of land for grazing:** Land productivity and available grazing areas are key considerations for investment.
- Fence and secure facilities
- Internal facilities
- Independent location so as not to be disturbed by nearby residents or other industries
- A shelter or barn used for severe weather
- Important machines

b. Management skills

- Enough labourers
- Deploying appropriate experts in the field
- Other skilled professionals

c. Concerning herd management

- Use of appropriate breeds
- Appropriate breeding program to increase the productivity of animals and better health
- Regular veterinary treatment, vaccination and controlling internal or external parasites
- Ensuring proper nutrition and feeding of balanced feed, including fodder, hay and necessary supplements.

d. Animal welfare

- Adequate area for animal movement and feeding
- Provide clean water and adequate feed (both in quantity and content).
- Monitoring the animal's health regularly
- Prepare appropriate animal transportation
- Implement national animal welfare guidelines and regulations

e. Considering environmental protection

- Implementation of sustainable land management
- Implementation of proper waste management systems for animal excreta, manure, and other biodegradable materials is essential.
- Considering the law of wildlife protection and management

f. Social responsibility

Corporate social responsibility (CSR) requires investments to act ethically and responsibly, addressing social, cultural, economic, and environmental issues. Some examples of social responsibility in investment are:

- Participation and contribution in activities that benefit the society in general, in a responsible and voluntary manner.
- Implementing environmentally sound policies and practices that reduce waste of environmental resources, emissions, and pollution.
- Ensuring fair and safe working conditions and human rights for workers and suppliers.
- Providing products and services that meet customer needs and stakeholder demands.
- Adhere to the laws and regulations that govern and regulate investment activities.

Social responsibility in ranch investments offer numerous benefits, such as:

- Protecting and enhancing the sector's reputation, fostering customer loyalty and trust.
- Motivating employees who share similar values and vision.
- Increasing profitability and competitiveness by reducing costs, improving efficiency, and creating value.
- Contributing to sustainable development and societal well-being.

3.2 Investing in Feedlot Red Meat Production

Meat is one of the most valuable livestock products, serving as a vital source of animal protein. It provides essential amino acids and various micronutrients in proper proportion for human health. Cattle, sheep, goats, and camel are the primary sources of red meat in Ethiopia, with a minor contribution from pork production in certain regions. These livestock resources make a substantial contribution to domestic food and nutrition security and to the export revenue. However, overall production and productivity remain below the potential of these resources. On the other hand, the domestic meat demand is believed to increase with increasing population, urbanization, and rising income. The red meat sector is also expected to generate a substantial amount of foreign currency.

Red meat production is targeted to grow by 7.3% annually, aiming for per-capita consumption of 10 kg by 2030. Promotion of investment and commercialization through policy provisions, financial access and advisory services as well as developing systems for abattoirs to support the live animal supply chain are among interventions

identified to transform the red meat sub-sector in the country. Therefore, this document is prepared to provide clear information in areas of red meat production and satisfy domestic consumption demand as well as foreign currency earnings from the export of meat and live animals. The detailed investment venture for the selected species is discussed in this document.

3.2.1 Beef Cattle Feedlot Investment

Cattle meat accounts for over 70% of the total red meat production and over 50% of the total meat output in sub-Saharan Africa. Although Ethiopia lacks a cattle breed exclusively selected for beef production, the Boran breed is recognized for its fast growth rate, high muscle accumulation, and adaptability to diverse climatic conditions. There are other indigenous cattle breeds such as Arsi, Horro, Begayit, Sheko, Fogera, Abigar, Afar and Raya which can produce considerable amount of meat under improved feeding and other management conditions. These indigenous cattle breeds are known for their disease resistance compared to exotic and crossbred cattle. Indigenous breeds, which have not been selectively developed for specific production traits, are typically used for multipurpose functions, including milk, meat, draft power, and manure production. Beef production in Ethiopia primarily comes from old oxen used for draft power, culled cows, surplus young bulls, and fattened bulls from urban and peri-urban areas. Dairy beef from male calves, which grow rapidly, remains an untapped resource with significant potential for contributing to the sector.

Feedlot operations require an intensive confinement system, characterized by high input costs for infrastructure, feeding, medical care, and labor. This involves a confined area for feeding animals on a ration prepared from industrial by products, grain, silage, and hay. This type of investment produces high-quality grade meat carcasses. This only takes 3-6 months for finishing and is mostly practiced in urban and peri-urban areas and in areas with easy access to purchased feeds (agro-industrial by-products).



Figure 5: Indigenous breeds of cattle for beef production

Commercial feedlot fattening allows fattening relatively large number of animals in a limited space. This is because most commercial feedlots may not own land for feed or forage production and thus are dependent on purchased feeds (both concentrates and roughages).

The beef produced from commercial feedlot-based fattening mainly targets foreign markets. The Middle East and North Africa are the major market destinations. To penetrate remaining markets, it is necessary to meet the quality standards of international markets. Even though the target market for live animal export is Middle Eastern countries, some may end up in the domestic market.

Box 4: Recommended standards and sizes for cattle feedlot

- a. Small-scale feedlot cattle fattening: Small-scale feedlots typically involve a limited number of animals and are often managed by individual farmers or small businesses.

Characteristics

- Number of animals: Small-scale feedlots usually handle fewer than 100 head of cattle.
- Management: These operations are more hands-on, with close monitoring of each animal.
- Profitability: While profit margins may be smaller, small-scale feedlots can be a good starting point for beginners or those with limited resources.

- b. Medium-scale feedlot cattle fattening: Medium-scale feedlots fall between small and large operations in terms of size and capacity.

Characteristics

- Number of animals: Medium-scale feedlots typically handle 100 to 500 head of cattle.
- Management: These feedlots require more structured management practices and may employ specialized staff.
- Profitability: Medium-scale operations can achieve better economies of scale and profitability.
- Infrastructure: Adequate facilities and equipment are essential for efficient feeding and handling.

- c. Large-scale feedlot cattle fattening: Large-scale feedlots are major commercial operations.

Characteristics

- Number of animals: Large-scale feedlots handle over 500 head of cattle, often reaching thousands.
- Management: These operations have professional management teams, advanced technology, and streamlined processes.
- Profitability: Large-scale feedlots benefit from economies of scale, efficient utilization of resources, and optimized production.
- Infrastructure: Extensive infrastructure, including feed storage, handling facilities, and waste management systems, is crucial.

Land size required for investment in feedlot cattle fattening: Adequate land must be allocated for the feedlot complex, including pens, animal handling areas, a feed mill, commodity storage, effluent ponds, and manure storage, with space for potential expansion. As a guideline, the total feedlot complex area should be at least three times the pen area (Watts et al., 2016). The pen area is determined by the maximum number of animals multiplied by the stocking density. For example, the recommended pen area for cattle is 15m² per head, resulting in a feedlot complex area of 45m² per head.

3.2.2 Investing on Sheep Feedlots

Feedlot sheep fattening is a practice of raising sheep in a confined area with high-quality feed to improve their weight and quality of meat. Sheep easily adapt to high intensity production systems in feedlots. A sheep fattening program aims to achieve the highest growth rate and carcass yield in the shortest possible time (75–90 days) and to increase production per unit of input (such as feed).

Various indigenous sheep breeds were identified for their meat production potential. These breeds are found in different climatic conditions and geographical locations. Some of the indigenous sheep breeds identified for their meat production potential include *Afar, Arsi-Bale, Black Head Somali, Horro, Menz, Washara, Bonga, Gumuz*, etc.

These sheep breeds have high potential for investment in their niche. They can also be transported to similar agro-ecologies for fattening under intensive feedlot management. Sheep fattening is a profitable venture due to its lower investment costs compared large ruminants, faster economic returns, and the potential for rapid expansion. Sheep accounts for 6% of the total target foreign currency exchange earnings from export of live animal by 2030.

Box 5: Recommended standards and sizes for sheep feedlot

- a. Small-scale feedlot sheep fattening: Small-scale feedlot is suitable for fatteners who have limited land, capital, and labor.

Characteristics

- Number of animals: The number of animals can range from 10 to 50, depending on the breed and size of sheep.
- The main expenses are the purchase of animals, feed, veterinary services, and transportation.
- The main risks are low productivity, high feed cost, and poor market access

- b. Medium-scale feedlot sheep fattening: Medium-scale feedlot is suitable for fatteners who have more land, capital, and labor, and want to increase their income and market share.

Characteristics

- Number of animals: The number of animals can range from 50 to 200, depending on the breed and size of sheep.
- The main expenses are the purchase of animals, feed, veterinary services, transportation, and processing.
- The main risks are higher investment, more labor, and more management skills.

- c. Large-scale feedlot sheep fattening: Large-scale feedlot is suitable for entrepreneurs who have ample land, capital, and labor, and want to establish a commercial enterprise.

Characteristics

- Number of animals: The number of animals can range from 200 to 1000 or more, depending on the breed and size of sheep.
- The main expenses are the purchase of animals, feed, veterinary services, transportation, processing, and marketing.
- The main risks are huge investment, skilled labor, and strict regulations.

Feedlot sheep fattening can be done at different scales, depending on the available resources, market demand, and management skills.

Land size required for investing on feedlot sheep fattening: The land required for investment in feedlot sheep fattening depends on the scale and design of the feedlot, the number and size of the sheep, the type and amount of feed, and the manure and effluent management systems. Based on various studies (Pasha, 2006; Zinga and associates, 2017; Mohammad, 2020), the approximate land size requirements for different scales of sheep feedlots are:

- **Small scale:** The total land size required for 20 sheep is about 0.07 hectare (35m²/animal).
- **Medium scale:** The total land size required for 100 sheep is about 0.45 hectare (45 m²/animal)
- **Large scale:** The total land size required for 1000 sheep is about 6 hectares (60 m²/animal)

These are only rough estimates and may vary depending on the specific conditions and requirements of each feedlot. Additionally, the land size required for waste control facility, such as the sedimentation system and the effluent evaporation pond, may range from 0.25 to 1 hectare per 100 head of sheep. The land size required for fodder production and storage may also vary depending on the type and yield of the fodder crops.

3.2.3 Investing in Goats Feedlots

Although goats are considered browsers by their feeding habit, research results show that goats can also perform under intensive feedlot management. Investing on Goats feedlots involves raising goats in confined areas and feeding them high-quality diets to enhance their weight and meat quality within a short period.

Goats are expected to account for 9.7% of the total target foreign currency exchange earnings from export of live animal by 2030. Goat meat often commands higher prices than beef in Ethiopian restaurants.

Various indigenous Goat breeds were identified for their meat production potential. These breeds are found in different climatic conditions and geographical locations. Some of the indigenous Goat breeds identified for their meat production potential include Abergelle, Afar, Arsi-Bale, Begayit, Central Highland, Hararghe Highland, Keffa, Woyto-Guji, Somali, Western Highland, and Western Lowland goats. These goat breeds have high potential for investment in their niches. They can also be transported to similar agro-ecologies for fattening under intensive feedlot operations.

The number of animals for different scales of feedlot goat fattening may vary depending on the available resources, market demand, and management practices. However, based on some sources, the following ranges can be suggested (Pasha, 2006).

Box 6: Recommended standards and sizes for goat feedlot

The number of animals for different scales of feedlot goat fattening may vary depending on the available resources, market demand, and management practices. However, based on some sources (Pasha, 2006), the following ranges can be suggested:

- Small scale: 10 to 100 goats
- Medium scale: 101 to 500 goats
- Large scale: More than 500 goats

These numbers are not fixed and may change according to the specific conditions and objectives of each feedlot operation. Some factors that may affect the optimal number of animals include:

- Land size and carrying capacity
- Feed availability and quality
- Animal breed and performance
- Capital and labor costs
- Marketing channels and prices
- Environmental and social impacts

Land required for investing feedlot goat fattening: The land required for goat feedlot depends on the number of animals, housing design, and waste management system. According to some sources, the following estimates can be given:

- For covered area, the floor space requirement is 1.12 m² per animal
- For open paddock, the floor space requirement is 2.32 m² per animal
- For waste management, the required land size ranges from 0.05 to 0.1 ha per 100 animals.

These estimates assume that the animals are fed with a total mixed ration (TMR) and have access to clean water. The land size may vary depending on feed availability, animal performance, and environmental factors. The following formula can be applied to calculate the approximate land size required for feedlot goat fattening:

$$\text{Land size (ha)} = N \times (A + B + C)$$

Where:

N=Number of goats to be fattened

A=Floor space requirement for covered area (m²/goat)

B=Floor space requirement for open paddock (m²/goat)

C=land size requirement for waste management (ha/100 goats)

For example, if one wants to fatten 500 goats in a covered area with an open paddock and a waste control facility, the land size required would be:

$$\begin{aligned}\text{Land size (ha)} &= 500 \times (1.12 + 2.32 + 0.001) \\ \text{Land size (ha)} &= 1.725 \text{ ha}\end{aligned}$$

3.2.4 Investing in Camel Feedlots

Camel meat is considered nutritionally superior due to its lower fat content compared to meat from many other animal species. As camel contains less saturated fat, the negative health implications associated with high-fat meat consumption do not apply, making it a preferred choice for health-conscious consumers.

The average slaughter weight of mature, fattened desert camels is around 450 kg. The dromedary (*Camelus dromedarius*) dresses out at approximately 56% of live body and 64% of empty bodyweight, yielding 56% meat, 19% bone, and 13.7% fat. Camels are expected to contribute 3.9 and 4.8% of the target red meat production and foreign currency exchange earnings from export of live animal respectively by 2030. Camel meat is well known in some regions of Ethiopia such as Somali, Afar, Borana, Eastern Oromia, Dire Dawa administration and Harari Region and societies in these areas. Particularly, the Muslim society consumes camel meat equally with other animal meat.

Camel feedlot fattening is the practice of raising camels in a confined area and feeding them with high-energy diet to improve their weight and meat quality. It is like cattle feedlot operation, but with some differences in the nutritional and health requirements of camels.

Some benefits of camel feedlot fattening are:

- It can provide a consistent supply of camel meat for the domestic and export markets.
- It can reduce the environmental impact of feral camels, which are considered a pest in some parts of the world.
- It can improve the income and livelihood of camel producers and feedlot operators.

Camel feedlot fattening can be done at different scales, depending on the available resources, market demand, and management skills. Here are some general guidelines for small, medium, and large-scale camel feedlot fattening:

Box 7: Recommended standards and sizes for camel feedlots

Camel feedlot fattening can be done at different scales, depending on the available resources, market demand, and management skills.

- a. Small scale feedlot camel fattening: This is suitable for farmers who have a few camels (less than 10) and want to fatten them for their own consumption or local market.

Characteristics

- The feedlot area can be a small pen or a fenced portion of a pasture.
- The feed can be a mixture of crop residues, agro-industrial by-products, and natural forages.
- The feeding period can range from 3 to 6 months, depending on the ideal body condition and the target weight of the camels.
- The average daily weight gain can be around 0.5 kg per camel.

- b. Medium-scale feedlot camel fattening: This is suitable for farmers or entrepreneurs who have a moderate number of camels (10 to 100) and want to fatten them for regional or national market.

Characteristics

- The feedlot area can be a large pen or a barn with adequate ventilation, shade, and water supply.
- The feed can be a balanced ration of concentrate and roughage, with supplements of minerals and vitamins.
- The feeding period can range from 2 to 4 months, depending on the market demand and the quality of the feed.
- The average daily weight gain can be around 1 kg per camel.

- c. Large-scale feedlot camel fattening: This is suitable for commercial feedlot operators who have a large number of camels (more than 100) and want to fatten them for export or domestic market.

Characteristics

- The feedlot area can be a well-designed facility with proper sanitation, waste management, and disease control.
- The feed can be a high-quality ration of concentrate and roughage, with additives of growth promoters and vitamin supplements.
- The feeding period can be around 2 months, depending on the market specifications and the performance of the camels.
- The average daily weight gain can be around 1.5 kg per camel.

Land required for investing on feedlot camel fattening

The land size required for camel feedlot fattening depends on factors such as the number of animals, type of feed, feeding duration, and environmental conditions. However, the following general estimates can be considered according to available sources:

- **Small scale:** For less than 10 camels, the land size can range from 0.5 to 1 hectare for the feedlot area.
- **Medium scale:** For 10 to 100 camels, the land size can range from 1 to 10 hectares for the feedlot area.
- **Large scale:** For more than 100 camels, the land size can vary widely depending on the feedlot design and the feed availability. However, one source suggests that a land size of 20 hectares can accommodate 500 camels in a feedlot.
- These are only rough estimates, and the actual land size required may differ depending on the specific situation and objectives of the feedlot operator.

3.2.5 Investing in Swine Production

Swine are highly prolific, have versatile feeding habits, grow quickly, and exhibit a higher carcass dressing percentage compared to other red meat producing animals. Swine can be relatively produced at low cost and promoted in areas where the demand for animal source foods is high. Foreign residents in Ethiopia, including the diplomatic community and tourists, are the primary consumers of pork in the country. The demand for pork is likely to increase soon. Some of the major drivers for this include large number of diasporas returning home with a culture of pork consumption; increase in tourists; the need to produce food (particularly in an efficient manner); increase in the expatriate community within the country; and change in lifestyle and modernization in the country.

A swine feedlot is a managed facility where pigs (swine) are raised, fed, and fattened to achieve specific production goals. These facilities provide controlled conditions for optimal growth, health, and efficiency. Proper swine nutrition is essential. Feedlots focus on providing balanced diets that meet the specific needs of pigs at different stages (piglets, growers, and finishers).

Regular health checks, vaccinations, and disease prevention protocols are crucial. Swine feedlots have well-designed pens or enclosures to accommodate pigs comfortably. Efficient waste management systems are necessary to minimize environmental impact. Assessing market demand for pork products is vital for profitability. Monitoring Average Daily Gain (ADG) helps evaluate pig growth. Swine feedlot profitability depends on feed costs, market prices, and operational efficiency. Balancing production with environmental stewardship is a challenge. Exploring value-added pork products (e.g., specialty cuts, processed meats) can enhance profitability. Implementing technology (such as precision feeding) can improve efficiency. In summary, swine feedlot production requires careful management, attention to health, and adaptation to market dynamics. It plays a crucial role in meeting global pork demand while ensuring sustainable practices. Therefore, swine production investment can be an alternative investment option for those who want to engage in meat production both for export and domestic consumption.

There are different standards for small, medium, and large-scale swine production investment, depending on the country, region, and market. However, some general criteria can be based on the number of sows, the type of production system, the level of technology, and the environmental impact. Here are some examples of the standards for investing on swine production in different scales:

Box 8: Recommended standards and sizes for swine feedlots

- a. Small-scale swine production: This is suitable for farmers who have less than 10 sows per household and use a backyard or semi-intensive system.

Characteristics

- The investment is low.
- The technology is simple.
- The environmental impact is minimal.
- The main objective is to provide food security, income diversification, and social benefits for the household.

- b. Medium-scale swine production: This is suitable for farmers or entrepreneurs who have 100 to 300 sows and use a semi-intensive or intensive system.

Characteristics

- The investment is moderate
- The technology is improved
- The environmental impact is moderate.
- The main objective is to supply the regional or national market with quality pork products.
- Large-scale feedlot swine fattening: This is suitable for commercial operators who have more than 300 sows and use an intensive or industrial system

Characteristics

- The investment is high
- The technology is advanced
- The environmental impact is high.
- The main objective is to compete in the domestic or export market with high efficiency and profitability.

Land requirement for investing on swine production

The land size required for swine production depends on the number of sows, the production system, technology level, and environmental impact. However, some general estimates can be given based on available information sources:

- **Small scale:** The land size can range from 0.5 to 1 hectare for the feedlot area, and from 7 to 60 hectares for the grazing area. The total land size can be from 7.5 to 61 hectares. This land size may carry from 16 to 120 pigs
- **Medium scale:** The land size can range from 1 to 10 hectares for the feedlot area, and from 70 to 600 hectares for the grazing area. The total land size can be from 71 to 610 hectares for 140 to 1200 pigs.
- **Large scale:** The land size can vary widely depending on the feedlot design and the feed availability. However, it is suggested that a land size of 20 hectares can accommodate 500 sows in a feedlot. The grazing area can be additional or optional, depending on the feed supply.

These are only rough estimates. The actual land size required may differ depending on the specific situation and objectives of the swine production investor.

Required work force and skills for feedlot investment in swine

- **Animal health professionals:** Professionals who provide vaccination and medical services to prevent and control animal diseases are very important.
- **Animal nutritionists:** Professionals with sufficient knowledge, skills and experience in fattening animal feed preparation and feeding are needed.

3.2.6 Investing on Red Meat Processing and Value Addition

Meat is consumed either as part of traditional kitchen-style preparations or as processed meat products. It is possible to fabricate nutrient-rich products from meat for human consumption.

Red meat processing involves various stages in transforming raw meat into consumer-ready products. Value addition refers to enhancing the quality, convenience, and appearance of meat products to meet consumer preferences and create economic value. Limited automation tools are implemented. For example, most cattle meat processing plants rely on manual labor for major processes such as cutting and deboning. Processing meat into value-added products sustains demand and facilitates efficient marketing. The bottleneck in meat processing impacts the local food economy. Addressing this challenge is essential for resilience. Enhancing convenience, taste, tenderness, or other consumer values, and Value-added benefits for processors and raw materials are opportunities in the red meat sector.

Meat processing enables the full utilization of edible carcass parts and provides shelf-stable meat products for regions lacking cold chain infrastructure. In Ethiopia, processed meat is commonly packaged and used by the army. Consequently, red meat processing and value addition present significant investment opportunities for private sector participation. In summary, investing in this area can enhance efficiency, improve product quality, and sustainable growth in the dynamic industry.

Facilities and human resources required for running red meat processing and value addition investment

Red meat processing and value addition is a complex and capital-intensive activity that requires adequate facilities and human resources to ensure food safety, quality, and profitability. Some of the facilities and human resources required for red meat processing and value addition investment are highlighted below:

Recommended facilities & Services for meat processing

A red meat processing and value addition plant requires suitable land and infrastructure to house the following facilities:

- **Slaughterhouse:** where animals are stunned, bled, skinned, eviscerated, and cut into carcasses. The slaughterhouse should have facilities for animal holding, stunning, bleeding, skinning, evisceration, inspection, chilling, and storage.
- **Cutting and deboning:** where carcasses are cut into primal and sub-primal cuts, and the bones are removed. The cutting and deboning area should have facilities for cutting, deboning, trimming, weighing, and packaging.
- **Value addition:** This involves processing meat cuts into products like sausages, burgers, meatballs, jerky, and other value-added items. The value addition area should have facilities for grinding, mixing, stuffing, smoking, drying, cooking, and packaging.

- **Cold chain:** where the meat products are stored and transported under controlled temperature and humidity conditions to prevent spoilage and contamination. The cold chain should have facilities for refrigeration, freezing, thawing, and transportation.
- **Waste management:** where the waste generated from the processing activities, such as blood, offal, bones, fat, etc., are collected, treated, and disposed in an environmentally friendly manner. The waste management system should have facilities for waste collection, treatment, and disposal.
- **Human resources:** A red meat processing and value addition plant needs skilled and trained workforce that can perform the following tasks.
 - **Supervisors and managers:** workers who oversee and coordinate the overall operations of the plant. They should have knowledge and skills in production planning, inventory management, quality assurance, food safety, and human resource management.
 - **Slaughterhouse personnel:** workers who handle the animals, perform the stunning, bleeding, skinning, evisceration, and inspection operations. They should have knowledge and skills in animal welfare, hygiene, sanitation, and meat quality.
 - **Cutting and deboning personnel:** workers who cut and debone the carcasses into meat cuts. They should have knowledge and skills in meat cutting, deboning, trimming, weighing, and packaging.
 - **Value addition personnel:** workers who process the meat cuts into value-added products. They should have knowledge and skills in meat processing, formulation, quality control, and packaging.
 - **Cold chain operators:** workers who manage the storage and transportation of the meat products. They should have knowledge and skills in cold chain management, temperature and humidity control, and logistics.
 - **Waste management team:** workers who handle the waste generated from the processing activities. They should have knowledge and skills in waste management, treatment, recycling and/or disposal.

Land required for establishing red meat processing and value addition plant: According to a guide from Iowa State University, the land size required for a small red meat processing plant can vary depending on the type and capacity of the plant. For example, a plant that processes 25 cattle per week and has a fabrication room, a cooler, a freezer, and a dry storage area would need about 375 square meter of building space and a site area of about 1900 square meter. A plant processing 50 cattle per week, with a larger fabrication room, cooler, freezer, and smokehouse, would require approximately 560 square meter of building space and 2800 square meter of site area. However, these are only general estimates, and the actual land size may depend on other factors such as the layout, the equipment, the waste management, the utilities, the parking, the loading, and the landscape of the plant.

3.2.7 Investing on Hides and Skins Collection and Processing

Hides and skins are essential by-products of red meat production. Hides and skins are processed into leather and subsequently manufactured into different finished leather products such as shoes, handbags, different clothes, etc. In Ethiopia, these valuable by-products have often been discarded as waste in recent years. However, if produced and flayed carefully from the carcass, hides and skins are one of the most precious export commodities.

Facilities for investing on hides and skins collection and processing: When considering an investment in hides and skins collection and processing, it is essential to understand the necessary facilities and human resources. Here are some key aspects to consider:

1 Processing premises:

- Constructing appropriate processing facilities is essential. These facilities should comply with industry standards and provide a hygienic environment for handling hides and skins.

- Ensure adequate ventilation, drainage, and waste disposal systems.
- Designate separate areas for different processing stages, such as cleaning, curing, and storage.

2 Raw material collection and reception:

- Establish efficient systems for collecting raw hides and skins. This involves collaborating with local suppliers, butcheries, and middlemen.
- Set up a reception area where raw materials are inspected, sorted, and recorded.

3 Operations

- Invest in machinery and equipment for processing hides and skins. This includes tools for cleaning, curing, and preserving.
- Train staff on proper handling techniques, including grading, salting, and storage.
- Implement quality control measures to ensure consistent output.

4 Quality assurance program

- Develop a quality assurance Program to maintain high standards. This program should cover all aspects of processing, from raw material handling to final product export.
- Regularly monitor and evaluate processes to identify areas for improvement.

Required human resource: Employing skilled personnel with expertise in hides and skins processing is required. Composition of staff may include:

- **Supervisors:** Oversee overall daily operations.
- **Technicians:** Handle machinery and curing processes.
- **Quality control inspectors:** Ensure product quality meets export requirements.
- Provide on-going training to enhance skills and keep up with industry best practices.

Land required for establishing hide and skin collection and processing plant

The land size needed for establishing a hide and skin collection and processing plant depends on various factors, including the scale of operations, equipment layout, and infrastructure design. However, the general guidelines are:

1 Processing area:

- Allocate space for the processing area where hides and skins are treated, cleaned, and preserved. This area should have sufficient room for workstations, machinery, and storage.
- Consider the flow of materials from collection to processing and packaging. Ensure there's enough space for workers to move efficiently.

2 Storage facilities:

- Set aside space for storing raw hides and skins before processing. Proper storage is crucial to prevent deterioration.
- Allocate additional space for finished products awaiting shipment.

3 Equipment and machinery:

- Depending on the processing methods (such as tanning), allocate space for equipment like soaking drums, fleshing machines, and drying racks.
- Consider the dimensions of each machine and their arrangement within the plant.

4 Utilities and infrastructure:

- Utilities such as water supply, drainage, and electricity are required.
- Plan for administrative offices, restrooms, and employee facilities.

5 Access and transportation:

- Ensure there's enough space for trucks to load and unload hides and skins.
- Consider proximity to transportation routes for efficient logistics.

6 Environmental considerations:

- Assess any environmental regulations or restrictions related to land use.
- If waste treatment facilities are required, allocate space for them.

Remember that these are general guidelines, and the specific land size will vary based on the production capacity, technology, and business plan.

3.3 Dairy-related Investment Options

3.3.1 Investing in Liquid Nitrogen Production

The supply of liquid nitrogen is vital for artificial insemination in dairy cattle, as it preserves both imported and locally produced semen, ensuring its viability over extended periods. By facilitating the cryopreservation of semen at temperatures around 196 degrees Celsius, liquid nitrogen ensures the long-term viability and integrity of semen. This preservation ensures that the semen can be used later, contributing to successful artificial insemination services activities. The scarcity of liquid nitrogen significantly affects the efficacy of artificial insemination services in the dairy sector. In Ethiopia, the production of liquid nitrogen is primarily managed by government-owned facilities. Despite these facilities, a significant gap persists between the demand for and supply of liquid nitrogen. Therefore, investment in liquid nitrogen production, whether for domestic consumption or other revenue-driven purposes, is both important and timely. Such investments are vital for realizing the government initiatives; for example, Lemat Tirufat. This can only be achieved when such provisions are improved.

Nitrogen, which constitutes 78% of atmospheric air, can be extracted through a straightforward process. This presents a valuable investment opportunity given its broad applicability and the growing demand across various sectors. Facilities producing liquid nitrogen can also produce other gases, such as oxygen for medical use in hospitals and carbon dioxide for the beverage industry, and liquid nitrogen for artificial insemination (AI).

Area of land required for this investment: The existing evidence shows that a total of 15,984,000 units of general gases (liquid nitrogen, liquid oxygen, industrial and medical oxygen, industrial and high purity nitrogen gas) require less than one hectare of land. This means that liquid nitrogen investment is an investment option that can be done on relatively limited land. Detailed technical specifications will be further evaluated in the business plan to be submitted by interested investors.

3.3.2 Investing on Crossbred Heifer Multiplication

As an alternative to crossbred heifer multiplication, investing in semen processing and supply could also be a valid option.

Ethiopia, according to the Central Statistical Agency (CSA, 2021), has the largest cattle population in Africa, with over 97% being indigenous breeds. Indigenous cattle have a notably low milk production capacity, averaging approximately 1.48 liters per day per cow, (CSA, 2021), less than 600 liters per lactation. Relying exclusively on indigenous cattle to meet national milk demand is unfeasible.

Therefore, implementing crossbreeding programs is a crucial strategy to enhance milk production. Crossbreeding indigenous cattle with exotic breeds produces crossbred heifers, which have significantly higher milk yields compared to indigenous cows. Therefore, investing in the multiplication of crossbred heifers is thus a particularly viable option, promising not only higher milk output but also a more sustainable dairy sector.

Currently, the demand for crossbred heifers far exceeds supply. Only a few research centers and private farms such as those around Selale, Sululta, and Holeta, are producing and supplying dairy heifers. This is based on small farming, not at a larger scale investment level. It would be difficult to meet the supply of improved dairy heifers with such modalities.



Figure 6: Crossbred heifer multiplication

Establishing breeding and multiplication centers or supplying crossbred heifers through contractual agreements with local farmers presents a viable investment option.

- **Genetic selection:** Selecting the right breeds for crossbreeding is foundational. Focus should be placed on breeds well-adapted to the local environment and possessing complementary traits, such as high milk yield and disease resistance.
- **Determining initial herd size:** The initial herd size for producing crossbred dairy heifers depends on the number of heifers planned for production and the capacity to utilize existing technologies in the sector. For instance, if an investor plans to start a business with a production of 100 heifers, there are many factors to consider. According to natural law, 50% of all births are supposed to be male. So out of 100 pregnant cows, only 50 heifers would be available. This is if all the pregnant cows could give birth, which happens in rare cases. In general, if you inseminate a hundred cows, only 90 will get pregnant. Out of 90, only 85 can give birth; of the 85, half are heifers, and the rest would be bulls. There are many additional health factors that determine the size of a starting herd, as those born may not all grow to maturity. Technologies such as sexed semen can significantly reduce the need for larger initial herds by increasing the likelihood of female calf births.

- **Land required:** The land required for dairy heifer production can vary based on several factors such as the breed of the heifers, the production system used, and the local environment. For the construction of dairy sheds and ancillary structures, including a milking parlour, maternity pens, straw store, feed store, implements room, milk room, chaff cutter shed, manure pit, roads, alleys, and office, requires approximately 46.5 square meter per animal for 20-animal dairy unit. More information about dairy heifer production requirements is detailed in Bediye et al. (2022).

Investment in semen processing and supply

Investment in semen processing and supply is another viable option, requiring the production and maintenance of elite bulls and the establishment of facilities for semen processing and handling. In this investment option, semen collection methods and management of bulls from which the semen is collected are discussed. Individuals or organizations interested in investing on semen processing and supply should consult relevant materials and expertise in addition to the hints provided here.

Breeding bull care and management

As the bull represents “half of the herd,” providing proper care and attention is crucial to maintain its fitness and health for breeding purposes. Health and safety are crucial when handling bulls. Both dairy and beef breed bulls can be aggressive, so it is advisable to begin halter training from an early age and consider using a nose ring. Using an appropriate race and crush is recommended, ensuring that facilities are large and strong enough to restrain a fully grown bull. Accidents can happen unexpectedly, so preparation is key.

Housing of breeding bull for semen collection

Bulls should be kept separately from other cattle. The ideal bull pen should be within sight of other cattle but strong enough to contain the bull. External gates should be lockable, and feeding and watering should be done from outside the pen. There should be a refuge or emergency escape route within the pen, and a crush or headgate should be available for securing the bull. Never enter the pen when the bull is loose and include a safety sign at the entrance to the building or pen.

Puberty of breeding bulls

Puberty in bulls typically occurs around 11 months of age, depending on the breed. Puberty is defined as the first time the animal produces a fertile ejaculate with a concentration of at least 50×10^6 /ml and 10% progressive motility. Scrotal circumference should be between 25-27 cm, although this can vary by breed. Behavioral changes may be observed at puberty. The bull starts showing sexual interest about three weeks before puberty and will achieve mating ability approximately six weeks after reaching puberty. Libido is influenced by the social hierarchy within the bull group, with younger bulls often being lower in the hierarchy.

Nutrition of breeding bull for semen collection

A diet rich in protein, vitamins, minerals, and energy can accelerate the onset of puberty in breeding bulls. However, high-energy diets in post-pubertal bulls can be detrimental, potentially leading to reduced sperm production, quality, and libido. Deficiencies in zinc and selenium can also impact fertility. The ideal body condition score (BCS) before mating should be between 3 and 3.5. Bulls can lose up to 90 kg during an intensive breeding season.

Environment-thermoregulation of breeding bull for semen collection

The testicular temperature should be maintained between 2°C and 6°C (35.6°F and 42.8°F). Breeding for a pendulous scrotum helps keep the testicles away from the abdomen, thus keeping them cooler. The dartos

muscle can adjust the scrotal position in response to temperature changes. Thin, hairless scrotal skin, which lacks subcutaneous fat, and testicular blood vessels facilitate heat exchange. Increased scrotal temperature can be caused by insulation of the scrotal neck in bulls with excess condition, high ambient environmental temperatures, inflammation of the scrotum or testes, generalized pyrexia, and prolonged recumbency (e.g., due to lameness). The effects of increased scrotal temperature include fewer live spermatozoa in the ejaculate, reduced progressive motility, and increased morphological abnormalities. It takes approximately six weeks for the ejaculate to return to normal after a thermal insult.

Breeding seasons

A bull breeding soundness examination should be conducted before each breeding season. This examination should include a general physical examination, an assessment of external and internal genitalia, and a semen evaluation. There is no definitive ratio for bulls to cows, as it depends on the results of an individual bull's breeding soundness exam. A common rule of thumb is one cow or heifer per month of the bull's age, up to 30 months. For example, an 18-month-old bull could be paired with 18 cows. Generally, young bulls should be paired at a ratio of around 1:20, while older bulls should be paired at around 1:30.

Semen collection methods and procedures

Semen collection in cattle is crucial for successful artificial insemination (AI) and genetic improvement. This comprehensive guide outlines the primary techniques for collecting bull semen, their advantages, and best practices.

Understanding semen collection

Semen collection in cattle is crucial for successful artificial insemination (AI) and genetic improvement. This comprehensive guide outlines the primary techniques for collecting bull semen, their advantages, and best practices.

Importance of semen collection

Semen collection plays a crucial role in livestock management. It enables:

- Genetic improvement: Breeders can select superior bulls to enhance herd quality.
- Disease control: AI reduces the risk of sexually transmitted diseases compared to natural breeding.
- Efficiency: Semen can be stored and transported, allowing for breeding across distances.

Primary semen collection techniques

1 Artificial vagina (AV) method

The artificial vagina method is the most used technique for collecting bull semen. It replicates the natural environment of a cow's vagina, ensuring comfort for the bull.

How the AV method works

1. **Preparation:** The AV is filled with warm water (around 37°C). This temperature helps relax the bull.
2. **Stimulation:** A teaser animal, usually a cow in heat, is used to encourage the bull to mount.
3. **Collection:** As the bull ejaculates, the AV collects the semen.

This method is effective and widely used due to its simplicity and reliability.

2 Electroejaculation

Electroejaculation is another effective method for collecting semen, especially from bulls that are difficult to handle or mount.

Procedure for electroejaculation

1. **Equipment setup:** An electro-ejaculator is prepared. This device sends electrical impulses to stimulate ejaculation.
2. **Insertion:** A lubricated electrode is inserted into the rectum.
3. **Stimulation:** Gradual electrical stimulation induces ejaculation, allowing for direct collection into a sterile container.

Electroejaculation is particularly useful when dealing with aggressive or untrained bulls.

3. Manual stimulation

Manual stimulation involves physically stimulating the bull's penis to induce ejaculation. This method is less common but can be effective in certain situations.

Steps involved in manual stimulation

1. **Preparation:** The handler ensures a calm environment.
2. **Stimulation:** The handler manually stimulates the penis until ejaculation occurs.

While this method can be effective, it requires skilled personnel to ensure safety and efficiency.

Best practices for semen collection

Hygiene and safety

Maintaining hygiene during semen collection is critical to prevent contamination. All equipment should be sterilized before use.

Key points

- Use disposable gloves when handling equipment.
- Clean all tools with disinfectants.
- Ensure that the collection area is clean and free from distractions.

Animal welfare considerations

Animal welfare should always be a priority during semen collection procedures. Stressful environments can affect both the bull's performance and the quality of collected semen.

Tips for ensuring animal welfare

- Use gentle handling techniques.
- Minimize noise and distractions during collection.
- Provide adequate rest periods between collections.

Storage and processing of semen

Once collected, semen needs proper storage to maintain its viability for AI procedures.

Storage techniques

1. **Dilution:** Collected semen is often diluted with extenders that provide nutrients and protect sperm during freezing.
2. **Freezing:** Semen can be frozen in liquid nitrogen for long-term storage.
3. **Thawing:** When ready for use, frozen semen must be thawed quickly at a controlled temperature.

3.3.3 Investing on Milk Production and Processing

Investing in milk production and processing is a profitable venture requiring careful planning and considerations. The cost of setting up a dairy processing plant can vary widely depending on the scale of operation, location, and applied technology. Approximately 15% of Ethiopia's total milk production is distributed through cooperatives and private dairy processing plants. This shows a wide scope for entrepreneurs to invest in milk processing and manufacture of dairy products for both domestic and export market. Processing of dairy products allows small-scale dairy producers to generate higher cash incomes than selling raw milk and offers better opportunities to reach regional and urban markets (fao.org). Milk processing can also help to deal with seasonal fluctuations in milk supply and demand. The profitability of a dairy processing plant depends on factors such as the cost of raw milk, operational expenses, the price of processed dairy products, and the efficiency of the plant. The demand for dairy products is growing rapidly around the world, providing opportunities for investment in milk processing.

A Investing in Cow Milk Production and Processing

Milk production can be enhanced by encouraging private sector participation in improved dairy cattle breeding and production. Such involvement could help replace imported dairy products with domestic alternatives and contribute to export trade. Indigenous cattle in Ethiopia are known for their low milk and meat production potential. However, their productivity can be increased through crossbreeding with improved exotic breeds or by enhancing the management of indigenous cattle.

Therefore, taking the suitable areas of the private sector into consideration and applying the private and contractual investment modality, engaging in milk production can be alternative type of investment.

- **Herd size:** Dairy production investment should start with a minimum of 25 or more dairy cows.
- **Size of land required:** Crossbred dairy cows are valued for their higher milk production but should not roam freely in large fields to meet their nutritional needs. Instead, they should be provided with balanced diets while kept under restricted movement, primarily indoors, to optimize feed conversion into milk. Consequently, the required land area is reduced and mainly needed for facilities such as night shelters, watering and feeding troughs, milking parlors, calf-rearing areas, maternity pens, and daily recreation spaces. However, if fodder is to be grown on the same farm, additional land will be necessary.

B Investing in Dairy Goat Production

Investing in goat milk production is a profitable venture that requires proper planning. The global goat milk market size was valued at \$8.5 billion in 2018 and is projected to reach \$11.4 billion by 2026, growing at a compounded annual growth rate (CAGR) of 3.8% from 2019 to 2026¹. The global goat milk products market size was estimated at USD 12.45 billion in 2022 and is expected to expand at a CAGR of 4.7% from 2023 to 2030².

Goat milk is generally used for direct consumption as well as to produce infant formula. Various end-products such as cheese, butter, ice cream, yogurt, etc. are also made from goat's milk. Investment in dairy goat farming

requires relatively low capital but offers high returns. However, the returns from commercial dairy goat farming business mostly depend on proper breed selection, proper feeding, proper housing, and other management practices such as health care.

Most of the goat breeds in Ethiopia's lowland and semi-lowland areas possess significant genetic potential for milk production. This means that most of them are used for dual purpose. For example: Somali goats with short and long ears; Afar goats, Abergele goats, the goats in Borena, Woyto-Guji goats and the like are used for milk production in addition to meat production. Goat milk has its own health benefits when compared to cow's milk. According to available studies, it has been shown that goats' milk is an irreplaceable substitute for children and lactose intolerant adults. Therefore, targeting goat milk production in Ethiopia, investors can consider:

- 1 Breeding and supplying selected indigenous goats for milk production.
- 2 Introducing improved exotic or crossbred dairy goats from feasible sources.

C Investing in Camel Milk Production, Processing, and Value Addition

Investing in camel milk production in Ethiopia is a promising opportunity that demands careful planning and consideration. While official reports from the Ethiopia Central Statistical Agency (CSA) historically underestimated the camel population, particularly in the non-sedentary areas of Somali and Afar regions, a more recent 2021 survey by the CSA now reports over 8 million camels in Ethiopia.

Dromedary camels produce more milk for a longer period than any other milk animal held under the same harsh conditions. Camel milk serves as a year-round source of food, nutrition, and income for many pastoralists in the region. Camel milk enhances livelihoods and contributes to national and global economic growth and development.

Although formal camel exports have stagnated, informal export significantly surpass formal ones in Ethiopia. Camel milk accounts for the largest proportion of milk produced and consumed in pastoral areas of Ethiopia. Due to its high medicinal and cosmetic value, the demand for camel milk in both domestic and export markets is very high.

Therefore, camel milk production presents an alternative investment opportunity in the arid and semi-arid areas of Ethiopia. Processing camel milk and developing value-added products for domestic and international markets provide additional investment opportunities.

D Investing in Strategic Milk Reserve

Investment in Ethiopia's dairy industry, including strategic milk reserve, is a critical area of focus. The International Livestock Research Institute (ILRI) has conducted research on the status, major challenges, and potential interventions for improvement in the dairy industry. They highlight that investment in livestock has the potential to create a multiple effect. The Ministry of Agriculture is also working towards transforming the smallholder subsistence farming system to a more commercial-oriented production system. The vision includes increasing the number of improved dairy cattle breeds and improving daily milk production. The World Bank is collaborating with the Ethiopian government to shift towards a more professional and efficient dairy system that benefits people, the economy, and the environment. Moreover, the Food and Agriculture Organization has developed a strategic analysis and intervention plan for cow milk and dairy products in the Central and Eastern parts of Oromia region. These initiatives indicate a strategic focus on improving the dairy industry, which could include the development of milk reserves. Surplus milk often accumulates in Ethiopia's mixed production systems, especially during Orthodox fasting periods. On the other hand, milk is surplus in the pastoral areas during seasons of adequate feed availability. Hence, investing on strategic milk reserve through processing and value addition could be one of the viable investment options.

Creating a strategic milk reserve to extend the shelf life of surplus milk—produced during low demand periods in highland areas and during fodder-rich seasons in lowlands—presents a viable investment option. Such experience has been widely used in Kenya and other countries; hence Ethiopia can also consider the private sector to establish a systematic reserve for cow and camel milk and contribute to the utilization of the country's milk production and contribute to the country's economy.

Box 9: Critical consideration & legal requirements for milk processing

a. Heat treatment (Pasteurization):

- Legal requirement: In most countries, milk processing plants must adhere to specific heat treatment standards to eliminate pathogenic microorganisms. The minimum temperature/holding time for pasteurization is typically 72°C for 15 seconds.
- Process: The milk undergoes heat treatment to kill harmful bacteria while preserving its nutritional quality. Proper temperature control and recording are essential.

b. Clarification:

- Legal requirement: Before pasteurization, milk must be clarified to remove solid impurities such as dirt particles, white blood corpuscles (leucocytes), and somatic cells from udder tissue.
- Process: Clarification can be achieved using filters or centrifugal clarifiers to ensure effective pasteurization by preventing bacteria from hiding in milk lumps or particles.

c. Project Engineering Considerations:

- Product-related: Consider raw material quality, treatment, and end-product quality.
- Process-related: Evaluate plant capacity, component selection, process control, heating and cooling media availability, and equipment cleaning.
- Economic: Strive for cost-effective production while meeting quality standards.
- Legal: Comply with legislation regarding process parameters, component choices, and system solutions.

d. Recording and monitoring:

- Legal requirement: Automatic temperature recording during pasteurization, with transcripts saved for a specified period. Process: Implement systems to monitor and record heating temperatures accurately.

e. Additional Standards:

- EFDA recommendations: The Ethiopian food and drugs administration authority (EFDA) provides guidelines for dairy product manufacturers.
- ISO standards: ISO/TC34/SC5 lists milk and milk product standards, including microbiological quality and bacterial testing.
- Grade "A" Pasteurized Milk Ordinance (PMO): Industry standard guide for dairy farm and processing plant specifications and regulations.

3.3.4 Investing in Improved Bulls Production

Investment in dairy bull production is a crucial aspect of the dairy industry in Ethiopia. The country's dairy production mainly depends on indigenous livestock genetic resources, with cattle contributing the largest share (81.2%) of the total national annual milk output.

Cattle keepers in Ethiopia often select their herds based on marketable traits, such as milk yield, growth rate, and reproductive performance in both heifers/cows, and steers/bulls. This indicates the importance of investing in quality dairy bull production for improving milk production.

The Ethiopian National Dairy Development Strategy (2022–2031) outlines a vision for comprehensive vision for dairy sector development, emphasizing dairy cattle improvement. The strategy recognizes the large and diverse livestock genetic resources, diverse agro-ecologies suitable for dairy production, increasing domestic demand for milk and milk products, improved market opportunities, and proximity to international markets as contributing factors to the growing potential and opportunities for dairy development in the country (Legese et al., 2023).

Exotic gene inheritance in dairy bulls refers to genetic traits inherited from foreign or non-native cattle breeds. This is often a result of crossbreeding, which is used to improve certain traits in the offspring, such as milk production, fertility, and disease resistance. A study on sub-fertility in crossbred bulls, specifically between zebu (*Bos indicus*) and crossbred (*Bos taurus* x *Bos indicus*) bulls, found that there were significant differences in the testicular transcriptome between these breeds. The study found that genes involved in cell proliferation, differentiation, and steroidogenesis were down regulated in crossbred bulls, which might be associated with higher incidence of poor semen quality and/or sub-fertility/infertility in crossbred bulls as compared to Zebu bulls. In addition, the study found that the SPATA7 gene, which is associated with spermatogenesis, was significantly down regulated in crossbred bulls, while transition proteins (TNP1 and TNP2), which are involved in chromatin compaction during sperm development, were significantly upregulated. These findings indicate that exotic genes inheritance significantly affects the fertility and semen quality of dairy bulls. Bull is said to be half of a herd. This is because half the genetics of the herd could be obtained from a bull as selected bull plays a very important role in impregnating the cows and heifers in the herd.



Figure 7: Elite Bull (Crossbred) Maintained at Holeta Agricultural Research Centre

Currently, the lack of quality semen and inefficiency of artificial insemination services remain critical challenges in Ethiopia's dairy cattle breeding. Therefore, production of improved dairy bulls to artificially collect quality semen to supply for needy dairy farms both in the form of natural and artificial insemination could be considered a viable investment option.

Equipment Required for Dairy Investment: Certain tools and facilities are essential for running a successful and profitable livestock farm. The practice of livestock rearing necessitates an assortment of both electric and non-electric equipment. Numerous livestock farmers prefer non-electric tools over the electric ones due to their superior reliability, user-friendliness, cost-effectiveness in terms of purchase, and durability. Such options also contribute to sustained profitability. Various equipment, including livestock guards, crates, and feeding and watering troughs, play essential roles in ensuring livestock security, feeding, and handling of livestock on the farm.

- **Guard:** A cattle guard is a mechanical apparatus made up of several metal components arranged between bars, spaced adequately to strain grazing animals from straying beyond a designated land enclosure. Moreover, it is typically constructed securely.
- **Crates:** Cattle crates also known as cages, are used to restrain animals for procedures such as inspection, marking, or processing. Modern crates are typically constructed from steel and come in various sizes.
- **Chute:** A chute is a confined corridor designed to direct or regulate the movement of a herd within a defined space.
- **Feeding and watering trough:** Livestock farming requires a variety of equipment for supplying feed and water. Feeding can be complex; therefore, steel feeding rings have been developed to simplify operations. These are available in different sizes that allow several of the cattle to feed at the same time. Feeding troughs are most common, but there are several alternative options such as creep feeders and feed bins. Water troughs are usually constructed with galvanized steel used for providing water to the cattle. Plastic troughs can be used but are easily damaged. Hence, care should be exercised in using any kind of plastic within a large operation. Additionally, storage tanks can be purchased to store water for some time.

Table 7: Job positions with their primary activities in dairy and related investments in Ethiopia

No	Job Title	Primary activity
1	Milker	• Responsible for caring for cows and calves on a farm. • Milk cows by hand or using milking equipment while following sanitary and safety regulations. • Maintain accurate milking records to ensure cows receiving medical treatment are excluded from milk production. • Inform the supervisor or herd manager if any cow has mastitis or other issues affecting milk production. • Assist with other farm duties as needed, such as cleaning barns and maintaining pastures.
2	Veterinary Technician	• Administers treatments to sick or injured cows under the provision of licensed veterinarian. • Assists with performing physical assessments, taking samples (e.g., blood, milk), or administering medications. • Uses training to keep cows calm during examinations and safely restrains them when necessary.
3	Farm Manager	• Coordinates the daily operations of a farm. • Supervises employees, including farm workers and herders. • Develops feeding schedules, trains staff on milking procedures, and maintains monthly inventories. • Oversee quality control processes and ensures compliance with regulations by discarding milk when necessary. • Develops and executes budgets and manages cow sales or purchases.

No	Job Title	Primary activity
4	Feeder	- Ensures cattle have adequate supplies of feed and water. - Performs daily monitoring to provide access to clean water. - Feeds cows and calves at scheduled times and takes feed samples for nutrient testing. - Inspects feed to ensure it is not spoiled and maintains feeding equipment. - Cleaning barns and stalls routinely to maintain animals' comfort.
5	Soil Technician	- Analyzes soil to improve pasture conditions. - Gathers data and creates plans to enhance soil and vegetation for higher-quality milk production. - Recommends strategies to improve pasture health, such as reducing tillage frequency. - Uses irrigation methods to help prevent erosion.
6	Nutritionist	- Creates and implements programs to maintain or improve herd diets. - Monitor overall herd health through dietary analysis. - Takes feed samples to determine nutritional value and develops balanced diets, including supplements or ration adjustments. - Tracks milk output and other data to optimize feeding plans. - Prepares progress reports to demonstrate results feeding programs.
7	Herd Manager	- Oversees the care and maintenance of the livestock herd. - Plans and delegates daily tasks, including feeding, milking, and cleaning. - Ensures compliance with regulations, including sanitation and mandatory identification monitoring. - Collaborates with nutritionists and veterinarians to maintain herd health. - Performs administrative tasks, such as record-keeping and payroll management.
8	Herder	- Cares for cows and calves, including herding to grazing areas for improved pasture quality. - Trims hooves to prevent infections and illnesses. - Monitors cow behaviour and keeps them calm in adverse conditions, such as inclement weather. - Assist with routine farm tasks, such as cleaning stalls, milking or feeding cows, and maintaining farm equipment.
9	Quality Control Inspector	- Examines products to ensure compliance with regulatory standards. - Collects milk samples for quality and safety testing. - Inspects animals, farmland, and equipment to ensure adheres to safety and sanitation regulations. - Documents regulatory violations, issue fines, and provides recommendations for improving product quality. - Prepares detailed inspection reports.
10	Sales Representative	- Sells the farm's products to customers and builds relationships with clients, such as veterinary and milk laboratories. - Attends industry events, to promote the farm's products. - Works with herding and farm managers to understand farming processes and milk quality. - Delivers product and manages inventories and rotates stock as needed.
11	Artificial Inseminator	- Provides reproductive services, including artificial insemination and in vitro fertilization. - Oversees cow breeding programs to ensure optimal genetics for productive herds. - Retrieves embryos, assesses their quality, and prepares them for transfer. - Preserves embryos, such as freezing them in liquid nitrogen for future use. - Assist veterinarians when needed.

No	Job Title	Primary activity
12	Veterinarian	- Manages herd health by performing preventive care, such as vaccinations and reproductive examinations. - Develops comprehensive health management plans in collaboration with herd or farm managers. - Responds to health emergencies, treats sick or injured animals, and performs diagnostics (e.g., X-rays) or surgeries. - Prescribes medications, such as antibiotics, when necessary.
13	Chemical Engineers	Design and operate equipment for liquid nitrogen production.
14	Industrial Gas Suppliers	Responsible for distributing liquid nitrogen production.
15	Safety Specialists	Ensures the safe handling, transportation, and storage of liquid nitrogen.
16	Sales and Marketing Professionals	Develop and implement strategies to promote the company's products and services.
17	Logistics and Supply Chain Managers	- Manage the end-to-end transportation and delivery of liquid nitrogen. - Optimize inventory management and supply chain routes.

Human power requirement for dairy related investments

Different professionals, including milkers, feeders, herd managers, and veterinarians, are employed by many dairy farms to ensure the production of high-quality milk. Certain roles of these employees require direct interaction with the animals to enhance the health and welfare of the animals, while others concentrate on different farm activities like administration and sales. Details of professionals or skilled human power suggested to be fulfilled by proposed dairy related investments are summarized in Table 8 below:

Table 8: Suggested human power positions for dairy related investments in Ethiopia

No	Required human power	Dairy-related investment options						
		Liquid nitrogen	Crossbred heifer multiplication	Veterinary services	Cow milk production and value addition	Camel and goat milk production and value addition	Strategic milk reserve	Improved bull production and semen processing
1	Milker	Not required	Optional	Not required	Required	Optional	Not required	Optional
2	Veterinary technician	Not required	Required	Required	Required	Required	Not required	Required
3	Farm manager	Not required	Required	Not required	Required	Required	Not required	Required
4	Feeder	Not required	Required	Not required	Required	Required	Not required	Required
5	Soil technician	Not required	Optional	Not required	Optional	Optional	Not required	Optional
6	Nutritionist	Not required	Required	Not required	Required	Required	Required	Required
7	Herd manager	Not required	Required	Not required	Required	Required	Not required	Required
8	Herder	Not required	Required	Not required	Required	Required	Not required	Required

No	Required human power	Dairy-related investment options						
		Liquid nitrogen	Crossbred heifer multiplication	Veterinary services	Cow milk production and value addition	Camel and goat milk production and value addition	Strategic milk reserve	Improved bull production and semen processing
10	Sales representative	Not required	Required	Not required	Required	Required	Required	Required
11	Embryologist	Not required	Optional	Not required	Optional	Optional	Optional	Optional
12	Veterinarian	Not required	Optional	Required	Optional	Optional	Optional	Optional
13	Chemical Engineers	Required	Not required	Not required	Not required	Not required	Not required	Not required
14	Industrial Gas Suppliers	Required	Not required	Not required	Not required	Not required	Not required	Not required
15	Safety Specialists	Required	Not required	Not required	Not required	Not required	Not required	Not required
16	Sales and Marketing Professionals:	Required	Not required	Not required	Not required	Not required	Not required	Not required
17	Logistics and Supply Chain Managers	Required	Not required	Not required	Not required	Not required	Not required	Not required

3.4 Investing in Poultry Production

Despite Ethiopia's large poultry population and favorable climate, the country has yet to fully capitalize on this sector's potential. Population growth, rising incomes, urbanization, and changing lifestyles have driven a significant increase in demand for chicken products. However, domestic production remains insufficient to meet this demand, resulting in egg and chicken meat consumption levels 2-10 times lower than many other African countries. According to 2021 data from the Regional Information Service, annual per capita consumption of eggs and chicken meat in Ethiopia is only 0.07 kg and 0.6 kg, respectively.

The primary challenges hindering the development of Ethiopia's poultry sector include low productivity of indigenous breeds, insufficient supply of improved breeds, poor-quality poultry feed, inadequate health services, weak extension and research systems, and a shortage of skilled manpower. Poultry production remains largely traditional, with limited private sector participation. This lack of involvement is primarily due to the absence of a comprehensive document detailing viable investment options and promoting opportunities in the sector. Therefore, addressing poultry sector issues is essential part of this Handbook.

3.4.1 Investing in Grandparent Stock Production

Grandparent stock production in Ethiopia is a viable investment, from where improved breeds for layers, broilers, and dual-purpose breeds are identified and preconditions are facilitated.

- A feasible grandparent stock investment requires a stock size of 5,000 or more, while 350,000 or more improved breeds of parent stock should be marketed annually. This highlights the importance of considering the export market to accessible neighboring countries.
- An investment model that shares risks with the private sector should be considered. Therefore, developing a Public-Private Partnership (PPP) modality for grandparent stock farming is a viable investment venture.

3.4.2 Investing in Parent Stock Production and Multiplication

In this system, hatchery centers are required to collect fertile eggs from other sources and produce chicks every 21 days using an artificial hatching machine (Incubator). Investment in parent stock production resolves the current supply shortage of improved poultry breeds in the country. Investment in parent stock production requires identification of best performing improved poultry breeds of broilers, layers, and dual-purpose breed poultry to ensure the feasibility of the business. Investors in parent stock production can supply fertile eggs to hatchery farms and provide day-old chicks to growers. The minimum feasible operation size for parent stock production is 5,000 chickens per production cycle.

3.4.3 Investing in Day-Old-Chicks Hatchery/Multiplication

The existing day-old chick hatching centers are not sufficient to meet the demand for the day-old chicks of improved breeds in Ethiopia. Therefore, to meet the supply shortage, it is necessary to engage private investors in day-old chick multiplication.

This system involves hatchery centers collecting fertile eggs from other sources and producing chicks every 21 days using an artificial hatching machine (incubators).

This investment venture requires an investor to have a machine capable of hatching more than 6000 eggs per cycle. The efficiency of the machine should be 75% and there should be 9 days off-time for the desired hygiene and free duration. With this consideration the hatchery plant could serve for 10 rounds annually and has the capacity to produce 45000 day-old-chicks in a year. Highly demanded broiler breeds like Cobb500, Rose 308, and Hubbard; dual-purpose breeds such as Cocok and Sasso; and layer breeds such as Bovan's Brown and Bovan's White should be considered for the investment.

3.4.4 Investing in Growing Pullets

Growing day-old chicks to pullet for establishing layer farm by a given individual looks less feasible since the technology of producing sexed day-old chicks is not common. A grower farm raises both male and female chicks together up to a certain age when both could be sold for different purposes. Male birds are sold as broilers while the pullets are sold to layer farms. This makes a mother brooder operation a feasible business. Well managed pullets could be marketed within 45 to 90 days depending on the situation.

To ensure a viable and sustainable investment in growing pullets, it is essential to raise at least 30,000 pullets per production season, producing a total of 90,000 to 120,000 pullets for market in 3-4 cycles per year.

3.4.5 Investing in Egg Production

Investing in egg production is a viable business venture for producing edible eggs and supplying to the market, and hence significantly contributing to the national economic growth, employment opportunities and ensuring food/nutrition security.

Ethiopia exhibits a significant gap between the demand and supply of eggs. Identification of improved layer and dual-purpose chicken breeds adaptable to different agro-ecologies and availing them for investment in egg production is a viable business venture. Egg production is a zero-waste business, generating not only from the sale of eggs but also from hens that have ceased laying (sold for meat) and litter, which can be utilized as fertilizer or sold.

Before starting the investment in egg production, it is essential to assess adaptable improved layer breeds with high egg production potential. Based on the interest of the investor and the availability of land, deep liter system, cage system, and semi-scavenging systems are viable. The lucrativeness of egg production is ensured if started with at least 10 thousand or more laying hens.

3.4.6 Investing in Broiler Production

Ethiopia has struggled to meet societal protein requirements from animal sources. Therefore, investing in chicken meat production in areas close to market and market opportunities is a viable investment option that can meet the demand for meat in a short period of time (within 38 - 45 days).

Investor in broiler production should consider improved breeds known for high meat production, such as Cobb-500, Rose-308, Hubbard, and any other commercial breeds. It is necessary to start with a minimum of 10 thousand chickens to make broiler investment more profitable.

Land Requirement for Investing in Poultry Production: The technological framework chosen for investing in poultry production is closely tied to both the scale of the investment and the corresponding land requirements. The magnitude of the venture dictates the level of sophistication and automation in the technologies deployed. Smaller-scale investments might lean towards more traditional and cost-effective approaches, while larger-scale operations could harness advanced technologies for enhanced efficiency. Concurrently, the allocation and suitability of the land play a pivotal role in determining the technological infrastructure that can be used.

The strategic location selection is crucial for the success of a poultry farming venture. A consistent and reliable water supply is essential to maintain optimal conditions for poultry. Additionally, the location should align with strong market opportunities, ensuring steady demand to support sustained profitability. Selecting a site away from residential areas helps mitigate issues such as noise, odors, and zoning restrictions. This decision not only reduces potential conflicts with local communities but also creates a more conducive environment for poultry operations.

Identifying suitable investment areas is equally important. To enhance biosecurity and minimize risks, the poultry center should be positioned as far as possible from other poultry operations. This spatial isolation helps prevent disease spread and cross-contamination. Implementing a phased approach, where each stage operates as a separate unit, further strengthens biosecurity. This compartmentalization ensures that issues in one phase are contained and do not affect the overall operation. This compartmentalization ensures that any issues in one phase are contained and do not compromise the overall operation.

The success of a poultry production investment depends on careful integration of technology, land selection, and strategic planning. Moreover, the investor should select a location that has dependable supply of water and good access to markets. It is also essential to ensure the following bio-security measures are considered when establishing and running a poultry investment.

- For investing in grandparent stock, allocate 20-30 hectares of dedicated land, distinct from other poultry activities. Maintain a 3.2 km radius separation from any other poultry farms to ensure vital biosecurity measures. This isolation safeguards breeding centres and prevents potential disease spread, fostering a secure and efficient operation.
- For parent stock multiplication centres, it is often advised maintaining specific stock densities during the rear phase (10–105 days), recommending 3 to 4 birds/m² for males and 4-8 birds/m² for females. It's crucial to consider the space required for each bird. For a population of 180 thousand chickens, the land size needed for parent stock production is estimated to be 12 to 15 hectares. This ensures adequate space for healthy development, minimizing stress and promoting optimal breeding conditions.
- To hatch day-old chicks successfully, it is imperative to designate a dedicated space. Allocate roughly 1 hectare for this purpose, ensuring ample room for the installation of essential equipment such as incubators and brooders. This designated area serves as a critical hub for the delicate process of chick hatching, facilitating optimal conditions for temperature control, sanitation, and overall hatchery efficiency. Establishing a separate space not only promotes biosecurity but also allows for streamlined management and meticulous attention to the unique requirements of the hatching phase, contributing to the overall success of the poultry production venture.

- Pullet grower investment with a viable stock population of 90 to 120 thousand and considering a stocking density range of 8 to 12 birds per square meter, an estimated land size of 1.125 to 1.5 Hectare of land size is required.
- For a robust stock population of 10,000 layers or egg-laying hens, the recommended stocking density is 5 to 7 birds per square meter. This rate depends on the agro-ecological zone: highland regions typically require less land but can support higher stocking densities, while lowland or hot areas demand more land due to lower stocking densities. Tailoring land use to agro-ecological conditions ensures optimal land utilization and stocking density for efficient layer production.

An estimated 0.14–0.20 hectares of land is required for a stock size of 10,000 hens. Although this land requirement appears smaller compared to other investment options, it reflects the distinct needs of layer production. Other options, such as breeder stock operations, require larger areas to maintain stringent biosecurity measures.

- For broiler production, allocating adequate land for poultry structures and farm activities is crucial. Compared to layer-type chickens, broilers require less land due to their limited mobility during the rearing process. Unlike layers, broiler houses do not require egg-laying nests, reflecting the specific characteristics and needs of broilers. Consequently, broiler production is highly space-efficient, allowing approximately 12 broiler chickens (meat-type) to be reared within 1 square meter.

This optimized use of space emphasizes the efficiency and practicality of broiler production, stressing the specialized requirements of these birds in the overall design and utilization of farmland. Therefore, the estimated land required for broiler production with a viable stock population of 10,000 and a recommended density of 12 birds per square meter, is approximately 0.0833 hectares.

Required Human Resource for the Poultry Production Investment

Table 9: Job positions with their primary activities performed in poultry investment options in Ethiopia

No.	Job title	Primary activities
1	Poultry farm manager	The poultry farm manager is responsible for overseeing the day-to-day operations of a poultry farm. His/her role includes managing staff, ensuring the health and well-being of the poultry, maintaining farm facilities, and implementing production plans. Responsible for coordinating feeding, breeding, and disease control activities, while overseeing record-keeping, budgeting, and ensuring regulatory compliance. The poultry farm manager plays a crucial role in optimizing production efficiency, ensuring product quality, and achieving overall farm success.
2	Poultry farm supervisor	The poultry farm supervisor works under the farm manager and oversees daily activities on the poultry farm. His/her role includes supervising farm workers, ensuring tasks are accomplished efficiently, monitoring flock health, and coordinating with other departments. Key responsibilities include implementing farm protocols, managing resources, reporting issues to the farm manager, training staff, and fostering a positive working environment.
3	Poultry farm technician	The poultry farm technician is responsible for hands-on tasks related to poultry care and farm maintenance. Their role includes feeding, watering, and monitoring the health of the poultry. Technicians assist in implementing breeding and hatching programs and participate in vaccination and disease control measures. They also contribute to facility maintenance, equipment operation, and record-keeping. Poultry Farm Technicians work closely with supervisors and managers to ensure the overall well-being and productivity of the flock on the farm.
4	Poultry farm veterinarian	The poultry farm veterinarian is a specialized professional responsible for the health and well-being of the poultry on the farm. Their role involves disease prevention, diagnosis, and treatment. Veterinarians develop vaccination programs, conduct health inspections, and perform post-mortem examinations when necessary. They work closely with farm management to develop biosecurity measures, implement health protocols, and ensure compliance with regulatory standards. Poultry Farm Veterinarians play a crucial role in maintaining flock health, minimizing disease risks, and optimizing overall production efficiency on the farm.

No.	Job title	Primary activities
5	Poultry farm breeding specialists	The poultry farm breeding specialist is responsible for managing the breeding program to improve genetic traits in poultry. Their role involves selecting breeding pairs, overseeing mating processes, and monitoring hatchery operations. Breeding specialists focus on enhancing traits such as growth rate, egg production, and disease resistance through strategic breeding programs. They also collaborate with geneticists to implement breeding strategies that align with farm goals. Additionally, they analyse data, conduct performance evaluations, and contribute to the overall genetic improvement of the poultry flock on the farm.
6	Poultry farm quality control officer	The poultry farm quality control officer is tasked with ensuring the production of high-quality poultry products. His/her role involves implementing and monitoring quality control processes throughout the production cycle. Quality control officers inspect poultry products for adherence to safety and quality standards, conduct regular audits, and collaborate with other departments to address any issues. They develop and enforce quality assurance protocols, participate in training programs, and stay informed about industry regulations. The goal is to maintain consistent product quality and safety on the poultry farm.
7	Hatchery operators	The hatchery operator is responsible for managing the operations of the chicken hatchery. Their role involves overseeing the incubation process, ensuring proper temperature and humidity levels, and monitoring equipment functionality. Hatchery operators manage egg incubation, monitor hatching, and ensure the health and care of newly hatched chicks. They also conduct routine equipment maintenance, troubleshoot issues, and keep accurate records of hatchery activities. The goal is to optimize hatching rates, ensure the health of newly hatched chicks, and contribute to the overall success of the poultry farm's breeding program.
8	Feed processing operators	The feed processing operators are responsible for managing the feed processing equipment on a poultry farm. Their role involves operating and maintaining feed processing machinery, ensuring accurate mixing of feed ingredients, and monitoring the production process for efficiency and quality. Feed processing operators adjust equipment settings, troubleshoot issues, and perform routine maintenance to ensure feed quality and efficiency. They work closely with nutritionists and farm managers to ensure that feed formulations meet the nutritional needs of the poultry flock. The goal is to produce high-quality feed efficiently to support the health and growth of the poultry on the farm.
9	Broiler farm workers	The broiler farm workers are responsible for carrying out various tasks on a broiler (meat chicken) farm. Their role includes feeding and watering the broilers, monitoring flock health, and ensuring a clean and well-maintained environment. Broiler farm workers may be involved in catching and loading birds for transportation to processing facilities. They assist with routine farm activities, including cleaning and sanitizing equipment, and perform basic record-keeping. Overall, their role is crucial in supporting the day-to-day operations of the broiler farm and contributing to the efficient and healthy growth of the flock.
10	Layer farm workers	The layer farm workers are responsible for tasks related to egg-laying hens on a layer farm. Their role includes daily care of the hens, ensuring proper feeding and watering, and monitoring the health of the flock. Layer farm workers collect eggs, maintain nest boxes, and ensure a clean and sanitary environment. They may also be involved in vaccination programs and record-keeping. Their primary goal is to ensure the well-being and productivity of laying hens, supporting the production of high-quality eggs.
11	Poultry health inspector	Monitors the overall health of the poultry, enforces biosecurity standards, and ensures the quality and safety of poultry products.
12	Poultry nutritionists	Poultry nutritionists are professionals who specialize in designing balanced and optimal diets for poultry. Their role involves formulating feed recipes that meet the specific nutritional requirements of different stages of poultry development, whether it's for broilers, layers, or breeding stock. Poultry nutritionists analyse parameters like protein, energy, vitamins, and minerals to make feed formulations that promote growth, egg production, and overall health in poultry flocks. Poultry nutritionists collaborate with farmers, feed manufacturers, and stakeholders to design diets, stay updated on industry research, and ensure the nutritional well-being of the flock.
13	Poultry farm equipment technicians	Poultry farm equipment technicians are responsible for maintaining and repairing the various types of equipment used on a poultry farm. Their responsibilities include inspecting, troubleshooting, and repairing machinery such as feeders, waterers, ventilation systems, and incubators. Poultry farm equipment technicians may also be involved in installing new equipment, conducting routine maintenance, and keeping detailed records of repairs and inspections. The goal is to ensure that all equipment functions efficiently, contributing to the overall productivity and well-being of the poultry farm.

No.	Job title	Primary activities
14	Research and development specialists in poultry science	Research and development specialists in poultry science are responsible for conducting scientific research to enhance various aspects of poultry production. Their role involves designing and implementing experiments to improve breeding programs, nutrition, disease control, and overall productivity in the poultry farm. They analyze data, remain updated on industry advancements, and collaborate with experts to develop innovative solutions for improving poultry production. They may also contribute to the development of new technologies, practices, or products that can benefit the poultry industry. The goal is to advance scientific knowledge and contribute to the continuous improvement of the poultry production practices.
15	Environmental specialists (focusing on waste management and sustainability)	Environmental specialists with a focus on waste management and sustainability in the context of poultry farming are responsible for developing and implementing strategies to minimize the environmental impact of poultry production. Environmental specialists optimize waste disposal systems, such as manure management, and implement sustainable practices to minimize environmental risks. They work on sustainable practices, which may include recycling initiatives, energy conservation, and water management. Environmental Specialists also stay informed about regulations, assess the environmental footprint of the poultry farm, and recommend improvements to enhance overall sustainability. The goal is to balance the needs of poultry production with environmentally responsible practices.
16	Poultry farm human resource personnel (HR)	Poultry farm human resource (HR) professionals are responsible for managing all aspects related to the human capital of the farm. Their role involves recruiting and hiring staff, conducting onboarding processes, managing employee records, and addressing HR-related issues. HR personnel oversee recruitment, training programs, labor law compliance, and communication between management and employees. They may also play a role in performance evaluations, employee development, and fostering a positive work environment. The HR professional contributes to building and maintaining skilled and motivated workforce on the poultry farm.
17	Poultry farm plumber	Poultry farm plumbers are responsible for installing, maintaining, and repairing plumbing systems on the poultry farm. They ensure a consistent water supply, maintain water quality, and address plumbing issues on the farm. Poultry Farm Plumbers play a critical role in the overall health and well-being of the birds by ensuring they have access to clean and uncontaminated water. Additionally, they may work on tasks such as installing waterers, checking pipelines, and addressing any leaks or malfunctions in the plumbing infrastructure of the farm.
18	Poultry farm drivers	The role of a poultry farm drivers includes transporting goods, equipment, or poultry products to and from the farm. Drivers transport goods, equipment, or poultry products, ensure timely deliveries, and adhere to transportation regulations. Poultry farm drivers may also be responsible for routine vehicle maintenance and reporting any issues to the farm management. Their role is crucial in facilitating the movement of materials and products, contributing to the overall efficiency of the poultry farm's operations.
19	Poultry farm electricity technicians	Poultry farm electricity technicians are responsible for managing the electrical systems and equipment on a poultry farm. Electricity technicians install, maintain, and repair electrical systems, including lighting, climate control, and automation equipment. They troubleshoot electrical issues, perform routine inspections, and ensure that all electrical systems meet safety and regulatory standards. Poultry farm electricity technicians may also be involved in wiring for incubators, ventilation systems, and other farm infrastructure. Their expertise is crucial in maintaining a safe and efficient electrical supply to support various operations on the poultry farm.
20	Daily labourers	Daily laborers on a poultry farm are typically hired for short-term or temporary tasks that require manual labour. Their role involves undertaking various physical activities necessary for the daily operations of the farm. Responsibilities include cleaning facilities, handling equipment, assisting with loading, and unloading supplies, and performing general maintenance tasks. Daily laborers play a flexible and supportive role in assisting with routine tasks that contribute to the overall functioning of the poultry farm.

3.5 Investing in Fishery and Aquaculture Development

Ethiopia is endowed with numerous lakes, rivers, and dams, offering significant potential for fishery investments. These water bodies with a variety of fish species, are presenting opportunities for sustainable exploitation. In 2015, the annual fish production was 101,360 metric tons, which met only a small portion of the country's needs. The fisheries sector in Ethiopia remains predominantly artisanal, with limited commercial and industrial-scale operations. As the culture of eating fish is increasing in our country, the demand for fish is increasing. Currently,

the availability of fish products in hotels and restaurants is increasing. However, relative to the country's natural water bodies and new and existing man-made lakes or dams recently constructed for various development activities, fish supply is low. Therefore, investing in fisheries and aquaculture development sector using natural and man-made water bodies can be a viable business area.

3.5.1 Investing in Fishing and Manufacturing and Supply of Fish Processing Equipment

Ethiopia lacks established suppliers for fishing equipment, post-harvest handling tools, processing, and preservation technologies. Due to the lack of supply of fishing gears in most of the water bodies that have fish resources, there is no adequate fish production in the country. Also, the fish resource is harvested with destructive fishing gears. In addition, fish post-harvest handling, processing, and preservation technologies are rarely available in the country. Considering the demand for fishing gears and post-harvest handling, processing, and preservation equipment, it is anticipated that engaging in these areas is a feasible investment. Therefore, engaging in the following areas of investment is recommended for investors:

- Establishing supply chains for fishing gear and inputs tailored for freshwater fisheries.
- Producing and distributing standardized, eco-friendly, and approved fishing equipment.
- Investing in boat engines, boats, fish refrigeration and cold storage equipment, fish transport vehicles, insulated and refrigerated vehicles, fish handling and processing equipment technologies, and other logistics.

3.5.2 Investing in Fish Fries Multiplication

The growing demand for fish fry, coupled with Ethiopia's favorable agro-ecology and abundant water resources, makes fish fry production and marketing a lucrative investment opportunity. Additionally, it is important to raise fish fry to stock reservoirs being built for various national projects that lack fishery resources, as well as to replenish natural water bodies with depleted fish production. Investing in this area offers the following advantages.

- Provides quality fish fry to the market.
- Produces improved and productive fish species.
- Distributes healthy and quality fish fry to various areas for fish farming.

Maintains and markets the quality of brood stock for fish and other aquatic organisms.

Size and capacity of fish hatchery: The size of water bodies for small, medium, and large-scale fish hatchery depends on production capacity, type of species, technology used and market demand. Therefore, considering the fish hatcheries that are being developed around the world, the following fish hatcheries have been suggested for consideration for investing in the multiplication and supply of fish fry:

Box 10: Recommended size and capacity of fish fry

a. Small fish hatcheries:

- Produce approximately 2 million fish fry per year.
- Typically have limited tanks and facilities.
- Suitable for low-investment, rural, and community-based aquaculture or for experimental and research purposes.

Box 10: ctd.**b. Medium-sized fish hatcheries:**

- Produce up to 10 million fish fry per year.
- Usually equipped with centralized feeding systems and advanced technology and equipment.
- Suitable for supplying seed for commercial and industrial aquaculture or for other hatcheries or fish farms.

c. Large-scale fish hatcheries:

- Produce more than 50 million fish fry per year.
- Feature sophisticated design and management systems with high levels of biosecurity and quality control.
- Suitable for large-scale, fully artificial fish farming, fish seed production, or export to other countries or regions.

Note: The mentioned production capacities refer to Nile tilapia species. The number of hatchlings varies depending on the fish species, as some fish lay significantly more eggs.

Standard facilities and equipment required for fish hatchery

- a Ponds or tanks:** These are used for holding and rearing brood stocks (adult fish used for breeding). Specific types include:
- Spawning ponds, tanks, or hapas: Where fish spawn and lay eggs.
 - Nursery ponds, tanks, or hapas: For rearing young fish (fry or fingerlings).
 - Conditioning pond/tank: Used for preparing brood stocks before spawning.
- b Water supply system and storage tank:** A reliable water supply is crucial for maintaining water quality and supporting fish growth. Storage tanks ensure a consistent water supply including during fluctuations.
- c Aeration system:** Proper aeration enhances dissolved oxygen levels in water, benefiting fish health and growth.
- d Pumps (for re-circulatory egg incubation systems):** Pumps are essential for water circulation in recirculating systems, especially during egg incubation. Remember that understanding the biology of the fish species you plan to rear and optimizing the fish rearing systems are equally important. Sufficient space must be allocated for broodstock management, egg incubation, larval rearing, and grow-out facilities to ensure efficient hatchery operations.

Professional, experts and skills required for the fish hatchery investment: Professionals specialized in fish hatcheries are essential for ensuring efficient operations and sustainable production. Below are some key skills required in the fish hatchery and their roles:

a Fishery biologists:

- These experts have a deep understanding of fish biology, behavior, and ecology.
- They contribute to hatchery design, species selection, and design management strategies.

b Aquaculturists:

- Aquaculture specialists focus on fish farming techniques.
- They oversee hatchery operations, water quality, feeding, and disease prevention.

c Hatchery managers:

- Responsible for overall hatchery management and administration.
- They coordinate staff, monitor production, and ensure compliance with regulations.

d Broodstock managers:

- Handle adult fish (broodstock) used for breeding.
- They manage spawning, egg collection, and broodstock health.

e Fish health specialists:

- Monitor fish health, diagnose diseases, and implement preventive measures.
- They work closely with veterinarians and biologists.

f Water quality experts:

- Ensure optimal water conditions for fish growth.
- They monitor important water quality parameters such as oxygen levels, pH, temperature, and nutrient balance.

g Nutritionists:

- Develop appropriate diets for different fish at the different stages.
- They optimize feed formulations to enhance growth.

h Engineering and facility managers:

- Oversee infrastructure, equipment maintenance, and facility design.
- They ensure efficient water supply, aeration, and waste management.

i Environmental compliance specialists:

- Ensure hatchery operations adhere to environmental regulations.
- They minimize ecological impact and promote sustainability.

Collaboration among the different professionals is essential for running a successful fish hatchery. Their combined expertise contributes to sustainable fish production, maintenance, and utilization.

3.5.3 Investing in Cage Fish Farming

Cage culture is a modern fish farming method conducted in water bodies such as lakes, dams, rivers, and reservoirs, enabling enhanced fish production. It has the following features: Cage system floating frame, netting materials, and suspension system (ropes, floats, anchors, etc.) Round, rectangle or square floating net cage, cage can hold large numbers of growing fish. Cage fish farming can be conducted in natural water bodies like rivers, lakes, seas and in small water bodies as well as in dams. In addition, since it is built on the body of water itself, it reduces the cost of water purification while keeping the fishes from stress due to the constant water movement. It is also suitable for monitoring and harvesting fish.

There are four main types of fish farming cages: fixed, floating, submerged, and submersible. When handled and maintained properly, these cages can last for over 10 years. Modern cage fish farming requires a range of technologies and equipment, including tools for transporting fish feed, monitoring, and maintaining fish growth and breeding, and harvesting the fish.

Key inputs include boats and boat engines, cage frameworks made from HDPE pipes, galvanized metal, or stainless steel, and cage floats. Additionally, equipment such as floating roads, fiber or stainless-steel nets, suspension systems to stabilize the cages, aquaculture cage mooring, anchoring systems, and boat-operated fish feeding machines are essential for effective cage culture operations.

Investing in cage fish farming offers significant advantages by boosting the production of healthy fish for both local and international markets. Proper handling, including adhering to withdrawal periods for any treatments, ensures the fish are safe for consumption when harvested. Cage fish farming allows for environmentally sustainable fish production, adhering to regulatory guidelines while minimizing ecological impact.

Size and capacity of cage fish farming for investment: The size and capacity of cage fish farms depend on factors such as cage type, fish species, water depth, environmental conditions, and market demand.

Box 11: Recommended size and capacity of cage for fish farming

a. Small-scale cage fish farming

- Uses a limited number of cages and produces fish using less than 20 million fish fry per year.
- Suitable for small investments, rural and community-based aquaculture, or experimental and research purposes.
- Cages are typically fixed or floating, 1 to 5 meters wide per side, and 1 to 100 cubic meters in volume.
- Fish stocking density ranges from 5 to 50 fish per cubic meter.

b. Medium-scale cage fish farming

- Uses 20 to 100 million fish fry as inputs per year.
- Typically features centralized feeding systems and advanced technology and equipment.
- Suitable for supplying seeds for commercial and industrial aquaculture or other breeding or hatcheries.
- Cages are typically floating or submersible, 5 to 10 meters wide per side, and 100 to 1000 cubic meters in volume.
- Fish stocking density ranges from 50 to 200 fish per cubic meter.

c. Large-scale cage fish farming

- Represents an input of more than 100 million fish fry per year.
- Features sophisticated design, advanced management, high biosecurity, and quality control.
- Suitable for large-scale modern cage breeding or exporting fish seeds to other countries or regions.
- Cages are typically submerged, 10 to 20 meters wide per side, and 1000 to 10,000 cubic meters in volume.
- Fish stocking density ranges from 200 to 500 fish per cubic meter.

Standard facility and equipment required for cage fish farming

The following facilities and equipment are required for setting up a cage fish farming operation:

1. **Cage system components:** A cage confines fish or shellfish within a mesh enclosure. Components include:
 - **Cage frame:** Rigid frame surrounding the cage.
 - **Cage bag:** Mesh enclosure holding the fish.
 - **Floaters:** Buoyant materials keeping the cage afloat.
 - **Feed barrier:** Prevents feed from drifting away.
 - **Cage cover:** Shields fish from external elements.
 - **Sinkers:** Maintain cage stability underwater.
2. **Environmentally friendly materials:** Use eco-friendly materials and apply anti-corrosive paint to prevent metallic frames from rusting.
3. **Mesh size:** Minimum recommended mesh size for the cage bag is 5mm.
4. **Water body selection:**
 - Cages can be installed in various water bodies (streams, rivers, lakes, or reservoirs).
 - Seek advice from local fishery offices.
 - Choose an area free from environmental pollution.
5. **Fish species selection:**
 - Consider growth rate, reproductive behavior, nutritional requirements, and market value.
 - Common species for cage culture include tilapia, African catfish, bony tongue, and shrimps.

Water Bodies and Land Required For Cage Fish Farming

When considering cage fish farming, availability of water bodies and land is essential.

1. **Water bodies suitable for cage culture:**
 - **Lakes, reservoirs, and ponds:** These natural or man-made water bodies are commonly adapted for cage culture. They provide ample space and stable water conditions.
 - **Rivers and streams:** Flowing water bodies can be suitable, especially if water quality is favorable.
 - **Quarries:** Abandoned quarries can be repurposed for cage culture.
 - **Access to public waters:** Be aware that laws governing the use of public waters may vary by state. Some regulations restrict private individuals from engaging in fish farming in public waters or require permits¹.
2. **Water quality considerations:**
 - **Proper water quality:** Ensure that the water quality meets the requirements for fish growth and health.
 - **Depth:** The water should be deep enough to accommodate the cage. Typically, the cage should be at least 50 centimeters (about 20 inches) from the bottom.
3. **Land requirements:** While cage fish farming primarily involves water bodies, consider the following land-related aspects:
 - **Access point:** Accessible land near the water body is essential for cage installation, maintenance, and fish handling.

- **Infrastructure:** Adequate space for assembling and launching cages.
- **Legal authority:** Ensure compliance with local regulations and obtain necessary permits for land use and cage installation.

For small to medium-scale fish farms in landlocked water bodies, fixed cages (for water depths of 3 to 10 feet) or floating cages (for water depths of over 16 feet) can be excellent options.

Experts and Skills Required for Investing in Cage Fish Farming

1. Fishery biologists and aquaculturists

- Experts in fish biology, behavior, and aquaculture techniques.
- Provide guidance on cage design, species selection, and farming practices.

2. Hatchery managers

- Responsible for overall cage farm administration.
- Coordinate operations, monitor fish health, and ensure compliance.

3. Site selection specialists

- Choose suitable water bodies (lakes, rivers, or reservoirs) for cage installation.
- Consider water quality, depth, and environmental factors.

4. Cage design engineers

- Design and install cages based on site-specific requirements.
- Ensure proper buoyancy, stability, and material durability.

5. Fish health experts

- Monitor fish health, diagnose diseases, and implement preventive measures.
- Collaborate with veterinarians and biologists.

6. Business and marketing professionals:

- Develop business plans, marketing strategies, and market linkages.
- Understand pricing, distribution, and customer preferences.

7. Environmental compliance specialists:

- Ensure adherence to environmental regulations.
- Minimize ecological impact and promote sustainability.

8. Manpower with practical skills:

- Farm workers skilled in cage installation, maintenance, and fish handling.
- Practical experience is invaluable.

3.5.4 Investing in Fisheries Development in Large Water Bodies

Investing in fish farming involves utilizing natural or artificial water bodies to breed and raise various species of fish, shellfish, and crabs for personal consumption or commercial purposes. The primary objective is to achieve high fish production at a reduced cost through public-private partnership arrangements by leasing extensive natural or artificial water bodies. Therefore, considering the country's natural endowment and the current fish

market situation, fish farming can be a viable business sector for investment. Investing in fish farming in natural and/or artificial water bodies accompanied by fish processing centers by the private sector helps to speed up the development of fishery resources and aquaculture.

Leasing natural or artificial water bodies for fish production requires careful consideration of factors such as water quality, ecological impact, and compliance with local regulations. For natural water bodies such as lakes, rivers, and ponds, leasing involves obtaining rights to use the water for fish farming. Consider water quality, depth, and ecological impact. Ensure compliance with local regulations and permits. Artificial water bodies, which are man-made and serve various purposes, require negotiation with landowners or authorities for leasing. Regarding legal and regulatory aspects, understand local laws about water use and leasing rights, obtain necessary permits and licenses, and consult legal experts if needed.

3.5.5 Investing in Integrated Aquaculture

Integrated aquaculture combines two or more agricultural activities, with at least one being aquaculture, to share resources such as water and feed efficiently. This provides sustainable solutions for food security, environmental protection, and economic development.

Integrated fish farming operations:

- **Integrated crop-fish farming:** Enhances productivity and profitability by cultivating crops and fish simultaneously or alternately.
- Integrated farming combines fish farming with fruit, vegetable, and poultry production, creating a system where by-products from each component benefit the others. Fruits, vegetables, and fish by-products can be used as feed for chickens and fish, while chicken droppings serve as fertilizer for fishponds, promoting the growth of zooplankton and phytoplankton that support fish production. Additionally, the enriched water from fishponds can be used to nourish fruits and vegetables, establishing a mutually supportive ecosystem where each element contributes to the productivity of the others.
- Integrated poultry-fish farming involves raising poultry (such as chickens, ducks, or geese) next to a fishpond. In this kind of arrangement, the poultry litter can be used as a fish feed and/or source of organic fertilizer, and the fish by-products can be used as feed sources for the poultry.

3.5.6 Investing in Indoor Fish Hatchery/Production

This is a type of fish farming system that involves raising fish in holding tanks, or ponds, either indoors, in buildings, or in greenhouses. Indoor fish farming offers distinct advantages, such as protection from predators and harsh weather, enhanced water quality and temperature control, and improved biosecurity measures to prevent disease. However, it requires more investment, modern technology, and technical know-how than outdoor fishpond production. Some of the factors that affect the success of indoor fish farming are:

Some fish species, such as tilapia and catfish, are better suited for indoor farming due to their fast growth rates, efficient feed conversion, high market demand, and resilience to high stocking densities. Some of the fish species that can be raised in indoor fishponds are tilapia, heterotis, catfish, bagrus, carp, trout, and ornamental fish etc.

When designing and constructing a fishpond, space, water, and energy should be optimized to facilitate effective management of fish and maintain water quality. Fishponds can be built using various materials, such as concrete, fiberglass, plastic, or metal, and can vary in shape and size based on the available space and budget. This indoor fish farming method incorporates modern fish hatchery technologies. Proper filtration and drainage systems are essential to maintain adequate oxygen levels, remove waste, and prevent toxin buildup in the water. These measures help reduce fish fry mortality and enhance production efficiency.

To ensure the healthy growth and well-being of the fish, the fishpond must be safeguarded against diseases and parasites. Effective fishpond management involves providing species-specific feed at regular intervals, monitoring water quality and temperature, cleaning the pond and filters, and harvesting the fish once they reach the desired size or weight.

Standard facility and equipment required for indoor fish farming: Different facilities and equipment are required for setting up an indoor fish hatchery and production business. Below are some of them:

1. Infrastructure and facility design:

- Designate separate areas for broodstock, spawning, hatching, and larval rearing.
- Quarantine space for new fish arrivals.
- Maturation tanks for broodstock conditioning.
- Properly designed tanks or containers for each stage.

2. Water handling infrastructure:

- Install systems for water abstraction, filtration, storage, and distribution systems.
- Install water quality monitoring tools (dissolved oxygen, pH meters).

3. Laboratories and testing facilities:

- Labs for disease diagnosis, water quality analysis, and research.
- Health assessments through regular testing.

4. Equipment and supplies:

- Equip the facility with generators for backup power to maintain uninterrupted operations.
- Water pumps, air blowers, and filtration systems.
- Tanks, nets, and chemical containers.
- Feed preparation tools.

Land required for indoor fish farming: When planning an indoor fish hatchery and production business, the required land area depends on several factors. Some of the key considerations include:

1. Facility size and layout:

- Plan the number of tanks, raceways, or containers need for the different stages (broodstock, spawning, hatching, and larval rearing).
- Allocate space for laboratories, offices, and equipment storage.
- Consider the flow of operations and ease of movement within the facility.

2. Fish species and production scale:

- Different fish species have varying space requirements.
- Tilapia, for example, can be raised in relatively small areas.
- Larger species may need more space.
- Consider the total production capacity aimed to be achieved.

3. Water supply and filtration:

- Allocate space for water treatment systems, pumps, and filtration units.
- Ensure sufficient room for water storage tanks.

4. Biosecurity measures:

- Separate areas to prevent disease transmission.
- Quarantine zones for new fish arrivals.

5. Infrastructure and utilities:

- Space for electrical panels, generators, and backup systems.
- Adequate ventilation and temperature control (especially in colder climates).

6. Accessibility and safety:

- Plan for easy access for maintenance, cleaning, and emergency response.
- Compliance with safety regulations.

7. Business expansion:

- Consider future growth and scalability.
- Allow room for additional tanks or expansion of facilities.

The specific land area will vary based on production goals, fish species, and available resources. Consulting with aquaculture experts and considering local regulations is essential.

Experts and Skills Required for Indoor Fish Farming**1. Fishery biologists and aquaculturists:**

- Experts in fish biology, behavior, and aquaculture techniques
- They are essential for guiding pond design, species selection, and operational practices.

2. Pond managers:

- Responsible for overall pond administration.
- They coordinate operations, monitor fish health, and ensure compliance.

3. Fish health experts:

- Monitor fish health, diagnose diseases, and implement preventive measures.
- They collaborate with veterinarians and biologists.

4. Business and marketing professionals:

- Develop business plans, marketing strategies, and market linkages.
- They understand pricing, distribution, and customer preferences.

5. Environmental compliance specialists:

- Ensure adherence to environmental regulations.
- They minimize ecological impact and promote sustainability.

6. Other skilled personnel:

- Farm workers skilled in cage installation, maintenance, and fish handling.
- Their practical experience is invaluable.

3.5.7 Investing in Greenhouse Fish Farming

Greenhouse fish farming integrates aquaculture (fish raising) and hydroponics (soil-free plant cultivation), creating a mutually beneficial ecosystem. Greenhouse fish farming works with aquaponics system which integrates fish farming and plant cultivation in a single system. The fish waste provides organic nutrients for the growing plants, while the plants naturally filter and purify the water in which the fish grows/lives. In a greenhouse, the aquaponics setup can create a sustainable ecosystem where fish and plants mutually benefit each other.

Greenhouse fish farming has components such as greenhouse structures, fish tanks, hydroponic beds, water circulation, plant varieties, and fish species.

The greenhouse provides a controlled environment, shielding fish and plants from extreme weather conditions. Inside, fish tanks or containers are installed to house the fish and collect their waste. Hydroponic beds or channels are set up adjacent to the tanks, containing growing media such as gravel or clay pellets where plants can thrive. A pump circulates water from the fish tanks to the hydroponic beds, allowing plants to absorb nutrients from the fish waste. Suitable plant varieties for hydroponic systems include leafy greens like lettuce, spinach, and kale, as well as herbs and fruiting plants such as tomatoes and peppers. For fish farming, species like tilapia, catfish, trout, and perch are common choices, as their waste provides essential nutrients for the plants.

Greenhouse fish farming allows year-round fish and plant production, regardless of external weather conditions, and the aquaponics systems maximize space utilization. Water circulates between fish tanks and hydroponic beds, reducing waste. Aquaponics is inherently organic, eliminating the need for chemical fertilizers as fish waste serves as a natural nutrient source.

Box 12: Recommended size and capacity of greenhouse fish farms

a. Small-scale greenhouse fish farm

- Size: Ranges from 100 to 500 square meters (approximately 1,000 to 5,400 square feet).
- Capacity: Stock 100 to 500 fish (such as tilapia or catfish) and grow a variety of leafy greens or herbs.
- Advantages: Cost-effective, manageable, and suitable for beginners.

b. Medium-scale greenhouse fish farm

- Size: Typically ranges from 500 to 1,500 square meters (approximately 5,400 to 16,150 square feet).
- Capacity: Stock 500 to 2,000 fish and expand crop variety to include not only leafy greens but also tomatoes, peppers, and other fruiting plants.
- Advantages: Allows for increased production and more diverse crops.

c. Large-scale greenhouse fish farm

- Size: Exceeds 1,500 square meters (approximately 16,150 square feet).
- Capacity: Stock 2,000 to 5,000 fish or more. Consider a mix of fish species and a wide range of vegetables.
- Advantages: Offers substantial production capacity, commercial viability, and year-round yields.

Additional Considerations for Greenhouse Fish Farming

- **Climate:** Design the greenhouse size to accommodate local climate conditions. In colder regions, larger greenhouses help maintain stable temperatures.
- **Infrastructure:** Ensure proper water supply, electricity, and drainage systems.
- **Crop selection:** Choose crops that thrive in aquaponic systems and complement fish growth.
- **Fish species:** Select fish species based on the market demand and climate suitability.

Remember that greenhouse size and capacity should align with the intended business goals, available resources, and long-term vision. Start small, gain experience, and gradually scale up as needed.

Recommended Facilities and Equipment for Greenhouse Fish Farming

There are several essential facilities and equipment required to create a successful and sustainable greenhouse fish farming operations.

1. Aquaponic systems:

- Aquaponics combines fish culture with hydroponic plant production in an integrated ecosystem.
- Aquaponic systems are easy to set up and maintain, providing/producing fresh fish year-round.
- Components include:
 - Fish rearing tank: Typically, around 1 m³ in capacity.
 - Hydroponic growing bed: Sized at 4 x 8, suitable for herbs, lettuce, or other salad greens.
 - Air pump: An energy-efficient, UL-listed pump.
 - Plumbing: Necessary for water circulation.
 - Instruction manual: Guides you through the setup process.
- The fish provide nutrients for the plants, while the plants help clean the water, creating a mutually beneficial environment.
- Ideal for both aquaculture and hydroponics

2. Recirculating Aquaculture Systems (RAS):

- Incorporate water pumps to ensure optimal water circulation, ammonia removal, and oxygenation for fish health.
- In land-based and smolt farms, fish are reared at high density in indoor tanks.
- Precision pump control is crucial for optimizing fish health and energy consumption.
- Control the flow volume to prevent excess ammonia and ensure adequate oxygen based on fish age.
- Larger fish have higher flow requirements due to increased pollution.

3. Temperature control:

- Maintain optimal water temperature for fish health.
- Use efficient heating and cooling systems within the greenhouse.
- Precise temperature regulation is critical for successful fish farming.

4. Clean power with harmonic mitigation:

- Ensure stable and reliable power supply to all equipment.

- Harmonic mitigation technology helps to reduce electrical disturbances and ensures smooth operation².

5. Land-based fish farms:

- Recirculating Aquaculture Systems (RAS) in greenhouses requires:
 - Efficient temperature control and power distribution technology.
 - Sustainable and efficient facilities for raising fish.

Remember that each facility and equipment choice should align with intended specific fish species, greenhouse size, and local conditions.

Expertise and Skills Required for Greenhouse Fish Farming

1. Aquaponics experts:

- Aquaponics integrates fish farming with hydroponic plant cultivation.
- Experts in aquaponics should understand the symbiotic relationship between fish and plants.
- They can design and manage aquaponic systems within greenhouses.
- Skills Required: Aquaponics system design, water quality management, fish health, and plant growth.

2. Fish farming specialists:

- These professionals focus on fish health, nutrition, and growth.
- They should understand different fish species and their specific requirements.
- Skills Required: Fish husbandry, water quality monitoring, disease prevention, and feeding protocols.

3. Greenhouse managers:

- Responsible for overall greenhouse operations.
- They ensure optimal environmental conditions (temperature, humidity, light) for both fish and plants.
- Skills Required: Greenhouse management, climate control, and crop planning.

4. Mechanical engineers:

- Design and maintain greenhouse infrastructure.
- Ensure efficient heating, cooling, and ventilation systems.
- Skills required: HVAC systems, automation, and energy efficiency.

5. Electrical engineers:

- Handle electrical systems within the greenhouse.
- Ensure stable power supply for pumps, lighting, and other equipment.
- Skills: Electrical design, safety, and troubleshooting.

6. Fisheries biologists:

- Understand fish behavior, breeding, and habitat requirements.
- Advise on fish stocking density and species selection.
- Skills: Fish biology, genetics, and population dynamics.

3.5.8 Investing in Pond Fish Farming

While the consumption of fish is steadily increasing, the supply from natural sources struggles to keep pace with societal demand. Given the growing demand for fish in the country, pond fish farming is considered a promising and potentially profitable investment in Ethiopia.

Pond fish farming is a widely used method involving the cultivation of aquatic species such as finfish and shellfish in artificially constructed ponds. These ponds can be filled with various water sources, including canal water, rainwater, bore well water, or other available water sources. Such ponds can be either earthen ponds or concrete ponds.

Earthen ponds

- Earthen ponds are widely used in large-scale aquaculture.
- They allow fish to be kept in a natural environment.
- These ponds are relatively easy and inexpensive to construct.
- Ideal for raising fish species like catfish, tilapia, carp, koi, and goldfish.
- Constructed by digging a hole in the ground, often using clay soils that prevent water seepage.
- Different types of earthen ponds include dugout ponds, which are excavated areas with gently sloping floors.

Concrete ponds

- Constructed with concrete walls and floors.
- Provide better control over water quality and prevent seepage.
- Suitable for intensive fish farming and specific species with precise environmental requirements.

Pond-based fish farming is a type of development that uses earthen, concrete ponds to grow fish. Fishponds can be fed by a variety of water sources such as natural springs, rivers, rainwater runoff or streams. Ponds can have different designs and structures, such as watershed systems. Ponds are the most used structures for commercial fish farming/aquaculture production.

The size of the fishpond depends on the type and size of fish farming that the investor wants to operate. In general, the larger the size of the pond, the higher the fish production and the investment. However, other factors such as water quality, fish species, pond management and market demand can increase or decrease the profitability of pond fish farming.

Box 13: Recommended size and capacity of fish ponds

a. Small-scale fish farming ponds

- **Pond Size:** 100–400 square meters. Their primary purpose is to produce fish for self-consumption and the local market.
- **Depth:** Between 0.5 and 1.5 meters, suitable for culturing most freshwater species.
- **Construction:** These ponds can be built with minimal input and cost, often on the shores of lakes, rivers, wetlands, or in areas with underground water, depending on water availability and environmental conditions.

Box 13: ctd.**b. Medium-scale fish farming ponds**

- Pond Size: 400–1,000 square meters, depending on water supply and local conditions.
- Depth: Should be between 0.5 and 1.5 meters.

c. Large commercial fish farming ponds

- Pond size: 1,000–5,000 square meters, depending on water supply and environmental conditions.
- Depth: Ranges from 0.5 to 1.5 meters.

These are approximate conditions, and the conditions above may vary depending on the local conditions and the type of fishpond and fish species that one chooses. There are different types of fishponds based on the type of water source, sewage, or the type of pond construction material and purpose of use. However, it is important to choose the right type of fishpond according to the desired type and number of resources.

Facilities and Equipment Required for Pond Fish Farming

The right facilities and equipment are crucial for successful aquaculture in pond fish farming. Some of them include:

1. Ponds:

- Ponds are the foundation of fish farming. They serve as the habitat for your fish from the day you introduce them until harvest. There are different types of ponds, including above-ground ponds made of plastic, concrete, or block, as well as dugout ponds.
- Soil type and slope play a significant role in pond construction. Consult with aquaculture experts to assess the viability of your property for pond building.

2. Equipment needed to build a fishpond:

- **Digger:** You'll need a digger to excavate and shape the pond.
- **Sand or sodium bentonite clay:** Sand is used in the pond lining to reduce tarp tears. Alternatively, sodium bentonite clay can be more cost-effective and durable.
- **Trap liner:** Place this liner on top of the pond; it's safe for fishing. In some cases, sodium bentonite clay can replace liners.
- **Geotextile fabric:** This special fabric protects the pond water and helps regulate the water filling rate.
- **Filter:** Cleans water coming from the pump.
- **Liner:** Prevents water from seeping into the ground.
- **Underlayment:** Protects the liner from punctures during installation.

3. Pond liner installation:

- Before placing the liner or underlay, remove sharp objects.
- Lay down the underlay on the base and sides, ensuring full coverage.
- Gradually fill the pond with water, adjusting the liner to avoid creases.
- Leave it to settle overnight and trim any excess liner the next day.
- Maintain an overlap of at least 30 cm on the edges to protect against UV damage.

Expertise and Skills Needed for Pond Fish Farming

- **Aquaculturist:** These should have expertise related to fish growth, development, breeding, and production of aquatic animals.
- **Aquaculture equipment technician:** Professionals with sufficient skills are needed for proper handling and maintenance of aquaculture equipment.
- **Fish feed expert:** Experts with sufficient knowledge, skills and experience in fish feed processing and feeding are needed.
- **Fishery pathologist:** Professionals who provide the necessary services to prevent and control fish diseases are very important in fisheries and aquaculture development.
- **Fish post-harvest technology expert:** There is a need for an expert who handles, processes, and preserves the fish products and deliver them to market.

3.5.9 Investing in Fish Processing

Fish processing factories focus on preparing and processing edible fish for the domestic and international markets. In this preparation and processing process, the raw fish that are used as raw materials by the processing factories will go through different processes made available for domestic and foreign markets.

Implementing standard preparation and processing stages is essential to ensure the quality, safety, and consistency of fish products for both domestic and international markets. The following processes are mainly performed during processing.

Types of fish preservation and processing methods

- Keeping fish alive
- Short-term storage in a deep freezer
- Mild refrigeration
- Drying and preserving with dry salt
- Washing and Natural sun drying
- Drying with dissolved salt
- Smoking
- Deep freezing
- Canning and other

Fish processing plants must follow strict hygiene and safety standards to ensure the quality and freshness of the fish product. It should also have efficient equipment and skilled human power and systems to increase the factory's production, output, and profitability.

At present, few investors are engaged in preparation and processing high-quality fish products for domestic and international markets.

Therefore, in connection with the increase in demand for fish production in the country, and in the world's fish market, fish species produced in non-salty areas are being selected because they are suitable for health. At present, fish products prepared with appropriate quality and standards are not being offered to consumers. Thus, expanding investment in fish product processing by adhering to market-required quality standards presents a significant opportunity.

Recommended Facilities and Equipment for Fish Processing

When setting up a fish processing facility, it's crucial to have the right equipment and facilities to ensure efficient and safe operations. Here are some key considerations:

1. Infeed tanks:

- Infeed tanks move whole fish from tubs to conveyors efficiently, ensuring cleanliness and user safety.
- Infeed tanks ensure that the product is cleaned, cooled, and individually fed into the production line.
- Optional cleaning conveyors can be added to remove any ice and debris from the tub.
- Hygienic design allows easy cleaning of the entire belt assembly

2. Gutting line:

- The gutting line is designed for user safety and operational efficiency.
- Main assembly can be lifted for cleaning, along with the workstation and cutting boards.
- Provides six workstations for workers to clean whole fishes, with convenient placements for slicing and waste.

3. Trimming lines:

- After filleting, each fillet needs inspection and cleaning before continuing with the process.
- Trimming lines allow up to six workers to process a total of 400 fillets per hour (60 fillets per worker).
- Size and capabilities can be customized.

4. Scales:

- A variety of scales are available to fit specific requirements.
- Designed with precision, safety, and hygiene for whole fish, fillets, or pieces.
- Achieve any level of precision in weighing.

5. Glazing conveyors:

- Inspect and clean fillets after filleting.
- Customizable trimming lines based on client needs.
- Number of worker platforms tailored to requested work platforms.

6. Packing scales:

- Equipped with weight monitoring systems to minimize manual handling and ensure precision during packaging.
- When desired weight is reached, the bin input closes, and the output opens, collecting the product into packaging boxes.
- Minimizes worker handling of the product.

7. Packing tables:

- Accommodate up to six workers for efficient packing while optimizing floor space.
- Worktables on both sides of the in-feed belt with convenient box storage on top.
- Maximizes productivity while minimizing required floor space.

8. Salt hopper:

- Manual salting system.

- Prevents fish from sticking together during storage in containers.
- Handle on the machine used to pour salt into the container with the product.

Remember that the design and layout of the processing facility should also consider factors like hygiene, ventilation, lighting, and protection against pests. Properly equipped facilities enhance productivity, quality, and safety in fish processing operations.

Required Trained Human Power

- **Fish production and technology specialist:** Oversees fish product preparation and processing equipment operation.
- **Fish product quality control expert:** Ensures fish products meet safety and quality standards.
- **Fish refrigeration technician:** Maintains and repairs refrigeration systems to ensure proper storage.
- **Weighing and stocking expert:** Manage fish weighing, inventory, and stock processes.
- **Fish processing expert:** Prepares and processes fish products for market distribution.

3.6 Investment in Beekeeping/Honey Production

Numerous studies have shown that Ethiopia has significant potential to produce and process honey and wax more efficiently. Honeybee production contributes significantly to environmental protection, plant diversity, crop yield, and productivity. Honey, wax, and other bee products derived from honeybee production are in high demand in the European market. To capitalize on this potential, it is necessary to modernize the sub-sector and enhance its economic worth through competitive quality and quantity.

However, expanding private sector engagement has been determined to be critical because the advantages obtained from the sub-sector are quite restricted. There are three investment alternatives suggested for the beekeeping/apiculture subsector. This includes honeybee production, honey processing, and wax gathering, refining, and processing. The raw materials required, the types of technical and material inputs, and the land area, initial capital list for each of these investment alternatives are listed under each investment option.

3.6.1 Investing in Honeybee Production

Investing in the honey business can be both rewarding and profitable. However, gaining a solid understanding is crucial before starting the business. Beginning with small-scale operations and gaining experience is recommended before scaling up.

Providing a suitable hives for your bees is a critical factor in beekeeping. Hives serve as homes for bees and are crucial for honey production. It is mandatory to regularly maintain the hives to ensure the bees' well-being and productivity. In addition to honey production, investors can explore other lucrative bee products such as beeswax, queen bees, packaged bee sales, pollen, propolis, and pollination services.

Ethiopia has various natural flora and forest resources that are ideal for honeybee production, such as coffee, spices, fruit, and pulse crops, which can be produced in an integrated manner.

Furthermore, protected areas (enclosures) can be used to boost national honeybee production by attracting new investors. Understanding the nature of honeybee production operations help us to discover the following potential investment opportunities.

Modern beekeeping produces a highly demanded honey product in foreign markets. Beeswax processing related to honey production is a viable business sector for investment. Moreover, queen rearing, colony multiplication, and bee breeding investment will benefit the private sector as the country faces a bee deficit. The private sector, which invests in honeybee breeding can help address the country's bee colony shortfall and would gain from this investment option. In addition to honey production, manufacturing of other bee products (pollen, Propolis, royal jelly, etc.) is also an alternative investment area.

Box 14: Recommended capacity and size of honeybee production

a. Small-scale beekeeping

- Number of hives: Typically fewer than 100 hives.
- Focus: Ideal for hobbyists, beginners, or those with limited space and time.
- Benefits:
 - Learn beekeeping basics.
 - Minimal investment required.
 - Manageable workload.
- Considerations:
 - Start with a few hives.
 - Develop skills in bee behavior and hive management.
 - Focus on local sales or small markets.

b. Medium-scale beekeeping

- Number of hives: Around 200 hives.
- Focus: Suitable for moderate honey production and pollination services.
- Benefits:
 - Increased honey yield.
 - Expanded pollination services.
 - Potential for local and regional sales.
- Considerations:
 - Expand operations gradually.
 - Invest in high-quality hives and equipment.
 - Explore larger market opportunities.

Box 14: ctd.**c. Large-scale beekeeping**

- Number of hives: 200 or more hives.
- Focus: Designed for commercial beekeeping, with significant honey production and pollination services.
- Benefits:
 - High honey yield.
 - Strong profit potential.
 - Extensive pollination services.
- Considerations:
 - Requires a professional setup.
 - Employ experienced staff.
 - Explore export opportunities.

Land Requirement and Considerations for Honeybee Production**1 Site selection:**

- **Dry and well-drained:** Choose a site that is dry and free from dampness. High humidity can affect bee flight and nectar ripening.
- **Water Source:** Ensure access to a clean natural or artificial water source for the bees.
- **Shade:** Trees can serve as windbreaks in cooler areas. You can keep hives under the shade of trees or construct artificial structures for shade.

2 Land size:

- The land required for honeybee production depends on the scale of operation:
- Small scale: A few hives can fit in a small area.
- Medium scale: For up to 200 hives, allocate more space.
- Large scale: Commercial beekeeping with 200 or more hives requires substantial land.

3 Hive placement:

- **Sheltered location:** Position hives in a sheltered location to protect them from extreme weather conditions.
- **Sun exposure:** Ensure hives receive adequate sunlight for bee activity and hive health.

4 Bee pasturage and forage:

- **Plant diversity:** Encourage a variety of plants that produce pollen and nectar for the bees.
- **Flowering seasons:** Plan for continuous flowering throughout the seasons to sustain the bee colonies.

5. Legal considerations:

- Check local regulations regarding beekeeping permits, land use, and zoning.
- Understand any restrictions related to hive placement near residential areas.

A beekeeping site will depend on the nectar and pollen production of bee plants that can produce better flowers. However, on average 8 to 10 beehives can be placed per hectare of natural forest, fruit plants, crops, or other areas rich in bee flora.

Accordingly, if an investor wants to engage in beekeeping with a medium-level investment or large-scale level, it can be started with 1000 beehives/hives, and it may need one hundred (100) hectares of forest land, or the land covered with bee flora.

3.6.2 Investing in Honey Processing

Despite Ethiopia's high potential for honey and beeswax production, the current quantity and quality of products are insufficient to meet international market standards. Because of this, the source of the well-known and high-quality processed honey product has a high market demand even in developed countries.

Investing in collection and processing of raw honey produced by modern hives or small growers can be a viable investment option to produce quality honey that is required in the domestic and foreign markets. Such an investment can be implemented in combination with beekeeping.

Technological input: Essential technological inputs for honey processing include a honey filter, a jacketed boiling tank with temperature control, a honey filtering machine, and quality measurement devices.

3.6.3 Investing in Beeswax Collection and Processing

Beeswax is a highly sought-after product for various industrial applications and in modern beekeeping. Investing in refining raw beeswax to improve its quality and ease of handling presents a viable business opportunity. For investors interested in wax processing, this venture offers opportunities to refine and prepare wax for both domestic and export markets. Wax can be sourced from traditional beekeepers, raw wax generated through modern beekeeping practices, and local honey beverage centers.

Land required: On average, a wax refinery investment requires 800 to 1,000 square meters of land to accommodate refining machines, raw and refined wax storage, and office space.

Technology input

Technology input for the wax processing investment includes a wax boiler or boiling water jacket tank that measures temperature, packaging that filters/squeezes the wax as it boils, wax quality measuring device, and other necessary equipment.

Expertise and Skills Required

Investing in honeybee production and processing of honey and beeswax requires different types of experts and skills, including:

- **Apiarist or beekeeper:** Experts in bee behaviour and managing honeybee colonies, including hive management, queen rearing, and honey production.
- **Honey processing and handling expert:** Specialists in refining and screening honey to remove impurities and ensure proper storage conditions.
- **Food technologist:** A food technologist with experience in honey processing is a professional who can provide insights into food safety standards, preservation techniques, and quality control measures specific to honey.

- **Wax processing expert:** A wax processing expert has in-depth knowledge of wax collection, refining and processing techniques. He/she is an expert in the proper wax melting, refining processes to get the highest quality wax.
- **Quality assurance specialist:** A quality assurance specialist helps to ensure that honey and wax products meet industry standards and regulatory requirements. She/he is an expert in quality control measures, and certifications for honey and beeswax processing.

3.7 Investing in Livestock Feed Development and Processing

Feed sources for livestock production can be divided into two categories: roughage and concentrate.

Roughages broadly include high fiber feeds, including pasture, planted forages, fodder tree leaves, hay and crop residues. These are cheap sources of nutrients for livestock.

Concentrate feeds are low fiber feeds which mainly include agro-industrial by-products of cereal grains, oilseeds, pulse grains, and sugarcane. Whole cereal grains also constitute part of fattening rations and poultry diets. Cereal grains and their by-products generally serve as energy supplements, whereas oilseed by-products serve as protein supplements.

For a profitable and sustainable ruminant livestock enterprise, it is essential that the bulk of the energy and nutrient demands are fulfilled from roughage feeds. This helps to minimize feeding costs and reduce the need for concentrate feeds to meet nutrient requirements. On the other hand, for monogastrics, including poultry, it is important to maximize the use of agro-industrial by-products and diversify feed sources from non-conventional feeds. In both cases, the following are key considerations:

- 1 Allocation of sufficient land for improved pasture production,
- 2 Investment in commercial scale forage production, and
- 3 Capacity in feed processing, compound feeds production and marketing.

The major challenge in Ethiopia's feed marketing system is the significant gap between the supply and demand for various feed types, including forage crops, agricultural by-products, hay, and agro-industrial by-products. Addressing this imbalance requires strategic mitigation measures. One of the main reasons that limit the supply of fodder is the lack of sufficient land for fodder production in the highland areas (where mixed agriculture is practiced) and failure to identify suitable land for fodder production in the lowland areas, where vast land is available. In addition to land scarcity, the lack of efficient forage seed system and limited supply of forage seeds/planting material is the other factor hampering forage development in the country.

3.7.1 Investing in Hay and Silage Making

The Ethiopian research system has released numerous grasses and leguminous forages. These forage varieties have high potential for being produced and stored in the form of hay to meet a growing demand for quality animal feed, by the Ethiopian livestock industry. Hay and silage making involves converting green, perishable forage into a storable and transportable product that resists spoilage while retaining its nutritional value. Hay and silage making businesses are promising ventures in Ethiopia given the importance of fodder preservation for a huge livestock sector in the country. Common fodder crops used for hay and silage in Ethiopia include natural fodder, cereals (maize, sorghum), and legumes like alfalfa and clover.

It is essential to invest in the necessary equipment for hay and silage making, such as mowers, balers, forage harvesters, and silage storage facilities. Investing in appropriate equipment is crucial for efficient fodder processing and storage, which ensures the quality of the final product.

Proper storage and preservation techniques are essential for maintaining the quality of hay and silage. Ensure that you have adequate storage facilities, such as silos or bunkers, to protect the fodder from moisture and spoilage, especially during the rainy season.

Starting a hay making business in Ethiopia can be a rewarding opportunity to contribute to the livestock farming sector and provide valuable feed solutions to farmers. By considering market demand, fodder availability, processing equipment, quality control, storage practices, marketing strategy, and regulatory compliance, one can establish a successful business in the hay industry.

Producing economically important types of feeds, investing in hay and green fodder with improved technology could be a viable investment option in the feed sub-sector.

To meet the needs of the foreign and domestic markets, investors can be engaged in large, mechanized feed development using forages of high economic value through irrigation. In areas where grazing land and mixed agriculture are practiced, it is possible to use high yielding annual forage crops with short growth cycle such as forage oats to produce high quality forage and free for other crop production.

Another option for private investors is multiplication of improved fodder seeds, seedling, cuttings and/or root splits. Increasing the participation of the investor will be done by providing skill gap training for actors involved in the development, through supply of source seeds, seedlings, and stems, provision of theoretical and technical support. To secure adequate land for investing in forage development, one can consider contractual and out grower schemes with farmers and/or pastoralists as an alternative approach for investment.

Required facilities and minimum criteria for investing in hay making: Having the right machinery and facilities is crucial for efficiency and quality hay making. Here are some standard equipment and facilities commonly required in the hay making business:

1 Compact tractor:

- A staple of every operation, the compact tractor is versatile and essential for various tasks.

2 Mowers:

- Drum and disc mowers are commonly used for cutting grass for hay making.
- They efficiently cut the grass to prepare it for drying and baling.

3 Conditioners:

- These machines help speed up the drying process by crimping or fluffing the cut hay.
- Improved drying leads to better-quality hay.

4 Hay rakes:

- Hay rakes gather the cut hay into windrows for easier baling.
- Different types include wheel rakes, rotary rakes, and side-delivery rakes.

5 Balers:

- Balers compress the hay into rectangular or round bales.
- Choose between small square balers, large square balers, or round balers based on your needs.

6 Hay tedders:

- These machines spread and aerate the hay to accelerate drying.
- Useful in areas with high humidity or frequent rain.

7 Bale wrappers:

- If you're producing silage bales, bale wrappers are essential.
- They protect the bales and maintain their quality during storage.

Professionals and Experts Required for Hay and Silage Making

1 Haymaking professionals:

- Farm managers and operators:
 - **Farm managers:** Oversee the entire haymaking process, including planning, scheduling, and resource management.
 - **Equipment operators:** Technicians that operate mowers, tedders, rakes, and balers.
- Agronomists and crop specialists:
 - **Agronomists:** Provide expertise on crop selection, planting, and identifying the proper growth stages for harvest.
 - **Crop specialists:** Monitor hay fields, assess plant health, and recommend appropriate practices.
- Quality control inspectors:
 - **Hay quality inspectors:** Evaluate hay quality based on factors like maturity, leafiness, and foreign matter.
- Storage and logistics personnel:
 - **Stackers and loaders:** Arrange bales or stacks in storage sheds.
 - **Truck drivers:** Transport hay to markets or storage facilities.

2 Silage-making experts:

- Forage crop specialists:
 - **Crop scientists:** Research and develop high-yielding forage crop suitable for silage.
 - **Extension officers:** Educate farmers on best practices for growing silage crops.
- Silage technicians:
 - **Choppers and compactors:** Operate machinery for cutting, chopping, and compacting fresh fodder.
 - **Silo builders:** Construct and maintain silos or pits.
- Nutritionists and veterinarians:
 - **Nutritionists:** Advise on silage based balanced rations.
 - **Veterinarians:** Monitor livestock health and recommend appropriate feed.
- Environmental consultants:
 - **Sustainable practices experts:** Promote efficient land use and resource conservation.
 - **Waste management specialists:** Guide disposal of silage by-products.

3.7.2 Investing in Forage Seed Production

Forage seed production business involves the cultivation and harvesting of seeds from forage crops. To enhance the supply of fodder plants (seeds, seedlings, clumps, and cuttings) suitable for diverse ecosystems, private investors can take early-generation forage seeds from research centers, produce certified seeds, and widely distribute them in the country. Investors could choose to multiply forage seeds either in lowland areas where there is access to large tracts of land with access to irrigation or in highland areas with contract farming arrangements. Forage production in highland areas requires clustering farmers to meet minimum land size criteria: 5 hectares per cluster and 10 hectares per village.

Farm Sizes and Criteria for Investing in Forage Seed Production

1 Farm sizes:

- The ideal farm size for forage seed production can vary based on factors such as the specific forage species, soil quality, and available resources.
- Generally, a minimum of 5 hectares is recommended for efficient forage seed production.
- Larger farms may be more economically viable due to economies of scale, but smaller farms can also succeed with proper management.

2 Criteria for land selection:

- **Soil quality:** Choose well-drained soils with good fertility. Soil testing is crucial to assess nutrient levels.
- **Climate:** Consider temperature, rainfall, and frost risk. Forage crops have varying climate preferences.
- **Topography:** Flat or gently sloping land is preferable for ease of cultivation and use of machinery.
- **Altitude:** Match the forage species to the specific altitude range.
- **Water availability:** Adequate water supply for irrigation or reliance on natural rainfall.
- **Pest and disease pressure:** Avoid areas with high pest or disease incidence.
- **Soil pH:** Different forage crops thrive at varying pH levels.

3 Machinery and equipment:

- **Tractors:** Vital for land preparation, planting, and other field operations.
- **Seed drills or broadcast seeders:** Used for precise seed placement during planting.
- **Harvesting equipment:** Depending on the crop, you may need mowers, swathers, or combine harvesters.
- **Threshers:** For separating seeds from the harvested crop.
- **Cleaning and grading machines:** To ensure seed quality.
- **Storage facilities:** Proper storage structures to maintain seed quality.

Remember that successful forage seed production involves a combination of technical knowledge, appropriate machinery, and effective management practices. Collaborate with local agricultural experts and extension services to tailor your approach to the specific context in Ethiopia.

Professions and Occupations Required for Running a Commercial Forage Seed Production Business

1 Farm managers and agronomists:

- **Site selection and management:** Experts assess soil quality, climate suitability, and other factors to optimize seed production.

- **Field management practices:** Agronomists oversee guide activities from planting to harvest, ensuring optimal conditions for forage the seed crops.

2 Seed processing and quality control specialists:

- **Post-harvest seed management:** Professionals handle seed processing, including pre-threshing, threshing, cleaning, and quality assessment.
- **Seed quality standards:** Ensuring genetic purity, viability, and adherence to quality standards is crucial.
- **Storage and Packaging:** Proper storage facilities and packaging are essential for maintaining seed quality.

3 Seed marketing and sales personnel:

- **Market research:** Understanding demand, pricing, and market dynamics.
- **Promotion and distribution:** Marketing forage seeds to potential buyers, including farmers, cooperatives, and other stakeholders.

Remember that successful forage seed production involves a collaborative effort across various professions, from field management to marketing. Each role contributes to ensuring high-quality forage seeds for sustainable agriculture and livestock nutrition.

3.7.3 Investing in Production of Raw Materials and Feed Ingredients

Currently, 59 different feed processing plants—32 operated by private investors and 27 by farmers' unions—are involved in producing and supplying compound feeds in Ethiopia. These plants have an average production capacity of 2–3 tons per hour. However, evidence indicates that they operate at only 30–40% of their total installed capacity, primarily due to insufficient raw materials or ingredients.

Vitamin premixes for poultry production are currently entirely imported, highlighting the need to build local capacity and produce domestically. Premixes, concentrates, vitamins, and minerals are essential for improving livestock productivity, making their manufacturing or import a promising investment opportunity. Hence, investment in this sector are highly encouraged and incentivized with duty exemptions and access to local finances.

Machinery importers play a critical role in supporting livestock feed sector by supplying equipment such as feed grinders, mixers of various capacities, forage harvesters, and feed pelletizers to establish compound livestock feed processing plant in Ethiopia. Moreover, domestic machinery manufacturers are encouraged to meet the feed sector's needs by designing and producing context-specific machinery for the local market.

Agro-industries, including flour mills, oilseed processing plants, breweries, and sugar factories, along with feed value chain actors such as wholesalers and retailers, must be well interconnected to ensure efficient delivery of feed ingredients to end users. Investments that support optimized use of agro-industrial by-products will be actively encouraged and supported.

Equally important are investments in raw material production for agro-industries and feed processing plants. For example, the production of soybeans and yellow corn —key raw materials for poultry diets—represents a critical investment area the government is keen to support.

Starting a feed inputs and ingredients manufacturing business offers several benefits:

- **Profitability and sustainability:** The growing demand for animal feed, driven by the expansion of livestock and poultry industries, especially in developing countries like Ethiopia, makes this a lucrative and sustainable business opportunity.

- **Employment and community development:** such businesses can generate employment and income for local community while fostering growth in agriculture and food processing sectors.
- **Enhanced animal health and food quality:** By supplying high-quality, nutritious feed inputs and ingredients, the business can improve animal health and welfare, while also contributing to better food safety and product quality.

Required Considerations and Criteria for Investing in Feed Raw Materials and Ingredients Processing

1 Micro ingredients

- Give attention to micro ingredients such as vitamins and amino acids.

2 Sustainable feed ingredients:

- As the industry evolves, there is growing interest in sustainable supply of feed ingredients.
- Research and invest in alternative protein sources, such as insect-based proteins or algae.
- Explore novel ingredients that minimize environmental impact and enhance animal health.

3 Quality control and raw materials:

- Ensure rigorous quality control of the raw materials.
- Collaborate with suppliers to maintain consistent quality.
- Monitor anti-nutritional factors in feed ingredients.

4 Processing efficiency:

- Invest in efficient feed processing equipment (e.g., milling, mixing, packaging).
- Optimize processing techniques to preserve nutrient content and improve digestibility.
- Consider automation and up-to-date technology.

5 Traceability and safety:

- Traceability is crucial for ingredient sourcing.
- Implement safety protocols to prevent contamination and ensure product integrity.
- Regularly audit suppliers and processors.

6 Market trends and consumer preferences:

- Stay informed about market trends and changing consumer preferences.
- Adapt ingredient formulations to meet consumer demands (e.g., organic, non-GMO, antibiotic-free).

Remember that a well-informed investment strategy considers both short-term challenges and long-term sustainability. Collaborate with experts, research institutions, and industry peers to make informed decisions.

Professionals and Experts Required for Running a Feed Raw Material and Ingredients Production/Processing Business

1 Nutritionists and feed formulators:

- Nutritionist design balanced feed formulations based on animal requirements.

2 Quality control specialists:

- **Post-harvest management:** These professionals handle processing, including cleaning, grinding, and mixing.
- **Quality assurance:** Ensuring consistent ingredient quality and safety.

3 Supply chain managers:

- **Sourcing and Procurement:** They manage relationships with suppliers, ensuring timely and reliable ingredient supply.
- **Traceability:** Tracking ingredients from source to processing facility.

4 Market analysts and economists:

- **Market trends:** Monitoring ingredient prices, availability, and market dynamics.
- **Risk assessment:** Analyzing economic risks related to ingredient sourcing.

5 Regulatory compliance specialists:

- **Safety and labeling:** Ensuring compliance with food safety regulations and accurate labeling.

3.7.4 Investing in Crops Residue Quality Enhancement

With much of Ethiopia's pastureland being converted to crop production, crop residues have become the primary livestock feed source, particularly in mid-altitude and highland regions where crop production and animal husbandry coexist. However, in the actual situation, the management and use of crops (either cereals or any other commercial crops or industrial crop) by-product feed is in a very traditional way. Due to lack of knowledge and technology, significant seasonal wastage of these valuable by-products occurs across various regions. Therefore, in areas where there is no shortage of livestock feed, crop residues could be a feed resource provided that there is proper collection and piling in a suitable place. If this source of feed is used properly, it can cover the basic needs of the animals in our country for about 4 to 6 months a year.

Crop residues are naturally high in fiber and low in protein. Furthermore, they contain significant amounts of lignin, a compound that reduces palatability and digestibility. Lignin hinders proper digestion and breakdown of the feed in the animal's stomach. It is possible to invest in improving the utilization of crop by-residues by enhancing them with different improvement methods (physical, chemical, and biological) and processing them with additional supplementary feeds.

Effective micro-organism (EM) compounds, free of chemical additives, naturally aid the digestive process in animal's stomach. EM also has anti-microbial properties and is very important for animal nutrition and health. Thus, Effective micro-organism (EM) compound helps to improve feed utilization by animals, increase the quality of milk and meat products, prevent diseases, and eliminates bad odors and pathogens in barns. Thus, investors may consider investing in the production and supply of this compound.

Improving crop residue palatability and nutrient content through physical treatment (Using a chopper to cut crop residues into 2-4 cm lengths) enhances their palatability and digestibility. The size reduction allows animals to consume larger quantities of the feed and improves its digestibility. Thus, it is possible to invest in the manufacture and supply of machineries for cutting and chopping, as well as by providing rental services.

In addition, baling the crop residue is a viable business activity to compress the large volume of a crop residue into a small pack making it convenient and cost-effective for transportation and storage.

Investing in urea molasses block production by combining different feed materials (wheat bran, oil seed cakes, molasses, cement, salt, and water) is also another viable business sector.

3.8 Investing in the Provision of Private Veterinary Services

Private veterinary service investment involves establishing businesses that provide animal healthcare services, often independent of government-operated veterinary facilities. These services are owned and operated by individual veterinarians or veterinarian groups which provide a range of services, including medical treatment, surgery, diagnostics, and preventive care such as clinical care, vaccinations, surgery, health checks, and consultancy. Private veterinary practices operate as a business entity through managing their finances, marketing, staffing, and client relationships.

Such private businesses can adopt a Public-Private Partnerships (PPPs) model, fostering collaboration between government and private sectors to enhance veterinary services delivery.

Investing in veterinary services is a viable business for potential professionals to provide veterinary services to smallholder dairy and other types of livestock producers. Animal health sub-sector is one of the sectors that should be considered by investors and the veterinary professionals to contribute to overall animal disease control activities and improve employment opportunities in the livestock sector. In this regard, mobile veterinary services could be considered as the most feasible option for investment.

Considerations for Investing in Private Veterinary Service

While investment in the private veterinary services as a business, adherence to standards is crucial. Below are some key aspects to consider:

1 Quality of veterinary services:

- Fundamental operating principles:
 - **Professional judgment:** Personnel should have relevant qualifications and expertise to make sound professional judgments.
 - **Independence and objectivity:** Ensure freedom from undue pressures (commercial, financial, political) that may affect judgment.
 - **Impartiality:** Deliver services reasonably and without discrimination.
 - **Integrity:** Maintain consistently high ethical standards.
 - **Transparency:** Be transparent in governance, decision-making, and reporting.
 - **Scientific basis:** Develop activities based on scientific inputs (risk analysis, epidemiology, economics).
 - **Intersectoral collaboration:** Collaborate across sectors following a One Health approach.
- Compliance with international standards ensures trust, trade, and protection of communities.

2 Accreditation and monitoring:

- Accreditation of private suppliers ensures adherence to quality standards.
- Regular monitoring maintains compliance and quality.

3 Business license requirements:

- Comply with local business license regulations.
- Stay informed about ever-changing requirements.

4 Sustainability of the investment:

- The investment should consider long-term sustainability.
- Consider environmental impact, resource utilization, and community well-being.

Section IV: Issuing/Renewing Certificate of Competency

4.1 Prerequisite for Licensing

Guidelines based on Business Registration and Licensing Decree No. 686/2002 have been established to verify eligibility for Ministry of Agriculture business categories.

- a Livestock Development Investment License is a general category of activities that are closely related and whose main activities are focused on the breeding of animal species, reproduction, and production of relevant animal products.
- b Animal fattening business, including cattle, sheep, goat, and camel fattening, fall under licensing category 1127, with specific qualification requirements.
- c It is necessary to fulfill and implement the guidelines issued by the Ministry of Agriculture to determine the requirements for investment in chicken resource development.
- d The requirements to be met to obtain a fishing license are listed in License No. 1310.
- e The beekeeping investment trade license is different from the licensing categories listed under the main section 112, and it is suggested to include the business fields of commercial beekeeping, beekeeping equipment and material manufacturers and importers to deal with the separate licensing category 1122.
- f Animal fodder development investment permit granting condition to determine qualification requirements for the business categories for which the Ministry of Agriculture prepares criteria and the guidelines issued in 2004 by the Agriculture Authority for the registration of animal feed and feed raw material manufacturers, importers, wholesalers, exporters, and retailers Issuance of work permit will be in accordance with the operating instructions No. 02/2010.

4.2 Prerequisite for Renewing Licensing

The renewal of investment license is effective according to “An Investment Guide to Ethiopia” which has been established by Ethiopian Investment Commission.

Section V: Duties and Responsibilities of Stakeholders to Support Livestock Investment

SN	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
1	Ministry of Agriculture Proclamation No. 1263/20(1)	Establish a system to promote private sector participation in agricultural development; ensure conducive implementation conditions and support private investors and cooperatives to increase meat and milk production and productivity, ensure its effectiveness. (b) Create, in coordination with concerned organs, conducive condition for the establishment of rural financial system accessible to farmers, pastoralists, and semi-pastoralists and to private sector actors engaged in agricultural activities; follow up its implementation; cause the expansion and strengthening of agricultural cooperatives. (c) Cause the expansion and utilization of agricultural extension advisory service, supply of technology and techniques of production to promote production and productivity of crops, livestock, and fishery; ensure their effectiveness. (d) Establish a system for demand, supply, distribution, and marketing inputs for crop production, veterinary, fishery and natural resource development; follow up the implementation and effectiveness of the same. (e) Establish a system which enable the prevention and control of plant, animal, and fish diseases, lead and coordinate studies and research with respect to the same. (f) Establish a system and infrastructure that enable to improve the quality and accessibility of plant and veterinary health services; cause the construction of laboratories and clinics as may be necessary and build their capacity and monitor its effectiveness. (g) Establish a system for registration and monitoring of agricultural technology, input, and service; establish a system for monitoring quality, health, and safety of production; coordinate monitoring activities on plants and quarantine of animals and animal products brought into and taken out of the country. (h) Ensure the proper implementation of animal genetic improvement; lead and coordinate system for identification of technologies that enable to maintain the quality of animal and fish production and their products through research and making the same enter the market; establish, in collaboration with the concerned institution, a system for the introduction of livestock and fishery products to domestic and foreign markets. (i)	Phone +2511164119 69/71 http://www.moa.gov.et P.O.Box 62347

S N	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
		Coordinate the compilation of technologies necessary for livestock and fishery products development and the introduction of the same to users as may be necessary. (k) Provide technical assistant to introduce market led agricultural development and to promote modern farming; cause the creation of market linkage; establish a system which enable to maintain quality standard of any crops, livestock or livestock and fishery product to be supplied to the market in collaboration with the concerned organs; and follow up its implementation; (s) Ensure that activities related agricultural investment are properly organized in coordination with the concerned organ; identify large agricultural investment opportunities and potentials and devise a strategy for the expansion of large-scale agricultural investment; cause the provision of support for investors engaged in the sector. (t) Ensure that the system of production of agricultural products are safe and rich in nutrition, diversified and healthy. (u) Work in coordination with the concerned Federal and Regional organs to strengthen the linkage between agriculture and other economic sectors; devise strategy to bring about inclusive and sustainable structural change; establish a system for its implementation; (v) Ensure that agricultural research activities are problem solving and ensure that they are conducted in coordination with the concerned organs and coordinate the same; (w)	
2	The Ministry of Trade and Regional Integration Proclamation No. 1263/22/1	Initiate policies, strategies, and laws with respect to foreign and domestic trade in particular, regional trade and economic integration with neighboring countries and national quality assurance infrastructure; prepare detailed program compatible with national development plan for their implementation and implement the same upon approval. (a) Take appropriate measures to expand and modernize domestic trade and maintain lawful trade practices; lead and oversee trade relations between regions; (b) Create conducive conditions for the expansion and promotion of the country's export trade; (c) Establish system, in collaboration with other organs, for the provision of support to domestic investors in exporting their products to overseas markets; and implement the same; (d) In collaboration with relevant organs, establish foreign trade relations, sign trade agreements in accordance with the law and implement the same upon approval. (e) Control the qualities of export and import goods; prohibit the importation or exportation of goods that do not conform with the required standards; (f) Establish system to ascertain that export or import goods are traded or bought at appropriate prices; follow up the same in collaboration with concerned organs; (g) Provide simple, cost effective and technology supported commercial registration and business licensing services; (h) Conduct studies and research to facilitate the realization of plans that enhance export industries having strategic importance; and implement the same in collaboration with the relevant organs; (m) Provide commercial registration and business licensing services in accordance with the relevant laws; ensures the use of such business licenses for the authorized purposes; (n)	https://motri.gov.et/am/

S N	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
3	Ministry of Labor and Skills Proclamation No. 1263/25 (1)	Follow up and support labor relation of enterprises situated in more than one Region: (h) Establish a system to prevent occupational accidents and occupational diseases; issue occupational health and safety standards and supervise their implementation; (i) Encourage and support employers and workers to form associations and thereby exercise their rights of collective bargaining; register employers' association and trade unions established at national level. (k) Support the practice of bipartite forums between employees and employers and tripartite forums involving the Government; devise mechanism to minimize occurrence of labor disputes and establish efficient system for settlement of the same. (l) Issue work permits to foreign nationals and, monitor the compliance therewith in collaboration with concerned organs; regulate the Ethiopians overseas employment in collaboration with concerned organs. (p) Conduct periodic surveys on labor market skills gap in collaboration with regional concerned agencies, coordinate capacity building trainings, (r) Support and coordinate cooperation between agencies of the Federal government, regional governments, the private sector, the informal sector, development partners and institutions to promote and increase access to employment; ensure training and work experiences match the job market requirements; (s)	https://mols.gov.et
4	Ministry of Finance Proclamation No. (1263/26)/1 Regulation No. 517/23	Initiate policies, strategies and laws that serve as a base for fiscal, particularly for taxes and custom duty laws; prepare detail program compatible with national development plan; follow up the proper implementation of the same; (a) Grant tax incentives to investments eligible under Regulation No. 517/2022 which entitles them to tax or duty exemption. (1) Issue a Directive on the eligibility criteria for tax incentives, the list of items that can be allowed to be imported free of duties and taxes or purchased locally, and the documentation that shall be provided to be entitled for such privileges. (2) Monitor on a regular basis the performance of each Regulatory Institution with respect to ensuring that tax incentives are used for designated purposes. (3) Maintain a database for monitoring and analysis of tax incentives granted. (5) For purposes of monitoring and transparency, shall maintain the aggregate data on a sectoral and per industry basis of: (6) a. The amount of tax incentives availed for registered investors, b. The estimate claims of tax incentives immediately preceding the current year. c. The programmed tax incentives for the current year, d. The projected tax incentives for the following years. Shall conduct cost benefit analysis on the investment incentives to determine the impact of tax incentives on the economy of the country. (7)	https://www.mofed.gov.et

SN	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
5	Ministry of Revenue 1263/27(1) Regulation No. 517/21	Cause the proper implementation of incentives of customs and tax exemptions given to investors to encourage investment and follow up its implementation and take measures on those who misuse the exemption; (d) Implement the tax holiday incentive after ascertaining that it is consistent with the Directive issued by the Ministry. (1) Maintain a record that shows list of investors which are granted income tax exemption, the length of period of such exemption and the time the tax holiday ends. (2) Submit annual report to the Ministry within two months after the end of the fiscal year which among others, show the list of investors, the area of investment and the amount of tax forgone as well as other information. (4) Prepare, in collaboration with the concerned organs, national integrated infrastructure master plan; follow up and monitor its implementation; (b) Ensure that national road infrastructure works are carried out based on economic efficiency, importance, and equitable access; (c) Determine quality standards of water used for various purposes; undertake supervision to avert water pollution; follow up its implementation; (i) Establish system that facilitates the expansion of potable water supplies and coverage of sanitation infrastructure; follow up implementation of same; establish a system to enhance participation and role of the private sector in potable water supply and sanitation infrastructure sector; create conducive condition for implementation of same; (j)	http://www.mor.gov.et
6	The Ministry of Urban and Infrastructure Proclamation No. 1263/31(1)	Ensure the integration, efficiency and accessibility of land, air and sea transportation services, and thereby realize the country's development strategies and meet the needs of transport and logistics of development hubs and corridors; (b) Establish, in collaboration with concerned organs, a system for a coordinated and integrated holistic national transport and logistics; create conducive conditions for implementation of the same; (c) In collaboration with Ministry of Urban and infrastructure and other concerned organs, prepare master plan of the country's transport and comprehensive logistics infrastructure; follow up its implementation; (d) Ensure the establishment and implementation of regulatory frameworks to guarantee the provision of reliable and safe transport and logistics infrastructure; (i) Ensure that the national logistic system with respect to import and export is efficient and competitive; (o)	Phone: +251115154580 www.mudho.gov.et E-mail: ent@mudho.gov.et
7	Ministry of Water and Energy Proclamation No. 1263/32(1)	Ensure the integration, efficiency and accessibility of land, air and sea transportation services, and thereby realize the country's development strategies and meet the needs of transport and logistics of development hubs and corridors; (b) Establish, in collaboration with concerned organs, a system for a coordinated and integrated holistic national transport and logistics; create conducive conditions for implementation of the same; (c) In collaboration with Ministry of Urban and infrastructure and other concerned organs, prepare master plan of the country's transport and comprehensive logistics infrastructure; follow up its implementation; (d) Ensure the establishment and implementation of regulatory frameworks to guarantee the provision of reliable and safe transport and logistics infrastructure; (i) Ensure that the national logistic system with respect to import and export is efficient and competitive; (o)	https://www.mowe.gov.et
8	Ministry of Transport and Logistics Proclamation No. 1263/30(1)	Ensure the integration, efficiency and accessibility of land, air and sea transportation services, and thereby realize the country's development strategies and meet the needs of transport and logistics of development hubs and corridors; (b) Establish, in collaboration with concerned organs, a system for a coordinated and integrated holistic national transport and logistics; create conducive conditions for implementation of the same; (c) In collaboration with Ministry of Urban and infrastructure and other concerned organs, prepare master plan of the country's transport and comprehensive logistics infrastructure; follow up its implementation; (d) Ensure the establishment and implementation of regulatory frameworks to guarantee the provision of reliable and safe transport and logistics infrastructure; (i) Ensure that the national logistic system with respect to import and export is efficient and competitive; (o)	Phone +251 115518292 Email: transportethiopia@gmail.com Website: http://www.moti.gov
9	Regulation No. 517/2014 (18)	The Ethiopian Investment Commission, Ministry of Mines, Regional Governments and Addis Ababa and Dire Dawa City Administrations Investment Organs, Ministry of Trade and Regional Integration, Ministry of Revenue and other Institutions mandated to regulate the implementation of tax incentives have the following Duties & Responsibilities. Ascertain the following to the ministry of finance to enable the investor to eligible for tax holiday privilege a. That the investor has obtained business license and started operations b. The date on which the investor started production or rendition of services. Submit a proposal, to the ministry of Finance, regarding the list and their exact and current market price of equipment, that may be allowed to be imported by investors that are required for its operation free of duties and taxes in accordance with the regulation No. 517/2014. 3/ Participate in setting standards or eligibility criteria for entitlement of tax incentive. 4/ Submit to the Ministry of Finance quarterly reports that shows the items imported free of duties and taxes and the amount of duties and taxes forgone with respect to each investment. 5/ Carry out annual evaluation on the benefits that each investment has brought in terms of creating employment opportunity and earning foreign currency and report the same to the Ministry of Finance not later than three months after the end of the fiscal year.	

SN	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
10	Ethiopian Investment Commission Regulation No. 517/2014 (19)	In accordance with Regulation No. 517/2022 Article 19, Accept applications for duty free privilege from investors who have acquired investment license through the system developed, verify whether the request for incentives is consistent with the directives issued by the Ministry of Finance, transfer the application with its recommendation for approval by the Ministry of Finance. (1/a) Through field inspections, reports, by assigning supervisors or through any other means ascertain that the investor granted duty free privileges to import capital goods, building materials and spare parts in accordance with the relevant laws and Directive have used such goods for the designated purposes, and submit annual consolidated reports to the Ministry of Finance. (2) It offers medium- and long-term loans to investors at an interest rate of 5% less than other banks depending on the kind of investment they are engaged. Provides loan services through lease financing for companies with an investment cost of up to 75 million ETB for the purchase of various processing machines such as dairy products, animal feed, poultry products, fish products, and farm machinery. Depending on the type of investment, it provides project financing loan services with more than 75-million-birr investment costs for large projects. The bank will provide 80% of the 20% advance savings to the users organized in shares, and the advance savings will be released for operation when the investment is in implementation Facilitates an 85% loan with 15% advance savings for investors who present a business plan proven by a feasibility study and are engaged in export business. Offers an 85% loan with 15% pre-savings for export-oriented investors who can provide a viable company plan through feasibility studies The loan grace period is determined by the kind, nature, and time of production.	https://www.investethiopia.com
11	Development Bank of Ethiopia	Provides loan services through lease financing for companies with an investment cost of up to 75 million ETB for the purchase of various processing machines such as dairy products, animal feed, poultry products, fish products, and farm machinery. Depending on the type of investment, it provides project financing loan services with more than 75-million-birr investment costs for large projects. The bank will provide 80% of the 20% advance savings to the users organized in shares, and the advance savings will be released for operation when the investment is in implementation Facilitates an 85% loan with 15% advance savings for investors who present a business plan proven by a feasibility study and are engaged in export business. Offers an 85% loan with 15% pre-savings for export-oriented investors who can provide a viable company plan through feasibility studies The loan grace period is determined by the kind, nature, and time of production.	Tel. +251-11-5511 11 88/89 Fax. +251-11-55 11 606 Email: dbet@ethionet.et Website: www.dbet.com.et P.O. Box 1900
12	Customs Commission Regulation No. 437/2018/5	To assess duty paying values, collect duties and taxes, collect license and service charges in accordance with laws; To inspect and examine documents of importers, exporters, or any other person, for the purpose of enforcing customs laws; To issue, renew, suspend or cancel various types of licenses in accordance with the customs laws; To provide efficient, equitable and quality service within the sector based on the principles of transparency and accountability, and enforce the proper implementation of incentives and tax exemption granted to investors and ensure that the privileges are used for their intended purposes, Allow goods to enter Ethiopia free of taxes and duties after ascertaining that the tax incentive is consistent with the Directive issued by the Ministry of Finance. Maintain a record that shows the list of investors which are granted custom duties exemption, the area of investment, the price of items they have imported free of customs duties and the tax forgone. Carry out post audit to ascertain that item imported by the investors free of taxes and duties are used for intended purposes, Take legal measures in accordance with applicable law if proved through post audit that the investor has used goods imported under incentive scheme for unintended purposes,	Phone No. +251-11 5 57 88 51 E-mail: hocrecordad@gmail.com
13	Investment Ethiopian Agriculture Authority Regulation No. 509/2022/5	Prepares professional licensing and certificate of competence requirements for agricultural services, agricultural input, product and marketing, issue, renew, suspend, or revoke license may be necessary. (1)	Phone No. 011 553 4520 http://www.eaa.gov.et

SN	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
		Provides and registers certificate of competence to importers or exporters of agricultural inputs or agricultural products, as may be necessary, renews, suspends, and cancels such certificates. (3) Issues and registers competence of certificate for activities run related to agricultural input, agricultural production, and marketing activities in more than one region within the country, renews, suspends and cancels the certificate. (4) Issues certificate of competency to livestock and plant products production, processing, storage, wholesale areas in accordance with requirements agricultural standards, renews, suspends, and revoke as may be necessary. (7) Ensures agricultural services provision, agricultural input production and agriculture production and marketing are implemented according to national or international quality health, food safety standards through field inspection and laboratory testing or through third party service providers, as necessary and issues a valid plant or animal health certificate. (9) Ensures that imported and regulated agricultural inputs and products meet the legal requirements of quality, health and safety, issue pre import permit and import release permit and export permit, if it does not meet the requirement, suspends, or orders treatment or corrective measure or, if necessary, dispose of or return to the country of origin. (10) Issues, renews, suspends revokes, as may be necessary, an international health certificate to agricultural inputs and products, produced locally and destined for export, approving that they fulfill international or importing country's standards for quality, safety and health. (11) Cause to implement international, continental, and regional regulatory and quarantine principles and agreements. (13) Conducts plant quarantine pests and diseases surveillance, as well as trans boundary animal disease surveys, carries out risk analyses, and sets up a system and prepare a Directive. (17) Establishes and organizes pre and post entry plant and animal quarantine posts and plant seed post control stations. (18) Regulates plant and animal inputs after registration during storage, transportation, distribution, marketing, use and disposal in accordance with appropriate legal framework. (20) Identifies, registers and monitors animals, animal products, animal by-products, feed, plant and plant products from regulatory perspective, studies and monitors their traceability as may be necessary. (21) Confiscate agricultural inputs and products that are counterfeit, out of date, of unknown origin, adulterated with foreign matter or that do not meet requirements, it shall remove non-conforming input or product along with an appropriate body and monitors proper disposal. (27) Issues import permit to a sample of any micro-organism or animal or plant life forms when imported from foreign countries, regulates and monitors domestic biodiversity to prevent from any adverse effect by invasive alien species, authorize access to genetic resources based on available laws. (28)	
14	Ethiopian Institute of Agricultural Research / EIAR	Provision of Improved livestock and fodder species, as well as different commencing technologies, for commercial and small-scale farmers. To generate, develop and adapt agricultural technologies that focus on the needs of the overall agricultural development and its beneficiaries; To coordinate technically the research activities of Ethiopian Agricultural Research System; Build up a research capacity and establish a system that will make agricultural research efficient, effective and based on development needs; Popularize agricultural research results.	http://www.eiar.gov.et

SN	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
15	Livestock Development Institute Regulation No. 506/2022/5	Undertake research and studies on livestock breed improvement to expand sustainable breed supply, livestock product and by-product processing, works towards technology transfer. (1) Establish model processing units, identify sectoral indigenous knowledge, renders technical support to livestock product and by-product private investments to establish research units of breed improvement and livestock product processing. (2) Generate ideas on policies, strategies, programs, and action plans that ensure the overall competitiveness of breed improvement and livestock product processing. (3) Import, domestically produce and multiply quality and standardized inputs for breed improvement, livestock product and by-product processing and makes it available for use, provide technical support to importers. (4) Work together with stakeholders at national level on livestock breeding and livestock products processing, advise and support regions whenever necessary. (5) Establish, organize, and lead animal breeding centers that contribute for genetic improvement, collaborate with other breed improvement and multiplication centers in the country. (6) Collect and analyses technological knowledge, market information and investment data necessary for breed improvement and livestock product and by-product processing, develop database and webpages, disseminate information through appropriate media. (7) Provide practical focused trainings, workshops, symposia, seminars, and other tailor-made trainings on technical, technical technological, management and marketing issue that assists the development and competitiveness of the breed improvement and livestock product processing. (8) Works together with pertinent stakeholders on twinning capacity building programs, on importation and exportation of standard breeds and genetic materials and on establishment of effective market system to enable the livestock product processing and genetic improvement to attain international standard. (9) Provide support and advisory services to livestock breed improvement and livestock product processing on production process plan, quality compliance by establishing sample production laboratories and model processing plant in the institute. (10) In collaboration with other stakeholders, ensure proper organization of breed improvement and product processing investment activities, identify potential investment capacity of the sector, devise mechanism for proper investment promotion and work towards the effectiveness of the investments. (11) Advice and give technical support for investors who wish to engage in breed improvement, livestock product and by-product processing and livestock feed processing in the selection of technology, negotiation, construction, installation and product testing (12) Identify, compile, scale up and support the implementation of internationally accepted best practices to speed up competitive breed improvement and product processing (13)	Phone No. +251-(0)11 439 0060
16	National Bank of Ethiopia Proclamation No. 591/2008/5	Regulate and determine the supply and availability of money and credit as well as the applicable interest rates and other charges; 591/5(4) Formulate and implement exchange rate policy; 591/5(5) Licensing and inspection services Issuance of clearance papers for the use of foreign currency by the importer/exporter upon the request of the Inland Revenue; Dealing with requests to transfer capital when a foreign investment is dissolved/established;	Website: https://nbe.gov.et

S N	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
		Granting permission to foreign organizations/investors and foreign nationals to open foreign currency accounts; Foreign Exchange Statistics Service	
		Providing information on foreign currency income and expenditure permits, in the relevant country according to the request of revenue offices.	
		• Providing information on the use of foreign currency to the importer/exporter • Providing the national bank identification number of the importer/exporter; • performing micro-laboratory biological testing of meat and meat products, animal products, chicken and poultry products, and fish and fish products. • Conducting radiation laboratory testing of powdered milk and fish. • Providing independent third-party inspection services in accordance with ISO/IEC 17020 for products at every stage of the process (from manufacturing to transporting) • Ensuring that agricultural inputs and other raw materials used as raw materials for the factory meet the appropriate quality characteristics through pre-production inspection. • Identifying products produced without meeting the required quality characteristics during the production process for products produced in factories (industries) and adjusting them so that they can be produced with the desired quality characteristics. • Following the completion of the pre-cargo inspection, during the loading of the product, the convenience of transportation conditions, cleanliness, strength of the loading materials, and suitability to deliver the product from the destination will be inspected. • It provides certification services based on mandatory and voluntary production and process system certificates based on Ethiopian standards and international standards	Phone -+251(0)11 646 05 69 Fax -+251(0) 11 645 97 20 Website http://www.eca.com Posta- 11145
17	Ethiopian Conformity Assessment Enterprise (ECAE) Source: (http://www.eca.com)		
18	Ethiopian Food and Drug Authority /EFDA Proclamation No. 1112/2019/4)	Initiate regulatory standards and implement standards issued regarding food safety; safety, efficacy, quality, and rational use of medicines; safety, quality, and effectiveness of medical devices; and other products regulated under this proclamation; adopt appropriate pharmacopeia from another country or manufacturers in house method; (1) Issue, renew, suspend or revoke a certificate of competence or take another appropriate measure of an importer, exporter or quality control service provider, bioequivalence centers, and a manufacturer or wholesaler whose product is intended to be traded in more than one region; (2) Issue import permits and, upon request, grant export certificate for regulated products, their raw materials and packaging materials. (7) Regulate the cross regional advertisement of regulated products in cooperation with the appropriate government body. (14) Ensure, in collaboration with appropriate bodies, proper disposal of expired and other non-complying product regulated under this proclamation. (17) Appoint inspectors, and, as appropriate, order the inspection of any premises in accordance with this Proclamation; (18)	

SN	Name of organization/ Stakeholder	Duties and responsibilities of stakeholders to support livestock investment	Address
19	Ethiopian Standards Institute Regulation No. 193/2003/6	Develop, implement, and follow up standardization strategy for the purpose of quality promotion activities which are in line with the country's development programs. (1) Develop, through stakeholders' involvement, approve and publicize Ethiopian standards. (2) Stabilish national enquiry point and deliver services on standardization, conformity assessment guidelines and technical regulations. (6) Develop and implement awareness creation strategies for consumers on quality and standards. (7) Enable domestic industries to benefit from technology transfer through providing technical support, training, and consultancy services in the implementation of standards. (8) Build the capacity of companies through technical support, training, and consultancy services for developing their own company standards. (9) Promote the use of technologies, in the industries, which help to reduce pollution and wastage during production process. (10) Undertake research on the development application and impacts of standards and related issues. (15)	
20	Ethiopian Electric Power (EEP) Regulation No. 381/2016	• Undertaking design, surveying and construction works of electric power generators, transmission lines and distribution stations by contractors. • Manage, operate, and maintain power stations, transmission lines and distribution stations;	Website-https://www.eep.com.et Telegram https://t.me/EEPCommunication http://www.eeu.gov.et
21	Ethiopian Electricity Service/EEU Regulation 303/2006	Carrying out the construction and maintenance works of electric distribution lines, as necessary, the construction of distribution lines by contractors; Managing electricity distribution lines and purchasing wholesale electricity and selling electricity services to customers; Proposing the amendment of electricity tariff, and implementing it when approved	
22	Ethio-Telecom	• Providing and delivering world-class information technology services based on next-generation network technology. • Building a qualified and suitable manpower with the knowledge, skills, work attitude and culture that can provide world-class secure telecom services based on the next generation network technology. • Establish, operate, maintain, and expand telecommunication services and networks. • Providing local and international voice, data, video and other related additional services;	https://www.ethiotelecom.et
23	Institutions of all regional states	According to the EFDR Constitution article 52(2)/(d) and the Federal Rural Land Proclamation No. 456/97; article 17(1), states can enact laws to manage and determine the use of rural land. Accordingly, federal ministries and hierarchical regional institutions, are responsible for providing services of identification and transfer of land for livestock investment, including other activities that are helpful for the expansion and improvement of livestock investment.	

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