FEASIBILITY STUDY FOR THE PILOT PROJECT OF LIVESTOCK MODERNIZATION IN THE LATA GRAZING RESERVE, KWARA STATE, NIGERIA

FINAL REPORT – Action Plan –

BRL Ingénierie

LRQA CERTIFIED ISO 9001

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LIVESTOCK MODERNIZATION IN THE LATA GRAZING RESERVE

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ACRONYMS

Acronym	Signification
$	USD
%	Percent
~	Around
₦	Naira
€	Euro
°C	Degree celsius
ADG	Average Daily Gain
AET	Actual EvapoTranspiration
AFD	Agence Française de Développement
AfDB	African Development Bank
AI	Artificial Insemination
AMR	Antimicrobial resistance
ANSES	Agence Nationale de Sécurité Sanitaire de l'alimentation, de l'environnement et du travail
ARMTI	Agricultural and Rural Management Training Institute
BCS	Body Condition Score
C	Carbon
C.E.C	Cation-Exchange Capacity
CAHW	Community animal health workers
CBPP	Contagious Bovine Pleuropneumonia
CET	Crop EvapoTranspiration
CIRAD	Centre International de la Recherche Agronomique pour le Développement
CVO	Chief Veterinary Officer
d	day
DLD	Department of Livestock Development
DMI	Dry Matter Intake
DVS	Department of Veterinary Services
ESIA	Environmental and Social Impact Assessment
Etc	Fodder water requirement
Eto	Reference Evapotranspiration
EUR/€	Euro
F1	First generation hybrids
FCT	Federal Capital Territory
FG	Focus Group
FMARD	Federal Ministry of Agriculture and Rural Development
FMD	Foot and mouth disease
FME	Federal Ministry of Environment
g	Gram
Ge	Ground water contribution
GNC	Groundnut Cake
GV	Grazing Value
ha	Hectare
ha	Hectare
HS	Hyptis suaveolens
ILRI	International Livestock Research Institute
INRAB	Institut National des Recherches Agricoles du Benin

Acronym	Signification
Int	Interception
IS	Irrigation scheme
K	Potash
Kc	Crop coefficient
kg	kilogram
kg	Kilogram
km	kilometer
KPI	Key Performance Indicator
KSG	Kwara State Government
KSMARD	Kwara State Ministry of Agriculture and Rural Development
KSMWASD	Kwara State Ministry of Women Affairs and Social Development
l	liter
LGA	Local Government Area (administrative subdivision within the state)
LGA	Local Government Area
LITS	Livestock Identification adn Traceability System
LITS	Livestock Identification and Traceability Systems
m	meter
m^2	square meter
m3	cubic meter
MCC	Milk Collecting Centre
MCP	Milk Collecting Point
meq	milliequivalent
mm	milimeter
NADIS	Nigerian Animal Disease Information System
NAFDAC	National Agency for Food and Drug Administration and Control
NAPRI	National Animal Production Research Institute
Nbr	Number
NGN	Nigerian Naira (local currency)
NGO	Non gouvernmental organization
NIR	Near Infrared
NIWR	Net irrigation Water Requirement
NLDP	Nigeria Livestock Development Project
NVRI	National Veterinary Research Institute
P	Precipitations
PANVAC	African Union Pan African Veterinary Vaccine Centre
Pe	Effective Rainfall
PEHD	High-density polyethylene
PET	Potential EvapoTranspiration
pH	Potential of Hydrogen
PM	Panicum maximum
PPR	Peste des Petits Ruminants
PV	Photovoltaic
PVC	Polyvinyl chloride
Run	Runoff
s	second
SAPZ	Special Agro-Processing Zones
SLPZ	Special Livestock Processing Zone
SPC	Semen Production Center

Acronym	Signification
t	ton
TDM	Total Dry Matter
TDM	Total Dry Matter
ToT	Training of Trainers
UBT	Unité de Bovin Tropical
UBT	Unité de Bétail Tropicale
USD	United State Dollar
VPP	Veterinary paraprofessional
VSB	Veterinary Statutory Body
VTH	Veterinary Teaching Hospital
Wb	Stored soil water contribution
WOAH	World Animal Health Organization
y	year
Yrs	Years

EXECUTIVE SUMMARY

The Lata-Nna Livestock Modernization Project aims to transform and modernize the livestock sector in Kwara State, and serve as a federal pilot for all states in Nigeria by addressing critical challenges across forage management, feed availability, animal health, reproduction, and milk and meat value chains. This initiative focuses on enhancing productivity, sustainability, and economic resilience, especially for herders, women, and youth in rural areas. By combining innovative strategies, infrastructure investments, and capacity-building programs, the project provides a comprehensive roadmap to overcome existing barriers.

THE COMPONENTS OF THE PROJECT

The Project is, for practical structuring reasons, made up of 10 Components that unfold into objectives, outputs and outcomes, investments, and activities. The interactions between components are multiple and varied, forming an indivisible whole. At most, one could assign more or less emphasis to an activity within a component but eliminating a component would not be a sensible option.

Component 1 improves forage and grazing practices through demo farms, irrigation systems, and advanced grazing methods, addressing water scarcity and low forage quality.
Component 2 ensures sustainable feed availability by establishing feed mills, storage facilities, and training programs to reduce dependence on external resources.
Component 3 enhances animal health via vaccination campaigns, veterinary networks, and disease control measures, securing livestock productivity.
Component 4 focuses on genetic improvement and reproductive efficiency with artificial insemination, crossbreeding programs, and technician training.
Component 5 introduces a traceability system to monitor livestock movements, improve disease control, and boost market trust.

On the value chain side, **Component 6** strengthens the dairy supply chain with milk collection centers, cold chain infrastructure, and market access improvements while **Component 7** enhances the meat value chain by upgrading slaughterhouses, promoting feedlots, and establishing contracts between stakeholders.

The development of infrastructure (water and transport) addresses the shortcomings identified during the assessment: these infrastructures are designed to support livestock activities (without water, herds migrate out of the Reserve) and the development of the dairy and meat sectors. Moreover, they will also provide direct benefits to the Reserve's population by increasing the availability of drinking water and facilitating the movement of people and goods. Infrastructure development under **Component 8** includes boreholes, irrigation systems, and rural road rehabilitation to support sustainable livestock activities.

Component 9 aims to empower women and youth with education, microfinance, and cooperative structures, fostering inclusion and economic growth.

Finally, **Component 10** promotes environmental conservation and governance with waste management systems and regulatory frameworks to ensure sustainability.

Together, these components form a cohesive strategy to modernize Nigeria's livestock sector, improve livelihoods, and drive long-term economic growth.

Component 1: Forage and Grazing Management

The grazing system in Nigeria faces significant challenges due to limited water resources, irregular rainfall patterns, and invasive weeds. Poor soil quality and a lack of technical knowledge among herders further hinder the production of high-quality forage. Transhumance is widely practiced due to insufficient local resources, exacerbating the pressure on the ecosystem. Enhancing forage production locally is essential to reduce reliance on migration and improve livestock productivity sustainably.

- Objective: Improve forage quality, grazing practices, and water management.
- Strategy: Establish demo farms, provide training, and create seed production units.
- Main Investments:
  - Construction of irrigation systems and water reservoirs.
  - Development of seed production units with trial plots.
  - Equipment for hay production, storage barns, and demo farm infrastructure.
- Key Activities: Set up irrigation, develop hay storage, and introduce rotational grazing.

Component 2: Access to Feed

Access to balanced feed is a critical issue, as herders depend on low-nutrition forage that fails to meet livestock needs. The absence of feed mills and high costs of transporting feed from other regions worsen the situation. Additionally, herders face cash flow challenges, limiting their ability to invest in long-term feed programs. Addressing these gaps is vital to enhancing productivity and supporting the economic stability of livestock-dependent communities.

- Objective: Ensure sustainable and affordable feed production within the reserve.
- Strategy: Build feed mills, establish raw material supply chains, and conduct trials.
- Main Investments:
  - Construction of warehouses for raw materials and feed storage.
  - Purchase of feed processing equipment (grinders, mixers, conditioners).
  - Development of trial farms for feed testing and demonstrations.
- Key Activities: Develop storage facilities, train herders on feed programs, and create trial farms.

Component 3: Strengthening Animal Health

The prevalence of diseases such as FMD, CBPP, and PPR severely impacts livestock productivity in Nigeria. Herders rely on unregulated veterinary drugs and self-medication, leading to poor health outcomes and public health risks. Veterinary clinics are scarce, and vaccination campaigns are almost nonexistent. Improving veterinary infrastructure and disease prevention measures is critical to securing the health and productivity of livestock.

- Objective: Enhance animal health and productivity through better disease control.
- Strategy: Implement vaccination campaigns and strengthen veterinary networks.
- Main Investments:
  - Construction of vaccination parks and mobile clinics.
  - Purchase of cold storage for vaccines and veterinary equipment.
  - Motorbikes and solar-powered refrigerators for veterinary staff.
- Key Activities: Organize training, provide equipment to clinics, and conduct awareness campaigns.

Component 4: Reproduction Management and Genetic Improvement

Nigeria's livestock sector struggles with low reproductive rates and limited access to high-quality genetic resources. Artificial insemination (AI) is underutilized, and herders rely on natural mating with suboptimal genetic outcomes. Long calving intervals and a lack of breeding expertise further reduce productivity. Improving reproductive management and introducing targeted genetic improvement programs will support higher milk and meat yields.

- Objective: Improve herd productivity through AI and crossbreeding programs.
- Strategy: Develop semen production centers, AI substations, and a nucleus farm.
- Main Investments:
  - Construction of a semen production center with labs and cryopreservation facilities.
  - Establishment of AI substations and storage for nitrogen tanks.
  - Procurement of ultrasound scanners, breeding bulls, and AI kits.
- Key Activities: Train AI technicians, import high-quality bulls, and promote community adoption.

Component 5: Traceability

The absence of a livestock traceability system leads to difficulties in disease control, unreliable market data, and inefficiencies in livestock management. High levels of transhumance and uncontrolled cattle movement exacerbate the problem, making it hard to track health and ownership records. Establishing a traceability system will improve disease surveillance, market transparency, and consumer trust.

- Objective: Establish a Livestock Identification and Traceability System (LITS).
- Strategy: Use RFID ear tags, mobile apps, and centralized databases.
- Main Investments:
  - Purchase of tamper-proof visual ear tags and RFID tags.
  - Development of centralized software and mobile applications.
  - Tablets for field data collection and infrastructure for identification offices.
- Key Activities: Conduct tagging campaigns, train technicians, and improve market transparency.

Component 6: Strengthening the Dairy Supply Chain

Milk production in Nigeria is constrained by a lack of infrastructure for collection, storage, and processing. Most dairy activities are conducted at the household level, with limited market access and poor hygiene practices. These challenges prevent producers from capitalizing on the high demand for dairy products. Developing a robust supply chain will unlock the sector's potential, particularly for women and youth.

- Objective: Boost milk collection, processing, and access to markets.
- Strategy: Develop milk collection centers (MCCs) and improve processing capacity.
- Main Investments:
  - Installation of milk cooling tanks and solar-powered refrigeration units.
  - Development of small processing facilities with basic laboratory equipment.
  - Procurement of motorbikes or tricycles for milk transportation.
- Key Activities: Train women in hygiene practices, install cooling systems, and explore market opportunities.

Component 7: Meat Chain Value

The meat value chain suffers from poor handling practices, inadequate infrastructure, and low profitability for stakeholders. Slaughterhouses lack modern equipment, and butchers operate under unhygienic conditions. Additionally, the absence of cold chains leads to significant product losses. Addressing these issues is essential to improving meat quality, reducing waste, and increasing economic opportunities.

- Objective: Enhance the productivity and hygiene of meat value chains.
- Strategy: Upgrade slaughterhouses, promote feedlots, and establish contracts between stakeholders.
- Main Investments:
  - Construction of cold chambers, hanging rails, and tripe rooms.
  - Installation of waste management systems and water boreholes.
  - Technical consultancy for market layout and slaughterhouse design.
- Key Activities: Train butchers, develop cold storage, and implement biosecurity measures.

Component 8: Water and Transportation Infrastructure

Insufficient access to water and poor transportation networks hinder the effectiveness of livestock activities. Water scarcity affects grazing and feed production, while inadequate roads limit market connectivity and increase costs for herders. Improving water and transport infrastructure is critical to boosting productivity and ensuring the sustainability of livestock systems in remote areas.

- Objective: Ensure reliable access to water and improve transportation for livestock activities.
- Strategy: Construct boreholes, irrigation systems, and access roads.
- Main Investments:
  - Drilling of boreholes and installation of water storage tanks.
  - Construction of irrigation systems for grazing reserves.
  - Rehabilitation of rural roads to improve market access.
- Key Activities: Drill water points, build storage tanks, and rehabilitate key transportation routes.

Component 9: Women and Youth Empowerment

Women and youth in Nigeria's livestock sector face systemic barriers to education, training, and economic opportunities. They are often excluded from decision-making and have limited access to credit or resources. Empowering these groups through targeted initiatives will not only enhance their livelihoods but also strengthen the social and economic fabric of their communities.

- Objective: Empower women and youth through education, training, and access to microfinance.
- Strategy: Provide functional literacy programs and support cooperative structures.
- Main Investments:
  - Development of training centers and literacy materials.
  - Microcredit funds for small business development.
  - Support for cooperative and collective structures.
- Key Activities: Offer technical training, fund microcredit programs, and create cooperative models.

Component 10: Environment & Governance

The environmental impact of livestock activities, such as overgrazing and waste mismanagement, threatens long-term sustainability. Governance challenges, including weak institutional frameworks and lack of regulation, further exacerbate these issues. Promoting environmental conservation and improving governance structures are essential for the project's success.

- Objective: Promote environmental conservation and good governance practices.
- Strategy: Implement waste management systems and establish governance frameworks.
- Main Investments:
  - Installation of biogas systems and waste treatment facilities.
  - Environmental weather station and other environmental sensors
- Key Activities: Proposes adaptations to building designs and road improvements to enable construction using the Labor-Intensive Methods (LIW) approach and to incorporate local materials into the planned structures (low carbon footprint, promotion of local labour...), training on biogas systems, launching of a waste collect system and ensure compliance with environmental policies.

Technical Assistance

The **Technical Assistance (TA) component 11** will conduct the smooth implementation and successful execution of the project. Its main objectives include launching the project, ensuring effective daily management, fostering communication among stakeholders, and promoting the pilot project for broader impact beyond the reserve. The strategy emphasizes close monitoring of activities and efficient coordination.

The component comprises two subcomponents:

Technical Assistance for operational and technical support.

Kwara State Coordination to align activities with local governance and ensure strategic oversight.

This approach guarantees streamlined project delivery and maximizes its effectiveness.

BUDGET AND ECONOMIC ANALYSIS

The economic evaluation of the program aims to measure the potential profitability of an investment deployed over a 25-year period. The cost-benefit analysis model, designed in Excel, incorporates adjustable data through a dashboard. This program, focused on agricultural and livestock development, includes socio-environmental measures.

The Project's budget

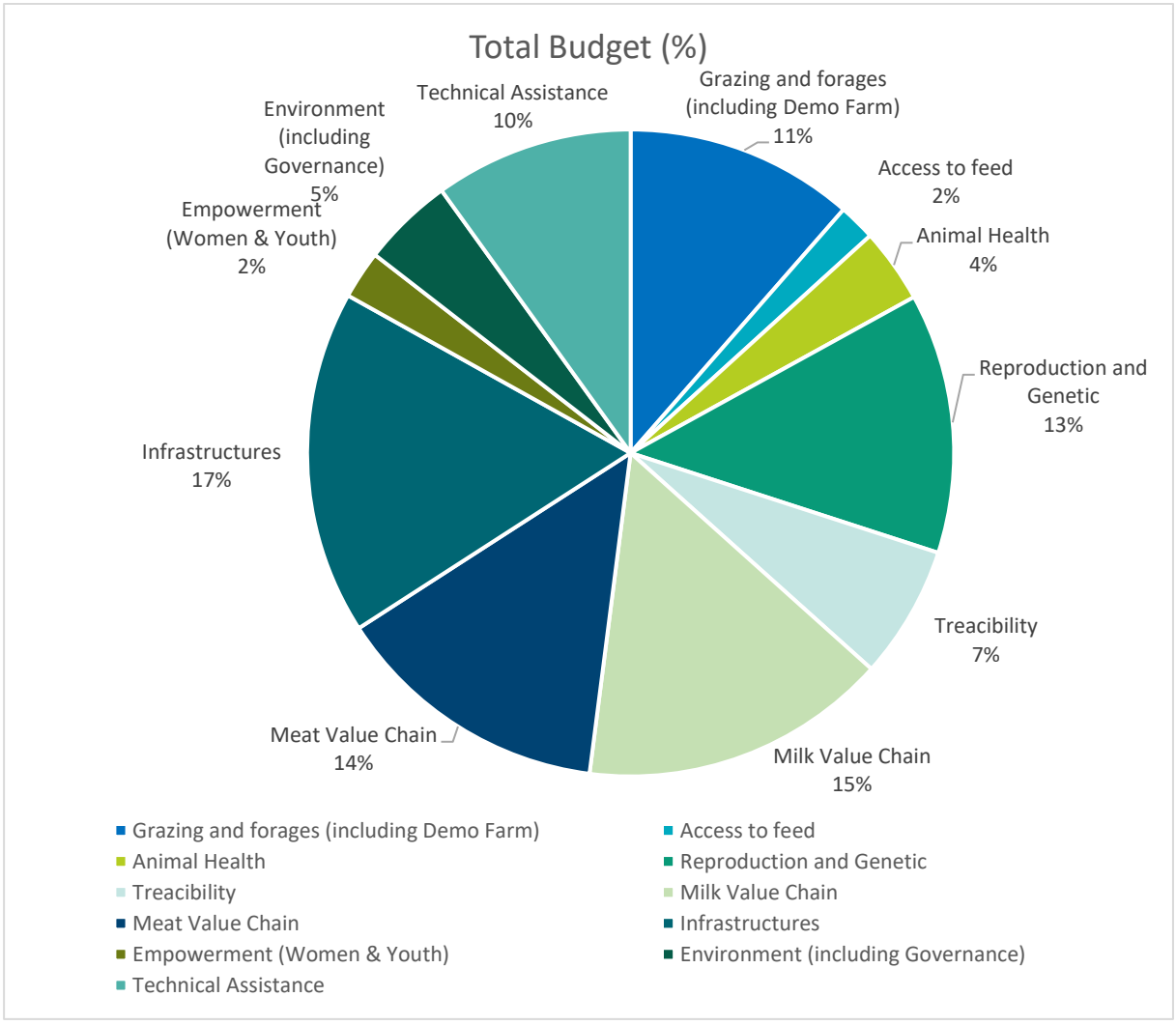
The total budget of the project is estimated to 58,069,750 €. The amounts for the various components are distributed as shown in the following table:

Table 1:Amounts of the components of the Project

Code	Component Name	Total Amount (€)	% Component
G&F	Grazing and forages (including Demo Farm)	6,641,000	11.4%
AF	Access to feed	1,066,500	1.8%

Code	Component Name	Total Amount (€)	% Component
AH	Animal Health	2,160,550	3.7%
R&G	Reproduction and Genetic	7,550,000	13.0%
TRA	Traceability	3,857,000	6.6%
MKVC	Milk Value Chain	8,939,000	15.4%
MVC	Meat Value Chain	8,045,000	13.9%
Infra	Infrastructures	9,992,000	17.2%
WE	Empowerment (Women & Youth)	1,395,500	2.4%
Enviro	Environment (including Governance)	2,655,000	4.6%
TA	Technical Assistance	5,768,200	9.9%
Total		**58,069,750**	**100.0%**

Figure 1: Chart repartition of each component of the budget



The Economic Analysis

Key Assumptions

- Analysis duration: 25 years.
- Discount rate: 9%.
- Exchange rate: 1 € = 825 Naira.
- Main investment duration: 5 years.
- Infrastructure: Renewal of equipment with a lifespan of less than 25 years (roads, solar equipment, agricultural materials, etc.).

Costs and Maintenance

The total investment costs amount to €80.2 million, including €4 million for socio-environmental measures. Annual operating costs after the investment are estimated at €443,404. A breakdown of the lifespan of components shows that some major infrastructures (dams, buildings) last 25 years, while others (roads, machinery) require more frequent renewals.

Anticipated Benefits

- Within the Reserve:
  - Agricultural Production:
    - Maize cultivation on 9,530 ha initially, gradually reduced in favor of pastures.
    - Annual maize production increasing from 23,834 tons (year 0) to 28,601 tons (year 5), then dropping to 0 (year 15).
  - Dairy Production:
    - From 1.46 million liters (year 0) to 17.9 million liters (year 15).
    - Progressive adoption of advanced practices (genetic improvement, efficient reproduction).
  - Meat Production:
    - Cattle heads sold: 6,000 (year 0) to 14,200 (year 15).
- Outside the Reserve:
  - National Dairy Production:11 million additional liters (year 15) due to the dissemination of best practices.
  - Animal Production: Fattening: 57,500 heads by year 15 through concentrate and pasture-based fattening.

Economic Results

- Internal Rate of Return (IRR): 16.7%.
- Net Present Value (NPV): €39.7 million over 25 years.
- Benefit/Cost Ratio: 1.85.
- Sensitivity Analysis

A variation analysis shows that the project remains economically viable, even if costs increase by 30% or profits decrease by 10%. Removing investments in the dairy unit yields similar results, highlighting the project's overall robustness.

Conclusions

This investment program offers solid economic returns and generates significant benefits for agriculture and livestock in Nigeria, both within and outside the reserve. The results strengthen the case for such a project to support rural and national development.

1 COMPONENT 1: FORAGE AND GRAZING MANAGEMENT (INCLUDING DEMO FARM)

1.1 REMINDER OF THE MAIN GAPS IDENTIFIED

The following key gaps have been identified in the current forage and grazing management, highlighting critical issues across knowledge, technical capacity, financial resources, and productivity at different levels.

1. **Access to Water**: Water availability is a significant issue in Kwara State, exacerbated by the seasonal nature of rainfall. This limits forage and grazing productivity, especially during dry seasons.
2. **Seasonality of Rainfall**: The irregularity in rainfall patterns affects the consistency of forage production. Without adequate irrigation solutions, forage quality and availability fluctuate, impacting livestock nutrition and productivity.
3. **Soil Potential**: The soil in certain areas has limitations for high-quality forage production. Soil preparation and the introduction of resilient forage species are necessary to maximize output and optimize land use.
4. **Proliferation of Inedible Weeds**: The presence of highly proliferative weeds, which cows do not consume, hinders forage production. These weeds take up space and nutrients, reducing the area available for nutritious forage growth.
5. **Dependence on Transhumance**: Due to the limited local resources, transhumance remains a common practice. Improving forage, grazing, and hay resources locally can reduce the need for seasonal migrations and enhance productivity.
6. **Need for Improved Forage Quality**: The quality of available forage directly influences cattle productivity. Enhancing forage production methods, along with providing training on grazing and hay management, is essential to meet nutritional requirements and support herd health.
7. **Lack of Knowledge and Expertise:** Farmers and herders lack the necessary knowledge and technical expertise to adopt modern livestock and farm management practices. There is no structured training system in place, including well-equipped classrooms, demonstration areas, and training programs to address practical needs.
8. **Difficulty in Demonstrating Practical Applications**: Without a centralized demo farm, it is challenging to provide real-life examples of effective management and modern techniques. To convince herders to adopt new practices, it is essential that they witness real-life applications that are accessible and come with adequate training. Demonstrations of effective management and modern techniques must be available and supported by structured training systems. By ensuring that herders have the necessary knowledge and technical expertise, they will be more likely to embrace and implement new practices.

In conclusion, there is a lack of knowledge, resources, and structured organization in forage and grazing management, with a need for adapted techniques to enable herders to improve productivity and support sustainable livestock practices.

1.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT FORAGE AND GRAZING MANAGEMENT

OBJECTIVE AND KPIS

For this component, challenges in both knowledge and production require detailed KPIs across key areas to track progress effectively. By measuring engagement, adoption of practices, and direct production outcomes, these KPIs provide essential insights to understand overall performance and identify targeted improvements in forage management, livestock growth, and breeder training.

A Demo Farm subcomponent is designed to establish a dedicated training and demonstration hub to equip technicians, farmers, and herders with practical knowledge of modern livestock and farm management practices. This farm will serve as a real-world example of sustainable and efficient farming techniques while providing the necessary infrastructure to host large-scale training programs. It will also foster knowledge transfer and act as a welcoming space for participants to learn and apply new methods

Knowledge KPIs

1. **Training Attendance:** Number of people attending training sessions and workshops (on the field and at the Demo Farm site)
2. **Practice Adoption:** Number of herders changing cattle management practices.
3. Training Test Results: Knowledge retention based on test scores after training.
4. **Manual Distribution**: Number of manuals distributed to support best practices.
5. Training capacity: Track the number of technicians, farmers, and herders trained annually to assess the scale of knowledge transfer.
6. **Infrastructure readiness**: Monitor the completion and operational status of planned facilities, such as classrooms, housing, and administrative blocks.
7. **Satisfaction rate:** Collect feedback from participants to evaluate the effectiveness and quality of training programs.
8. **Community outreach:** Measure the reach and impact of awareness campaigns aimed at promoting the demo farm and engaging local communities.

Production KPIs

1. Pasture Reseeded: Surface area of pasture reseeded with improved forage.
2. Daily Weight Gain: Average daily weight gain of cattle.
3. Pasture Mowed for Hay: Area mowed for hay production.
4. Feedlot Cattle Count: Number of cattle grown in feedlots.
5. Meat Production: Total quantity of meat produced in the area.

STRATEGY

Grazing and Forages Strategy Overview

1. **Seed Production Unit**
   Objective: Establish a seed production unit to support local forage development and yield improvement. This includes trial plots to test new forage varieties and monitor yields, ensuring that optimal seeds are available for high-quality forage production. Facilities for irrigation, storage, and processing will be set up, along with quality control and marketing initiatives to support sustainable seed production.

2. **Preparation of Forage Plots for Fulani Herders**
   Objective: Provide Fulani herders with access to dedicated forage plots averaging 10 hectares each to improve grazing efficiency and reduce dependency on transhumance. This includes land preparation, seeding, tree planting for plot

boundaries, and basic infrastructure like fencing and boreholes, offering a sustainable and manageable grazing solution.

3. **Training on Forages, Grazing, and Hay**

   Objective: Enhance herders' knowledge of sustainable grazing, hay production, and forage management practices through comprehensive training and extension services. Training programs, manuals, and media resources will support awareness, while workshops and a Training of Trainers (ToT) program will empower local extension officers to sustain knowledge transfer in the long term.

4. **Hay Production & Storage**

   Objective: Develop hay production and storage facilities to ensure a consistent feed supply throughout the year, particularly during dry seasons. Investments in hay-making equipment, storage barns, and maintenance training will support efficient hay production and preservation, reducing reliance on seasonal forage availability.

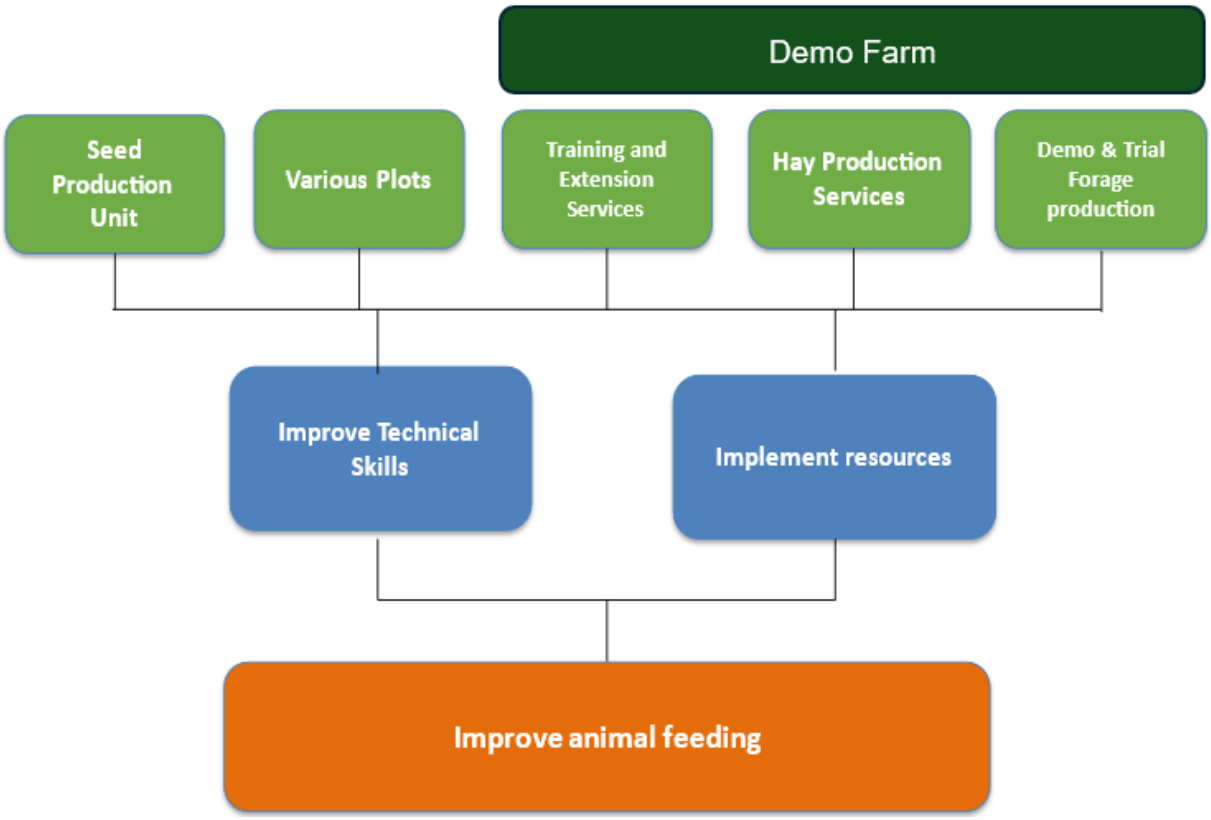
5. **Demo & Trial Forage Production**

   Objective: Create demonstration and trial plots for forage production to showcase innovative practices, including electric fencing, rotational grazing, and irrigation. This setup will allow for trials of various forage species and techniques, measuring yields and quality. The demo plots will serve as a learning hub for herders, highlighting effective methods for forage and grazing management that can be applied to their own operations.

6. . **Demo Farm**

   Establish a Demo Farm as a central hub for training and practical knowledge transfer in modern livestock and farm management techniques. The farm will provide infrastructure for hands-on demonstrations, classrooms for theoretical sessions, and facilities to host trainees. This initiative will support sustainable farming practices and long-term capacity building.

Figure 2: Strategy to improve grazing and forage



1.3 SUBCOMPONENT 1: SEED PRODUCTION UNIT

Objective	• Training Attendance • Practice Adoption • Pasture Reseeded • Daily Weight Gain
Outputs / outcomes	**Outputs** • A 60-hectare seed production site equipped with trial plots and functional facilities for quality seed production. **Outcomes** • Improved access to certified forage seeds, enhancing yields and promoting sustainable agricultural practices.
Key partners	• **Local Agricultural Research Institute**: Offers expertise in forage variety trials and seed certification. • **Irrigation and Infrastructure Providers**: Ensures effective setup and maintenance of irrigation and storage facilities. • **French Seed Production Specialists**: Guides seed processing, branding, and market strategies.

	• **Farm Machinery Suppliers**: Supplies tractors, plows, and other equipment essential for seed production. • **Local Government**: Facilitates land acquisition, compliance, and regional agricultural support.
Investments on equipment and facilities	1. Land acquisition and preparation. 2. Drip or sprinkler irrigation systems. 3. Controlled storage facilities. 4. Seed processing units for cleaning and grading. 5. Farm machinery, including tractors and harvesters. 6. Initial seed stock for trials. 7. Quality control equipment for testing and certification. 8. Training and breeder engagement spaces. 9. Marketing and sales resources.
Key activities	1. Establish Trial Plots and Begin Production Secure and prepare 60 hectares for seed production, install irrigation, and implement trial plots to evaluate forage varieties. 2. Set Up Facilities Construct storage and seed processing facilities, ensuring quality preservation and preparation for market distribution. 3. Equip the Unit Procure machinery and quality control equipment to ensure operational efficiency and adherence to standards. 4. Engage Farmers and Promote Adoption Develop training programs and distribute manuals to educate herders on forage selection, planting, and hay production. 5. Market Development Brand, package, and promote the seeds through established distribution channels to enhance market presence and accessibility.
Interest	The Seed Production Unit supports local self-sufficiency in forage seed production, empowering herders with consistent access to high-yield, certified seeds. This initiative enhances forage quality and livestock productivity while promoting sustainable agricultural practices. Additionally, the component drives economic growth by creating jobs and fostering a thriving local seed market, contributing to long-term agricultural resilience.
Hypothesis and risks	1. **Environmental Challenges:** Unpredictable weather may affect seed growth and irrigation system efficiency. 2. **Soil Variability:** Uneven soil conditions could limit productivity without proper management. 3. **Market Demand:** Fluctuating interest in forage seeds may impact profitability

	. 4. **Maintenance:** Ensuring consistent functionality of irrigation and processing equipment may pose logistical challenges. 5. **Adoption Resistance:** Herders may hesitate to adopt improved practices, affecting the unit's impact.
Budget	Investment : 1,070 k€ Op. Budget : 400 k€

Seed Production and Processing Overview

The production of forage grass seeds follows a structured process designed to meet local agricultural needs and ensure consistent output. French specialists play a crucial role in selecting forage varieties that combine high productivity with adaptability to local conditions. The steps in the process are outlined below:

1. Selection of Forage Varieties

Three forage species have been selected for their adaptability, nutritional value, and productivity:

- Brachiaria spp. (locally tested varieties such as Mulato II)
- Guinea Grass (*Panicum maximum*)
- Stylosanthes spp. (*Stylo legume*)

These species are chosen to enhance livestock nutrition and meet the forage requirements of the region.

2. Irrigation

Surface water will be captured and stored in a dam, then distributed using sprinkler systems to secure seed production. The seed production will positively impact over 3,000 hectares of land.

3. Seed Harvesting

Grass is harvested at peak maturity to preserve seed viability and ensure high germination rates.

4. Cleaning and Sorting

Harvested seeds are processed with specialized equipment to remove impurities, retaining only mature, high-quality seeds.

5. Grading and Quality Control

Seeds are graded and tested for size, germination rate, and nutrient content, ensuring they meet quality standards.

6. Drying and Conditioning

Seeds are dried to the optimal moisture level to maintain their viability during storage.

7. Storage and Packaging

Processed seeds are stored in controlled conditions and packaged with essential details such as variety, origin, and processing date to ensure traceability.

8. Distribution and Education

Seeds are distributed to farmers and herders along with instructions for planting, soil preparation, and forage management to support effective forage production.

Production Capacity and Impact

Hectares Dedicated to Seed Production
The seed production process will be carried out on 60 hectares of land, ensuring a significant yield of forage seeds.

Seed Yield and Potential Coverage
In Nigeria, forage seed yields for Brachiaria typically range from 200 to 400 kilograms per hectare under suitable conditions. Based on an average yield of 300 kilograms per hectare, the 60-hectare production area is expected to produce approximately 18,000 kilograms (18 metric tons) of seeds.

Seeding Rate and Area Coverage
With a recommended seeding rate of 5 kilograms per hectare, this seed production will enable the seeding of approximately 3,600 hectares of forage land. This expanded forage area will provide a sustainable feed source, significantly improving livestock productivity and pasture quality for farmers and herders.

Business Plan Overview

In this model, the government provides the foundational resources, including land, facilities, and essential materials. This private partner sets up the physical infrastructure and initial resources for the Seed Production Unit, creating a foundation for sustainable operations. Additionally, in the first year,

The private operator is responsible for:

- Daily Operations Management: Overseeing agricultural tasks, seed production and processing, storage, distribution and sales to ensure the unit operates smoothly.
-
- Organizing Workshops and Trials: Working with French specialists, the operator conducts workshops and establishes trial plots to test new forage varieties, irrigation methods, and breeding techniques, which provide insights and training to herders.

From the revenue generated, the operator will cover maintenance, consumables, fuel, and workshop expenses. The operator also receives a commission per dose sold, creating an incentive for efficient and effective operations.

1.4 SUBCOMPONENT 2 : RENTAL PLOTS FOR FULANI HERDERS IN LATA GRAZING RESERVE

Objective	**Practice Adoption**: Number of herders changing cattle management practices. **Pasture Reseeded**: Surface area of pasture reseeded with improved forage. **Daily Weight Gain**: Average daily weight gain of cattle.
Outputs / outcomes	**Outputs** 200 grazing plots (10 ha each) equipped with fencing, water supply, and kraals, ready for herders' use. **Outcomes** Increased adoption of managed grazing practices, enhancing forage productivity and livestock growth.

Key partners	• **French Agricultural Specialists**: Provide expertise in sustainable land management techniques and infrastructure planning. • **Local Government**: Facilitates land allocation, ensures regulatory compliance, and supports infrastructure development. • **Irrigation and Infrastructure Providers**: Install boreholes, fencing, and kraals to make plots operational. • **Community Contact Person**: Acts as a mediator for plot disputes, assists with herder collaboration, and liaises with French specialists. • **Nigerian Company**: Responsible for land preparation and irrigation system setup to ensure plots are operational.
Investments on equipment and facilities	1. Land clearing and preparation. 2. Fencing installation. 3. Boundary tree planting. 4. Access road construction. 5. Wooden kraal construction. 6. Initial fertilization and seeding.
Key activities	1. Plot Layout and Preparation Design and clear 200 plots, prepare the soil, and establish grazing areas. 2. Infrastructure Setup Install watering points (boreholes and water trough), irrigation systems, fencing, and kraals to make plots fully operational. 3. Boundary Demarcation Use natural markers such as trees to define plot boundaries and promote agroforestry. 4. Technical Training Provide hands-on training for herders in sustainable grazing techniques, plot management, and forage utilization. 5. Road Construction Build access roads to ensure smooth connectivity between plots. 6. Forage Seeding and Fertilization Seed plots with high-yield forage varieties and apply fertilizers to boost initial growth and productivity.
Interest	This subcomponent empowers Fulani herders to adopt sustainable land management practices through pre-prepared rental plots, reducing their financial burden while promoting productivity and environmental sustainability. By showcasing effective grazing and forage production techniques, it accelerates the transition to modern livestock management practices, boosting livestock productivity and contributing to the regional economy.
Hypothesis and risks	• **Environmental Challenges**: Weather unpredictability may affect forage growth and water availability.

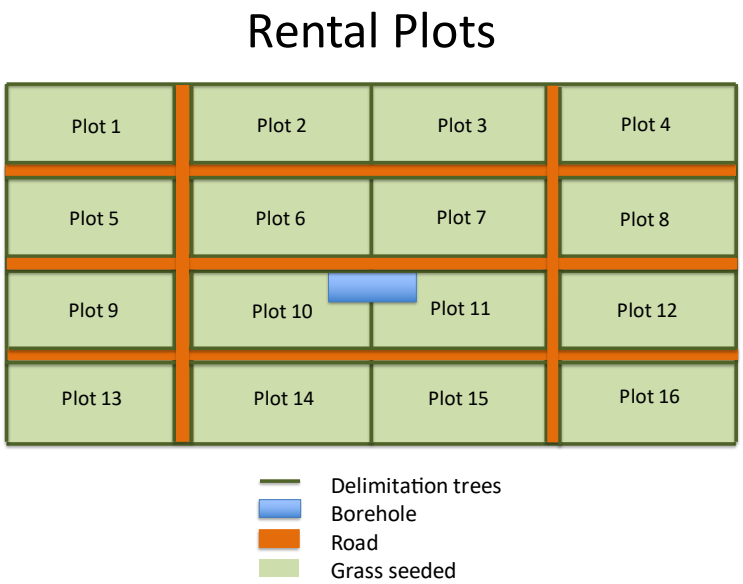
	• **High Maintenance Costs**: Sustaining infrastructure like fencing, boreholes, and kraals may strain budgets. • **Resistance to Change**: Herders may prefer traditional grazing methods, slowing adoption rates. • **Boundary Conflicts**: Disputes over plot boundaries could arise, necessitating effective oversight. • **Infrastructure Challenges**: Uneven terrain may complicate layout and accessibility for grazing plots. • **Vegetable growing :** Farmers may want to grow vegetables that makes more profit on those plots.
Budget	Investment : 2,055 k€ Op. Budget : 500 k€

Plots Concept

As illustrated in the schematic below, these rental plots of 10 hectares each are designed to accommodate approximately 50 cattle per plot. These lands, which will be leveled and seeded with imported grass seeds, will ensure optimal forage productivity, allowing both grazing and hay harvesting. Each group of 16 plots will be equipped with a borehole, providing water for cattle watering and human needs, but not intended for irrigation.

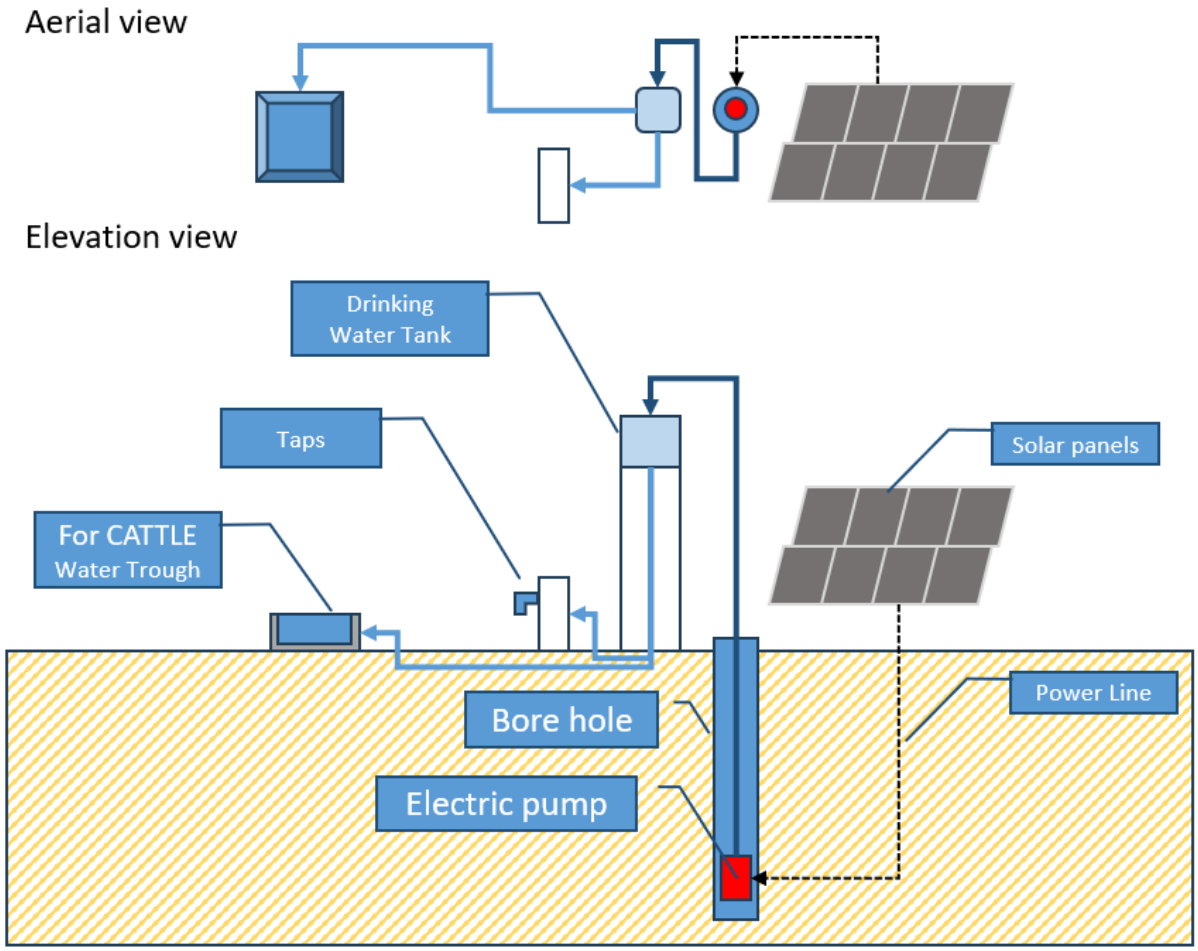
The boundary trees, used to fence the plots, reduce the need for constant supervision, allowing breeders to visit the plots only once a day, mainly for milking the cows. Additionally, the structured roads will facilitate access for milk collection, supply deliveries, and breeder visits. This initiative aims to settle livestock farming, while increasing productivity and farmers' income through modern and efficient resource management.

Figure 3 : Rental Plots



The rental plots will be grouped by 16 units with one standard borehole for each group (one borehole will comprise the borehole itself, all its equipment, the solar pumping system, a water tank and a water trough as illustrated on the following picture.

Figure 4 : Watering Point of Rental Plots



Plot Interest for Fulani

The Fulani Rental Plot offers herders flexible options for maximizing the utility of their rented land, enabling them to diversify their activities and enhance productivity. Through careful management, these plots remain productive year-round, supporting various agricultural and livestock uses:

1. Grazing:

Herders can allocate a portion of the plot for grazing, creating a controlled and sustainable environment for their cattle. This enhances the production of milk or meat, meeting market demands while improving livestock health and productivity.

2. Hay Production:

Forage grasses can be grown and harvested as hay, either for personal use or for sale. Selling hay provides an additional income stream, particularly valuable during the dry season when demand peaks.

By combining grazing, hay production, herders can optimize the plot's utility, boosting livestock productivity and generating income from multiple sources such as milk, meat, or hay sales.

Phased Deployment Plan

To ensure the gradual and sustainable implementation of the project, 50 rental plots will be established each year. This phased approach allows for effective resource management, proper

oversight, and the opportunity to refine processes as the project grows. By the fifth year, all plots will be fully operational, giving herders access to training and resources simultaneously. This strategy not only ensures scalability but also facilitates smoother adoption and integration of modern practices among participants.

Business Model Integration

The revenue generated from leasing the plots will support the progressive rollout, funding the maintenance and establishment of new plots each year. Additionally, phased deployment allows for continuous reinvestment into the project to enhance infrastructure, provide technical training, and scale up water and forage management systems. By aligning plot development with the business model, the project guarantees a self-sustaining structure, ensuring long-term impact and accessibility for all stakeholders.

1.5 SUBCOMPONENT 3: TRAINING ON GRASS MANAGEMENT

Objective	• Training Attendance • Practice Adoption • Daily Weight Gain
Outputs / outcomes	Outputs Trained extension officers and herders with access to workshops, educational materials, and digital training content. Outcomes Improved livestock productivity and resilience through the adoption of advanced forage and hay management practices.
Key partners	• **French Agricultural and Nutrition Specialists**: Develop training materials and deliver workshops on advanced forage and hay management techniques, focusing on productivity and resilience. • **Media and Communication Specialists**: Execute a targeted awareness campaign using radio, print, and digital platforms to ensure herder engagement. • **Community Contact Person**: Facilitate herder participation, encourage adoption of practices, and support knowledge sharing. • **Government**: Provide funding, resources, and marketing support to raise awareness and ensure program scalability.
Investments on equipment and facilities	
Key activities	1. **Training of Trainers (ToT):** Train extension officers in grass management, hay production, and irrigation techniques to deliver workshops to herders.

	2. **Awareness Campaign:** Implement a media strategy, including radio broadcasts, print materials, and digital content, to inform herders about training opportunities. 3. **Workshops and Hands-On Training:** Conduct workshops to teach herders fattening techniques, forage management, and hay storage strategies. 4. **Educational Material Development:** Create manuals and guides to provide herders with practical, ongoing reference materials. 5. **Digital Training Content Creation:** Produce videos and tutorials to make training accessible to herders in remote areas.
Interest	This component improves forage quality and availability, enabling herders to adopt sustainable practices that enhance livestock productivity and resilience. The focus on hay storage and irrigation mitigates seasonal challenges, while advanced fattening techniques empower herders to achieve greater profitability. By fostering knowledge transfer and practice adoption, the component strengthens the livestock value chain and promotes long-term agricultural sustainability.
Hypothesis and risks	• **Environmental Challenges**: Drought or excessive rainfall may affect forage growth and hay production. • **Resistance to Change**: Some herders may be reluctant to adopt new techniques due to traditional preferences. • **Low Adoption Rates**: Limited engagement from herders could reduce the overall impact of the training.
Budget	Investment : 0 k€ Op. Budget : 795 k€

The training aims to raise awareness among herders about the benefits of new grass species and teach them hay management techniques, highlighting the importance of these practices for livestock feeding. It also includes training on irrigation to help maintain forage productivity during dry seasons. Additionally, herders will learn fattening techniques to improve productivity, supported by educational resources such as manuals, videos, and online tutorials. This training is designed to promote sustainable practices and encourage independent environmental management by herders

This program will be fully funded by the government, with French specialists conducting the initial Training of Trainers (ToT) program for extension officers, who will then train the herders directly. The French specialists will also organize regular follow-ups to ensure continued support and guidance for herders as they apply these practices.

1.6 SUBCOMPONENT 4: HAY PRODUCTION SERVICE PROVIDER

Objective	1. **Pasture Mowed for Hay**: Area mowed for hay production. 2. **Daily Weight Gain**: Average daily weight gain of cattle supported by the hay supply.

	3. **Training Attendance**: Number of herders trained in hay production and utilization.
Outputs / outcomes	Outputs A fully operational hay production service equipped with modern machinery and storage facilities, delivering hay to herders year-round. Outcomes Reliable access to hay boosts livestock productivity, reduces dependence on seasonal grazing, and strengthens herder resilience.
Key partners	• **Livestock Association**: Facilitates communication with herders, promotes service adoption, and aligns herders' needs with service offerings. • **French Machinery Producer**: Supplies hay production machinery, provides technical training in operation and maintenance, and ensures effective use of equipment. • **Government**: Funds infrastructure, supports accessibility, and ensures long-term sustainability through regulatory and financial backing.
Investments on equipment and facilities	1. Acquisition of hay production machinery (tractor, mower, rake, baler). 2. Construction of a weather-proof hay storage barn. 3. Development of a workshop for equipment maintenance. 4. Installation of a weather station for optimized hay production planning. 5. Procurement of a moisture meter for hay quality assurance.
Key activities	1. **Hay Production Scheduling**: Plan hay production cycles based on weather conditions to optimize cutting, drying, and storage. 2. **Machinery Operation and Maintenance**: Regularly operate and maintain hay production equipment to ensure efficiency and durability. 3. **Training Sessions**: Conduct workshops to train operators and herders in hay production techniques and equipment upkeep. 4. **Quality Assurance**: Monitor hay moisture levels and storage conditions to maintain optimal quality. 5. **Hay Distribution**: Deliver hay to farms, ensuring consistent and timely supply. 6. **Breeder Outreach**: Promote the service among local herders, emphasizing its benefits and accessibility.
Interest	The hay production service ensures year-round forage availability, reducing reliance on unpredictable grazing conditions. By improving livestock health and productivity, this initiative stabilizes herder incomes and fosters agricultural resilience. Additionally, it builds local expertise in hay production and equipment maintenance, creating a sustainable support system for regional livestock development.
Hypothesis and risks	• **Environmental Challenges**: Drought or excessive rainfall may disrupt hay production cycles. • **High Maintenance Costs**: Sustaining equipment and facilities may pose financial challenges. • **Low Adoption**: Some herders may prefer traditional grazing methods over purchasing hay. • **Weather Dependency**: Unpredictable conditions could affect hay quality and availability.

	• **Insufficient Training**: Operators and herders may lack the skills to fully utilize the service's potential.
Budget	Investment : 758 k€ Op. Budget : 15 k€

Hay Production Process

The hay production process involves several key steps to ensure the production of high-quality forage. Initially, the grass is cut using a mower, followed by tedding to spread the grass out for drying. After adequate drying, the grass is raked into windrows and then baled using a baler to create manageable bales. Once the bales are formed, they are stored in a dedicated barn to protect them from weather conditions that could compromise their quality. Proper storage is essential to maintain the hay's nutritional value and prevent spoilage. Throughout the process, monitoring moisture levels is critical, and weather conditions are tracked to optimize production timing.

Business Plan

In this business model, the government will provide the necessary hay production and storage equipment and offer training to young Fulani entrepreneurs. The training will include hay-making techniques and equipment maintenance, ending with a certification process. Once certified, participants will rent the equipment from the government and manage operational costs such as fuel and consumables while building a customer base. To support the initiative, the government will also launch a promotional campaign to engage local herders. Herders will contribute a fee for each bale of hay produced, ensuring a sustainable revenue system that benefits both the hay producers and the local agricultural community.

1.7 SUBCOMPONENT 5: DEMO AND TRIAL FORAGE PRODUCTION

Objective	• **Pasture Reseeded**: Surface area of pasture reseeded with improved forage species. • **Daily Weight Gain**: Average daily weight gain of cattle grazed on trial forage species. • **Training Attendance**: Number of herders attending workshops and demonstration events.
Outputs / outcomes	Outputs Comprehensive trial results showcasing optimal forage species, irrigation methods, and grazing practices tailored to local conditions. Outcomes Improved forage productivity and herder adoption of sustainable practices, enhancing livestock health and regional agricultural resilience.
Key partners	• **Local Agricultural Research Institutes:** Provide expertise in trial design, forage species selection, and data analysis, ensuring scientific rigor in testing. • **French Agricultural Specialists:** Offer technical guidance, training, and support for implementing innovative forage management techniques. • **Government Agencies:** Provide funding, regulatory compliance, ad land acquisition support, ensuring successful trial implementation. • **Livestock Associations:** Engage herders and promote trial participation while facilitating communication between stakeholders. • **Irrigation and Infrastructure Providers:** Install and maintain irrigation systems, ensuring reliable water supply for forage trials.

Investments on equipment and facilities	1. Forage species acquisition for trials. 2. Irrigation system installation for consistent water supply. 3. Hay production machinery, including mowers, balers, and tedders. 4. Construction of a barn for equipment and hay storage. 5. Weather station installation for monitoring trial conditions. 6. Borehole development to provide a sustainable water source. 7. Kraal construction for livestock management during trials. 8. Tree planting to delineate trial plots and support biodiversity.
Key activities	1. **Conduct Trials**: Test various forage species, grazing techniques, and irrigation methods to identify the most effective practices. 2. **Data Collection**: Monitor yields, forage quality, and livestock performance to analyze the results of different techniques. 3. **Training Workshops**: Educate herders on trial findings and effective forage management practices. 4. **Demonstration Events**: Showcase successful techniques and innovations to encourage adoption among herders. 5. **Monitoring and Reporting**: Regularly assess trial progress and share findings with stakeholders, highlighting best practices. 6. **Community Engagement**: Collaborate with herders and local institutions to foster knowledge exchange and promote sustainable practices.
Interest	This component is designed to empower herders with practical, science-based forage management techniques, helping them improve productivity and sustainability. By testing and showcasing innovative methods, the initiative promotes resilience in agricultural practices, enhances livestock health, and fosters a collaborative environment for continuous improvement in the region's farming systems.
Hypothesis and risks	• **Environmental Challenges:** Unpredictable weather conditions, such as drought or excessive rainfall, can adversely affect forage growth and trial results. • **Limited Adoption of New Practices:** Herders may be resistant to changing traditional methods, leading to low participation in the trials and limited uptake of new techniques. • **Resource Availability:** There may be insufficient resources (e.g., water for irrigation) to support the trials effectively, impacting the quality of the results. • **Training Effectiveness:** Inadequate training or support for herders could hinder their ability to implement the practices demonstrated in the trials. • **Data Collection and Analysis:** Challenges in accurately collecting and analyzing data may result in inconclusive findings, undermining the credibility of the trials. • **Community Engagement:** Difficulty in engaging the local community and stakeholders could limit the reach and impact of the trials.
Budget	Investment : 211 k€ Op. Budget : 20 k€

Trial Management

1. **Irrigation Trials:**

   These trials aim to test different irrigation methods (such as drip and sprinkler systems) to determine the most efficient and effective technique for forage production under local conditions. By monitoring water use, plant growth, and yield, the trials will identify the best irrigation setup to maximize forage growth while conserving water. The water used for these trials will be collected and stored in a surface water dam during the rainy season, ensuring a sustainable supply for irrigation. This data will inform the unit's irrigation strategy and guide herders on optimal watering practices for their fields.

2. **Hay Production Trials:**

   Hay trials will explore various forage varieties and techniques to determine which grasses produce the most nutritious and high-yield hay. This includes evaluating cutting times, drying methods, and moisture levels to ensure optimal hay quality and preservation. Showcasing these techniques provides herders with insights into best practices for hay production, enabling them to produce valuable forage that supports livestock health throughout the year.

3. **Varieties Trials:**

   These trials focus on testing different forage varieties for suitability with specific cattle breeds, ensuring that the forage produced meets the nutritional needs of local livestock. By analyzing growth rates, health, and productivity in livestock fed with trial forage varieties, the trials will help to identify the best forage-breed combinations. This information will guide forage production and improve the alignment of local forage resources with cattle nutritional needs.

Training and Support

Training sessions will be organized for herders, focusing on the results of the trials and best practices in forage management. These sessions will include hands-on workshops and demonstrations of the techniques showcased in the trials, allowing herders to gain practical experience. Additionally, a Training of Trainers (ToT) approach will be adopted, equipping selected individuals with the skills needed to disseminate knowledge further within their communities. The government will provide support for these training initiatives, ensuring that resources are available and accessible. French specialists will also be involved, offering ongoing training and maintaining communication to ensure that herders receive continuous support and guidance as they implement new practices. Overall, the collaboration between the government and French specialists will foster a robust framework for knowledge sharing and practical training, ultimately benefiting the local farming community.

1.8 SUBCOMPONENT 6: DEMO FARM

Key Components:

- Technical consultancy for the design of the integrated farm infrastructure.
- Construction of admin blocks, classrooms, housing, and access roads for training activities.
- Preparation of land for grazing and demonstration purposes.
- Small dam and associated irrigation scheme (see Water Mobilization components 8)
- Development of training resources, including manuals, videos, and a Training of Trainers (ToT) program.

- Communication campaigns to promote the Demo Farm and engage local farmers and herders.

Objective	1. Training capacity 2. Infrastructure readiness 3. Satisfaction rate 4. Knowledge application 5. Community outreach
Outputs / outcomes	**Outputs** • Integrated Demo Farm infrastructure supporting training, demonstrations, and practical applications. **Outcomes** • Improved adoption of innovative agricultural practices, fostering productivity and sustainability.
Key partners	• **Government of Kwara State**: Provides land allocation, financial support, and ensures regulatory compliance. The government also coordinates local stakeholder collaboration and ensures that the Demo Farm integrates seamlessly with regional agricultural goals. • **French Agricultural Specialists**: Lead the design and implementation of training programs and infrastructure, offering advanced expertise in livestock and forage management practices. They play a critical role in delivering the Training of Trainers (ToT) program and supporting innovation in agricultural practices. • **Nigerian Agricultural Research Institute (NARI):** Aligns Demo Farm activities with local agricultural contexts, offering research-backed solutions and ensuring the integration of regional best practices. • **Local Community Leaders**: Facilitate connections between the project team and community members, mobilizing participation and fostering trust in adopting innovative farming methods. • **Feedlot, Nucleus Farm, and Forage Trial Plot Teams**: Ensure operational alignment between the Demo Farm and related components, providing practical demonstrations and real-time insights to enhance training effectiveness.
Investments on equipment and facilities	1. Classrooms for training sessions. 2. Administrative block and canteen for operations. 3. Housing for students and staff. 4. Access roads for transportation and connectivity. 5. Utility infrastructure, including water, electricity, and waste management systems. 6. Land development with fencing, levelling, and landscaping.
Key activities	1. Develop site layout and integrate infrastructure. 2. Construct classrooms, administrative blocks, housing, and access roads. 3. Implement the Training of Trainers (ToT) program. 4. Develop and distribute manuals, videos, and training materials. 5. Conduct workshops and demonstrations using Feedlot, Forage Trial Plots, and Nucleus Farm methods.

	6. Execute a communication plan to promote the Demo Farm and its benefits. 7. Provide operational support to ensure the Demo Farm's success.
Interest	The Demo Farm will serve as a cornerstone for capacity building, empowering stakeholders with practical knowledge to improve livestock and agricultural systems. By integrating key project components, it promotes innovation, skill development, and sustainable practices. This hub will strengthen the resilience of farming communities while creating a scalable model for agricultural excellence across regions. The demo farm will serve as a national training hub in the long term, providing education and resources to support the development of sustainable agricultural practices across the country.
Hypothesis and risks	1. **Low Adoption Rates**: Farmers may resist new methods, limiting the farm's impact. 2. **Coordination Challenges**: Misalignment between Demo Farm and other components could disrupt integration. 3. **Knowledge Transfer Gaps**: Inadequate outreach may restrict the spread of knowledge beyond participants.
Budget	Investment : 480 k€ Op. Budget : 338 k€

Budget and Financial Support for the Demo Farm Component

The budget for the Demo Farm component has been carefully planned to complement the investments and activities already detailed in other components, such as the Nucleus Farm, Feedlot, and Forage Trial Plots. While the other components focus on operational and practical applications, this component specifically addresses the infrastructure, training programs, and resources required to establish a hub of excellence for education and skill-building.

The Government of Kwara State will provide significant support for the construction and development of the Demo Farm's facilities, including administrative buildings, classrooms, housing, and access roads. To finance French specialists, students attending the training programs will contribute a participation fee. This fee reflects the value of the skills they will gain, enabling them to increase their income and productivity in the long term.

To make the training accessible to all, banks will offer student loans that allow participants to finance their education. These loans are tailored for small-scale farmers and technicians who wish to upgrade their skills but lack the upfront resources. The aim is to make the program inclusive while fostering economic responsibility and empowerment.

Training Focus and Target Audience

The Demo Farm will offer training programs designed to build skills in:

- **Forage Management**: Including rotational grazing, hay production, and irrigation techniques demonstrated at the Forage Trial Plots.
- **Livestock Fattening**: Practical sessions at the Feedlot focusing on nutrition and feeding strategies.
- **Genetic Improvement and Reproductive Techniques**: Insights from the Nucleus Farm on artificial insemination, bull services, and breeding programs.
- **Sustainable Practices**: Covering resource management, business skills, and market integration.

The primary audience for these programs includes:

1. **Farmers**: Small-scale and large-scale farmers aiming to adopt modern practices for improved productivity.
2. **Technicians**: Agricultural professionals who will serve as trainers or advisors within the community.
3. **Students**: Young individuals pursuing careers in agriculture and livestock management, who will gain hands-on experience and technical expertise.

This approach ensures that the training directly impacts the region's agricultural productivity while building a pipeline of skilled professionals to sustain development efforts.

As a training and trial hub, the demo farm will also be used to **promote good integrated waste management practices**. A methanizer and a urban waste incinerator will be installed within the area of the Demo Farm (see Component 10 Environment).

2 COMPONENT 2: ACCES TO FEED

2.1 REMINDER OF THE MAIN GAPS IDENTIFIED

The following key gaps have been identified in the current forage and grazing management, highlighting critical issues across knowledge, technical capacity, financial resources, and productivity at different levels.

1. **Lack of access to feed in the reserve**

   In the reserve, herders are not able to find balanced feed to produce milk or meat with price of feed that help to make margin of their animals.

   Feed mills are not able on the reserve yet and ask feed from other area will increase the cost. As mentioned below, cash flow is a challenge for herder thus increase cost of feed due to transport of feed will reduce the durability of feed supply in the reserve.

2. **Lack of knowledge in nutritional needs to produce milk or meat**

   Balanced feeds are important to maximise the profit of farmer and improve productivity of animals. Provide only forages to the animals will cover the maintenance needs and a bit of production needs but if we want to target higher level of milk yield or growth we need to densify the ration.

   To densify the ration, we should provide feed with higher content of energy and protein to compensate forage with high level of fibber but low level of protein and energy.

3. **Low productivity of animals**

   Regarding animals saw in slaughtering house (thin animal) or average milk yield on the reserve compared to the body weight of the animal, animals are not efficient due to lack of forage intake and density of the ration.

   For estimated 500 kg of body weight on local cows, we can target more than 5.0 to 10.0 litres/day form milk animal and minimum 275 kg of carcass weight. Right now, wilk yield is about 2.0 litres/day and carcass found in the slaughtering house look not fattened.

4. **Cash flow challenge to access to feed**

   For meat production, the feed programs are long : between 60 to 90 days thus herders should invest in feed for the period with any return before they sell the first animals thus for first batch of animals, cash invest will be important and herder can be struggle by lack of cash flow.

   For milk, the return on investment can be faster however feed efficiency grows when we work on second lactation after starts the feed programs thus return on investment will be lower in first instance because farmer will pay the feed only with the increase of the milk yield.

In conclusion, we see that feed is important for animal to improve productivity on meat and milk production but feed should be supply directly in the reserve to use local raw materials and reduce as much as we can the feed cost to get the return on investment. We also need to help herder to finance the first months of feed investment.

2.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT ACCESS TO FEED

OBJECTIVES AND KPIS

For this component, challenges are divided in 2 groups : knowledge and production. For knowledge we should understand local raw materials and improve knowledge of the herders to make them adopt the feed programs and improve productivity of the animal. For production, it will be the capacity to produce feed in the reserve.

Knowledge KPIs

1. Training attendance : to teach how to feed a cow and to improve productivity of animals
2. Practice adoption : change the cattle management
3. Trials of feed program : to show the result of feed program in local conditions
4. Manual distribution : to give tools and knowledge for herders for keeping them good practices
5. Local raw materials : improve knowledge on local stuff to make cheap feed.

Production KPIs

1. Feed mill : mixing, conditioning machine and storage for raw materials and feed
2. Trials farm : to show the benefit of feed programs
3. Meat production : to measure the increase with feed
4. Milk production : to measure the increase with feed

STRATEGY

To produce feed, tools and raw materials are need. At the same we start to build the storage and feed mill, characterization of local materials to produce local feed is important.

1. **Raw materials**

- Build supply raw materials chain around the reserve to valorise by-product from human food or monogastric feed
- Analyse the local raw materials (and forage) to formulate balanced feed and ration for efficient feed program
- Estimate quantity of raw materials available during the year with season variation

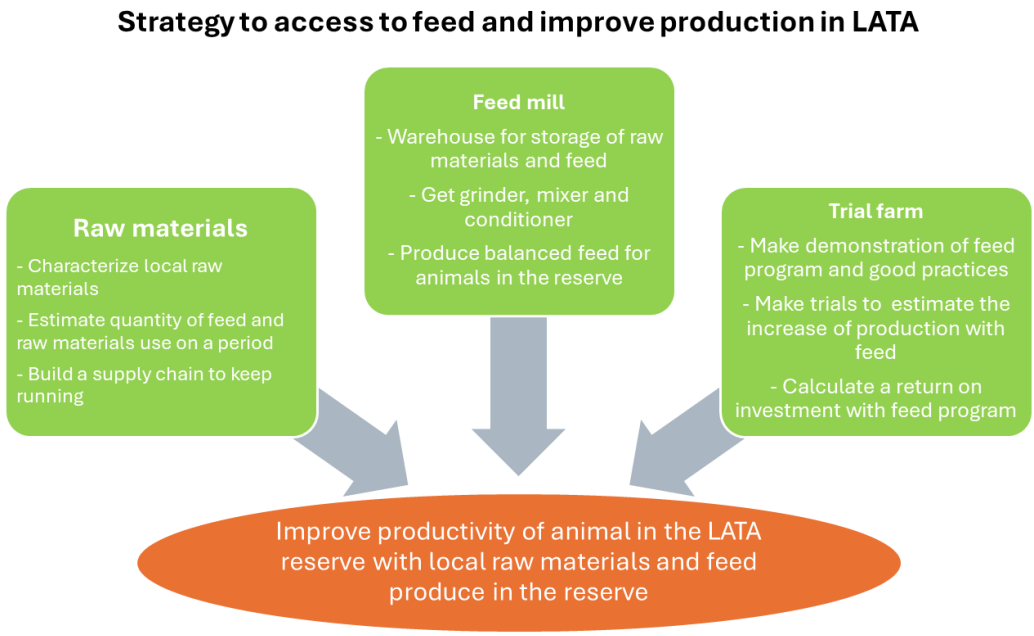
2. **Feed mill**

- Build a warehouse to store raw materials for feed and anticipate dry season
- Include in the warehouse a final product storage area

- Get a grinder, mixer and conditioner for to produce feed

3. **Trial farm**

Figure 1 : Access to feed strategy structure



- build a trial farm to make trials, demonstration and teach good practices with the objective to improve productivity of animals (see subcomponent 1.7)

2.3 SUBCOMPONENT 1: RAW MATERIALS

Objective	• Find raw materials to make feed on the LATA reserve • Characterize the raw local raw materials around the reserve • Build a network to supply the reserve in commune raw materials (cotton seed cake, soja bean meal, maize…)
Outputs / outcomes	**Outputs** • Get local and national supply for raw materials to produce feed in the reserve **Outcomes** • Warehouse for 250 tons of raw materials
Key partners	• **National supplier of raw materials** : to provide commune raw materials. Partners can find in northern area (Kano) • **Local supplier of raw materials** : to provide local raw materials to valorise by-product from sugar cane, maize, soja…
Investments on equipment and facilities	• Mapping and quantification of local raw materials • Road to access to the storage (in LATA village) • Warehouse of 250 t capacity for raw materials (double the capacity for feed) • Quality control equipment for raw materials
Key activities	Screens the environment around the reserve to find local raw materials and by-product from other production that can be used on cattle feed.

	Storage of raw materials for feed factory Control of the quality of the raw materials: sampling for analysis in referenced laboratory, easy test control (colour, taste, smell) with comparison with standard raw materials.
Interest	Feed production is based on different raw materials to get the same quality of feed all the year. Characterize the raw materials, make a control plan on input and have a strong supply chain to produce quality feed is a key point to stabilise the feed production and increase and the end increase the productivity of animal
Hypothesis and risks	The most important risk on feed supply is a rupture of the chain. We should characterize as much as we can local raw materials to face problem of lack of supply from national partner Storage : if the storage can't permit to keep raw materials to degradation from humidity or sun, we will decrease the feed quality thus production efficiency of animals.
Budget	Investment : 258 k€ Op. Budget : 22 k€

SPECIFICATIONS FOR SUPPLY CHAIN AND RAW MATERIALS

Supply chain of raw materials can be built around the reserve with local raw with example below :

- By product from sugar cane and sugar production : molasses, bagasse (fibber residue)
- By product from cereals manufacturing : wheat bran, maize offal, rice offal…
- By product from local food chain industry : hibiscus cake, dry brewery waste…
- Also, some plant can be dried and use on cattle feed: Pilostigma (plant from the north of Nigeria used to increase palatability of the feed.

Raw materials should be dry to reduce the cost of transport and make easy the storage condition. For example, brewery wastes are not recommended to make feed due to the high level of humidity (70-80 %) and risk of mycotoxins and moisture development during storage is important.

CONSULTANCY FOR RAW MATERIALS ANALYSIS

To characterize a new raw material, it is essential to perform a chemical analysis. Indeed, NIR (Near Infrared) speed analysers are not calibrated to identify new raw materials. Using a French laboratory will be crucial to create a reference matrix with accurate values for formulation purposes. Additionally, to properly characterize a raw material, at least 10 samples are required to capture variations in composition and assess quality fluctuations, especially for non-seasonal by-products such as *Pilostigma*, brewery waste, and bagasse."

At the target can be to get calibration of NIR on local raw materials to facilitate the analysis but budget of NIR is around 200 000 € and calibration 1 raw materials is about 2000 €.

2.4 SUBCOMPONENT 2: FEED MILL

Objective	• Build a factory to produce from 5 000 to 15 000 tons of feed per year • Produce feed for cattle (milking and fattening) with local and commune raw materials • Store feed for 1 week of consumption on the reserve (250 t) • Adapt the formula to local raw materials disponible and prices
Outputs / outcomes	Feed factory running over 312 days a year (6 days per week) to feed around 10 000 dairy cows and 5 to 6 000 fattening animals
Key partners	**Feed formulation and control**

	Laboratory and formulation service to control and adapt the formulas to keep the same value with variables raw materials and prices **Community Contact Person**: Facilitate herder participation, encourage adoption of practices, and support knowledge sharing for feed program
Investments on equipment and facilities	• Feed factory Feed factory is huge investment and return on investment can be problematic. On first approach, we can work with Ali'Lab : mobile feed factory with grinder, mixer and conditioner in container. Regarding the quantity of feed needed for the reserve, number of containers can be adjusted and when the production is stable, a feed factory can be built and container can be used for another project. • Warehouse of 250 t capacity for feed (double the capacity for raw materials) • Quality control equipment for feed (same than for raw materials) • Solar panel to provide electricity for the machines
Key activities	Production of specific feed : In first approach 2 feeds : • Lactating cows • Fattening After, we can look for other formula : Calf concentrate, high, medium and low milk producer, maintenance feed (dry season), small ruminants…
Interest	Feed helps to improve productivity of animal by balancing the forage and cover the needs of animal in normal period. In dry season, feed permit to cover maintenance need of the animals and help to recover and start the production after the end of dry season. Also, feed permit premix inclusion in feed to bring minerals, trace elements and vitamins that forage or raw materials do not bring. This key point is important to build immunity and better health for the animals.
Hypothesis and risks	Lack of raw materials is a critical point in feed industry. Without raw materials, feed cannot be produced and the chain is block. Work on supply chain and storage will be important. Also, variability of raw materials values and disponible will influence the quality of feed. Errors on dosage of premix or inversion between 2 raw materials can alter the heath of animal and affect the productivity.
Budget	Investment : 440 k€ Op. Budget : 30 k€

SPECIFICATIONS FOR FEED PRODUCTION

For an estimation of 50 000 animals in the reserve, we have identified around 10 000 lactating cows and 5 to 6 000 animals are sold for the meat market.

Regarding the feed program we can make and the capacity of production for the animal, we can target an average of 2.0 kg/d of concentrate for lactating cows during the year and increase to 5.0 kg during dry season (due to lack of pasture).

Fattening program already made in Nigeria for Fulanis cows used 2.0 kg/d during 60 to 90 days per animals.

In total per year, we will need 10 000 tons of dairy feed and 2 700 tons of fattening feeds. Capacity of feed mill should be at minimum of the quantity mentioned before. 1 Ali'Lab can produce 1 t/hour, with 9 hours running per day, 6 days per week and 52 weeks a year, we can produce around 2 800 tons per Ali'Lab. We will need 5 Ali'Lab to produce the total quantity of feed.

CONSULTANCY FOR FEED FORMULAS

Feed formula should change regarding the raw materials prices and disponible. To reduce loss of cost, formulation should be made each month to keep the same quality of feed within the lower price. Specific software and competences are needed to make formula. The formulas should be made by nutritionist to guaranty the quality of feed.

Also, in case of lack of raw materials due to transport issue or shut down of supplement of raw materials, specific formula can be made but only by nutritionist. With experience of raw materials and after the factory is running well, we can provide substitute roles for certain raw materials.

2.5 SUBCOMPONENT 3 : TRIAL FARM

Objective	• Test on field conditions the feeding program to have an idea of the results we can expect with different formulas, feeding program and breed • Practice adoptions by herders
Outputs / outcomes	**Outputs** Trained extension officers and herders with access to workshops, educational materials, and digital training content on the farm **Outcomes** Improved livestock productivity through the adoption of advanced Feed program and feed formulas
Key partners	**French Nutrition Specialists**: Develop training materials and deliver workshops on advanced feed and feeding program management focusing productivity and resilience **Community Contact Person**: Facilitate herder participation, encourage adoption of practices, and support knowledge sharing.
Investments on equipment and facilities	Barn and equipment are needed for animals. Size of the farm will correlate to budget but 30 for fattening program and 30 lactating will be minimum to make trials and teach good practice to farmers.
Key activities	**1. Training of Trainers :** Train extension officers in grass management, hay production, and irrigation techniques to deliver workshops to herders. **2. Workshops and Hands-On Training:** Conduct workshops to teach herders fattening techniques, forage management, and hay storage strategies. **3. Educational Material Development:** Create manuals and guides to provide herders with practical, ongoing reference materials.
Interest	The trial farms are key point to convince the herders to chance their practices. They have been using old practices for long and the best way to teach the is to shows how it works and to involve them in the project. If we only propose feed, they will see it as a constraint but if we involve them, they will see it as an investment.
Hypothesis and risks	Critical point of trial farm is management. If labours or animals are not in good conditions, the image of the program will be spotted.
Budget	**Trial Feedlot** Investment : 92 k€ Op. Budget : 50 k€ **Trial dairy farm** Investment : 130 k€ Op. Budget : 50 k€

The trainings are important to understand field conditions and get real data from the field and adjust formulas and feeding program. In fact, within analysis of raw materials and formulation of feed with software, field results are more important. Take the risk of changes of formulas or new formulas can be try on trial farm before being spread in the reserve.

Moreover, to train people and make adopt new practices, it more affective with situation training and results advanced on farm. Knowledge and practices will cross the reserve easily with farm show, workshop on specific topics or other ideas.

3 COMPONENT 3: STRENGTHENING ANIMAL HEALTH

1.1-REMIND OF THE MAIN GAPS IDENTIFIED

Most of the major diseases are present with high prevalence and severe impacts (FMD, CBPP, PPR, trypanosomiasis, parasites…), jeopardizing the productivity of the animals. **This is a very challenging situation that should be improved as a prerequisite**.
Beyond the difficult epidemiological situation of the region, some other factors are aggravating the impact of the diseases:

- There is no real vaccination campaign to protect the animals.
- There is shortage of veterinary clinics with lack of o office and no or limited logistics.
- A difficult access to clinic services for herders leading mainly to practice self-medication without any relevant advice.
- The access to veterinary drugs is very easy with many traders without any background on animal health. This is also a public health issue with high risk of residues on meat and milk and the development of antimicrobial resistance (AMR).

3.1 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "ANIMAL HEALTH"

OBJECTIVE AND KPIS

The main objective of this component is to improve the animal health situation to improve the animal productivity and to allow investment with an acceptable return of investment.
The main KPI could be the **number of clinical cases** recorded by the veterinarians on the NADIS system. However, it is not sure that the reporting is probably done and an increase of the number of cases can mean just an improvement of the level of reporting which is also expected. The number of cases (PPCP, FMD) observed in slaughterhouses can be also an indicator.

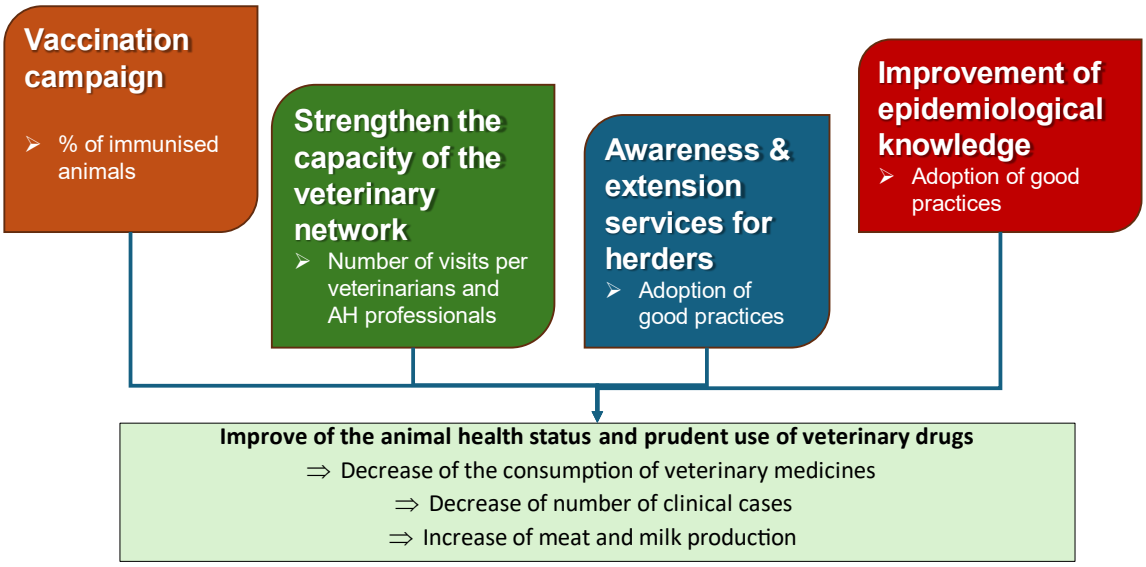
STRATEGY

The strategy will aim to:

- Develop vaccination campaign to improve the level of immunization of the herds and limit the impact of the diseases.
- Strengthen the capacity of the veterinary network with private veterinary clinics and or Local Government Area LGAs veterinarians through a sustainable business model to facilitate the access to clinical services for herders and a better use of veterinary drugs.
- Develop awareness and extension services to encourage the vaccination and a better use of the veterinary drugs limiting residues and AMR risks.
- Improve the epidemiological knowledge of the animal health situation using the presence of a research centre within the Ilorin veterinary faculty.

The strategy to improve the animal health cannot be limited to the Lata zone but should be considered at Kwara state level. The budget of this component is defined for all the state with some complementary information or Lata grazing zone.

Strategy proposed to strengthen animal health



1.2- SUBCOMPONENT 1: VACCINATION CAMPAIGN

Objective	Improve the level of immunization of livestock of Kwara state, against FMD, CBPP brucellosis, and PPR. Brucellosis should be developed in the herds of Fulanis population considering their consumption and sale of milk. The brucellosis vaccination shall be performed on young female only to provide them a long-term immunity with S19 strain on cattle and REV1 on sheep and goats. The vaccination campaigns could be used to promote other preventive treatments such as blackleg and anthrax, antiparasitic treatments
Outputs / outcomes	Output: Reports of the vaccination campaigns with the estimate of vaccination *Outcome: Increase of the % of animals with antibodies, decrease of the number of clinical cases.*
Key partners	Department of Veterinary Services (DVS)veterinary services to organize and supervise the vaccination campaign. Private veterinarians to perform the vaccination on the field, with, potentially the support of the LGAs veterinarians.
Investments on equipment and facilities	10 vaccination parks in Kwara state with 4 for Lata zones[1]. Around one per 12,500 cattle. The location could be determined with a mapping of the herds. Some investments are prosed in subcomponent 2 to strengthen the veterinary networks with some equipment for private veterinarians and veterinarians in LGAs.
Key activities	As for other components, a deep population / herds / sheep and goat survey would be undertaken first Two vaccination campaigns could be organized per year for the following vaccination:

[1] Despite, it is in French, the document from Mauritania « Amenagements pastoraux : fiche parcs de vaccination" provides the specifications and an estimate of the budgethttps://rim-rural.org/wp-content/plugins/download-attachments/includes/download.php?id=19114 '.)

	- FMD every 6 months on cattle more than 6 months old, - CBPP once per year on cattle more than 6 months, - PPR once per year on sheep and goats. We can vaccinate the female born during the year for a long-term immunity and young male dedicated for reproduction. - Brucellosis on cattle female between 6 and 9 months with S19. The young female of sheep and goats can be vaccinated between 3 and 6 months with REV1 if the milk is used and if sheep and goats are raised in close contact with cattle. - The vaccination campaigns can be used to propose some other vaccination based on the request of herders and the experience of veterinarians (anthrax, blackleg…) and parasiticides treatment. According to the number of animals to vaccinate, a vaccination campaign will request between 12 and 40 days depending on the number of teams to vaccinate and the number of animals within Kwara state. With 25 veterinarians and 1 team per veterinarians, 15 days are needed for cattle and 10 days for sheep and goats per campaign for all livestock of the state. Each campaign should be organized according to the following sequence: - Order of the vaccines by the DVS, and enforcement of the needed regulation for the mandatory vaccination. - Information of the private veterinarians on the organization of the campaign with distribution of the vaccine - Information of herders by private veterinarians before the organization of the vaccination campaigns. - Vaccination by the veterinarian and its team (1 vet and 2 or 3 veterinary paraprofessionals). - Some visits post vaccination campaign to verify the condition of the campaign (on 2 vaccination parks). - Sampling 30-45 days later top test the immunity on around 500 animals (50 vaccination park). - Feed-back meeting with private veterinarians and information to herders.
Interest	Four years vaccination campaigns will let the needed time to reach a full coverage of vaccination. The first year will focus on quality of the vaccination than the number and the consolidation of the procedures. The second year will target a 70% coverage. And the last two year will focus on the populations difficult to reach and the management of animals moving from other states. The implementation of the vaccination campaign will strengthen the veterinary network and will provide an opportunity to the private veterinarians to discuss with herders, provide them appropriate medications for their animals, to record the main animals' events, and to strengthen their business model by the delegation of the vaccination.
Hypothesis and risks	The main difficulty is the right estimate of the number of cattle, sheep and goats. The estimates have been prepared for 130,000 cattle and 210,000 sheep and goats with an objective of 90% of vaccination coverage. One of the key questions will be the movement of the cattle from and to the other states. One strategy could be to perform the vaccination when the number of animals in Kwara state is higher, or to request a certificate of vaccination[2]. The sustainability on the capacity to establish a sustainable model with a financial participation from the herders. This participation shall be accessible to

[2] Vaccination can be requested for any movements to go outside the reserve or to go back inside the reserve, including for fattening.

	not reduce the vaccination coverage but shall contribute significantly to the expenses.
Budget	Investment : 310 k€ Op. Budget : 970 k€

1.3-SUBCOMPONENT 2: STRENGTHEN THE CAPACITY OF THE VETERINARY NETWORK

Objective	Improve the access and the quality of animal care services for herders
Outputs / outcomes	Output: Training modules and number of veterinarians and veterinary paraprofessionals trained. Study on the business model of the veterinary clinics.
Key partners	The first partner will be the **Veterinary Association of Kwara** state and the **Veterinary Statutory Body (VSB)** of the state. The first target will be the private veterinarians, but their technicians can be also involved. The continuing education program should be developed in coordination with the DVS, Department of Livestock Development (DLD) and the Veterinary Faculty of Ilorin.
Investments on equipment and facilities	A budget is dedicated to strengthening the capacities of the veterinary clinics to allow to buy motorbikes to facilitate the access to herders (1 per veterinary clinic) and to provide some equipment such as refrigerator (solar or gas), equipment for ear tags or for some surgery… It would be interesting to have an assessment of the needs by reviewing all veterinary clinics. It can be subsidies or provided through a loan with low interest. A French expertise to organize the studies could be useful to apply the WOAH principles.
Key activities	1. Study to assess needs in veterinary clinics (equipment, staff, and competencies) and the best strategy to provide this equipment (micro loans, partial subsidies, grant). 2. Definition of a continuing education plan with 2 training per year at least on priority topics. 3. Study about the sustainability of the business model of veterinary clinics considering the margin on veterinary drugs sales, the animal care services and the delegated activities by the veterinary services (vaccination, ante and postmortem inspection in villages…). 4. Organization of 2 training per year for the veterinarians and their technicians (4 days per year for 25 persons). A part of these training should be focused on the prudent use of antimicrobials and the control of the AMR. 5. Open consultation with veterinary drugs retailers to organize a control by a veterinarian (private or public).
Interest	The main interest is to create a regular partnership between the DVS and the private veterinarians to develop the public private partnership (PPP) approach. Providing continuing education and access to some equipment, it is a way for the DVS to be more demanding in the reporting and the quality of the services of the private veterinarians. They could coordinate a control with the state the VSB of Kara state.
Hypothesis and risks	The sustainability of the business model will depend on the capacity to organise the control of the veterinary drugs market under the private veterinarians. It will allow to use the margin from the sales of veterinary drugs to support the

	veterinary network. Considering the current number of traders without any animal health skills, a consultation should be established to organise transitional period. The sustainability of the vaccination campaign will be also important as it will probably represents 20-30% of the income of the veterinary clinics.
Budget	Investment : 351 k€ Op. Budget : 100 k€

1.4-SUBCOMPONENT 3: AWARENESS AND EXTENSION SERVICES FOR HERDERS

Objective	Improve the background of herders on the animal health situation and good practices for better biosecurity and prudent use of veterinary drugs.
Outputs / outcomes	Output: Meetings, training and publications for awareness campaigns. Outcome: Level of adoption of good practices such as vaccination before movement of animals…
Key partners	DVS, private veterinarians, local extension services and especially the Agricultural and Rural Management Training Institute (ARMTI) in Ilorin.
Investments on equipment and facilities	No specific investment.
Key activities	The list of topics for awareness campaign for herders can be adapted according to the needs and the priority of the DVS and the herders. However, we can suggest the following topics: - Biosecurity measures in case of movements and introduction of new animals with the key role of vaccination. - Interest to prevent brucellosis both livestock and for the human population. - Hygiene of milking and processing milk. - Good practices on the use of veterinary drugs (withdrawal period, prescription by an animal professional or a veterinarian, concept of resistance…). - Prevention of FMD and CBPP. One or two awareness campaigns could be organized. According to the messages, it will be important to target also women in charge of milking or raising the young calves, and often the sheep and goats.
Interest	These awareness campaigns should involve the private veterinarians to provide their experience and their knowledge. This will increase the interest and the trust of the Fulanis for these animal health professionals. They can support and work with organizations specialized on extension services.
Hypothesis and risks	To motivate herders, it could be interesting to work with demo farm or with local pilot herders integrating good practices and encourage the dissemination[3].
Budget	Investment : 0 k€ Op. Budget : 170 k€

[3] For instance, some technical activities such as training or vaccination, could facilitate the access to small credits for animal feed (beef fattening)

1.5-SUBCOMPONENT 4: IMPROVEMENT OF EPIDEMIOLOGICAL KNOWLEDGE

Objective	Improve data on epidemiological situation in Lata zone and Kwara state to understand the dynamic of the diseases and improve the efficiency of the control programs.
Outputs / outcomes	Output: - Reports and publications on the studies. - Meetings and training to disseminate the results.
Key partners	The veterinary faculty of Ilorin can be one of the main partners for this subcomponent with the DVS defining the needs. In case of lack of testing capacity in Ilorin, it is possible to use the NVRI (National Veterinary Research Institute) of Vom. If needed, some support could be provided with the French research centres, ANSES and CIRAD.
Investments on equipment and facilities	No need of investment or equipment
Key activities	No precise activities have been defined. However, several questions have been identified to improve the knowledge of the animal health situation. The work can be done using the testing capacities of the faculty or the capacity to use veterinary students to perform survey. During this study, several questions have been identified and could be investigate: - Monitoring of FMD strains. - CBPP strains and frequency and antimicrobial resistance profile of the identified trains. - Mastitis pathogens and AMR on Fulanis cows. - Prevalence of brucellosis in a One Health approach and its impact (frequency of local population with antibodies against brucellosis, prevalence on cows and small ruminants…).
Interest	The results of such studies could be used to train veterinarians (subcomponent 2) on such specific topic with local data and to provide awareness for herders (subcomponent 3). It could encourage the synergies between the Veterinary faculty and the DVS for better connection between the local scientists and the needs of Kwara state.
Hypothesis and risks	The main risk is the lack of some needed competencies within the Veterinary faculty that can be compensate by involving the NVRI or some French animal health reference centres.
Budget	Investment : 15 k€ Op. Budget : 260 k€

4 COMPONENT 4: REPRODUCTION MANAGEMENT AND GENETIC IMPROVEMENT

4.1 REMINDER OF THE MAIN GAPS IDENTIFIED

1.Genetic Improvement in the Nigerian Bovine Sector

Objective: The primary focus is to offer improved genetics to breeders in order to improve meat and milk production. Regarding the improvement of dairy production, the strategy focuses on developing a Nigerian-specific crossbreed to enhance milk and meat productivity, inspired by the Brazilian Girolando model. The local breeds are very well suited for meat production, they however could benefit from a formal genetic improvement program in order o improve growth rates while keeping the capacity to thrive in local conditions. Reproductive management will be leveraged as a tool to support this genetic advancement.

Main Gaps Identified :

- **Unavailable High-Potential Genetics**: Without access to genetics, the sector cannot achieve meaningful improvements in productivity.
  No Access to AI Services: Reliance on bulls limits genetic enhancement and herders' control over reproduction, impacting herd productivity.

Crossbreeding Strategy:

- **Milk Production Improvement**: Crossbreeding local breeds with a targeted European dairy breed will improve milk yields, creating cattle adapted to local conditions while increasing productivity.
- **Meat Production Enhancement**: Improve local breeds with high-genetic-potential bulls from within Nigeria to enhance meat production. This approach preserves local adaptability while increasing growth rates and meat quality.

Accessibility of Genetic Resources:

- **Goal**: Make improved genetics accessible to local herders, establishing AI services and crossbreeding programs that support genetic advancement. This will drive widespread productivity gains, aligning with the country's agricultural objectives. Provide high quality bulls

2.Reproduction Management for Genetic Improvement

Objective: Enhance reproductive management practices to support genetic improvement goals and boost productivity across the sector.

Key Challenges:

- **Lack of AI Services**: The absence of AI limits reproduction control, making it difficult for herders to optimize reproductive parameters and genetic potential.
- **Long Calving Intervals**: Extended non-productive periods reduce herd productivity, underscoring the need for effective reproductive management.
- **Weak Herd Management Knowledge**: Knowledge gaps prevent herders from optimizing breeding decisions, missing opportunities for productivity improvements.

Strategic Approach to Reproduction Management:

- **Expanding AI Access**: Introduce AI with crossbreeding to empower herders to optimize reproductive outcomes and improve herd quality.
- **Reducing Calving Intervals**: Provide training and technical support to help herders monitor and improve calving intervals, boosting herd productivity.

- **Strengthening Herd Management Skills**: Implement training programs focused on reproductive monitoring and herd management to enable informed decision-making and sustainable productivity growth.

Objective: By enhancing reproductive management, herders gain control over genetic improvement processes, resulting in a more productive and efficient sector.

4.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "REPRODUCTION MANAGEMENT AND GENETIC IMPROVEMENT"

OBJECTIVE AND KPIS

To effectively measure the impact of the program, we will track KPIs in two main areas: **Genetic Improvement** and **Herd Management**.

KPIs: Genetic Improvement

1. **Number of Confirmed Pregnancies through AI**: Tracks the success rate of pregnancies achieved through AI, reflecting the effectiveness of AI services and the quality of genetic material used.
2. **Rate of Genetic Adoption**: Measures the percentage of herders adopting improved genetics, whether through AI or natural mating with high-genetic-potential bulls, indicating the accessibility and acceptance of new genetic resources across the community.
3. **Milk and Meat Productivity**: Assesses gains in milk yield and meat quality within crossbred cattle, showing direct outcomes of genetic enhancement efforts.

KPIs: Herd Management

1. **Average Calving Interval**: Monitors reductions in the time between successive calvings, providing insights into improved reproductive efficiency.
2. **Pregnancy Diagnosis Rate**: Tracks the use of pregnancy diagnostics (e.g., ultrasound) to ensure timely breeding decisions and optimized reproductive cycles.
3. **Breeder Satisfaction with AI Services**: Captures feedback from herders regarding the quality and accessibility of AI services, technician support, and herd management training, allowing for continuous improvement.

STRATEGY

1.Establishing a Semen Production Center

- To produce and supply semen to support AI services across the region.

2. Implementing AI Substations for Service Accessibility and Community Sensitization

- To provide herders with accessible AI services, crossbreeding, and mating support, while promoting these services through community outreach.

3. Developing an AI Technician Training Program with Calving Interval Management

- To establish a skilled workforce capable of delivering effective reproductive services and to enhance reproductive efficiency by reducing calving intervals.

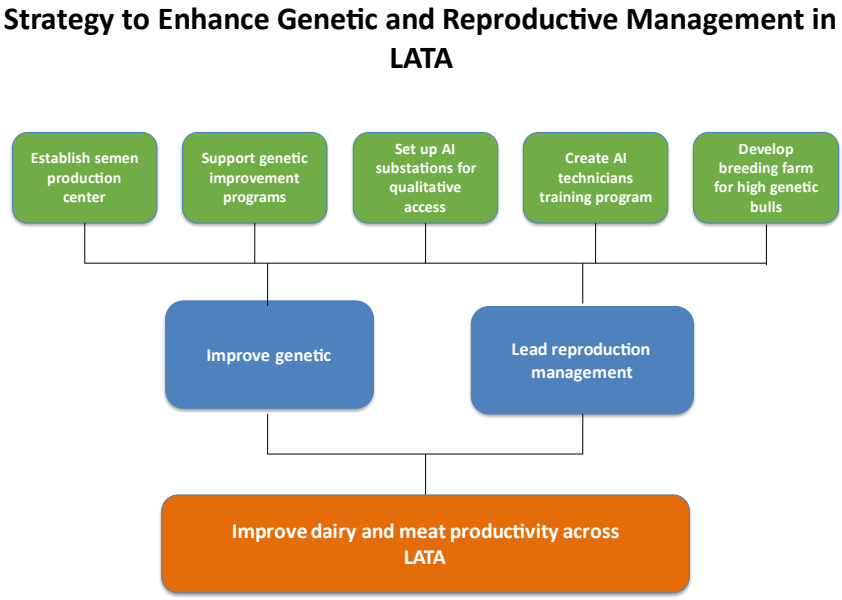
4. Supporting Tailored Genetic Improvement Programs

- To align genetic selection and mating practices with specific farm-level needs and environmental conditions.

5. Establishing a Breeding Farm for Bulls with Local-Adapted Crossbreeding and innovative practices

- To provide natural mating options with superior genetics and develop a Nigerian-specific crossbreed adapted to local conditions, inspired by the Girolando model.
- The farm will also serve as a demonstration farm, allowing herders to observe and adopt these practices.

Figure 5 : Reproduction and Genetic strategy structure



4.3 SUBCOMPONENT 1: FOUNDATION OF A SEMEN PRODUCTION CENTER

Objective	**KPI Ccorrespondence** • Rate of Genetic Adoption • Milk and Meat Productivity
Outputs / outcomes	**Outputs** • A fully operational semen production center with established protocols for collection, processing, and storage. **Outcomes** • Enhanced genetic potential across herds, leading to increased milk and meat productivity.
Key partners	• **IMV Technologies:** Provides expertise in semen processing, equipment, and quality control. • **Synetics:** Contributes to genetic selection and breeding strategies. • **Government:** Acts as an investor, aligning the center's goals with national objectives. • **Private Operator:** Manages daily operations to ensure efficiency and goal alignment
Investments on equipment and facilities	• Bull housing and lab facilities. • Semen collection and processing equipment (e.g., artificial vaginas, analyzers). • Cryopreservation and storage infrastructure (e.g., liquid nitrogen tanks, freezing units). • Quality control tools (e.g., CASA, photometers). • Training modules and materials for staff.
Key activities	**Technical Consultancy for Design and Planning:** Conduct consultancy to design the facility, prepare technical plans, and develop a detailed bill of quantities, ensuring operational efficiency and compliance with standards. **Construction and Equipment Setup:** Build and equip the production center to produce up to 100,000 semen doses annually. This includes establishing specialized processing and storage facilities. **Selection and Management of Breeding Bulls:** Identify high-potential breeding bulls suited to local environmental and productivity goals. Regular health monitoring ensures the bulls contribute to quality semen production. **Training in Semen Production Techniques:** Train staff in semen collection, processing, and storage, emphasizing best practices in equipment handling, biosecurity, and quality control.

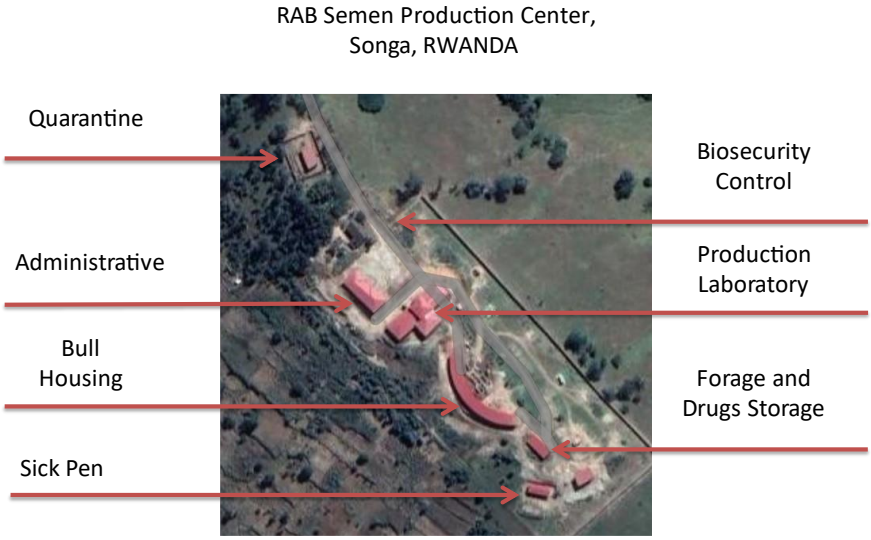
	Quality Control Protocols: Establish rigorous quality control at every stage of semen production, with frequent testing to meet health and genetic standards. **Data Collection:** Develop a data collection system to monitor semen production, usage, and outcomes, ensuring traceability and performance tracking.
Interest	The semen production center focuses on crossbreeding as a cornerstone of genetic improvement, providing a reliable source of semen to support AI initiatives. By enhancing herd productivity and genetic diversity, the center addresses regional demand while advancing cattle quality. Rigorous quality control and specialized training ensure consistent genetic progress, reducing reliance on traditional methods and fostering a resilient livestock sector in Kwara State.
Hypothesis and risks	1. **Demand for Genetics:** Initial adoption of AI may be slow as farmers adapt to genetic improvement. Awareness campaigns and accurate forecasting will mitigate this risk. 2. **Health and Biosecurity Risks**: Strict biosecurity protocols and regular health checks are essential to prevent disease outbreaks. Quarantine measures will manage risks associated with disease transmission. 3. **Cattle Movement and Tracking**: Ensuring consistent genetic quality requires a certification system and monitoring cattle movement to manage the risk of untracked semen use and outcomes.
Budget	Investment : 2,235 k€ Op. Budget : 620 k€

The semen production center should operate on a public-private partnership model, with the government as the primary investor and a private operator responsible for daily management. This structure allows the center to align closely with national objectives for genetic improvement and livestock productivity.
Explain on which bases the private company should be chosen on

Revenue generation is primarily driven by sales of semen doses to AI substations, veterinary services, and local farms. To maintain affordability, the goal is to produce each semen dose for less than $3.30, allowing the total cost to herders, including services, to be under $10. Government subsidies may also support these efforts, keeping prices accessible to promote broad adoption of improved genetics. This approach ensures that the center remains sustainable while meeting its operational goals, ultimately driving genetic improvement at scale and benefiting the broader agricultural community.

In the first year, a technical consultancy will be conducted to support the design and planning of the center. This consultancy will focus on developing the site layout, technical plans, and a comprehensive bill of quantities to ensure the center is built to meet operational needs and efficiency standards.

Figure 6 : RAB Semen Production Center



The **RAB Semen Production Center** in Songa, Rwanda, is meticulously designed to ensure efficient and biosecure semen production. The facility comprises several key components:

- **Quarantine Area**: Located at the top left, this section isolates new animals to prevent potential contamination.
- **Administrative Building**: This central hub manages operations and houses staff offices.
- **Production Laboratory**: Dedicated to semen processing and quality control, ensuring high standards in genetic material.
- **Bull Housing**: Provides shelter and care for the main livestock involved in semen production.
- **Sick Pen**: Designated for isolating and treating unwell animals, maintaining overall herd health.
- **Forage and Drugs Storage**: Secures essential feed and medical supplies necessary for daily operations.
- **Biosecurity Control Station**: Monitors and enforces health protocols to prevent disease outbreaks.

The entire facility is enclosed by a perimeter wall, ensuring controlled access exclusively through the security checkpoint, thereby enhancing site security and biosecurity measures.

Figure 7 Semen Production Laboratory

Figure 8 Semen Production Laboratory

This picture refers to the "Investments in Equipment and Facilities" section, representing various areas of the semen production process. It includes dedicated areas for semen collection, quality control, storage, and essential support functions to ensure efficient processing and traceability.

The center's focus on making genetic resources affordable and accessible opens up additional possibilities for tailored breeding approaches. One potential avenue is sexed semen technology, which could bring added efficiency to Nigeria's livestock goals.

By using sexed semen, herders can selectively produce female calves in dairy crossbreeding programs to increase milk production, while favoring male calves in beef breeding programs for optimal growth and meat yield. This targeted approach would allow herders to maximize outputs based on specific needs in dairy or beef, aligning well with the country's productivity objectives. However, establishing a sexed semen facility will generate a substantial investment and operational challenge as it is a technically complicated process.

Advantage of sexed semen is that it would introduce a,n additional benefit to Ai which is the possibility to choose the sex of the calve.

4.4 SUBCOMPONENT 2: STRUCTURING AI SUBSTATIONS FOR EFFECTIVE DISTRIBUTION

Objective	• Pregnancy Diagnosis Rate • Breeder Satisfaction with AI Services • Rate of Genetic Adoption
Outputs / outcomes	**Output**: Structured AI centers developed to ensure effective semen distribution, accessible AI services, and deployment of pregnancy diagnostics. **Outcomes**: Improved access to reliable AI services for herders, with secure storage, transport protocols, and pregnancy monitoring to ensure semen quality and herd productivity.
Key partners	• **Local Agricultural Associations and Reproductive Organizations:** Support AI distribution and outreach efforts. • **AI Technicians and Veterinarians:** Provide AI services and reproductive health support, ensuring widespread accessibility. • **IMV Technologies:** Supply ultrasound scanners, AI kits, and other reproductive tools. • **Private Operator:** Oversee coordination of AI distribution, aligning efforts between the semen production center, technicians, and herders, and ensuring outreach success.
Investments on equipment and facilities	• Construction of substations for semen storage, AI consumables, and coordinator offices. • Motorbikes for technician mobility. • Nitrogen tanks for semen storage. • Ultrasound scanners for pregnancy monitoring. • Tools for semen handling and specialized AI kits. • Training programs for technicians and veterinarians. • Consumables to support AI services and sustainability.
Key activities	• Local Sub-Station Studies: Conduct studies to assess the technical, logistical, and resource needs of each sub-station. This includes evaluating herders' expectations and determining the optimal methods for resource allocation, such as consumables, motorbikes, and ultrasound scanners. • Development of Training Programs: Organize structured training sessions twice annually for technicians and veterinarians, focusing on AI techniques, reproductive health management, equipment handling, and quality control. Emphasis will be placed on proper semen handling and ultrasound operation. • Awareness and Outreach Campaigns:

	Design engagement programs targeting herders, explaining AI benefits, service accessibility, and reproductive health practices. These campaigns will foster trust and adoption among herders. • Performance Monitoring and Evaluation: Implement an evaluation framework to monitor the performance of AI centers, technician efficiency, and accessibility of services. Findings will inform continuous improvement strategies. • Stakeholder Consultations: Facilitate consultations with local agricultural associations, reproductive health organizations, and herders to maintain alignment on quality standards and service effectiveness.
Interest	This initiative focuses on creating a reliable and efficient network of AI centers, enhancing herders' access to reproductive services and genetic improvement programs. With streamlined organization and deployment of ultrasound scanners, the program ensures accurate monitoring of AI success and pregnancy rates. By building local capacity through collaboration with private technicians, agricultural associations, and government agencies, the project strengthens herders' adoption of reproductive technologies, improving productivity and economic outcomes.
Hypothesis and risks	• **Technician Capacity:** Continuous training is essential to ensure technicians' ability to perform AI, manage equipment, and engage effectively with herders. • **Ultrasound Utilization:** Consistent use of ultrasound scanners requires robust initial and follow-up training to ensure accuracy in pregnancy diagnosis. • **Transport Protocols:** Maintaining semen quality during transport depends on strict adherence to temperature control, handling practices, and nitrogen availability. • **Adoption and Demand:** Proactive sensitization campaigns are critical to raising awareness among herders about the benefits of AI and improving adoption rates.
Budget	Investment : 840 k€ Op. Budget : 225 k€

Technicians deployment:

The target area includes a population of 30,000 adult cows. These cows are divided into three groups based on breeding practices:

- **One-third** will adopt artificial insemination (AI).
- **One-third** will use natural mating with selected bulls from the program.
- **One-third** will continue with their current breeding methods.

AI Technician Roles

AI technicians will provide a comprehensive set of services, including:

- Performing artificial insemination (AI).
- Conducting pregnancy check-ups using ultrasound scanners.
- Implementing heat synchronization protocols.
- Advising herders on herd management, reproduction, and productivity improvements.

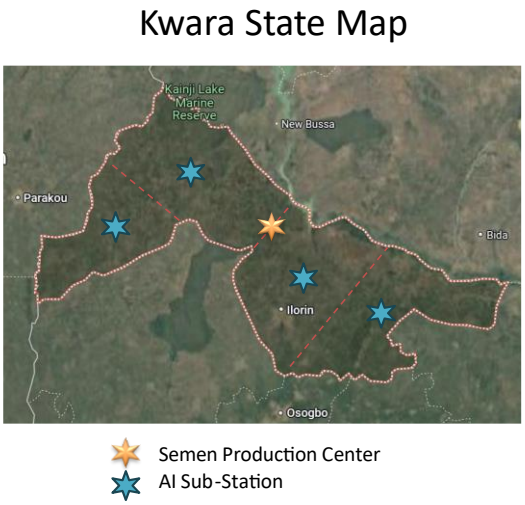
This integrated role ensures technicians not only manage reproduction but also support herders in improving herd health and performance.

AI Technician Deployment

Each technician is expected to perform around 1,000 inseminations annually, aligning with the goal of completing 10,000 inseminations per year. To meet this target, 80 AI technicians will be deployed across the region. These technicians will be organized into four sub-stations, with 20 technicians per sub-station, ensuring localized coverage and efficient service delivery.

This structure ensures effective follow-up and support for herders, with technicians strategically placed to address specific needs in their areas. Additionally, 30% of inseminations will initially receive pregnancy check-ups, supporting the program's goal of improving reproductive success rates.

Figure 9 : AI Sub-Stations Map



The area has been divided into equal parts, with sub-stations placed centrally to maximize accessibility, as shown on the map.

Long term strategy :

In the long term, this center will serve as a technical reference point for technicians, providing training, equipment, and consumables to support their ongoing development.
This will include

- **Continuous Technical and Operational Support:** Technicians will receive ongoing support to address any technical and operational challenges they may face. This support will help them maintain high performance levels and adapt to evolving practices in artificial insemination (AI) and herd management.
- **AI Technician Certification or Accreditation:** A formal certification or accreditation process is planned for AI technicians to ensure they meet a standardized level of competence. This process may include specific training and examinations to verify their skills and ability to deliver efficient AI services.

- **Holistic Approach for AI Technicians:** The training approach for technicians will go beyond artificial insemination alone. It will integrate skills in animal health, reproduction, and nutrition. This comprehensive approach will enable them to meet the full range of livestock needs, providing versatile support to herders by addressing not only reproduction but also general animal nutrition and health.

Business model:

The government plays a key role by establishing AI sub-stations, providing the necessary infrastructure, equipment, and guidelines to achieve national animal reproduction objectives. It ensures the foundational investments in facilities and resources required for the program's success.

A private entity will manage the entire operation, organizing all activities to ensure efficiency and profitability. The private entity can lease the government-provided infrastructure at a reduced rate. In return, it must fulfill mandates dictated by the government, such as meeting specific operational goals, adhering to national standards, and ensuring alignment with broader agricultural policies.

Technicians will operate within the private sector, either independently or through affiliations with private entities. This flexible workforce model allows technicians to adapt to market needs while complying with government-defined standards, ensuring the program remains accessible and effective. This structure fosters a collaborative approach where public infrastructure and private management drive sustainable outcomes.

AI Cost Structure and Value Chain

The AI program is designed to ensure that the cost of artificial insemination (AI) services remains under 10 USD per dose for herders, making it both affordable and accessible. This cost structure balances affordability for farmers with profitability for private technicians and sub-stations, ensuring the program’s long-term sustainability.

Sub-stations purchase semen doses from the production center and allocate resources for consumables, nitrogen, and synchronization, while technicians earn commissions for each insemination. This streamlined value chain ensures that all stakeholders benefit, creating an efficient system that supports widespread adoption of AI services.

4.5 SUBCOMPONENT 3: AI DEPLOYEMENT PROGRAM

Objective	• Number of Confirmed Pregnancies through AI • Rate of Genetic Adoption • Milk and Meat Productivity
Outputs / outcomes	**Outputs:** AI services and genetic resources deployed with synchronization protocols, providing herders access to tools for crossbreeding and reproduction management. **Outcomes:** Increased adoption of genetic improvement practices, leading to enhanced herd productivity and economic gains for herders.
Key partners	• **Ceva**: To provide expertise and resources for synchronization protocols, ensuring optimal timing for AI procedures. • **Synetics**: To supply high-potential genetic resources and expertise in crossbreeding strategies. • **National Animal Production Research Institute (NAPRI)** and **Nigerian Institute for Animal Science**: To offer insights and support on breeding programs tailored to Nigeria's local cattle breeds and environmental conditions. • **IMV technologies** to provide AI consumables and expertise. • **Government** To support the sensitization campaign, helping to raise awareness and encourage AI adoption among herders. • **AI Sub-Stations Operator**: To manage the AI deployment, overseeing coordination and logistics for effective field implementation.
Investments on equipment and facilities	• AI consumables (gloves, sheaths, synchronization kits). • Imported semen doses and breeding bulls. • Ultrasound scanners for pregnancy diagnosis. • Tools and training resources for technician capacity building.
Key activities	1. **Importation and Distribution of Genetic Resources:** Import high-genetic-potential semen doses and breeding bulls, ensuring their availability through well-structured AI substations. 2. **Synchronization and AI Protocols:** Implement estrus synchronization techniques to improve timing and success rates of AI services across herds. 3. **Training for Technicians:** Conduct specialized training in AI techniques, reproductive health management, and the use of ultrasound scanners for accurate pregnancy monitoring. 4. **Breeder Engagement Campaigns:**

	Raise awareness among herders about the benefits of genetic improvement through AI and crossbreeding, emphasizing productivity and economic gains. 5. **Performance Monitoring:** Use data collection systems to track AI adoption rates, reproductive success, and feedback from farmers for continuous program improvement.
Interest	This component supports the creation of resilient crossbreeds, boosting milk and meat productivity while improving reproductive success rates. Accessible AI services and advanced diagnostics foster breedertrust and satisfaction, driving genetic improvement adoption and ensuring long-term economic benefits for herders.
Hypothesis and risks	• **Adoption of Genetic Resources:** Farmers may initially hesitate to adopt genetic improvement methods. Awareness campaigns are crucial to mitigating this risk. • **Consistency in Pregnancy Diagnostics:** Ensuring technicians consistently and accurately use ultrasound scanners requires ongoing training and monitoring. • **Semen Distribution Challenges:** Efficient distribution of semen doses and consumables to remote areas will require robust transport and coordination systems.
Budget	Investment : 0 k€ Op. Budget : 950 k€

Five-Year Plan

1. **Year 2 and 3: Early AI Deployment with Imported Semen**
   The AI program will begin with the importation of high-potential genetic resources, focusing primarily on dairy breeds to increase milk production. A total of 20,000 AIs in Year 2 and 30,000 AIs in Year 3 will utilize these imported doses to establish a strong foundation for genetic improvement.

2. **Year 4: Transition to Locally Produced Semen**
   With the SPC becoming operational in Year 4, the program will scale up to 50,000 AIs, relying on locally produced semen. This transition ensures sustainable access to high-quality genetic material tailored to local needs, reducing reliance on imports.

3. **Year 5: Full Operational Capacity**
   By Year 5, the SPC will supply semen to support the full target of 80,000 AIs annually, marking a significant milestone in genetic improvement efforts across the region.

Synchronization and Heat Management

Heat Synchronization Protocols will be implemented to address the challenges faced by Fulani herders in detecting heat cycles, due to extensive grazing practices and limited reproductive knowledge. Synchronizing 20% of the herd between Years 2 and 5 ensures predictable AI timing, reducing the need for individual heat detection and making AI services more accessible for herders.

AI Consumables and Technical Support

The program will ensure the availability of 100% AI consumables, including gloves, sheaths, and synchronization kits. Training programs for technicians and outreach efforts to educate herders will support effective adoption. Additionally, support for key farmers will encourage community buy-in and help disseminate best practices.

Crossbreeding and F1 Management

The initial focus on dairy genetics will result in the production of F1 crosses (first-generation hybrids). These F1 cows, known for their higher productivity, will require tailored management strategies, including targeted AI programs.

- F1 cows will be inseminated using crossbreed bulls from the nucleus farm to maintain and enhance productivity while adapting to local environmental challenges.
- These F1 bulls will also serve herders who prefer natural mating, ensuring accessibility to improved genetics for those not utilizing AI.

Communication and Awareness

Convincing Fulani herders to adopt AI and improved genetics will require robust communication and stakeholder engagement strategies. This will include:

- Stakeholder meetings with key herders and agricultural associations.
- Dissemination of communication materials explaining the benefits of AI and synchronization protocols.
- Targeted support for leading farmers to demonstrate success and promote adoption within their communities.
-

4.6 SUBCOMPONENT 4: GENETIC IMPROVEMENT PROGRAM

Objective	• Number of Confirmed Pregnancies through AI • Rate of Genetic Adoption • Milk and Meat Productivity
Outputs / outcomes	**Outputs:** • **SPC**: A fully operational Semen Production Center producing up to 10,000 doses of semen per bull annually to support large-scale AI deployment. • **Nucleus Farm**: Consistent production of crossbred bulls tailored for natural mating, providing herders with an accessible alternative to AI. **Outcomes:** • **SPC**: Increased access to semen doses for AI, driving consistent genetic improvement and herd productivity. • **Nucleus Farm**: Broader adoption of improved genetics through natural mating, supporting local practices while advancing genetic potential.
Key partners	• **Synetics:** Provides expertise in genetic resources and crossbreeding strategies. • **National Animal Production Research Institute (NAPRI)** and Nigerian Institute for Animal Science: Offer insights on breeding programs tailored to Nigeria's environmental conditions. • **Government:** Sets objectives and coordinates specifications in collaboration with program partners. • **SPC and Nucleus Farm Teams:** Ensure operational efficiency and alignment with program goals.

Investments on equipment and facilities	• High-genetic-potential bulls for SPC. • Sexed semen doses for crossbreeding at the Nucleus Farm. • Semen collection and processing infrastructure at the SPC. • Feeding and housing facilities for bulls at both SPC and Nucleus Farm.
Key activities	1. Importation of High-Genetic-Potential Bulls for SPC: Select and import bulls with superior genetics to establish the SPC. These bulls will serve as the foundation for producing high-quality semen doses to support AI programs. 2. Importation of Sexed Semen for Nucleus Farm: Procure sexed semen for controlled crossbreeding, ensuring the production of crossbred bulls optimized for local conditions and intended for natural mating. 3. Semen Production at SPC: Develop a sustainable system to produce and store semen doses, focusing on high reproductive and genetic quality to meet AI demands. 4. Crossbred Bull Production at Nucleus Farm Use sexed semen to breed crossbred bulls that are adapted to local challenges. These bulls will be raised and distributed to herders for natural mating, ensuring genetic improvement for farmers who prefer traditional methods. 5. Stakeholder Engagement and Education: Conduct workshops and demonstrations to promote the benefits of AI and crossbreeding, ensuring herders understand the options available to enhance herd productivity.
Interest	The combined efforts of the SPC and Nucleus Farm provide herders with multiple pathways for genetic improvement, catering to preferences for both AI and natural mating. This program boosts productivity increases breeder incomes and enhances sustainability in Nigeria's livestock sector. By fostering a diverse genetic improvement system, it supports adaptability to local practices and environmental challenges while aligning with broader economic goals.
Hypothesis and risks	• **Acceptance of AI:** Resistance to AI or crossbreeding due to unfamiliarity with the methods or preference for traditional practices. Continuous education and field demonstrations will address this. • **Supply Chain for Sexed Semen:** Global supply chain disruptions could delay the delivery of sexed semen. Establishing reliable supplier relationships and contingency plans will mitigate this risk. • **Operational Challenges:** Ensuring consistent semen production at the SPC and maintaining bull health at the Nucleus Farm requires strict adherence to protocols, robust infrastructure, and skilled staff.
Budget	Investment : 200 k€ Op. Budget : 300 k€

The Genetic Improvement Program will enhance access to improved genetics through **artificial insemination (AI)** and **crossbred bull production**. The **Semen Production Center (SPC)** will

produce semen for AI, while the **Nucleus Farm** will raise crossbred bulls for natural mating. This dual approach provides all herders, regardless of breeding preference, with options to boost herd productivity and resilience.

The program will import **20 high-genetic-potential bulls** from **Holstein, Montbéliarde or Normande, and Tarentaise** breeds, selected for productive and resilient traits. Together, they create a strong genetic foundation, combining productivity with adaptability to local conditions.

Early matings will involve **pure exotic bulls** to introduce high genetic potential, with later phases using crossbred bulls from the Nucleus Farm. This phased approach ensures sustainable genetic progress, balancing purebred benefits with long-term adaptability.

Initially, crossbreeding will use a **50% local and 50% exotic** ratio, transitioning to **40% local and 60% exotic** over time at the Nucleus Farm. This gradual shift supports sustainable productivity gains while preserving local traits.

4.7 SUBCOMPONENT 5: NUCLEUS FARM

Objective	• Rate of Genetic Adoption • Milk and Meat Productivity
Outputs / outcomes	**Outputs:** • Annual production of 400 crossbred bulls to meet the genetic improvement needs of approximately 10,000 cows through natural mating. • Establishment of infrastructure and demonstration areas for advanced livestock practices, including feedlot management, hay production, milking, and milk processing. **Outcomes:** • Broader adoption of improved genetics through crossbred bulls, resulting in higher milk and meat yields and enhanced herd productivity. • Equipping herders with skills in modern livestock practices, promoting self-sufficiency and sustainability in farming operations.
Key partners	• **Local Government:** Provides funding, infrastructure, and program oversight to ensure compliance and success. • **MG2MIX:** Offers expertise in feed and forage management to develop effective feedlot practices and ensure sustainable forage production. • **Ceva:** Delivers herd health protocols and vaccination programs to maintain cattle productivity. • **French Companies:** Supply equipment for cattle handling, milking, and forage production while providing specialized training in livestock management. • **Private Operator:** Manages daily operations, ensuring alignment with program goals and partner standards.
Investments on equipment and facilities	• Breeding stock of 1,200 cows to ensure annual production of 400 crossbred bulls. • Infrastructure for cattle handling, fencing, employee housing, and water systems. • Milking and milk processing equipment for on-site demonstrations and practical training. • Equipment for hay production and feedlot management. • Training programs and extension support provided by French partners.
Key activities	• Infrastructure Development:

	Build essential facilities for cattle handling, perimeter and paddock fencing, employee housing, and water storage to support operations on the 1,000-hectare farm. • Breeding Stock Establishment: Acquire 1,200 breeding females to ensure sustainable production of crossbred bulls. Establish a breeding program tailored to meet local environmental conditions and productivity goals. • Land Management: Prepare and manage the farm's 1,000 hectares for optimal grazing and hay production. Implement irrigation and forage management practices to maintain a consistent feed supply. • Equipment Procurement: Purchase equipment for hay production, cattle handling, and milk processing to ensure efficient operations and provide demonstration capabilities. • Training and Demonstration Programs: Conduct hands-on training sessions for staff and herders, focusing on feedlot management, hay production, and innovative milking practices. Organize demonstration events to showcase these techniques. • Outreach to Herders: Engage herders through outreach programs to promote the benefits of crossbred bulls and modern livestock practices, encouraging adoption and knowledge sharing.
Interest	The Nucleus Farm's primary goal is to enhance herders' access to improved genetics through crossbred bulls, while also equipping them with practical skills in modern livestock practices. By integrating bull production with advanced training in feedlot management, hay production, and dairy processing, the farm empowers local herders to adopt sustainable practices, increasing their productivity and economic resilience. As a model facility, the farm supports the broader vision of advancing livestock development across the region.
Hypothesis and risks	1. **Environmental Factors**: The success of the farm depends on selecting a location with access to water, high-quality grazing land, and favorable weather conditions. 2. **Staff Competencies**: Effective management requires trained staff to oversee breeding programs and implement best practices in cattle care and forage production. 3. **Herders' Resistance to Change**: Some herders may be hesitant to adopt new breeding and livestock management practices. Ongoing education and engagement will be critical to overcoming this barrier.
Budget	Investment : 2,180 k€ Op. Budget : 0 k€

At the Nucleus Farm, G0 females refer to the initial generation of selected reproductive cows chosen for crossbreeding, while G1 represents their offspring. The farm will apply two distinct feeding strategies: one group will be raised on pasture with hay supplementation, and the other will be fed exclusively with hay. This setup applies across four main types of animals:

1. **G0 reproductive females**: Their reproductive performance and milk production will be monitored to compare the impact of each feeding strategy.
2. **G1 heifers for finishing**: Raised for meat production, these heifers will follow one of the two feeding regimes until they reach 18 months, after which they will enter the feedlot.
3. **G1 males for sale as reproducers**: Selected breeding bulls will be reared under both feeding conditions and sold as breeding stock at 12 months.

4. **G1 males for feedlot finishing**: Bulls not selected for reproduction will remain on the farm until 18 months and then enter the feedlot.

In the feedlot, two classes of G1 animals heifers and non-breeding males will receive a high-energy diet of hay and protein supplements to optimize weight and muscle gain prior to slaughter. This setup enhances profitability and meets quality standards for butchers, ensuring that animals not kept for breeding are efficiently prepared for meat production.

The government should allocate 1,000 hectares for the Nucleus Farm, situated alongside the Semen Production Center (SPC), providing ample space for cattle and forage operations. To facilitate hay production, the farm will be equipped with tractors, mowers, windrowers, and balers. Additionally, several French companies will provide the necessary equipment and train farm workers in key technical skills to support productive farming practices. This approach allows the Nucleus Farm to serve as a demonstration hub for advanced livestock management, offering valuable insights into optimal feeding strategies for both reproductive productivity and meat production.

The Nucleus Farm will be equipped with essential infrastructure to support efficient cattle management and operations. Cattle race and handling systems will facilitate safe and effective management of cattle for routine health checks and movement. Perimeter and paddock fencing will secure the farm's boundaries and create designated grazing areas, enabling organized rotational grazing. Employee housing will ensure that staff are on-site to oversee daily tasks and monitor animal welfare. For dairy operations, the farm will include milk storage facilities and manual milking equipment to handle milk from reproductive cows. Additionally, a water supply and irrigation system will maintain consistent water access for cattle and support forage production. To further secure this supply, water storage facilities will provide a reserve, ensuring the irrigation system's reliability, even during dry spells.

5 COMPONENT 5: TRACEABILITY

5.1 REMINDER OF THE MAIN GAPS IDENTIFIED

This component is based on one theme: Traceability, aimed at addressing health issues, stock management, and governmental oversight.

Gaps for Traceability

Lack of traceability - The absence of a structured system for identifying, tracking, and monitoring livestock makes it difficult to establish to trace cattle movements and sanitary stautus High levels of transhumance and uncontrolled cattle movement across regions create challenges in maintaining reliable data on livestock. Limited visibility of livestock numbers and locations leads to inefficiencies in stock management, impacting both health planning and market supply.

Difficulty in Disease Monitoring: Without a traceability system, it is challenging to identify and control disease outbreaks effectively, risking delays in response and greater economic losses. A lack of centralized and accessible data prevents stakeholders from understanding livestock movements, health conditions, and stock levels in real time.

Limited Awareness Farmers and stakeholders are often unaware of the benefits of traceability, resulting in resistance to new systems.

5.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT TRACEABILITY

OBJECTIVE AND KPIS

1. Traceability

Objective:

The Traceability component aims to implement a robust Livestock Identification and Traceability System (LITS) to enhance the monitoring of cattle health, movements, and stock levels. By providing real-time access to centralized data, it will enable better decision-making, improve responses to disease outbreaks, and support effective livestock management. Additionally, this system seeks to encourage widespread adoption among farmers and butchers by showcasing the benefits of organized traceability.

KPIs:

1. **Number of cattle tagged:** Monitor the proportion of livestock identified with visual ear tags for improved tracking and health monitoring.
2. **Data accessibility:** Assess how effectively stakeholders, including technicians and market operators, can access and use the traceability database.
3. **Incidence of disease outbreaks:** Measure the reduction in response time to reported health issues through improved traceability.
4. **Breeder adoption rate:** Track the participation of farmers in the traceability program, indicating its acceptance and usage.
5. **Data completeness:** Evaluate the accuracy and comprehensiveness of livestock movement and health data within the system.

STRATEGY

1. Traceability Strategy Overview

Objective:

Develop and implement a Livestock Identification and Traceability System (LITS) to improve cattle monitoring, health management, and stock tracking. This includes providing visual ear tags, a centralized database, and local infrastructure to ensure real-time data collection and analysis. Training programs, technical resources, and awareness campaigns will support adoption and operational efficiency.

Key Components:

- LITS Workshops and technical consultancy to design and adapt the system.
- Deployment of LITS software, visual ear tags, and local printing facilities.
- Establishment of market and central identification offices for data collection.
- Provision of tablets for mobile registration and database maintenance.
- Communication campaigns, training materials, and workshops to build stakeholder capacity.

5.3 SUBCOMPONENT 1: TRACABILITY

Objective	• Number of Cattle Tagged • Breeder Adoption Rate

	• Data Accessibility • Incidence of Disease Outbreaks • Data Completeness
Outputs / outcomes	**Outputs** • Establishment of a centralized LITS system with identification offices, tamperproof tags, tablets, and comprehensive training programs. **Outcomes** • Enhanced livestock traceability and health monitoring, supporting disease control, market planning, and genetic improvement initiatives.
Key partners	**Government Authorities** • **Federal Ministry of Agriculture and Rural Development**: Provides regulatory oversight, ensures policy alignment, and allocates resources for the implementation of LITS. • **State Ministries of Agriculture (Kwara)**: Oversee local execution, coordinate market-level activities, and support vaccination and tagging campaigns. **NAPRI (National Animal Production Research Institute)** • Offers technical guidance on livestock data management and disease control, ensuring the traceability system is aligned with national livestock management goals. **Veterinarians, AI Technicians, and Para-Veterinarians** • Lead vaccination efforts, tag cattle, and input data into the LITS system, ensuring accurate and real-time tracking of livestock health and movements. **Market Committees and Substation Operators** • Facilitate livestock registration during market transactions, monitor compliance with traceability standards, and ensure accurate data collection at substations. **Adventiel** • Provides advanced digital solutions tailored to livestock traceability, including centralized software for data management, hosting services, and training for stakeholders. **Datamars** • Supplies tamperproof visual ear tags, RFID tags, and applicators, ensuring that identification devices integrate seamlessly with the LITS system. **Herders' Community** • Plays a key role in adoption by promoting awareness among livestock owners, ensuring active participation, and providing local feedback to improve system implementation.
Investments on equipment and facilities	1. Visual Ear Tags and RFID Tags 2. Tag Printing Facilities 3. Identification Offices 4. Tablets with Mobile LITS App 5. Centralized Software and Database System 6. Training and Resource Materials 7. Technical Infrastructure
Key activities	• **Stakeholder Engagement:** Conduct workshops with federal, state, and local stakeholders to promote LITS adoption. • **System Design and Deployment:** Develop and launch LITS software and integrate it with tagging tools.

	• **Identification and Tagging:** Distribute and apply ear tags to cattle in pilot regions and beyond. • **Infrastructure Setup:** Establish identification offices in markets and a central coordination office in Ilorin. • **Training Programs:** Train veterinarians, technicians, and market operators on LITS operations and software use. • **Media and Communication Campaigns:** Raise awareness about LITS benefits among herders and butchers. • **Operational Rollout:** Implement LITS across vaccination campaigns and markets with ongoing technical support. • **Data Collection and Maintenance:** Regularly update the database to ensure accurate and reliable livestock records.
Interest	The implementation of LITS fosters transparency and efficiency in livestock management, benefiting all stakeholders. It supports the government with accurate data for policy-making and disease control, empowers veterinarians and technicians with tools for better livestock monitoring, and enhances trust and market stability for butchers and farmers. By improving traceability, the system strengthens vaccination campaigns, tracks AI outcomes, and facilitates genetic improvement. Additionally, it contributes to sustainable livestock development by promoting organized and accountable practices, boosting productivity, and ensuring long-term sector resilience.
Hypothesis and risks	• **Resistance to Adoption:** Farmers and stakeholders may resist the system due to unfamiliarity, distrust, or perceived complexity. • **Limited Technical Expertise:** Insufficient skills among local technicians could hinder system operations and maintenance. • **Infrastructure Challenges:** Poor internet connectivity, electricity shortages, and environmental issues could disrupt data collection and system functionality. • **Data Integrity and Security:** Risks of data loss, corruption, or unauthorized access could undermine the credibility and effectiveness of the system. • **Coordination Issues:** Weak collaboration among government bodies, technicians, and market operators could lead to inefficiencies and operational delays.
Budget	Investment : 1,720 k€ Op. Budget : 2,137 k€

Field Utilization of LITS

1. **Animal Identification:**
   - Each animal is assigned a unique identifier through tamperproof ear tags (visual and/or RFID), securely attached by trained technicians.
   - The identifier links to a centralized database, recording information such as owner details, farm location, and basic health data.

2. **Data Collection and Entry:**
   - Mobile devices, such as tablets equipped with the LITS mobile app, are used to register animals on-site. Information is uploaded to the system in real-time or stored offline in areas with limited connectivity.
   - Registration includes data on species, age, sex, and ownership, along with initial vaccination records.

3. **Vaccination Tracking:**

- During vaccination campaigns, technicians use the visual ear tags to record vaccine administration.
- Each vaccine event is logged in the animal's digital profile, including the date, type of vaccine, and batch number, enabling easy tracking for future booster schedules or disease surveillance.

4. **AI Follow-Up:**
   - Technicians performing artificial insemination (AI) can log insemination details into the LITS system, including genetic information of the semen, date of insemination, and expected calving date.
   - The system supports pregnancy follow-up by linking AI records to ultrasound results or pregnancy checks, ensuring comprehensive reproductive management.

5. **Market and Movement Monitoring:**
   - At livestock markets, animals are scanned or identified visually before transactions. Their identifiers are updated in the system to reflect changes in ownership or location.
   - This step ensures traceability of animal movement and supports theft prevention and recovery mechanisms.

6. **Disease Control:**
   - The system enables rapid identification of animals in disease outbreak zones. Officials can track the movements and vaccination history of affected livestock, helping to contain and respond to outbreaks effectively.

7. **Slaughterhouse Integration:**
   - At slaughterhouses, animal identifiers are recorded during processing. This data provides end-to-end traceability, ensuring compliance with food safety standards and building consumer trust.

8. **Reporting and Analysis:**
   - Government authorities and stakeholders access the LITS database for real-time insights into animal populations, health status, and movements.
   - These analytics support decision-making for vaccination strategies, genetic improvement programs, and market planning.

Coordination Between Market Offices and the Central Identification Office

The Market Offices and the Central Identification Office work together to ensure effective livestock traceability. Located in local markets, the Market Offices handle animal registration upon arrival and departure, update transaction details (ownership changes, health status), and distribute essential tools like ear tags. They also serve as points of contact for farmers, butchers, and veterinarians.

The Central Office, based in Ilorin, centralizes data collected by the Market Offices into a unified database. It coordinates operations, analyzes information to identify trends, and ensures the distribution of necessary resources to the Market Offices. Additionally, it acts as a liaison with local and national authorities, ensuring compliance with regulations and supporting informed decision-making.

Information will be added to the database by designated stakeholders using mobile devices and LITS-compatible software. Veterinarians will input vaccination records and health data during campaigns, while AI technicians will log insemination details and reproductive follow-ups. Butchers and market operators will register ownership changes during sales, and slaughterhouses will record final processing data. These inputs, synchronized to the centralized system in real-time or offline for later upload, ensure a continuous and reliable flow of information across the livestock value chain.

In case of a health issue, the Market Offices report to the Central Office, which mobilizes resources and coordinates a rapid response using its comprehensive overview of animal movements and health data. This connection between local management and centralized oversight guarantees smooth and responsive traceability, vital for public health and livestock management.

6 COMPONENT 6: STRENGTHENING THE DAIRY SUPPLY CHAIN

6.1 REMIND OF THE MAIN GAPS IDENTIFIED

First, the dairy supply chain because of the limited production due to various causes developed in the previous parts:

- Limited number of milking cows (around 3,000 to 4,000 milking cows among 50,000 cattle for 1,000 families) in the reserve limiting the capacity to collect this milk,
- Low milk production due to the lack of feeding partially due to the invasive weeds, and insufficient watering due to limited access to water,
- Milk production is shared between the family consumption, the calves and the remaining milk is sold in Lata village after basic processing (Ghee, fermented products).
- Milk production is available during few months after calving during the raining season.

The main gaps on the supply chain are:

- The absence of collection network of the raw milk. Currently, the milk collected (few litres) are bring to Lata market by the women.
- The absence of cold chain to preserve the quality of the milk. The development of cold chain requires an access to electricity (grid or solar) to cool the milk as soon as possible after milking.
- Due to the limited volume and the non-stable products the women have not access to more profitable markets such as Pategi or Ilorin.

However, the milk production, with an average price of milk around 250 to 400 Naira/litre, can be more profitable than the meat. The milk production has the potential to generate regular income: Average 10k Naira per day per herd.

Table 1: Evolution of the income according to various hypothesis milk production increase

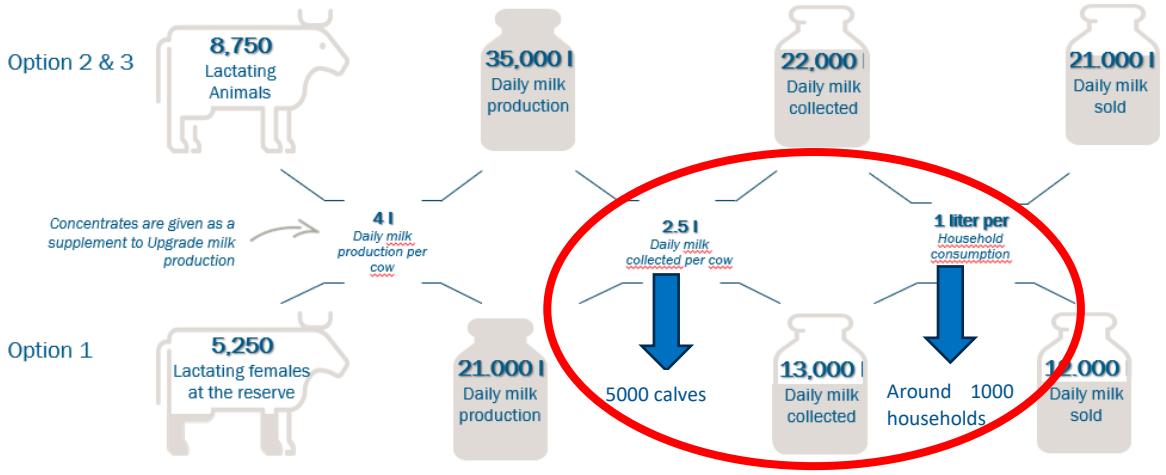
	Current system	Upgraded Reproduction Performances	Upgraded Genetics
	Only Upgraded feeding and forages	Better feeding, breeding and animal health	F1 Crossbreds Local x Holstein & Good management
Milk sold per lactation *(liters)*	625	625	2,100
Income/ha *(Naira)*	140,000	280,000	900,000
Total Herd & land Size	50 Cattle on 10 Ha		
Expected Yearly Revenue per herd *(Naira)*	**200,000**	**1,200,000**	**6,000,000**

Potential Average Yield 7.5 TDM/ha & Stocking rate of 3 UBT per Ha
Milk price 240 Naira/liter
Feed Costs 200 Naira/kg

6.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "STRENGTHEN DAIRY SUPPLY CHAIN"

Previously, the different actions on fodder production on Lata reserve, on nutrition and animal health can increase the milk production available for processing around 10 tons to 20 tons per day (figure 1).

Figure 1: Possible increase of the milk production available for processing within the reserve according to various improved practices.



This component is focused on the development of the collection of raw milk, the preservation of its quality by good hygiene practices and cold chain, the increase of the income through processing and access to market.

OBJECTIVE AND KPIS

The main objective of this component is to create added value for women through a better processing of raw milk and a better access to the market.

Th main KPIs to monitor the results of this component are:

- The price per litre of milk, in comparison with the price proposed by dairy companies,

- The income generated by the processing and sales of dairy products for Lata reserve and per households.
- The employment generated, especially among young people and women.

STRATEGY

The strategy will aim to:

- Develop a collection network of raw milk with a cold chain. It will require some investments with Milk Collecting Points (MCP)[4] and Milk Collecting Centre (MCC) and the organisation of this network.
- Improve processing capacity of the women to create added value on their products. The level of investments will depend on the volume of raw milk to process, and the processes developed.
- Strengthen good hygiene practices from milking to processing and marketing milk and milk products.

Four critical points shall be monitored during the establishment of this strategy:

- Currently, the income generated my milk production is for the women. The organisation of the dairy supply chain shall preserve and increase the incomes for the women, and not organise a transfer to men. The involvement of women will be essential with probably creation of specific organisation, according to the local culture.
- The access to drinkable water will be also essential to develop the processing unit. Access to electricity is also essential, but a part of the energy needs can be provided by solar electricity. The MCCs shall be accessible for a truck by paved road.
- The raw milk processing can be developed in the milk collecting centre existing in Lata village to allow women to prepare their dairy products on hygienic conditions and to try other handmade dairy products. In a first step, we can have a handmade process.
- If the volume of raw milk collected increases significantly, it can be interesting:
    - To create a small dairy processing unit able to process between 5 and 10 tons per day. The milk collection of raw milk shall be possible during all the year with seasonal variations. If no milk is available during the dry season, the collection of raw milk could also collect some modern farms.
    - To contract with some dairy companies that could be interested to collect raw milk. The minimum should be to collect around 10 tons per day to have a full truck. This can be compatible with some handmade processing.

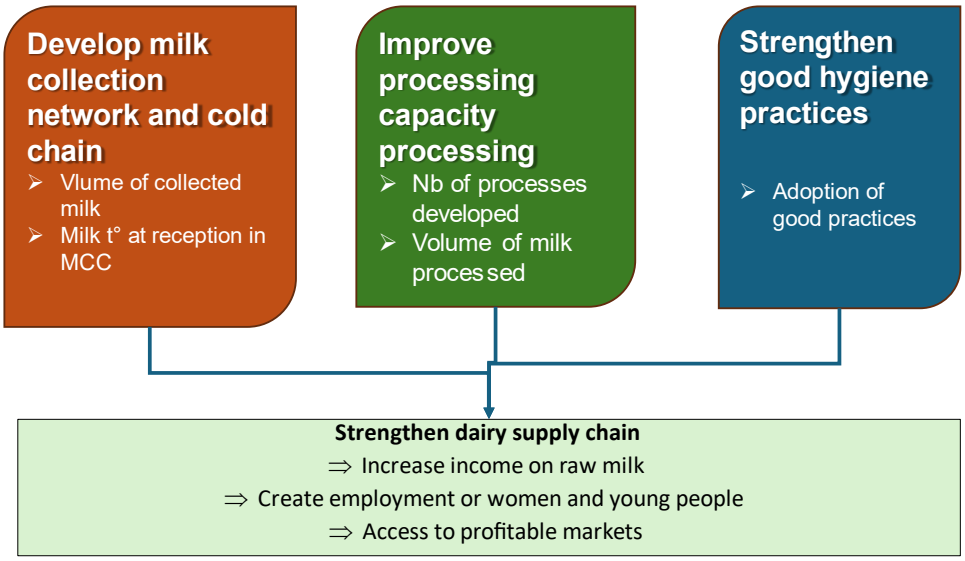
The sensitive question of the involvement of Fulanis women in dairy processing.

Fulani women usually work in their settlement without any hygienic conditions allowing to ensure the quality and safety of their products. It will be difficult to ensure access to adequate equipment and drinkable water for processing in each settlement. Furthermore, to develop the dairy products, it is important to have stable products for consumers with the same quality whatever the batch of production. This is only possible with a process in one place.

The issue of involvement of the Fulanis women should be considered at the beginning to define the best solution and prevent women from losing out on the added value of processing.

[4] MCP is a point where farmers can bring their cans for a first cooling. MCC is a collecting center with milk cooling tank where the can are unloaded after a quality heck of the raw milk.

Strategy proposed to strengthen dairy supply chain



6.3 SUBCOMPONENT 1: DEVELOP MILK COLLECTION NETWORK AND COLD CHAIN

Objectives	Develop women and young people organisations to be able develop consultation and coordination of milk collection. Develop a milk collection network from households to MCP and from MCPs to Lata collecting centre. Invest in a cold chain in collecting points and in Lata collecting point.
Outputs / outcomes	Output: Women organisations and report activities of their organisations, investments, dashboards on collected milk. *Outcome: Number of households collected, volume of milk collected per day /month / year; temperature of the milk at reception in the MCC and in the tank of the MCC.*
Key partners	The DLD and some extension services like ARMTI could be involved in the organisation of the supply chain with the targeted populations (women, and young people). Some French companies (SERAP, BOCCARD) could be involved to provide investment.
Investments on equipment and facilities	The investments will include: **1- In a first step:** - 10 milk can coolers with a capacity of 240 l each one with 100 cans (2 sets of can) (see appendix one). - A milk cooling tank about 3,000 l in the MCC in Lata village - One scooter or tricycle to collect the milk from milk can coolers in the MCPs. - Basic laboratory equipment to perform the quality tests in the MCC (acidity, density, alcohol, Californian Mastitis Test (CMT), pH…).

	2- **In a second step,** it will be possible to densify the milk collection network with: - Three others milk collecting centers with cooling tank with milk tank around 3000 to 5,000 l. - 15 other milk can coolers to complete the network. - A second scooter for the collection of milk. See paragraph below on the organization of the network.
Key activities	1- **Consultation with women, herder and young people** to discuss about the best organization of the milk collection. The consultation should be concluded to allow the needed investments before the starting of the raining season and the milking period. (see paragraph below). 2- **Equip the MCC in Lata village** with the milk cooling tank. Some works will be needed to improve the existing one, access to water, solar panels… At the same time, the MCP will be prepared with a shelter and solar panel for the milk can cooler. The motorbikes shall be prepared to be able to transport to cans and one scooter could be prepared with an insulated box to transport 10 to 15 cans. 3- **Monitor the milk production.** The women organisation, the managers of the MCPs and MCC shall be trained to establish a reporting system allowing to trace the milk delivered by each household and the quality per can (settlements and group of settlements). Dashboard can be prepared. Regular meeting should be organised to provide feedback on volume and quality. 4- **Develop the other MCCs, MCPs** with investment on new cooling tanks and new milk can coolers, scooter. New local managers shall be trained. A workshop could be organised to define the strategy of this second step.
Interest	The collection of milk collection with cold chain will give the opportunity to women to increase the milk production and their income. With the consultation in a preliminary step, they can have a key role for the development of the milk production and the milk supply chain.
Hypothesis and risks	The development of milk production is depending on the grass production and the water accessibility that will determine also the number of milking cows. This is the reason why the component is organised in 2 steps of investment. The first one around the MCCs in Lata that will be equipped. This first steps will allow to define the best strategy and the best support to develop milk. The second step will be dimensioned according to the lessons during the first phase.
Budget	Investment : 530 k€ Op. Budget : 157 k€

SOME SPECIFICATIONS FOR THE MILK COLLECTION NETWORK

The network for milk collection could be established around the following principles.

- 2 or 3 closed settlements could have a can in a first step according to the number of animals and the number of milking cows and their production. It could be decided to collect the milk only once per day during one milking, and the other milking will be for the calves and the family.

- Some young people with their motorbikes / or tricycles (tricycles can be owned by a Lata Milk Cooperative, tricycle could also serve for feed transport or agricultural inputs, drivers must be paid as drivers, not as milk merchants) could collect the cans and bring it to the milk can coolers (Milk Collecting Points). They will have fees for the transport. The milk could stay during the night for cooling in the milk can cooler. It is better to pay them through fees and not as trader to preserve the direct link between the quality check of the milk in the MCC and the settlement of origin of the raw milk.

- One milk can cooler (MCP) can be established with a shelter and solar panel for 5 to 10 settlements, according to the milk production. In a first step, 10 MCPS can be created and around 15 more later.

- Early morning the scooters could transport the cans from the milk can cooler to the MCCs and bring back the clean cans. The scooters (or tricycles) could be drive by young people of Lata.

- The MCC will have the cooling tank 3 to 5 000 litres. The MCC shall be equipped with drinkable water, and electricity and accessible all the year by heavy trucks (more than 15-20 tons).

- A MCC can have also some facilities to facilitate to the animal care services (see component on animal heath) with a room for the veterinarian for consultation: a store for some feed. The vaccination parks can be built close to MCPs and/or MCCs. Currently, there is an existing building for the MCC that can be used for processing and a building for feed store and feed preparation.

- The milk could be tested per can (1 to 3 settlements) for basic quality tests (acidity, alcohol, density…) before to mix it in the cooling tank. The milk not complying with the requirements will be rejected and not paid. This milk can be used for animal feeding. The can are cleaned in the MCC to be bring back next morning.

CONSULTATION WITH WOMEN, HERDER AND YOUNG PEOPLE

It will be important to organise consultation with women to identify the best organisation with some key questions:

- What could be the growth of milk production, if grass is available to dimension correctly the investments?

- What could be the best organisation for collecting the extra milk (morning or evening) after the needs for calves and family? It would be better to have only one collection of milk per day after milking.

- What could be the organisation of women to share the responsibilities? Appoint a leader per settlements, per MCP, per MCC. This consultation could discuss the interest to establish an association with leaders. It will be the place to discuss the various task needed to each level (settlements, MCPs, MCCs). Some leaders could manage the MCPs and the MCCs with some incentives.

- The role of the young people to collect and transport milk[5] should be defined and their remuneration. It would be better to determine some fees for the transport service than to transform them in traders. The women producing milk should keep the link between their production and the quality of their milk delivered and have the benefit of the quality of their work.

- Several jobs can be created or ensured by part-time jobs for women and young people: (i) a head of the MCCs to manage, collect the data and follow the dashboards, (ii) some people to clean the cans, the tank, the MCCs, (iii) someone to perform the rapid quality tests. The incentives for these jobs shall be defined.

[5] Their transport capacities can be used also for feed and other transport activities.

- A workshop could be organised with local extension services such as ARMTI that could determine the methodology using some key success stories in Nigeria and other African countries. It will be important to involve Fulanis women.

6.4 SUBCOMPONENT 2: IMPROVE PROCESSING CAPACITY

Objective	Improve the raw milk processing capacity
Outputs / outcomes	Output: development of a small processing unit. Outcome: Volume of processed dairy product and income generated for the unit and for the women.
Key partners	The choice of the partners will be essential: • A specific organisation shall be dedicated to the management of the MCC and the processing unit. It can be managed by the women or by a specific organisation. • Local institutions, such as DLD and ARMTI, can be involved to facilitate the organisation and coordinate the support. The University of Ilorin with the veterinary faculty that has expressed the interest to develop a processing unit could be also a partner to facilitate the transfer of know-how. • Expertise in processing will be needed. Some French experts with experience in west Africa can be involved. • Some dairy companies, such as Fan Milk, can be also interested if the volume produced milk is interesting.
Investments on equipment and facilities	We suggest having an approach in 2 steps for investments: • In a first step a limited investment (inox table, room with easy to clean wall and ground, dairy manufacturing utensils…) allowing some process (pasteurisation, cheese, ghee…) and packing to sale the products in Pategi and Ilorin. It will be mainly hand made. • In a second step, it is possible to invest in a mini dairy unit for some basic process for bigger volume of processed milk. Some French expertise to ensure the transfer of know-how can be useful.
Key activities	1 **Consultation with women, herder and young people**. Complementary of the consultation proposed in subcomponent, it is possible to define a specific organisation to develop hand-made processing in a first step. It can be interesting only for a part of the women. They can employ complementary staff if needed. 2 **Creation of the small processing unit**. Some basic investment ill be needed with a specific room and a refrigerator. An important support shall be provided to strengthen the processing methods to ensure the stability and the quality of the products, to develop some sale channels in Pategi, Ilorin… A basic accounting system shall be developed to measure the income generated. This support shall be coordinated with subcomponent 3 on good hygiene practices. 3 **Feasibility study of a mini dairy unit.** If the volume of raw milk increases, the capacity of handmade processing will be not sufficient in this case, a feasibility study shall be performed to identity the best options for a mini dairy processing unit (5 to 10 tons per day): definition of the process to develop considering the local market, identification of the local partners, business model of the unit with estimation of the return on investment. The feasibility study can also assess the opportunity and the possibility to collect milk in some modern farms on this part of Kwara state to collect milk along the year. 4 **Creation of a mini dairy unit.** It will require a significant investment (**6 to 8 million EUR**). Depending on the local operator, a support will be needed beyond the support of the company supplying the processing unit, for its management and the development of the market. It will be important to monitor the profitability of the unit and the income that can be generated for women collecting raw milk. **At this stage, we can recommend not including this**

	investment in the Project budget. In Year 3 or 4 of the Project, it will be appropriate to assess the profitability of this processing unit. Notably, dairy sector operators might purchase the milk produced in the Reserve and its surroundings, making such a processing unit unnecessary. However, for the Project's economic analysis, we have included the cost of this unit.
Interest	The main interest is to create and added value for the reserve by processing the milk and extend the market for the raw milk.
Hypothesis and risks	The main challenges will be (i) the organisation and the management of the processing unit with high quality dairy products justifying a good price, (ii) the access to the market, (iii) the sustainability of the business-model.
Budget	Investment : 8,010 k€ Op. Budget : 155 k€

ORGANISATION OF THE PROCESSING UNIT

The processing unit shall be an independent unit from the MCC, as a limited number of women and herders can be interested.

During the first step, it can be a unit processing limited quantity of the raw milk. A part of the collected milk (2,500 to 3,000 litres) could be sold as fresh milk locally, or after boiling or processing in fermented products and ghee in other towns. During this step, the unit can be led by the women processing the raw milk with some external supports (processing expertise, management expertise). This step will be useful to determine the capacity to develop processing milk, to assess the difficulties for market access, to measure the market opportunities (hotels, restaurants, supermarkets…). Some experiences on small dairy processing units can be assessed in West Africa or in some other countries[6].

In a second step, the process unit can be able to process 5 to 10 tons per day of raw milk. The management cannot be only based on local people. It can be managed by a dairy company, such as Fan Milk, if interested, or by a local operator. The investment can be supported by the state with a management delegated to a private company.

MINI DAIRY UNIT

A new concept of mini dairy unit has been developed by a French company, Boccard. The concept is based on a processing unit assembled in containers in France that will be easily installed locally. The capacity will be around 5 to 10 tons per day. It can be a basic process: pasteurized milk in pocket or small bottle with oven sterilization, liquid yoghurt…

To install the unit in container, the prerequisites are access to drinkable water, electricity, paved road. The containers for the mini dairy unit can be easily assembled with the different containers in few days.

The budget is around 6 to 10 million EUR depending on the utilities (management of wastewater, production of steam and hot water….).

If the unit is developed for dairy company, such as FanMilk, the process can be limited to first pasteurization to stabilize the milk and concentration to reduce the volume of milk for transport. In this case, a 10 tons truck could collect the concentrated milk every 3 days.

Boccard is a well-known French company building dairy factory. They have experience on the development of mini dairies (Sri Lanka). They have a good experience of Nigeria, as they are a provider of Danone/FanMilk.

[6] In Alula (Saudi Arabia), an interested experience is conducted to develop the processing of raw milk by local women with the support of a local NGO. They sale their products in local shops to local people and tourists.

6.5 SUBCOMPONENT 3: STRENGTHEN GOOD HYGIENE PRACTICES

Objective	Improve the level of hygiene and food safety from milking to processing.
Outputs / outcomes	Output: Good hygiene practices guide and pedagogic tools Outcome: Germs content on milk and dairy products decreasing
Key partners	ARMTI could lead this approach with some local food safety consultants. Several initiatives have been done in west Africa and materials are available[7]. Private veterinarians shall be involved to be able to provide adequate support for herders. DSV will validate the guide. This sub-component can be coordinated with the sub-component 3 on animal health.
Investments on equipment and facilities	No specific investment.
Key activities	1 Review of the existing materials and risk analysis. In a first step, a review of the existing materials and lessons learnt on various experience can be done3. It can be followed by an assessment of the current practices to prioritize the risk and practices on Lata reserve. 2 Conception of the good hygiene practices guides. The guide shall be adapted to the Lata reserve context. The first step will be to establish the guide for milking and collecting milk to the MCCs. In a second step, a guide can be developed for the processing. Pedagogic tools should be developed like posters, leaflet for the MCCs and MCPs. 3 Training and dissemination. Training shall be organized for all actors of the supply chain women milking at home, leaders managing MCPS, transporters, managers of the MCCs. It will be important to train trainers within the community. 4 Germ controls and feed-back on practices. Based on the result of the quality of the milk, and some estimate of the germs contents that could be performed in the Veterinary Faculty), a feed-back to the different actors can be organized through meeting to re-emphasize on key good practices and strengthen the understanding between good hygiene practices and safety of the milk (germs content…)
Interest	These awareness campaigns and training should involve the private veterinarians to provide their experience and their knowledge. This will increase the interest and the trust of the Fulanis for these animal health professionals. The veterinarians can play also a significant role on supporting hygiene. Some peer women can be selected as trainer to encourage a local support on good practices and demonstrate the interest of good practices. Visits to Demo farm can be also useful to show good practices.
Hypothesis and risks	The main actors of milking and processing are women, and it will be essential to develop a specific approach targeting them.
Budget	Investment : 0 k€ Op. Budget : 67 k€

[7] https://www.gret.org/wp-content/uploads/GP-31_Transformer-le-lait-local-en-AFO_WEB.pdf;
https://gret.org/wp-content/uploads/2021/12/Guide-Bonnes-Pratiques-dhygiene-lait.pdf
https://mel.cgiar.org/reporting/download/hash/7bfffe389e881acc684c96862ed68372#:~:text=Milking%20should%20be%20done%20at,after%20milking%20using%20iodine%20solution.

7 COMPONENT 7: MEAT CHAIN VALUE

7.1 REMINDER OF THE MAIN GAPS IDENTIFIED

The following key gaps have been identified in the current forage and grazing management, highlighting critical issues across knowledge, technical capacity, financial resources, and productivity at different levels:

1 Lack of Knowledge and Technical Skills Across the Chain:

- There is a significant knowledge gap at all levels—among herders, livestock markets, slaughterhouses, and butchers. Herders lack effective fattening and finishing techniques, limiting the potential for optimal weight gain and quality.
- Market operators, abattoir staff, and butchers often lack training in best practices for meat handling, preservation, and processing, leading to inefficiencies and reduced product quality.

1. Cash Flow Challenges at Every Stage:

- Herders often lack the funds to purchase adequate feed or to keep animals until they reach optimal finishing weight, resulting in early sales and lower profits.
- Butchers face financial constraints that limit their ability to purchase higher-quality, well-finished cattle, reducing their product offerings and profitability.
- Inadequate resources at the abattoir level lead to post-slaughter losses, with insufficient infrastructure to process, preserve, and utilize all parts of the animal.

2. High Levels of Waste, Lack of Traceability, and Insufficient Sanitary Standards:

- Poor infrastructure and lack of standards contribute to substantial waste at the abattoir stage, where meat and by-products are not fully utilized or preserved.
- Across the chain, the absence of a traceability system affects product reliability and consumer trust.
- Lack of sanitary regulations and enforcement leads to compromised quality and safety in meat products, impacting consumer health and market demand.

3. Low Productivity and Profitability Across the Chain:

- Low productivity at each level, from herders to butchers, results in reduced income and limited economic growth for all stakeholders in the value chain.
- The lack of structured support and resources prevents stakeholders from achieving profitability, which discourages investment in quality and sustainable practices.

4. Government Goal to Increase Self-Sufficiency:

- In response to low national self-sufficiency in meat production, the government aims to boost local production capacity. Meeting this goal will require enhancing the productivity, infrastructure, and efficiency of the entire meat value chain to meet domestic demand.

In conclusion, there is a lack of structured organization and adapted techniques needed for each stakeholder in the value chain to achieve better productivity and meet national production goals.

7.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "MEAT VALUE CHAIN"

OBJECTIVE AND KPIS

For this component, there are complex issues at each stage, so comprehensive KPIs are essential across the entire value chain to accurately understand performance and identify specific areas for improvement.

1. On-Farm KPIs

- **Average Sales Price and Weight of Cattle Sold**: Measure the average selling price and weight of cattle directly from farms, targeting higher prices and weights as a result of improved fattening practices.
- **Number of Cattle Raised in Feedlots**: Track the adoption and success of feedlot finishing by counting cattle raised in feedlots, with a focus on growth and quality improvement.
- **Direct Contracts with Butchers**: Count the number of formal agreements established between herders and butchers, ensuring steady demand and transparency in quality expectations.

2. Butcher KPIs

- **Weight of Processed Meat per Butcher**: Measure the amount of meat each butcher is able to process, targeting efficiency improvements due to better handling and cutting techniques.
- **Ratio of Refrigerated Stock to Total Processed Meat**: Measure the percentage of processed meat that is stored under refrigeration to maintain quality and reduce waste.

3. Market KPIs

- **Number of Cattle Registered per Week**: Track the weekly volume of cattle entering the market, monitoring growth and demand trends.
- **Total Quantity of Commercialized Meat from the Zone**: Measure the total amount of meat marketed from the project area, aiming for increased output from improved productivity and handling.

STRATEGY

Meat Value Chain Strategy Overview

1. **Slaughterhouse Improvement**

- **Objective**: Upgrade existing slaughterhouses to enhance meat safety, hygiene, and processing efficiency. By improving storage, waste management, and water systems, this component aims to reduce post-slaughter losses and ensure sanitary standards, supporting safer and better meat for the market.

2. **Market Infrastructure Improvement**

- **Objective**: Strengthen livestock market infrastructure to provide secure and organized spaces for animal sales. Upgraded facilities, including fencing, water access, and agrovet stores, will improve animal handling and provide herders with access to essential veterinary supplies.

3. **Training on New Fattening Methods, Awareness, and Extension Services for Herders**

- **Objective**: Train herders on advanced fattening techniques to increase cattle weight and market value, boosting profitability. Through targeted training and extension services, this component promotes sustainable practices that enhance productivity across the meat value chain.

4. **Contractualization Implementation**

- **Objective**: Establish formal contracts among stakeholders to ensure transparent, reliable transactions within the value chain. Structured agreements will promote consistent standards, fair pricing, and mutual trust between herders, slaughterhouses, and butchers.

5. **Demo Feedlot**

- **Objective**: Create a demonstration feedlot as a model facility to show best practices in cattle finishing, serving as an educational resource for local herders. This feedlot will display effective techniques to meet market standards, reinforcing productivity and profitability throughout the meat value chain..

Strategy to Enhance MEAT CHAIN VALUE

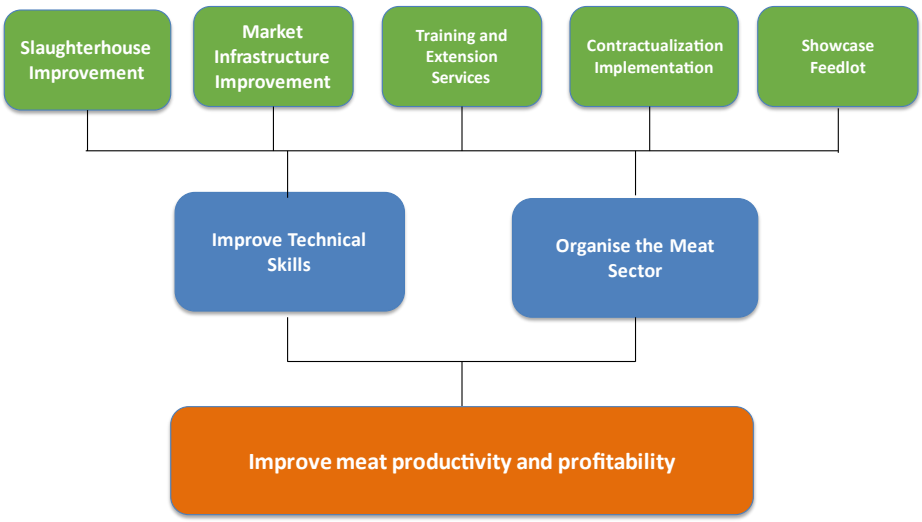


Figure 10 : Meat value chain strategy structure

7.3 SUBCOMPONENT 1: SLAUGHTERHOUSE IMPROVEMENT

Objective	1. Weight of Processed Meat per Butcher 2. Ratio of Refrigerated Stock to Total Processed Meat 3. Total Quantity of Commercialized Meat from the Zone
Outputs / outcomes	**Outputs** Improved slaughterhouses with modern facilities, cold storage, waste management systems, and reliable water infrastructure. **Outcomes** Higher-quality meat, better hygiene standards, and increased economic and environmental benefits.
Key partners	• **Local Government:** Responsible for funding, setting objectives, and ensuring compliance with regulations. • **French Specialists:** Provide expertise in slaughterhouse design, waste management, and the integration of renewable energy solutions, including photovoltaic systems.

	• **Butchers and Meat Processing Associations:** Train in advanced processing techniques, coordinate operations, and ensure adherence to quality standards. • **Private Operators:** Manage day-to-day operations of the slaughterhouses, ensuring alignment with project goals and maintaining operational efficiency.
Investments on equipment and facilities	1. Cold chambers with photovoltaic panels for refrigeration 2. Hanging rails, tripe rooms, and hide processing areas 3. Incinerators and effluent disposal systems for waste management 4. Boreholes and chlorinated water storage systems 5. Technical consultancy for site design and layout planning
Key activities	1. **Infrastructure Upgrades**: Build or enhance facilities with essential infrastructure like cold storage, cattle handling areas, and waste management systems. 2. **Training Programs**: Provide hands-on training for butchers and slaughterhouse staff on modern meat processing techniques and equipment maintenance. 3. **Hygiene and Quality Control**: Establish protocols for regular inspections, meat handling, and sanitation to maintain high safety standards. 4. **Sustainability Measures**: Introduce renewable energy solutions and efficient waste management practices to minimize environmental impact. 5. **Community Engagement**: Organize awareness campaigns with local herders and meat processing associations to ensure adoption of improved facilities.
Interest	The slaughterhouse improvements aim to increase the value of meat through better processing and hygiene while reducing environmental impacts. This component also creates economic opportunities through job creation and training programs, fostering resilience and self-sufficiency within the community.
Hypothesis and risks	1. **Operational Challenges:** Difficulties in effectively using and maintaining new equipment without adequate training. 2. **Community Resistance:** Potential reluctance to adopt upgraded facilities due to unfamiliarity or cost concerns. 3. **Maintenance Sustainability:** Renewable energy systems and waste management infrastructure require ongoing funding and expertise to remain operational.
Budget	Investment : 4,300 k€ Op. Budget : 200 k€

Meat Processing

The planned improvements in the slaughterhouse facilities will bring significant benefits to both meat processing efficiency and working conditions for butchers.

1. **Hanging Rails**: The installation of hanging rails streamlines meat processing by enabling easy movement of carcasses throughout the facility. This system reduces manual handling, minimizing the physical strain on workers and ensuring faster, more sanitary processing from slaughter to storage.

2. **Separated Killing Area**: By establishing a distinct area for slaughter, the facility can maintain higher hygiene standards, isolating the killing process from other activities. This separation also improves safety for butchers by confining specific tasks to designated areas, reducing the risk of contamination and accidents.

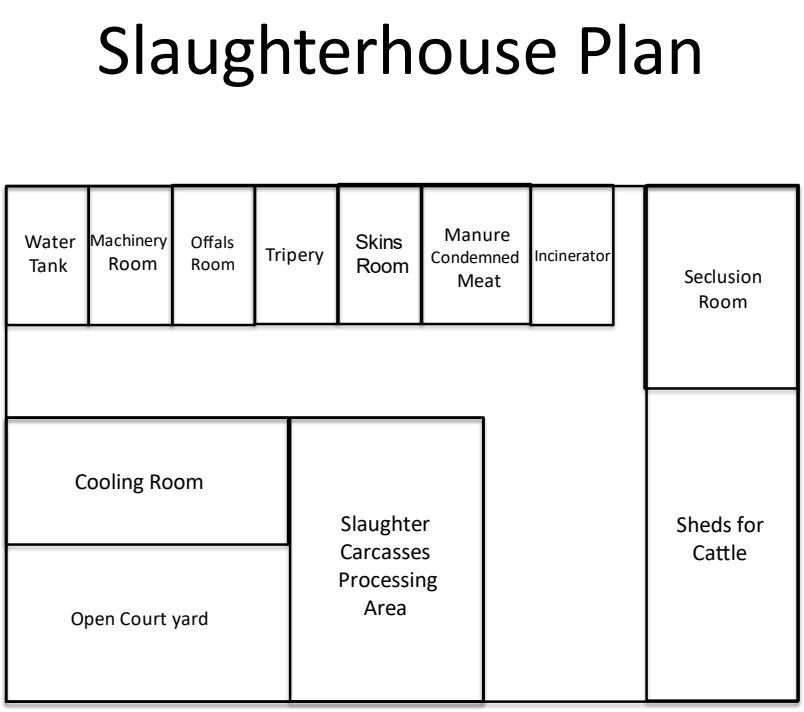
3. **Cattle Waiting Area**: A dedicated waiting area allows animals to rest before slaughter, reducing stress and improving meat quality. This area also contributes to more organized operations, enabling a steady workflow and a calmer working environment for butchers.

4. **Concrete Pad Facilities**: Concrete pads provide a stable, easy-to-clean surface that enhances sanitation and safety. This foundation minimizes slips, trips, and contamination, creating a safer, cleaner workspace for butchers and meat processors.

5. **Tripe Room**: The addition of a dedicated tripe room allows for the efficient processing of this valuable by-product without interfering with other operations. By isolating tripe processing, the facility can better manage sanitation and reduce odors, creating a more comfortable work environment.

6. **Hide and Skin Processing Area**: A designated hide and skin processing area adds value to by-products and reduces waste while keeping the main processing areas clean. This setup supports proper handling, reducing clutter and mess, and ultimately improves hygiene throughout the slaughterhouse.

Figure 11 Slaughterhouse Plan



Cold chain interest

The implementation of a cold chain in the slaughterhouse will enhance meat preservation by reducing bacterial growth, extending shelf life, and maintaining freshness. This reduces the pressure on butchers to sell within 12 hours and minimizes losses. It also allows for a wider variety of products, such as fresh cuts, ground meat, and processed items.

The goal is to store part of the production in cold storage, managing demand fluctuations and reducing waste. By minimizing spoilage and aligning supply with market needs, the cold chain ensures a more sustainable and profitable meat value chain.

Business plan

The government will finance the infrastructure, covering construction, equipment, and essential upgrades, while setting clear objectives for the operator. The government will also provide financial support to the operator for effective facility management and oversight.

Butchers will use the facility through a license fee, which will contribute to the infrastructure costs, ensuring they have access to necessary resources for efficient operations. Butchers will purchase livestock at daily market prices, process the meat on-site, and aim to minimize waste by utilizing all aspects of the facility, including cold storage and by-product processing.

This setup ensures that butchers operate sustainably and responsibly while supporting continuous skill development and resource availability within the facility.

7.4 SUBCOMPONENT 2: MARKET INFRASTRUCTURE IMPROVEMENT

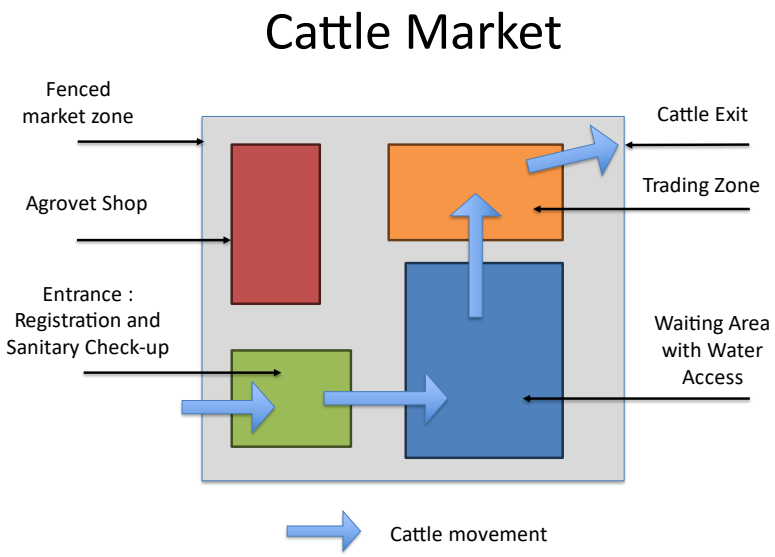
Objective	• Number of Cattle Registered per Week • Total Quantity of Commercialized Meat from the Zone
Outputs / outcomes	Outputs • Upgraded market infrastructure, including fencing, admin blocks, water systems, and agrovet stores. • Implemented traceability systems to enhance livestock monitoring and accountability. Outcomes • Secure and organized market operations, improving safety and biosecurity. • Transparent livestock tracking and enhanced trust in product origin.
Key partners	• **Local Government:** Funds infrastructure, sets regulations, and oversees compliance to ensure effective market operations. • **French Technical Consultants:** Design optimized market layouts and infrastructure plans, ensuring efficiency and functionality. • **Private Operator:** Manages daily operations, enforces biosecurity measures, and maintains traceability systems. • **Agrovet Suppliers:** Provide essential feed, veterinary supplies, and agricultural tools, supporting livestock welfare. • **Community and BreederCooperatives:** Engage with the project to ensure market facilities meet local needs, fostering community participation.

	• **Butchers:** Ensure efficient cattle flow while adhering to quality and biosecurity standards.
Investments on equipment and facilities	• Fencing, gates, and surveillance for market security and access control • Admin block for centralized management and record-keeping • Borehole, water storage tanks, and livestock troughs for reliable water supply • Agrovet stores for essential livestock supplies • Technical consultancy for market design and infrastructure planning
Key activities	1. Construction and Setup: Build fencing, admin blocks, and agrovet stores, and install security features to create a secure and functional market. 2. Water System Installation: Drill boreholes, install storage tanks, and set up troughs to ensure consistent water access for livestock. 3. Traceability System Implementation: Develop and implement livestock tracking measures to enhance transparency and accountability in market operations. 4. Technical Planning and Design: Work with French consultants to finalize site layouts and technical plans, ensuring efficient and practical infrastructure. 5. Community Engagement and Training: Conduct outreach programs to inform herders, and butchers about new facilities and provide biosecurity training. 6. Ongoing Management and Maintenance: Oversee daily market operations, maintain facilities, and ensure proper adherence to biosecurity protocols.
Interest	The market improvements aim to foster a professional trading environment that ensures safety, biosecurity, and operational efficiency. Reliable water access, traceability systems, and agrovet facilities strengthen animal welfare and market transparency, boosting confidence among buyers and sellers. These enhancements also encourage economic growth by supporting sustainable livestock practices and improving trading conditions.
Hypothesis and risks	1. **Challenges in Water Access:** Issues with boreholes or storage systems could disrupt water availability, affecting livestock welfare. 2. **Low Adoption:** Resistance from herders or butchers due to unfamiliarity or cost concerns may limit usage. 3. **Maintenance Challenges:** Long-term upkeep of fencing, water systems, and security features may face funding or operational issues. 4. **Biosecurity Compliance:** Ensuring consistent adherence to protocols amid high market activity is critical to reducing disease risks**.**

	5. **Agrovet Supply Chain Disruptions:** Delays or shortages in agrovet supplies could impact livestock health and market functionality.
Budget	Investment : 2,000 k€ Op. Budget : 250 k€

Infrastructure

Figure 12 : Cattle Market



The picture above illustrates the organized flow of cattle through the market, from entry and sanitary check-up to trading and exit, ensuring a secure and efficient process that prioritizes animal welfare and biosecurity.

1. Entrance: Registration and Sanitary Check-up:

Cattle enter the market through a designated entrance where they undergo registration and a sanitary check-up. This step ensures all animals meet biosecurity and health standards before entering the main market area.

2. Waiting Area with Water Access:

After passing through the entrance, cattle are directed to a waiting area with access to water troughs. This area allows animals to rest and hydrate before proceeding to the trading zones, reducing stress and improving welfare.

3. Trading Zone:

From the waiting area, cattle are guided into the trading zone, where buyers and sellers negotiate and conduct transactions. The structured trading zone helps maintain organized movement and ensures efficient handling of livestock.

4. Cattle Exit:

Once a transaction is completed, cattle are directed to the exit. This designated exit streamlines the flow, preventing congestion and ensuring that animals move smoothly out of the market after purchase.

5. Additional Facilities :

Throughout this flow, agrovet stores near the entrance offer feed, veterinary products, and farming supplies, supporting livestock needs and enabling herders to purchase essentials. The fenced perimeter around the market provides security and biosecurity, preventing unauthorized entry and controlling the flow of animals.

Cattle Negotiation

Cattle butchers purchase livestock from small rural markets, where farmers bring their animals for sale. After acquiring the cattle, butchers transport them to larger urban markets, where they are sold at higher prices. This system bridges the gap between herders and urban consumers, ensuring efficient distribution and meeting the demand for livestock in cities. Butchers play a key role in price negotiation, market supply, and connecting producers with buyers.

Business Model

The government will finance the construction and setup of five markets in Kwara State, creating secure and organized spaces for cattle trading. A committee in each market—comprising representatives from herders, butchers, and the operator—will oversee rules and organization, ensuring compliance with biosecurity, animal welfare, and fair trade standards.

The operator is the committee, they should be able to collect taxes on cattle sales to sustain the upkeep of market facilities

7.5 SUBCOMPONENT 3: TRAINING ON NEW FATTENING METHODS - AWARENESS AND EXTENSION SERVICES FOR HERDERS

Objective	1. Number of Cattle Raised in Feedlots 2. Average Sales Price and Weight of Cattle Sold
Outputs / outcomes	**Outputs** Established extension services, trained extension officers, and distributed communication material. **Outcomes** Improved cattle productivity and profitability through the adoption of sustainable fattening methods.
Key partners	• **Local Government and Agricultural Agencies:** Facilitate implementation, align with regulations, and ensure program outreach. • **French Technical Consultants:** Design and deliver expert training on nutrition, health, and fattening methods. • **Extension Officers:** Train herders locally to amplify knowledge and adoption. • **Industry Leaders:** Lead workshops to provide practical, hands-on fattening techniques. • **Community and BreederCooperatives:** Mobilize local participation and support adoption efforts.
Investments on equipment and facilities	
Key activities	

	1. **Setup Extension Services:** Provide ongoing support for herders and stakeholders across key cattle management areas. 2. **Develop Communication Strategy:** Create and implement campaigns to promote training programs and highlight the benefits of fattening techniques. 3. **Conduct ToT Sessions:** Train extension officers to deliver knowledge effectively at the community level. 4. **Host Fattening Workshops:** Provide hands-on training in nutrition, health, and commercialization practices. 5. **Distribute Learning Materials:** Ensure accessibility to guides, videos, and tutorials for all stakeholders. 6. **Community Sensitization:** Engage local stakeholders through meetings and informational sessions to build trust and promote transparency. 7. **Monitor and Support:** Conduct follow-ups to address challenges and ensure consistent application of training.
Interest	The component aims to build a resilient community equipped with modern cattle management skills. By empowering herders and other stakeholders, it promotes sustainable practices, improves economic outcomes, and strengthens the livestock value chain.
Hypothesis and risks	1. **Low Adoption**: Traditional practices and cost concerns may hinder acceptance of new methods. 2. **Access Challenges**: Remote communities may face barriers to participating in training. 3. **Sustainability of Impact**: Inconsistent follow-ups may reduce long-term adoption of techniques. 4. **Extension Officer Turnover**: A shortage or turnover of trainers could weaken the program's effectiveness.
Budget	Investment : 0 k€ Op. Budget : 595 k€

The objective is to provide holistic training for herders, covering all critical aspects of cattle management to improve productivity, profitability, and sustainability. This comprehensive approach means that the training will address multiple interconnected areas, giving herders a well-rounded understanding of modern cattle management practices that impact the entire livestock value chain. The training program includes:

1. Nutrition: Training on balanced diets, feed selection, and nutritional supplements to optimize cattle health and growth rates.

2. Health Management: Instruction on disease prevention, vaccinations, parasite control, and overall herd health practices to ensure a strong, resilient livestock population.

3. Reproduction: Guidance on reproduction strategies, including artificial insemination (AI) and breeding techniques, to improve herd quality and productivity.

4. Fattening Techniques: Modern fattening methods tailored to local conditions, aimed at enhancing cattle weight and meat quality efficiently.

5. Commercialization: Training on market trends, pricing strategies, and sales channels to help herders maximize profits and engage with the broader market effectively.

6. Record Keeping and Traceability: Teaching herders how to track animal health, breeding records, and sales, which supports transparency, accountability, and informed decision-making.

This holistic training approach empowers herders with the knowledge to manage all aspects of cattle care, health, and commercialization, ultimately contributing to a more efficient, profitable, and sustainable livestock industry.

The Training of Trainers (ToT) program is a key part of the training component, designed to expand knowledge and reach within the community efficiently. In this model, a group of selected individuals—typically extension officers or local leaders—receives in-depth training on the new cattle management techniques. These trainers then pass on what they've learned to a wider group of herders within the community, acting as local experts and points of reference.

Purpose and Benefits of ToT:

1. **Broader Reach:** By equipping trainers who are already embedded in the community, knowledge spreads widely and rapidly, reaching more herders than a centralized training program could alone.

2. **Sustainability:** The ToT program builds local expertise, ensuring that the knowledge remains within the community even after the initial program ends. Trainers can continue to share and support best practices long-term.

3. **Adaptability:** Local trainers understand community needs, cultural nuances, and specific challenges herders face. This allows them to adapt the training materials to be more relevant and effective.

4. **Continuous Support:** Trainers can provide ongoing guidance and answer questions as herders begin to implement new techniques, ensuring consistent application and troubleshooting any challenges.

The government's support is central to the success of the training program. They will collaborate with French specialists who bring expertise in cattle management, as well as with local communities and associations to ensure that the training is tailored to local needs. These French experts will train local trainers through the Training of Trainers (ToT) model, equipping them with advanced knowledge in areas like nutrition, health, and reproduction to share with the broader community.

A vital part of this effort is the sensitization campaign, which aims to raise awareness among herders about the benefits of adopting modern cattle management practices. This campaign will communicate how improved methods contribute to higher productivity, profitability, and animal welfare. Using community meetings, radio broadcasts, and printed materials, it ensures that even remote herders understand the project's value and are encouraged to participate actively.

Through this combined approach of training and sensitization, the project fosters trust, reduces resistance, and promotes community involvement. This collaboration with French specialists, local associations, and trained local leaders empowers herders with both the knowledge and the motivation to implement sustainable practices, benefiting individual livelihoods and the entire livestock sector.

7.6 SUBCOMPONENT 4: CONTRACTUALISATION IMPLEMENTATION

Objective	1. Number of Signed Contracts 2. Average Sales Price and Weight of Cattle Sold 3. Total Quantity of Commercialized Meat from the Zone
Outputs / outcomes	**Outputs** Signed contracts and organized delivery schedules. **Outcomes** Stabilized market operations and improved collaboration between herders and butchers.
Key partners	1. **Herders' Associations**: Ensure contract compliance and organized livestock supply. 2. **Butchers' Associations**: Align demand and supply schedules for reliable market operations. 3. **Local Government Authorities**: Provide oversight, mediate disputes, and ensure stability. 4. **Legal Consultants**: Draft enforceable contracts adhering to local regulations. 5. **Market Monitoring Committee**: Monitor adherence and ensure market equilibrium. 6. **Financial Institutions**: Support herders and butchers with financial solutions to meet obligations.
Investments on equipment and facilities	
Key activities	**1. Stakeholder Engagement:** Facilitate meetings to align herders, butchers, and partners on contract terms. **2. Contract Drafting:** Collaborate with legal consultants to develop clear and enforceable contracts. **3. Training Programs:** Educate stakeholders on contract terms, compliance, and market regulations. **4. Market Monitoring:** Implement systems to track adherence and ensure balance. **5. Contract Signing:** Distribute and securely store signed agreements. 6. **Performance Evaluation:** Conduct regular reviews to refine and adapt contracts as needed.
Interest	Contracts stabilize the market, foster trust, and enhance productivity by ensuring predictable supply-demand relationships and supporting economic resilience.

Hypothesis and risks	• **Resistance from Butchers**: Butchers may resist changes that bypass their traditional roles. • **Non-Compliance**: Some herders or butchers might not adhere to agreed terms. • **Regulatory Changes**: Shifts in laws could disrupt enforcement or require adjustments. • **Market Volatility**: Unpredictable supply-demand changes may strain contract commitments. • **Administrative Challenges**: Inefficient contract management could reduce effectiveness.
Budget	Investment : 0 k€ Op. Budget : 100 k€

The contract process will be facilitated within the cattle market, with herders and butchers in direct contact. Upon signing the contract, the butcher provides an advance payment to the farmer. This initial payment helps the butcher by slightly reducing the overall cost of the cattle while offering the breederimmediate access to funds. Farmers can use these funds to invest in critical resources, such as feed or veterinary care, to enhance the quality of their livestock.

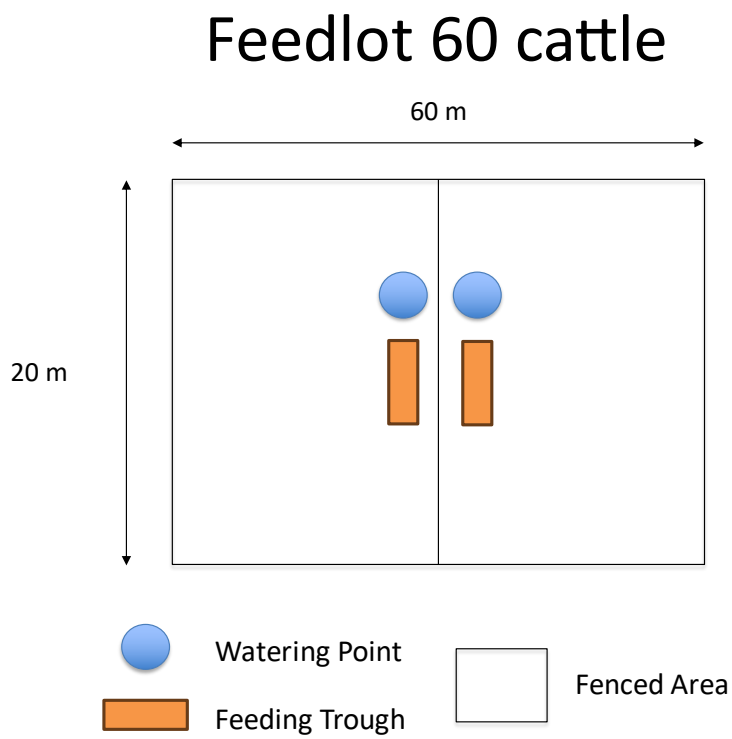
To ensure butchers can meet the advance payment requirement, negotiations with financial institutions will need to be carried out to develop tailored financing options, offering them the necessary liquidity without added financial strain. This approach creates a balanced market dynamic, enabling herders to improve productivity while fostering strong and sustainable relationships between all stakeholders.

7.7 SUBCOMPONENT 5: DEMONSTRATION FEEDLOT

Objective	• Average Sales Price and Weight of Cattle Sold • Weight of Processed Meat per Butcher • Total Quantity of Commercialized Meat from the Zone • Number of cattle raised in feedlot
Outputs / outcomes	**Outputs** Functional demonstration feedlot facility with regular training session **Outcomes** Improved livestock management practices and increased regional adoption of sustainable techniques.
Key partners	1. **Herders' Associations:** Mobilize participants for training and promote improved cattle management. 2. **French Cattle Specialists:** Provide technical training, oversee workshops, and ensure best practices in cattle handling and feedlot operations. 3. **Local Government Authorities:** Fund infrastructure, provide logistical support, and scale successful practices.

	4. **Feed and Equipment Suppliers:** Supply feed, handling tools, and materials needed to maintain the feedlot. 5. **NARI and NAPRI:** Collaborate on data collection, analyze system comparisons, and disseminate findings for broader adoption.
Investments on equipment and facilities	• Feedlot and grazing infrastructure. • Handling and weighing equipment. • Training and demonstration facilities. • Data collection and monitoring tools. • Feed storage and veterinary supplies.
Key activities	1. Construct Feedlot and Grazing Facilities Build pens, sheds, and feeding areas to enable hands-on training and system comparisons. 2. Train Herders and Technicians: Deliver workshops covering feeding, health management, and livestock handling practices. 3. Collaborate with Research Institutes: Partner with NARI and NAPRI to analyze data and document findings for national application. 4. Monitor and Evaluate: Track cattle performance to assess the impact of grazing and feedlot practices, refining training as needed. 5. Promote Knowledge Sharing: Engage communities to share results and encourage adoption of effective practices.
Interest	The Demo Feedlot empowers participants with practical skills in livestock management, fostering productivity, profitability, and sustainable development while serving as a regional hub for knowledge sharing and innovation.
Hypothesis and risks	1. **Low Adoption**: Resistance to change may reduce training effectiveness. 2. **Maintenance Issues**: Infrastructure upkeep could disrupt operations. 3. **Disease Risks**: High cattle density increases potential for disease outbreaks. 4. **Financial Constraints**: Sustaining operations may pose resource challenges.
Budget	Investment : 550 k€ Op. Budget : 50 k€

Figure 13 : Feedlot Design



Demo Feedlot with Integrated Grazing and Feedlot Fattening

The feedlot is a fenced area designed to hold cattle with approximately 20 square meters per animal, ensuring constant access to water and feed. By restricting movement, the design maximizes weight gain, enabling cattle to reach optimal finishing efficiently. Secure fencing is essential for containment and protection, forming a practical and cost-effective structure for fattening operations.

In this example, the feedlot can be divided into two pens, each accommodating 30 animals. This setup enables comparative evaluation of feed rations, cattle breeds, and performance metrics such as feed efficiency and growth rates, supporting data-driven decisions for improved productivity.

Grazing-Based Fattening Integration

The facility also includes dedicated infrastructure for grazing-based fattening, providing an alternative method to raise and finish cattle. Rotational grazing systems will be implemented, with well-maintained pastures that supply high-quality forage. Participants will learn to optimize grazing to enhance cattle health and growth while minimizing costs, creating a sustainable fattening model tailored to regional conditions.

Strategic Location and Integrated Facilities

The Demo Feedlot will be co-located with the Semen Production Center (SPC) and Nucleus Farm, ensuring seamless integration between breeding, training, and cattle management activities. This centralized hub facilitates resource sharing, operational efficiency, and hands-on learning across the livestock value chain.

Participants will observe and practice key techniques, from genetic improvement at the SPC to breeding and feeding practices at the Nucleus Farm, fostering a holistic approach to livestock

development. Robust biosecurity measures will be implemented to maintain animal health and prevent cross-contamination between facilities.

Comprehensive Training at the Demo Feedlot

Participants will gain hands-on experience in the following areas:

1. **Feeding and Hay Making**:
   Training in balanced nutrition, hay production, and efficient storage to ensure consistent, year-round feed quality.

2. **Grazing and Feedlot Systems**:
   Comparative workshops on grazing-based fattening versus feedlot systems, providing insights into costs, benefits, and best practices for each approach.

3. **Reproduction and Genetics**:
   Instruction on reproduction management, including artificial insemination (AI) and genetic selection, to enhance herd productivity and adaptability.

4. **Health Management**:
   Practical workshops on preventive care, disease identification, and basic treatments to maintain cattle health and reduce risks.

5. **Contract Training**:
   Guidance on establishing secure agreements with stakeholders to stabilize supply, ensure fair pricing, and secure revenue streams.

6. **Commercialization**:
   Market-driven skills development, including demand analysis, relationship building with buyers, and maximizing profitability.

7. **Financial Management**:
   Essentials of budgeting, record-keeping, and cash flow management to ensure sustainable and scalable operations.

This integrated approach equips participants with actionable knowledge and practical skills, empowering them to make informed decisions about cattle management and fattening systems. The Demo Feedlot's dual focus on grazing and feedlot systems ensures participants can tailor strategies to their resources and goals, fostering productivity and sustainability in the regional livestock sector.

8 COMPONENT 8: WATER AND TRANSPORTATION INFRASTRUCTURES

8.1 REMIND OF THE MAIN GAPS IDENTIFIED

Water is a big issue especially during dry season when the rivers dry. The Fulani community has no (or poor) access to drinking water in the Reserve.

- Water availability is a prerequisite for the development of milk and meat production in the reserve
- The lack of drinking water availability is time consuming for women who must fetch the water far from their settlement
- There is no irrigation supporting fodder production.
- There is a strong willingness (from the Ministry of Agriculture agents and the beneficiaries) to test and, if possible, deploy up-scaled irrigated systems to develop forage crops.
    - The communication network consists of dirt roads that are not practicable all during the year.

8.2 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "WATER AND TRANSPORTATION INFRASTRUCTURES"

OBJECTIVE AND KPIS

The main objective of this component is to support the development of the milk and meat production in the Reserve. Water is necessary for both the cattle and the humans. Using concentrate to feed the cattle requires large quantities of water it. Feeding the cattle also necessitates to improve the yields of the fodder production and irrigation could contribute to this objective.
KPI could be the number of watering points created, the number of households located within less than 400 m to a drinkable water source, the number of herds benefitting of water, the areas of irrigated fodder and the quantity of additional produced fodder and the numbers of realized dams, the areas of irrigated fodder and the additional fodder / hay production. A convenient transportation network is essential for the milk value chain development as well as for the transport of agricultural inputs or animal feed.
KPI could be the length of improved dirt roads and the households (herders that produce milk) located within 200 m of an improved track

STRATEGY

The strategy will aim to:

- Launch a general groundwater assessment in the Reserve
- Create watering points by drilling boreholes equipped with solar pumps, tanks and irrigation equipment
- Irrigate several fodder fields for hay production (legumes and performant grass)
- Launch a water surface study do identify appropriate sites
- Create small dams to develop irrigated fodder production
- Create small irrigation schemes
- Map the Reserve (existing dirt road network, location of the households…)
- Undertake a road network master plan study

- Improve the dirt road network to facilitate the milk collection and more generally the transportation of agriculture inputs and goods.

The FASEP April 2024 workshop revealed that there are high expectations regarding the development of irrigation to increase forage production (grass and legumes) in the Lata pasture reserve. Higher quantities and better forage quality are both expected.

Irrigation could be a game changer if it leads to productions of forages that can contribute significantly to higher milk production and to higher meat production as it was highlighted in the diagnostic report. More forages with more concentrated feed and more water are essential for the improvement of both milk and meat value chain especially at Lata Reserve level. Using concentrated feed requires increasing the quantities of water available for the cattle.

Irrigation in Lata Reserve can be developed using groundwater resources or by mobilizing surface water (see nextAnnex 4 8.3 component).

The estimation of the water requirements for fodder in the Lata Reserve area led to conclude that an annual average amount of net 435 mm of water (with about 50 m3 per day per ha max) would be a profitable irrigation dose that could increase the fodder yield from 5 to 10 tons of dry matter per ha. It is expected that large diameter borehole would serve 2 ha[8] of irrigated fodder in dry season and it will also contribute to decrease the irregularities of rains during rainy season, contributing to increase the quality of the fodder.

Details of fodder water requirements are provided in Annex 4, it also provides information about the different irrigation technologies (on the plot irrigation).

During the rainy season, as the solar power system is not used at 100%, a few test of “seasonal storage basins (macro basins)” with additional irrigation equipment will be tested to pump the groundwater during rainy season, to store it in a basin and to use it in dry season. This solution would increase the irrigated area of a borehole by 1 to 2ha.

8.3 SUBCOMPONENT 1: WATERING POINTS AND IRRIGATION SYSTEMS USING GROUNDWATER

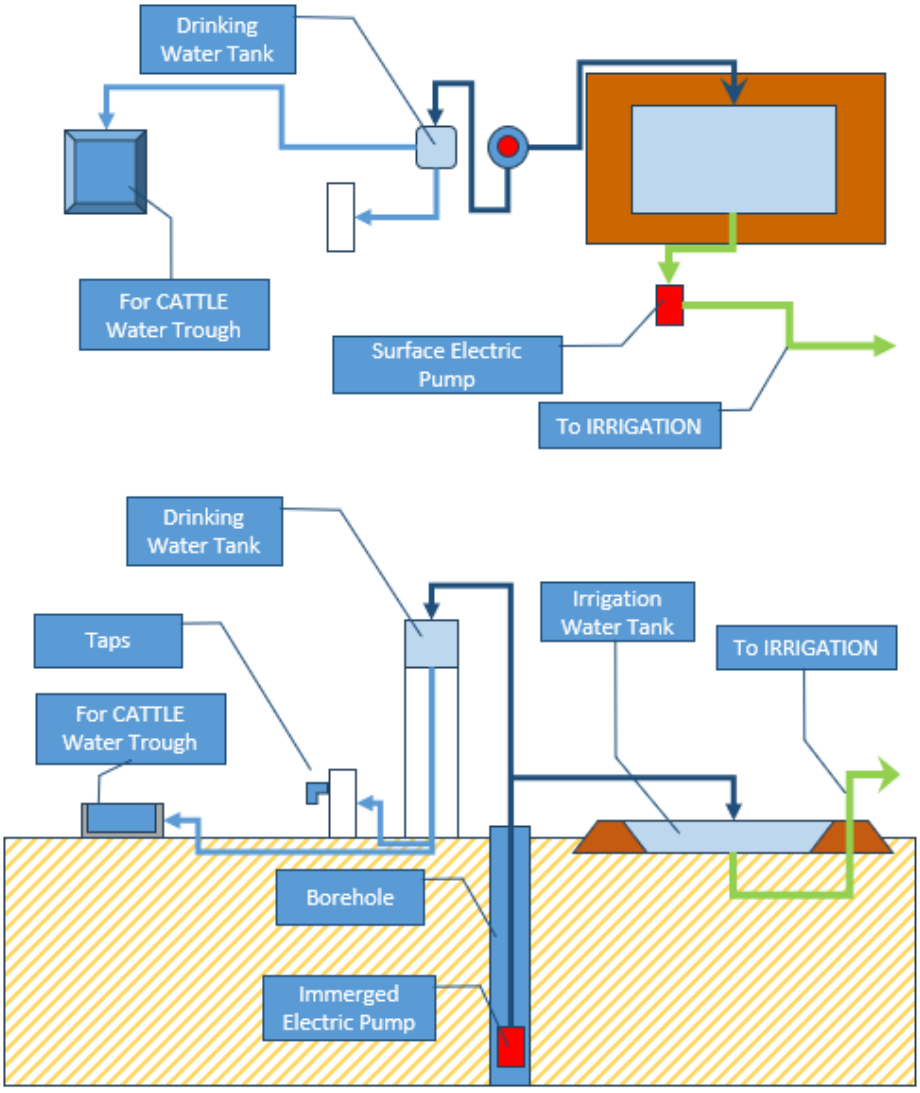
Objectives	Provide water for the cattle living in the Reserve and the Fulani. In addition, a part of the available water will be used for fodder irrigation.
Outputs / outcomes	Output: Watering points Outcome: Better cattle watering and irrigation of fodder crops.
Key partners	French Engineering firm Nigerian private sector Local youth community for Labor Intensive Works
Investments on equipment and facilities	83 watering points (drilling 8”) as standard watering points equipped with solar pumps, tanks and water trough scattered in the Reserve with 16 out of them dedicated to the **Rental Plots** For Fulani Herders In Lata Grazing Reserve 15 watering points (drilling 16”) full equipped (solar pumping, water tank…) with fodder irrigation system (**for 2 ha each).** 6 Seasonal storage basins (for 1 to 2 ha of irrigated forage each)
Key activities	1: General survey for groundwater potential with geophysical prospections 2: Bore hole drilling 3: Installation of equipment: solar generator, electrical pumps, tanks, taps, water trough, irrigation system 4: Training of the users 5: Training for maintenance of the systems
Interest	Better access to drinking water for the Fulani community.

[8] For all borehole, the capacity cannot be determined without appropriate on-site tests realized when the borehole is drilled. Then, it could be more or less than 2 ha.

	Provide water to the cattle that will better profit from feeding for milk and meat production. Allow better fodder production in irrigated areas.
Hypothesis and risks	The groundwater resource is sufficient and homogeneously spread in the Reserve.
Budget	Investment : 2,892 k€ Op. Budget : 540 k€

The way a watering point can be used for irrigation is illustrated below:

Figure 14: Borehole equipped for irrigation with inter-seasonal water storage (solar panels not represented)



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The different concepts of groundwater mobilization are presented in Annex 8.3.

8.4 SUBCOMPONENT 1: SMALL DAMS AND ASSOCIATED IRRIGATION SCHEME

Objectives	Create 3 small dams for fodder irrigation
Outputs / outcomes	Output: Realization of 3 small dams Outcome: Production of irrigated fodder
Key partners	French Engineering firm

	Nigerian public works companies Local youth community for Labor Intensive Works
Investments on equipment and facilities	Construction of 3 small dams with associated irrigation schemes (using gravity and pressurized irrigation techniques). Solar generators, electrical pumps. On dam will be dedicated to the Seed Production Unit (eventually located out of the Reserve), an other will be devoted to the Demo Farm and a third one would be built in case a sustainable business model is met with hay production activities or other animal feed related matter.
Key activities	1: Study on the water surface potential of the Reserve 2: 5 studies (5 feasibility and 3 detailed studies) for dams' construction 3: Construction of dams on 3 sites with associated irrigation scheme (50 ha expected for each) 4: Training and assistance to the beneficiaries (management of the facilities, irrigation techniques, fodder production and harvesting…)
Interest	Developing fodder production with irrigation.
Hypothesis and risks	The Reserve offers sufficient favorable sites (topography, water resources) The organization of the beneficiaries allows a good management of the infrastructures and equipment.
Budget	Investment : 1,575 k€ Op. Budget : 1,610 k€

8.5 SUBCOMPONENT 3: TRANSPORTATION NETWORK IMPROVEMENT

Objectives	Facilitate the milk collection and the transportation of agricultural inputs and other goods
Outputs / outcomes	Output: 40 km of dirt roads are improved Outcome: Contribution to the milk value chain development
Key partners	Nigerian private sector Local youth community for Labor Intensive Works
Investments on equipment and facilities	40 km of dirt roads will be improved. It concerns the dirt road (platform and drainage) and the necessary interventions on critical point (stream crossings).
Key activities	1: Study on the road network to plan regarding the expected developments of the Project 2: Road improvement works (with a LIW component)
Interest	Facilitate the transportation of dairy products and other goods.
Hypothesis and risks	The local government ensures, with the participation of the beneficiaries, proper maintenance of the improved road.
Budget	Investment : 3,200 k€ Op. Budget : 175 k€

9 COMPONENT 9 WOMEN AND YOUTH EMPOWERMENT

1.1-REMIND OF THE MAIN GAPS IDENTIFIED

Fulani women play an essential role in Fulani society, contributing significantly to the community's economic, social and cultural well-being. Their contributions are multiple and encompass various aspects of daily life within the Fulani community.
The interests of young people are divided according to their communities: the youth of Lata-Nna (Nupe) consider agriculture as an outdated activity, but they would be inclined to engage in agro-food-related activities, while the Fulani youth are relatively satisfied with the profession of livestock farming and practice agriculture opportunistically as it is a source of income. The youth from both communities aspire to secure salaried jobs (civil servants or employees of private companies), but such jobs are lacking in the area. They are all willing to develop small businesses, provided they have access to funds that will enable them to start these ventures.

- **Economic**: Fulani women actively participate in the pastoral economy by helping their husbands manage livestock, milk cows and prepare dairy products. They also contribute to the household economy by making and selling handicrafts, such as woven textiles, jewellery, mats and leather goods.
- **Social and cultural**: Fulani women are the pillars of the family and community. They look after children, the elderly and the sick (some of them have been introduced to the power of plants and have developed genuine expertise in medicinal plants). They are responsible for maintaining domestic traditions and passing on cultural knowledge to younger generations. Their role as educators and storytellers ensures the preservation of Fulani heritage and values.
- **Leadership roles**: Although Fulani society is traditionally patriarchal, there are instances where Fulani women have become leaders and decision-makers. Their experience has enabled them to play a leading role in resolving disputes, mediating conflicts and managing community affairs.
- **Challenges and resilience**: Fulani women face challenges such as gender inequality, limited access to education and healthcare, and the need to reconcile domestic responsibilities with economic activities.
- These women face **many domestic tasks** (fetching and carrying drinkable water, collecting firewood in the forest for cooking, collecting guinea fowl eggs, and then going to the market to sell them, etc.) that leave them with little time to educate themselves or engage in income-generating activities.
- Many young Fulani women aspire to improve their living conditions, both socially and in terms of their income. Thanks to the use of smartphones, they are becoming very open to engaging in non-traditional activities: nurse, teacher, even photographer...
- Lack of stable and well-paying jobs,
- Difficulty in raising funds to start a business, craft work, or any other venture.

9.1 MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "WOMEN EMPOWERMENT"

OBJECTIVE AND KPIS

The objective of this Component 12 is to empower Fulani women through education (functional literacy for those who haven't been to school and wish to, and/or more technical training focused on "crafts"), the development of a culture of teamwork (possibly in the form of a cooperative or

other structure if more suitable), and access to micro-financing to develop income-generating activities

Typical KPI are the number of new incomes generating activities launched by individuals and new associated (eventually cooperatives) structures that provide jobs and revenues to women.
The objective of this Component 13 is also to empower Fulani and Nupe youth through education (functional literacy for those who haven't been to school and wish to, and/or more technical training focused on "crafts") and access to micro-financing to develop income-generating activities

Typical KPI are the number of new incomes generating activities launched by individuals or any kind of association they would like to create. The number of permanent jobs (Fulani and Nupe) created will also be a KPI

STRATEGY

The strategy will aim to:

- Free time from time-consuming household tasks to invest time in training or income generating activities for the women
- Provide a full equipped vocational training center (metal, wood, electronic and FabLab workshop, collective kitchen…)
- Provide targeted vocational training
- Encourage the ability to work within a cooperative framework or other kind of association (see 0 Governance)
- Give easy access (after successfully completing a technical training and micro-business course) to micro-credit
- Provide a business activity follow-up and monitoring by the technicians of the Project.

9.2 SUBCOMPONENT 1: FREE UP TIME FROM TIME-CONSUMING HOUSEHOLD TASKS

Objectives	Free up time to focus on training and the development of income-generating activities.
Outputs / outcomes	Output: Dissemination of improved wood stoves. The large number of planned water wells will significantly reduce the time spent searching for water. Solar grain mills are used during periods of low water needs (same solar generators than those of the boreholes) Outcome: Women get time to follow literacy and / or vocational training (including small business management) and to ensure regular income generating activities.
Key partners	Eco-Benin (improved wood stoves skilled NGO)
Investments on equipment and facilities	1: Wood stoves: very little investment (that could be eventually funded by micro-credit) 2: Grain mills (using solar generators of the boreholes during low water demand period) 3: Boreholes: for drinkable water, financed for cattle needs but human needs are considered (then no specific budget in this component)
Key activities	1: Sensitization about wood fire collection and forest protection 2: Sensitization about the use of improved wood stoves 3: Adoption of improved wood stoves 4: Use of solar powered grain mills 5: Use of close boreholes as drinking water
Interest	Women (especially young ones) have time to train and engage in profitable activities.

Hypothesis and risks	Women and the head of the household are convinced that gaining time is profitable for all the household. Risk: Tradition could weigh on the possibility of women attending training or adopting activities that could free up time for other pursuits.
Budget	Investment : 6 k€ Op. Budget : 52 k€

9.3 SUBCOMPONENT 2: LITTERACY AND VOCATIONNAL TRAINING

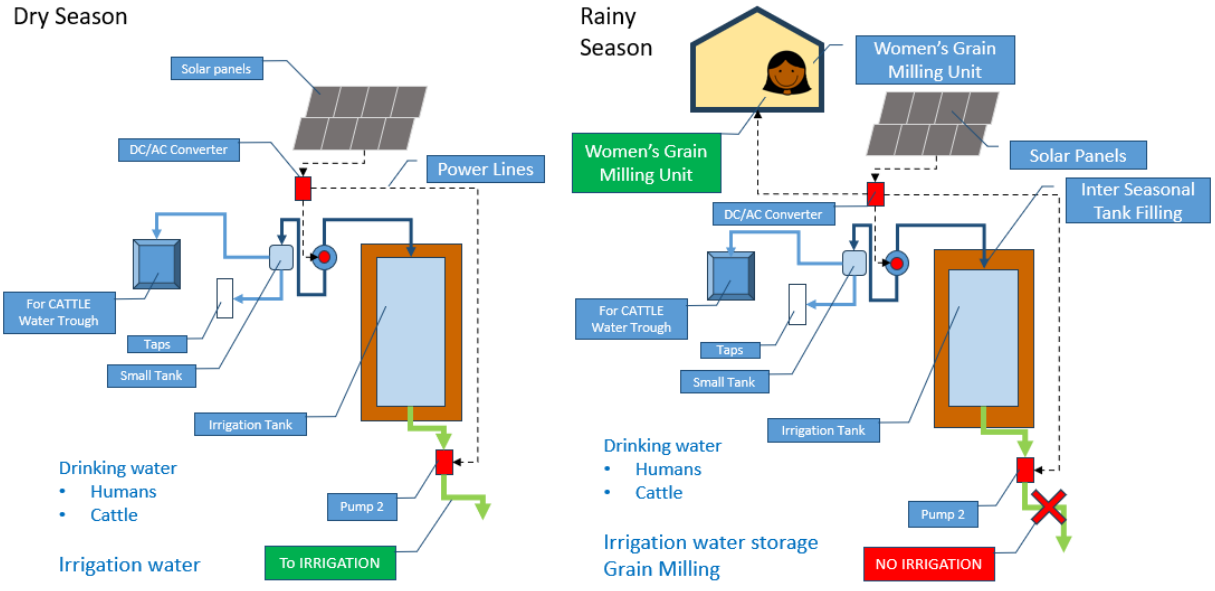
Objectives	Provide each woman with a skill set aligned with her desire for empowerment.
Outputs / outcomes	Output: Literacy training, vocational training and small business education. Outcome: Women have the capability to initiate a small, profitable project and engage in discussions with a representative from a microfinance agency to secure the necessary funding. This process not only enhances their entrepreneurial potential but also strengthens their financial independence. By developing viable business ideas, they can demonstrate the feasibility of their projects and present them for financing opportunities, which can, in turn, contribute to their economic empowerment and community development.
Key partners	Various NGO operating in Kwara state.
Investments on equipment and facilities	There is no investment as the requested premises will be built on the Demo Farm site and the budget is integrated to the Demo Farm budget. The required investment are recorded in the Component 13 (Youth empowerment). Women will have the opportunity to use the facilities described in the next chapter. The main part of the budget is allocated to workshops and training.
Key activities	1: Participatory inventory of training demands (workshops) 2: Training of trainers 3: Literacy training 4: Vocational training 5: Small business management training
Interest	These training programs will serve as a foundational reference, providing the learner with basic knowledge and practices to carry out the targeted activity. Additionally, they will act as a basic competency benchmark for the microfinance agency representative who may finance the activity.
Hypothesis and risks	During the appraisal phase of the Project, we saw a strong demand: women have high expectations regarding the improvement of their socio-economic prospects. Some have clearly expressed the desire to engage in non-traditional activities (photographer) while remaining within their community. The training are well suited allowing the young men to engage new and profitable activities (e.g. Beef Fattening). Risks: Men (father or husbands), sometimes more traditional, may hinder these desires for empowerment. Trained young men leave their community to live in other area such as Ilorin (especially those who followed vocational training)
Budget	Investment : 230 k€ Op. Budget : 748 k€

9.4 SUBCOMPONENT 3: ACTIVE WOMEN COOPERATIVES ENHENCEMENT

Objectives	Promote and support the organization of common resource exploitation to increase the income of Fulani women.
Outputs / outcomes	Output: Back yard garden development, grain milling, fish farming… Outcome: Women who decide to join forces to exploit community resources see their income and comfort increase.
Key partners	The Project, the Reserve herders' association, the Kwara State Ministry of Women Affairs and Social Development
Investments on equipment and facilities	The investments will concern: 1: Electric grain mills (using existing solar generator of boreholes during low water demand period) 2: Fish ponds (using pumped from existing borehole during rainy season) 3: Equipped collective kitchen room (food laboratory to test and to treat products of gardens) 4: Beehives and beekeeping equipment
Key activities	1: Grain milling 2: Fish farming 3: Bee keeping 4: Processing/preserving vegetables grown in kitchen gardens.
Interest	Strengthen community ties and increase household incomes.
Hypothesis and risks	Hypothesis: Proper coordination of the use of shared equipment is achieved (e.g., solar panels for pumping and grain milling). Risks: At the start of the project, water resources will remain limited, and there is a risk that the available solar power during the rainy season (a period without pumping needs) will still be used for watering animals.
Budget	Investment : 79 k€ Op. Budget : 52 k€

The concept of grain milling facility using existing solar system is illustrated below.

Figure 15Grain milling facility associated to existing solar system dedicated to water lifting



9.5 SUBCOMPONENT 4: MICRO-BUSINESS

Objectives	Provide incomes to the Fulani women / households
Outputs / outcomes	Output: Various income generating activities and gardening. Outcome: The economical resilience of the households is increased.
Key partners	Micro credit specialized bank
Investments on equipment and facilities	As it is linked with the realization of bocage forage plots (see Component Environment): • A workshop for manual metal mesh manufacturing • Starting kit of galvanized iron wires for fences (10 km) The micro-credit fund is an operating budget (but it remains constant all during the live span of the Project). The only investment of the Project will be the creation of irrigated small gardens using a thin part of the pumped water of the boreholes (fence, small irrigation equipment, gardening tools…).
Key activities	It is an open set of income-generating activities that women can launch using microcredit. The list is flexible, like "on-demand training," but we have identified that gardening is an activity practiced in most households within the Reserve. 1: Creation of 50 small gardens (0.20 ha each) 2: Allocation of funds through microcredit (women and men)
Interest	Women and the youth will improve their revenues.
Hypothesis and risks	Hypothesis: The demand for income-generating activities is strong and the micro-business promoters, following the ad hoc training they received, prepare relevant proposals. Risk: It is difficult to assess the risks at this stage as they are highly dependent on the nature of the activity or external factors (climate, livestock theft, etc.). However, the experience of microcredit operations with poor women worldwide shows that most repayments are made in full.
Budget	Investment : 55 k€ Op. Budget : 171 k€

10 COMPONENT 10 ENVIRONMENT & GOVERNANCE

1.2-REMIND OF THE MAIN GAPS IDENTIFIED

ENVIRONMENTAL ISSUES

The diagnostic phase of the study highlighted several environmental issues that could pose problems in the long term. These include:

- Significant deforestation in the Reserve;
- Extensive growth of the invasive plant *Hyptis suaveolens*;
- The accumulation of all kinds of waste in the streets of the village of Lata-Nna, and
- The careless use of pesticides (as well as veterinary drugs).

Addressing all these aspects is challenging, but cross-cutting actions from other components will help mitigate some of the identified issues: the dissemination of improved cookstoves will reduce pressure on the forest, pasture regeneration activities will lessen the impact of the invasive plant (*Hyptis suaveolens* also called “bush mint”), and training on animal health will promote better use of veterinary medicines. The use of agricultural pesticides will also be included in the technical training provided to young people.

GOVERNANCE

The “users” of the Reserve are :

- **The pastoralists** are the primary users of the reserve. They graze their cattle on the reserve's pastures and use its water resources. Pastoralists are responsible for adhering to grazing rules and regulations, and they should contribute to the maintenance and development of the reserve.
- **The farmers** who live around the reserve are also stakeholders in its governance. They are affected by the activities of pastoralists and should be involved in decision-making processes. Farmers should also respect the reserve's boundaries and avoid encroachment.

The governance of Lata Grazing Reserve is challenging due to several factors, including:

- **Lack of clear ownership**: The reserve is owned by the Kwara State government, but there is no clear ownership that can lead to conflicts over land use and resource allocation.
- **Overgrazing**: The reserve is overgrazed, which can lead to soil degradation and a decline in the quality of pasture. Overgrazing is caused by the high number of cattle that are grazed on the reserve and the lack of alternative grazing lands for pastoralists.
- **No demarcation for crops land**: The lack of demarcation for crop lands and the continuous expansion of agricultural areas intensifies conflicts and challenges in resource management.

We therefore consider that two areas require specific activities: integrated natural resource management on the one hand, and integrated waste management on the other.

Two participatory natural resources inventories are planned. The first one will cover all animals and flora living in the Reserve. It aims to get a good understanding of the living elements of the Reserve and eventually to identify useful plants (e.g. for traditional medicine uses). The second one will focus on the existing pastures: the Project plans to introduce new fodder crops and it is important to have a good understanding of the existing vegetation in order to preserve it in case the introduced plants do not perform well or are affected by disease. Preserving the existing heritage, which is adapted to the soils and climate of the Reserve, enhances the resilience of the system.

1.3-MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "ENVIRONMENT AND GOVERNANCE"

OBJECTIVE AND KPIS

In addition to the aspects listed above, the "Environment" component will aim to establish a thorough understanding of the area to preserve it while enabling the sustainable exploitation of its resources, as well as implementing an integrated waste management system.

KPI may include conducting natural resource inventories, monitoring the environment status (including weather and climate) resource use, and creating pilot pastures designed in the style of traditional European bocage systems (agro-sylvo-ecology).

Furthermore, the Demo Farm will house a herd of at least 60 cattle, whose waste can be used either as manure or converted into biogas and digestate. Organic waste from the village of Lata-Nna can be incorporated into this biogas production chain. The biogas can be purified to obtain rich methane gas that can be compressed and stored in steel gas bottles. These bottles could be delivered to the Fulani households. Plastic waste can be collected and incinerated, and the heat generated can be used to maintain the biogas digester temperature at 34°C (optimum temperature).

For the "Governance theme", the objective is to contribute to the definition of a participatory a frame of sustainable development for both the herders and the farmers. It concerns the management of improved pastures, the cropping activities and especially the interactions between herders and farmers and the establishment of appropriate structures (like cooperatives) to ensure proper use of the resources of the Reserve.
KPI could be the diminution of conflicts between farmers and herders, the adoption of good management practices related to improved pastures (rental plots for herders and bocage landscape pastures) and the number of created and functional appropriate collective structures.

STRATEGY

The strategy will aim to:

- Realize an exhaustive base-line survey (year 1) and a deep social assessment à the end of the Project (year 5)
- Ensure that **the Project design is conceived to avoid harming the environment and that the carbon footprint of the planned constructions is minimized**.
- Raise awareness among the population about environmental issues and the importance of protecting the environment;
- Conduct participatory natural resource inventories;
- Install a network of environmental sensors (weather station and soil moisture monitoring sensors);
- Create areas developed as bocage systems;
- Establish an integrated waste management system.

- Conduct a participatory assessment of how the Reserve's resources are utilized, including conflicts between herders and farmers; work with the population to identify the best strategies for mitigating or resolving future conflicts.
- Raise awareness among both groups to encourage the adoption of new practices in livestock and agricultural activities.
- Educate the population to foster a spirit of collaboration and promote the shared use of common resources and equipment.
- Introduce the digitalization in order to give new governance tool to the population of the Reserve and of the Lata-Nna village.

10.1 SUBCOMPONENT 1: NATURAL RESOURCES MANAGEMENT

Objectives	Understand the natural heritage of the reserve to preserve it and monitor its evolution. Test pasture management methods aligned with agroecology concepts.
Outputs / outcomes	Output: An assessment on the planned constructions (buildings, roads…). Natural resources inventories (general one and a specific one dedicated to pastures), network of weather, soil and water measure stations, bocages establishment. Outcome: A more resilient environment offering various opportunities to develop income generating activities (fodder for beef growing or beef fattening, bee keeping…)
Key partners	Local NGO like SAVE Sahara network NGO
Investments on equipment and facilities	• Bocage landscape realization. • Network of automatic weather (also soil and water) station.
Key activities	1: Adapt and develop a best practice guide for the design of planned constructions to minimize the carbon footprint associated with infrastructure development (buildings, roads, water boreholes, etc.) on one hand, and to maximize the use of local labor on the other. 2: Participatory natural resources inventory (animals and flora) 3: Participatory pastures inventory (focus on plants that are favored by the cattle and small ruminants
Interest	Environmental monitoring (including inventories and the weather station network) is essential for any project that will bring about significant changes, both in the behavior of herders and in the environment itself.
Hypothesis and risks	Hypothesis: as the major part of the budget of this subcomponent concerns the establishment of bocage landscape, it is supposed the population will consider these changes as a key for developing livestock activities. Risks: The establishment of bocages necessitates planting trees that must be protected from small ruminants during 2 or 3 years.
Budget	Investment : 1,468 k€ Op. Budget : 250 k€

Eco-construction and socially equitable design of infrastructures

This is the title of one important activity that aims to plan low carbon foot print and socially equitable design of infrastructures planned to be built for the Project.

Forty-five (45) buildings will be built during the Project's implementation phase. That could represent a huge carbon footprint if conventional[9] techniques are applied to the realization of the buildings. Then, alternatives would be envisaged to minimize this carbon footprint.

[9] Use of cement, reinforced concrete, steel, etc.

Low-carbon eco-construction is of paramount importance for sustainable development in Nigeria, a country experiencing rapid urban growth and increasing environmental challenges. The use of natural and locally sourced materials, such as wood and raw earth bricks, provides an ecological and economical alternative to high-carbon-footprint materials like metal structures and conventional construction methods.

Wood is a renewable resource with remarkable structural flexibility and excellent insulating properties. The use of timber is relevant if it comes from sustainably managed forests. Used for framing, cladding, or ceilings, it significantly reduces the embodied energy associated with the production and transportation of construction materials while offering an aesthetic harmony with the natural environment.

Moreover, raw earth bricks, produced from locally available resources, are an effective solution for building walls that are both strong and thermally efficient. When combined with reinforced concrete for foundations, beams, and columns, these bricks ensure structural robustness that meets the seismic and climatic demands of the region, while also reducing greenhouse gas emissions. They offer superior thermal regulation, lowering the reliance on air conditioning in homes. By promoting the use of these materials, Nigeria can develop a local architecture that values traditional craftsmanship while addressing climate and economic challenges. This approach not only helps to limit carbon emissions but also fosters more resilient and sustainable urbanization.

For example, the living base equipped with housing and office spaces, initially designed with prefabricated and pre-equipped containers, could be reimagined as a permanent construction extensively incorporating wood and raw earth.

Barns and storage facilities could integrate wooden structures (columns and beams).

Infrastructure design must consider its carbon footprint, but it is also possible to adopt an approach that promotes Labor-Intensive Works (LIW). The LIW approach is particularly useful when aiming to improve the economic situation of young people and women in the Project area. When properly implemented, this approach can become a true economic lever. For example, workers can be paid through a bank account (with the Project financing the account's opening if the worker does not already have one). Workers can also be encouraged to save money, so at the end of the project, they have a small capital that could complement a microcredit to start a small business. Finally, bringing many people together on a worksite helps foster stronger social ties, which can positively impact the subsequent development of collective structures such as cooperatives.

10.2 SUBCOMPONENT 2: INTEGRATED WASTE MANAGEMENT

Objectives	Improve the quality of the environment, especially in the Lata-Nna village.
Outputs / outcomes	**Output:** A biogas unit treat the effluents of the Demo Farm's cows and the organic wastes of Lata-Nna village, the digestate is used as fertilizer. A waste collect system is set up and an incinerator treat the combustible waste (like plastic). **Outcome:** The quality of the urban site of Lata-Nna village is improved, farmers use the digestate of the biogas processing as fertilizer in their fields.
Key partners	French expertise, French methanizer equipment providers.
Investments on equipment and facilities	• Biogas plant, biogas purification system, gas compressor, empty steel gas bottles • Waste collect system (tricycle, individual protection equipment, tools) • Incinerator and heat exchanger
Key activities	1: Training of trainers 2: Training of operators (biomethanization plant and waste collect system) 3: Testing the 2 systems
Interest	Improving the quality of life of the population, provide an alternative to wood fuel to the households (biogas) and provide digestates used as fertilizer to the farmers.

Hypothesis and risks	Hypothesis: The effluents produced by the cows of the demo farm are sufficient to justify the investment and a system of gas distribution is conceived within Risks: The Lata-Nna population or the herders of the Reserve do not fully participate in the implementation of a waste collection system (waste sorting, use of bins, etc.).
Budget	Investment : 228 k€ Op. Budget : 190 k€

10.3 SUBCOMPONENT 3: IMPROVE THE GOVERNANCE OF LATA-NNA GRAZING RESERVE

Objectives	Promote sustainable management of the Reserve while ensuring improved social harmony.
Outputs / outcomes	Output: Social survey, participatory workshops and training, definition of exploitation rules for the improved territories of the Reserve development of a digitalization process (access to computers) Outcome: The socio-economical development is operated in harmony.
Key partners	Local NGOs, Authorities of the Ministry at Ilorin, LGA responsible.
Investments on equipment and facilities	• One 200 m2 Community house • Portable computers
Key activities	1: Participatory workshop on the diagnostic of governance issues 2: Participatory workshop on the definition of management rules related to the Reserve 3: Communication and sensitization 4: Digitalization to ensure smooth communication between herders, farmers and all other actors concerned by the Reserve (including private sector).
Interest	Harmony encourages private investments that are profitable for the Fulani and the farmers around the Reserve.
Hypothesis and risks	**Hypothesis:** A close collaboration between the Technical Assistance of the Project and the Kwara state authorities is established, the herders and farmers are keen to develop by themselves new solutions to reduce conflicts and to improve their revenues. **Risks:** The communities stay in their position without any desire to make things better.
Budget	Investment : 105 k€ Op. Budget : 415 k€

11 COMPONENT 11: TECHNICAL ASSISTANCE

1.4-REMIND OF THE MAIN GAPS IDENTIFIED

During the diagnostic phase, it was determined that the human resources of the entities involved in the development of the area are insufficient; the staff is neither numerous nor adequately equipped to effectively fulfill their core missions. This pilot project aims to address this issue by providing equipment and, above all, numerous training sessions.

The scope of the Project's activities (over 440 activities to be completed over a 5-year period) necessitates a dedicated implementation team. This team must be provided with transport and operational resources. It should consist of permanent core staff complemented by experts working for shorter periods.

The team must possess the required expertise, including high-level international experience in development project management and project accounting.[2]

1.5-MAIN OBJECTIVES AND STRATEGY OF THE COMPONENT "TECHNICAL ASSISTANCE"

OBJECTIVE AND KPIS

The objectives of a TA are easy to understand: the TA ensure a smooth development of the Project's implementation. It is responsible for the launching and the good achievement of the Project's activities.

STRATEGY

The strategy will aim to:

- Launch the Project
- Ensure proper daily management of the Project
- Ensure smooth communication between the various actors in the Project's area
- Ensure effective promotion of the pilot project to maximize its positive impact beyond the Reserve.
- Ensure a close monitoring of the Project's activities

This Project Management Component has 2 subcomponents:

- Technical Assistance
- The Kwara State Coordination

11.1 SUBCOMPONENT 1: TECHNICAL ASSISTANCE

Objectives	Ensure the daily management of the Project
Outputs / outcomes	Output: Implementation of activities and reporting Outcome: The Project reaches its targets.
Key partners	The Kwara State Ministry of Agriculture
Investments on	• Worksite facility (containers accommodation & offices) close to Lata-Nna village

equipment and facilities	
Key activities	1: Project management 2: Periodic reporting 3: Engagement of any required expertise 4: Participate to the procurement processes
Interest	Ensure a professional and rigorous Project management.
Hypothesis and risks	The TA is engaged as soon as the Project starts.
Budget	Investment : 150 k€ Op. Budget : 5,238 k€

11.2 SUBCOMPONENT 2: NATIONAL COORDINATION

Objectives	Ensure proper coordination between the Project actors and all implicated Kwara State actors or Federal Actors and facilitate the implementation of the Project's activities.
Outputs / outcomes	Output: Demand driven reports Outcome: The Steering Committee receive pertinent information.
Key partners	Kwara State Authorities / Federal Agriculture Authorities / LGA Authorities…
Investments on equipment and facilities	No specific investment is required.
Key activities	1 Monitoring of the Project 2 Establish effective and smooth communication procedures amongst the various stakeholders of the Project. 3 Ensure the Steering Committee of the Project plays its role.
Interest	High level monitoring.
Hypothesis and risks	The authorities of Kwara State, particularly the Ministry of Agriculture, appoint a focal point person for the Project (coordinator) and the officers required to carry out this task.
Budget	Investment : 0 k€ Op. Budget : 380 k€

12 GLOBAL ECONOMIC ANALYSIS

A cost-benefit analysis model was developed using Excel to estimate the potential economic profitability of the proposed program. This model is organized into several sheets, including a "dashboard" sheet that allows for adjustments to the various assumptions used.

KEY ASSUMPTIONS

This economic assessment uses the following key assumptions:

- The analysis is carried out over 25 years;
- The discount rate used is 9% for the investment, and direct benefits;
- An exchange rate of 825 Naira = 1 Euro has been used;
- The investment program is spread over a period of 5 years and the costs of the program are those estimated for the purposes of this study. However, as the modelling is based on a 25-year timeframe, the model considers a certain amount of investment required to renew infrastructures/equipment with a lifespan of less than 25 years, which is the case for Dirt road, Machinery, Borehole, solar equipment, irrigation scheme equipment. No residual value has been considered in the investment plan.

Table 2: Assumption for project lifespan component (in years)

Service life	in years
Barrages	25
Dirt Roads	10
Machinery	7
Buildings	25
Bore hole	12
Solar	18
Equipment	8
Irrig. Scheme/Equip	7
Consumables	1
Animals	25

- Operating and maintenance costs are estimated on the basis of percentage of the investment cost linked to the components that will required annual operation and maintenance. The following table summarized both the investment cost considered and the percentage apply for the annual O&M cost estimated

Table 3: Assumption O&M cost estimation

Entity	total investment cost after year 5 (€)	% of investment cost used for annual O&M cost	Estimated annual O&M cost after full investment (€)
Barrages	1,000,000	0.50%	5,000

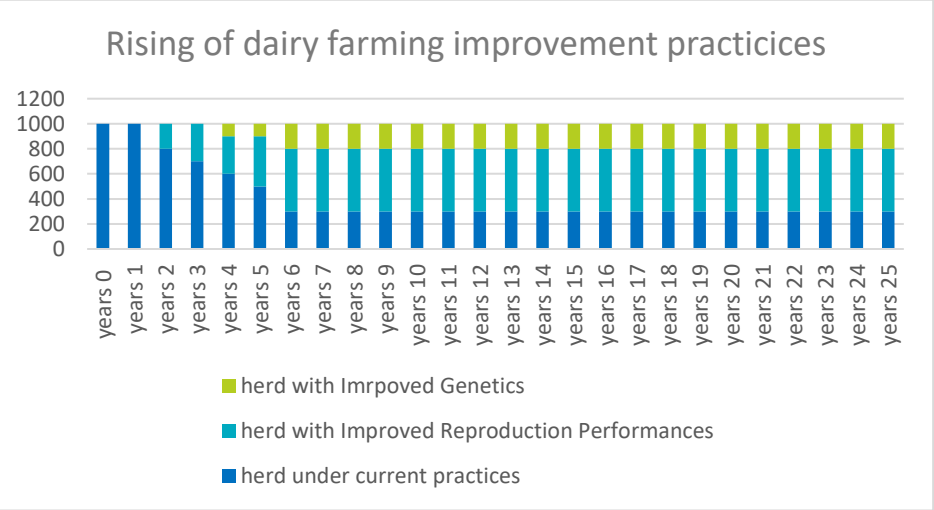
Dirt Roads	4,500,000	1.00%	45,000
Machinery	707,500	2.00%	14,150
Buildings	9,022,500	0.50%	45,113
Bore hole	4,175,000	0.50%	20,875
Solar	95,000	2.00%	1,900
Equipment	15,137,050	2.00%	302,741
Irrig. Scheme/Equip	575,000	1.50%	8,625
Total annual O&M COST after full investment			443,404

- Several types of benefits have been considered to make the program's investment profitable. Those benefits are estimated using the gross margin estimated in the framework of the study and presented in Annex 7:

  Benefits generated inside the reserve

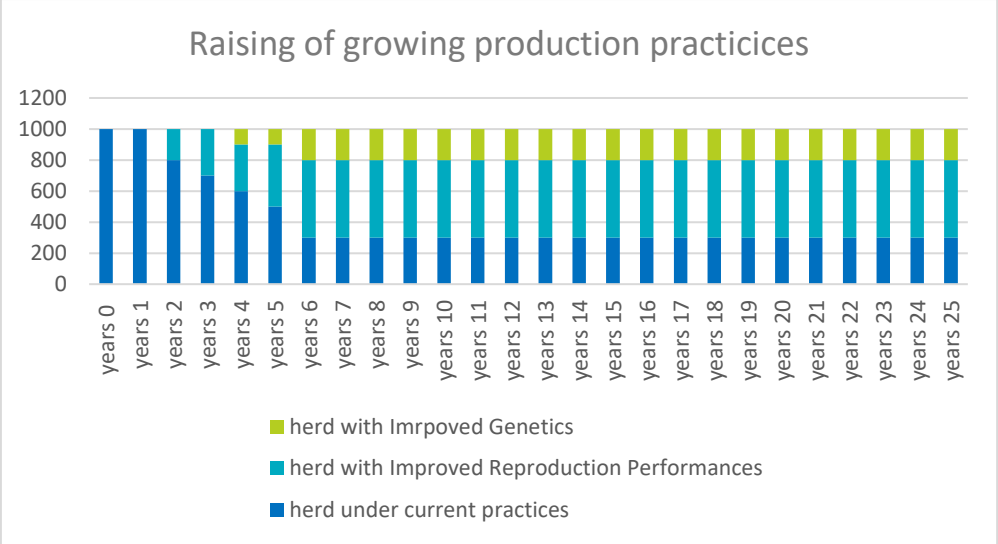
  - **Agricultural benefits** linked to the production of cash crops produced on the reserve's land (Fulgani area / villagers area). In the model, this area, estimated at around 9530 ha at the start of the project, is gradually reduced from year 7 onwards in favour of grazing land in the reserve. The agricultural benefits estimated for this land are associated with maize cultivation. The performance per ha of this crop without and with the project is presented in Annex 7.
  - **the benefits of dairy farming** associated with an estimated 1000 herds of 50 head in the reserve. In the model, this production gradually shifts over a 5-year period from the current operating mode to more efficient operating modes, associated on the one hand with improvements in the herds' reproductive performance and on the other with genetic improvements in the herds. It is considered that the situation passes from the current operating mode for 100% of the herds to a situation in year 6 with 30% of the herds using the current operating mode, 50% of the herds having adapted new practices through improvements in reproductive performance and 20% of the herds having resorted to genetic improvements. The following table shows this gradual increase. The performance of the different systems considered in terms of gross margin is shown in Annex 7.

Figure 16 hypothesis of dairy farming improvement among the reserve herds



- **the benefits linked to meat production** practices, which are moving away from the current mode of operation towards more efficient practices relating, on the one hand, to better feeding and, on the other, to genetic improvement of the herds. The conversion rate is the same as for dairy farming. It is considered that the situation passes from the current operating mode for 100% of the herds to a situation in year 6 with 30% of the herds using the current operating mode, 50% of the herds having adapted new practices through improvements in feeding and 20% of the herds having resorted to genetic improvements with F1 Crossbreds - LocalxHolstein & Good management .

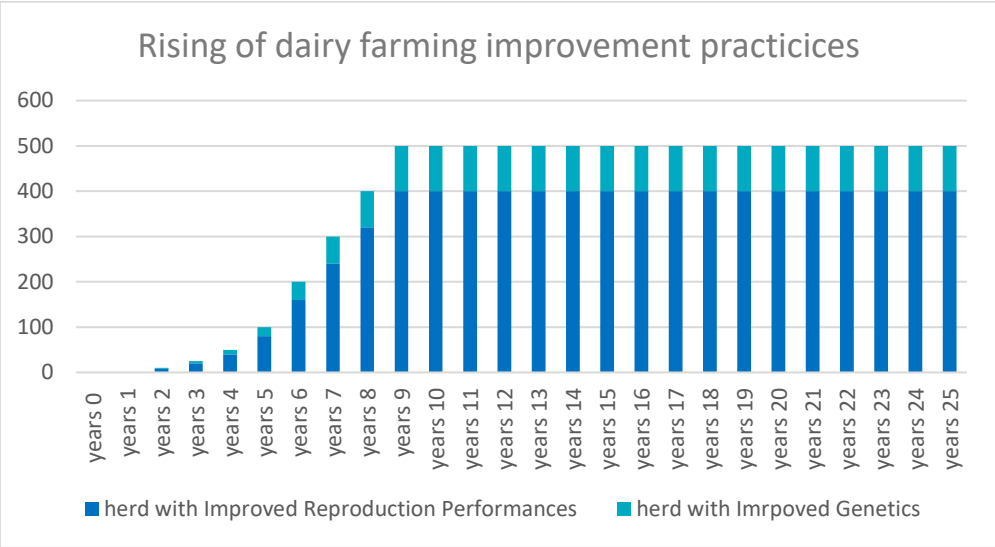
Figure 17 hypothesis of growing improvement among the reserve herds



Benefices gendered outside the reserve: in addition to the benefits generated by the program within the reserve, it is assumed that the investment program will have an impact on livestock management practices at a national level. Some components of the investment directly benefit the improvement of livestock management practices at a national level and not only within the reserve. For this reason, it is also necessary to consider the additional benefits that the program could generate outside the reserve. 3 types of benefits have been considered at national level, but their estimation is based on a number of assumptions that can be adjusted in the model.

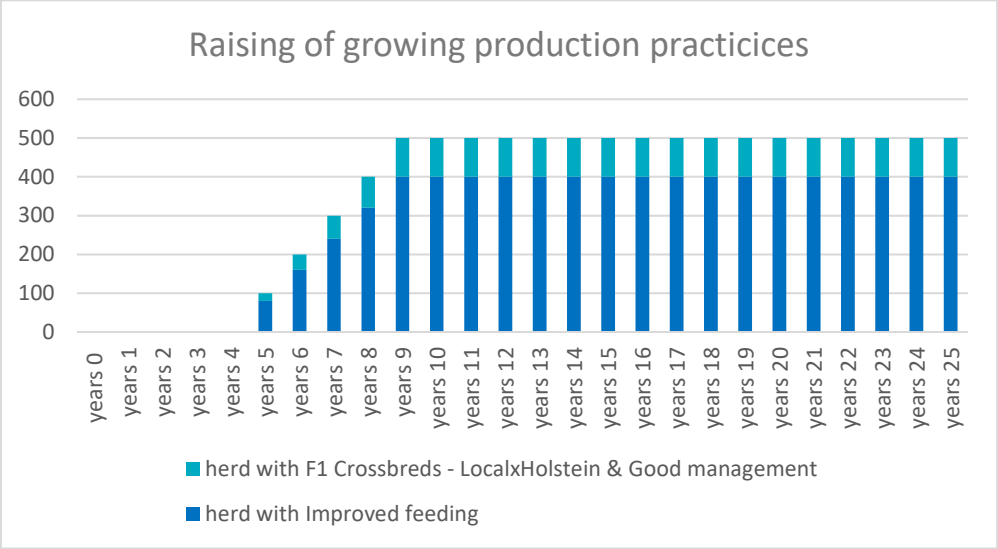
- **The benefits of milk production outside the reserve** will primarily be generated through the dissemination of best practices and the knowledge transfer planned within the program. It is hypothesized that approximately 500 herds (each with around 50 heads of cattle) will benefit from the improvements implemented in the reserve, with 80% of these herds improving their performance through best reproductive practices and 20% improving their performance through genetic enhancement. These benefits will begin to materialize from year 5 onwards, once these practices start proving effective within the reserve. The performance of the different systems considered in terms of gross margin is shown in Annex 7.

Figure 18 hypothesis of dairy farming improvement outside of the reserve



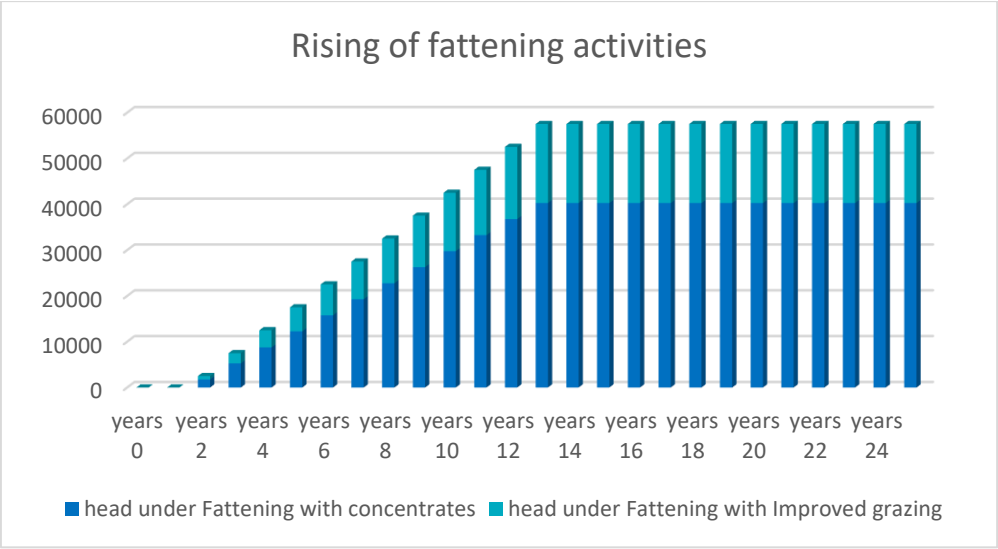
- The same hypothesis as previously is applied regarding **the improvement of meat production outside the reserve**, which is also expected to affect these 500 herds. Of these, 80% are expected to see an increase in production through the implementation of better feeding practices, while 20% are expected to achieve production gains through genetic improvements. The performance of the different systems considered in terms of gross margin is shown in Annex 7.

Figure 19 hypothesis of growing improvement outside the reserve



Finally, it has been considered that fattening practices will be developed both within and outside the reserve, with two possible fattening methods: one based on fattening with concentrates and the other on fattening with improved grazing. Thus, it is hypothesized that, out of the one million animals to which the project will provide ear tags,50 % will be male and 10% of them will benefit from these fattening practices wich correspond at around 50 000 head. It as been then set as hypothesis that 70% of those 50 000 heads will be fattening with concentrates and the remaining 30% will be fattening with improved grazing. The growth of this business is based on the following model. The performance of the different systems considered in terms of gross margin is shown in Annex 7

Figure 20 hypothesis of growing improvement outside the reserve



In addition to the direct costs and benefits linked to the program, the overall economic analysis considers additional costs linked to socio environmental actions. The investment cost of those socio environmental actions are those estimated for the purposes of this study as (i) women empowerment, (ii) youth empowerment, (iii) environment, (iv) governance. At this stage of the study, the few benefits generated by these social and economic measures have not been taken into account in the model. These include production from the 10 ha of market gardens for women, the production of 10 tonnes of flour per year from the electric mills supplied as part of the program, and the operation of a 250m3 fish farm fed by borehole water also developed as part of the program.

RESULTS OF GLOBAL ECONOMIC ASSESSMENT

the results of the global economic analysis and the various results of the analysis model are summarized in the following table.

The detail of the assessment are provided in Annex 7.

Table 4 : Analysis results for the global project

Scenario concerned	**full scenario**
Number of family beneficiaries into the reserve	1,000
Number of beneficiaries into the reserve	12,000
Number of animals breeded	50,000
Total reserve area (ha)	20,725
Of which Surface Cash crop Fulani before project	3,731
Of which Surface Cash crop Fulani after project (15years)	0
Of which Surface Cash crops villagers before project	5,803
Of which Surface Cash crops villagers after project (15 years)	0
Of which Surface grazing, invasive weed before project	8,497
Of which Surface grazing, invasive weed after project (15 years)	0
Of which Surface grazing, no weed before project	415
Of which Surface grazing, no weed after project (15 years)	18,445
Of which forest	2,280
Economic Investment Costs (€ 2025) for the program	80,204,300
Of which economic Investment Costs (€ 2025) for the socio-environmental measure	4,050,500
Main Investment Duration (years)	5
Discounted Value (25 years) of Investment Costs (€ 2025)	55,384,131
Discounted Value (25 years) of socio-environmental measure (€ 2025)	3,593,627
Annual Operating Costs (€ 2025)	443,404
Discounted Value (25 years) of Operating Costs (€ 2025)	3,586,454
Average annual benefit with project (€ 2025)	18,074,497
Delta annual benefit generated by the project (€ 2025)	12,083,888
Discounted Value (25 years) of Benefits Generated (delta) by the Project (€ 2025)	102,258,117
Production generated by the Project into the Reserve :	
cash crops produced (Mais) in the Reserved year 0 (T/year)	23,834
cash crops produced (Mais) in the Reserved year 5 (T/year)	28,601
cash crops produced (Mais) in the Reserved year 15 (T/year)	0
Milk produced and sold from the reserved year 0 (l/year)	1,460,000
Milk produced and sold from the reserved year 5 (l/year)	*11,730,000*
Milk produced and sold from the reserved year 15 (l/year)	*17,938,000*
Animals produced and sold from the reserved year0 (head/year)	*6,000*
Animals produced and sold from the reserved year 5 (head/year)	*11,900*
Animals produced and sold from the reserved year 15 (head/year)	*14,200*

Additional production generated by the Project out of the Reserve :	
Additional benefit out of the reserve Milk production year 5 (l/year)	*392,727*
Additional benefit out of the reserve Milk production year 15 (l/year)	*11,000,000*
Additional benefit out of the reserve Animals production year 5 (head/year)	*1,602*
Additional benefit out of the reserve Animals production year 15 (head/year)	*17,800*
Additional benefit out of the reserve Animals fattened year 5 (head/year)	*17,500*
Additional benefit out of the reserve Animals fattened year 15(head/year)	*57,500*
Internal Rate of Return	**16.7%**
Net Present Value (25 years) (euros)	39,693,904
Return on Investment Ratio (profit/costs)	1.85

Specific economic indicators

Total investment cost (euros 2025): the investment cost of the project will be around 80,204 k€, with the support socio-environmental measures set out in this study, the total investment program will be around 80,204 k€, 4.050 k€ specifically allocated for socio-environmental measures.

Internal rate of return (IRR): the IRR is 16.7%

Net present value (NPV) over 25 years (USD million): the NPV is 39,693 k€

Benefit/cost ratio (profit/costs): the ratio is around 1.85

Interpretation of results

These results point to an overall project with a fair economic return and no particular economic risks.

Production Generated Within the Reserve:

- **Cash Crops (Maize):** at the start of the project (year 0), production reaches **23,834 tons per year**. It increases to **28,601 tons per year** by year 5, due to initial investments and improved management. After 15 years, cash crop production within the reserve drops to **0 tons**, reflecting the conversion of agricultural land into pastures and forest areas as part of the project's socio-environmental measures.
- **Milk Production:** Milk production increases from **1.460 million liters per year** in year 0 to **approx.. 12 million liters per year** in year 5. By year 15, it reaches a peak of **18 million liters per year**, indicating optimized livestock practices.
- **Livestock Production (Live Animals):** the number of animals produced and sold within the reserve increases from **6,000 heads per year** in year 0 to **11,900 heads per year** in year 5. By year 15, this figure further rises to **14,200 heads per year**, confirming the positive impact of infrastructure improvements and better livestock management.

Additional Production Generated Outside the Reserve:

- **Milk Production:** a gradual increase is observed, with 146,000 liters in year 0, **2.2 million liters per year** by year 5, reaching a peak of **11 million liters per year** by year 15. This reflects the dissemination of improved livestock practices beyond the reserve boundaries.
- **Livestock Production (Live Animals):** by year 5, **1,780 heads per year** are produced outside the reserve, rising to **8,900 heads per year** by year 15. These figures highlight a significant economic impact on the surrounding areas.

- **Fattened Animals:** the number of fattened animals increases from **2,500 heads in year 2**, **17,500 heads** in year 5 to **57,500 heads per year** 2in year 15, underscoring a strong development in adding value to livestock production outside the reserve.

The project leads to a reorganization of production within the reserve, with a reduction in cash crop cultivation in favor of intensified livestock and milk production.

Outside the reserve, the project generates significant benefits through increases in milk and livestock production, as well as the development of animal fattening practices.

SENSITIVITY ANALYSIS

A sensitivity analysis is proposed to study the sensitivity of the economic model to four key parameters:

the variation in investment costs for the global program;

the variation in estimated profits in the situation with the global program;

the same analysis is then done considering that the mini dairy unit will not be finance and that no impact will be considered on national milk production (milk profit outside the reserve);

The following tables show for the global project the evolution of the IRR and NPV for a variation in investment costs from -30% to +30% compared to the proposed amount, and a variation in profits with project from -10 to +10% of estimated profits.

Table 5 : Sensitivity analysis of the global program

			Internal Rate of Return as a function of the variation in the project's profits			**Net Present Value of the project, as a function of the variation project profits (Euros)**		
			-10%	**0%**	**10%**	-10%	**0%**	**10%**
			85,637,763	**102,258,117**	**118,878,470**	85,637,763	**102,258,117**	**118,878,470**
Change in the total amount of investments compared with the current total	30%	69,496,341	10%	**13%**	**16%**	8,961,341	**25,581,694**	**42,202,048**
	20%	64,792,271	11%	**14%**	**17%**	13,665,411	**30,285,764**	**46,906,118**
	10%	60,088,201	12%	**15%**	**18%**	18,369,481	**34,989,834**	**51,610,188**
	0%	**55,384,131**	**13%**	**16.7%**	**20%**	**23,073,551**	**39,693,904**	**56,314,258**
	-10%	50,680,061	15%	**18%**	**22%**	27,777,621	**44,397,974**	**61,018,328**
	-20%	45,975,991	16%	**20%**	**24%**	32,481,691	**49,102,044**	**65,722,398**
	-30%	41,271,921	18%	**23%**	**27%**	37,185,761	**53,806,114**	**70,426,468**

Internal rate of return (IRR): IRRs vary from 10 % to 27% depending on variations in investment costs and agricultural profits. When investment costs fall by 30% and agricultural profits rise by 10%, the IRR rises to 27%. Conversely, if investment costs rise by 30% and agricultural profits fall by 10%, the IRR falls to 10%.

Net present value (NPV): NPV varies from 8,961k€ to 70,426 k€. The NPV remains positive when costs increase by 30% and livestock profits decrease by 10%. The NPV is highest (70,426 k€) when costs decrease by 30% and livestock profits increase by 10%.

To test the robustness of the project and avoid any potential bias due to the **mini dairy unit** proposed, the economic profitability analysis was also carried out without considering this investment and the potential impact on dairy production at national level. The results are summarized in the following table for this specific scenario.

*Table 6: Sensitivity analysis of the program **without taking into consideration the dairy unit** and its potential impact on national milk production*

			Internal Rate of Return as a function of the variation in the project's profits			Net Present Value of the project, as a function of the variation project profits (Euros)		
			-10%	**0%**	**10%**	-10%	**0%**	**10%**
			77,932,880	**93,661,619**	**109,390,357**	77,932,880	**93,661,619**	**109,390,357**
Change in the total amount of investments compared with the current total amount (Euro)	30%	61,465,632	11%	**14%**	**17%**	10,453,771	**26,182,510**	**41,911,249**
	20%	57,379,309	12%	**15%**	**18%**	14,540,095	**30,268,833**	**45,997,572**
	10%	53,292,986	13%	**16%**	**20%**	18,626,418	**34,355,157**	**50,083,895**
	0%	**49,206,663**	**14%**	**17.8%**	**21%**	**22,712,741**	**38,441,480**	**54,170,218**
	-10%	45,120,340	16%	**19%**	**23%**	26,799,064	**42,527,803**	**58,256,542**
	-20%	41,034,016	17%	**22%**	**26%**	30,885,387	**46,614,126**	**62,342,865**
	-30%	36,947,693	19%	**24%**	**29%**	34,971,711	**50,700,449**	**66,429,188**

The results are roughly like those of the overall project, if not better, as the NPV is never negative regardless of the variations tested and the IRR raises of 1%.

On the basis of the assumptions made and the variations tested in the sensitivity analysis, the overall project is robust from an economic point of view in most of the situations tested above but in case of a strong investment rising cost and lower profits compared to what is estimated a little economic risk can exist considering the project in its globality

ANNEXES

Annex 1. The Project's Budget

The 11 budget of the Components are presented hereinafter.

Grazing and forages (including Demo Farm)

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Grazing and forages	G&F_1	Seed Production Unit	Technical consultancy -design & plans	4	50,000	200,000	1	Operational budget	
			Land Acquisition/Leasing	60	4,000	240,000	2	Investment	
			Irrigation System Setup	60	2,000	120,000	2	Investment	
			Storage Facility Construction	1	150,000	150,000	2	Investment	
			Seed Processing Unit	1	250,000	250,000	2	Investment	
			Farm Machinery	1	200,000	200,000	2	Investment	
			Initial seed purchase	1,000	50	50,000	2	Operational budget	
			Quality Control & Certification	1	50,000	50,000	2	Investment	
			Contingency (10%)	1	100,000	100,000	2	Operational budget	
			Marketing & Sales	1	50,000	50,000	3	Operational budget	
			Watering standard systems	2	30,000	60,000	3	Investment	**1,470,000**
	G&F_2	Rental Plots For Fulani Herders In Lata Grazing Reserve	Technical consultancy -design & plans	4	50,000	200,000	1	Operational budget	
			Year 1 Clearing	500	200	100,000	1	Investment	
			Year 1 Land Preparation	500	35	17,500	1	Investment	
			Year 1 Initial fertilizer	500	75	37,500	1	Operational budget	
			Year 1 Seeding	500	25	12,500	1	Operational budget	
			Year 1 Planting Trees (Plot Delimitation)	50	500	25,000	1	Operational budget	
			Year 1 Fencing	500	50	25,000	1	Investment	
			Year 1 Watering Borehole Installation	4	30,000	120,000	1	Investment	
			Year 1 Road Access	50	5,000	250,000	1	Investment	
			Kraal	1	5,000	5,000	1	Investment	
			Year 2 Clearing	500	200	100,000	2	Investment	
			Year 2 Land Preparation	500	35	17,500	2	Investment	
			Year 2 Initial fertilizer	500	75	37,500	2	Operational budget	
			Year 2 Seeding	500	25	12,500	2	Operational budget	
			Year 2 Planting Trees (Plot Delimitation)	50	500	25,000	2	Operational budget	
			Year 2 Fencing	500	50	25,000	2	Investment	
			Year 2 Watering Borehole Installation	4	30,000	120,000	2	Investment	
			Year 2 Road Access	50	5,000	250,000	2	Investment	
			Year 3 Clearing	500	200	100,000	3	Investment	
			Year 3 Land Preparation	500	35	17,500	3	Investment	
			Year 3 Initial fertilizer	500	75	37,500	3	Operational budget	
			Year 3 Seeding	500	25	12,500	3	Operational budget	
			Year 3 Planting Trees (Plot Delimitation)	50	500	25,000	3	Operational budget	
			Year 3 Fencing	500	50	25,000	3	Investment	
			Year 3 Watering Borehole Installation	4	30,000	120,000	3	Investment	
			Year 3 Road Access	50	5,000	250,000	3	Investment	
			Year 4 Initial fertilizer	500	75	37,500	3	Operational budget	
			Year 4 Clearing	500	200	100,000	4	Investment	
			Year 4 Land Preparation	500	35	17,500	4	Investment	
			Year 4 Seeding	500	25	12,500	4	Operational budget	
			Year 4 Planting Trees (Plot Delimitation)	50	500	25,000	4	Operational budget	
			Year 4 Fencing	500	50	25,000	4	Investment	
			Year 4 Watering Borehole Installation	4	30,000	120,000	4	Investment	
			Year 4 Road Access	50	5,000	250,000	4	Investment	**2,555,000**
	G&F_3	Training On Grass Management	Technical consultancy -design & plans	4	50,000	200,000	1	Operational budget	
			Preparation of the extension services	1	22,500	22,500	2	Operational budget	
			Communication and media plan	1	22,500	22,500	2	Operational budget	
			Training of Trainers (ToT) Program for extension officers	1	75,000	75,000	2	Operational budget	
			Workshops for new fattening techniques - industry leaders	5	75,000	375,000	2	Operational budget	
			Manuals and resource materials	1	50,000	50,000	2	Operational budget	
			Training videos and online tutorials	1	50,000	50,000	2	Operational budget	**795,000**
	G&F_4	Hay Production Service Provider	Hay Making Equipment	1	150,000	150,000	2	Investment	
			Weather Station	1	1,500	1,500	2	Investment	
			Moisture Meter	2	500	1,000	2	Investment	
			Hay Making Equipment	3	150,000	450,000	3	Investment	
			Hay Storage Barn	1	50,000	50,000	3	Investment	
			Input Storage Barn	1	50,000	50,000	3	Investment	
			Maintenance Shop	1	50,000	50,000	3	Investment	
			Moisture Meter	5	500	2,500	3	Investment	
			Weather Station	2	1,500	3,000	3	Investment	
			Training on Equipment Maintenance	1	15,000	15,000	3	Operational budget	**773,000**
	G&F_5	Demo And Trial Forage Production	Land Acquisition and Clearing	10	4,500	45,000	2	Investment	
			Electrical Fencing	10	2,500	25,000	2	Investment	
			Irrigation System Setup	10	2,000	20,000	2	Investment	
			Barn for Equipment and Hay Storage	1	50,000	50,000	2	Investment	
			Workshop for Maintenance	1	30,000	30,000	2	Investment	
			Borehole Installation	1	35,000	35,000	2	Investment	
			Tree Planting for Plot Delimitation	1	500	500	2	Investment	
			Kraal	1	5,000	5,000	2	Investment	
			Cows	50	400	20,000	3	Operational budget	**230,500**
	G&F_6	Demo Farm	Watering & Irrigation boreholes (2 to 5 ha demo farm) - see GWM)	2	0	0	0	0	
			Technical consultancy for SPC -design & plans	1	50,000	50,000	1	Operational budget	
			Operationnal support for design - implementation - deployment	1	90,000	90,000	1	Operational budget	
			Land	1	0	0	1	Investment	
			Infrastructure -Admin block & canteen	1	150,000	150,000	2	Investment	
			Admin block & canteen Solar Panels	20	1,750	35,000	2	Investment	
			Borehole for infra _Admin bloc -housing for students	1	35,000	35,000	2	Investment	
			Infrastructure- Housing for students & staff	1	125,000	125,000	2	Investment	
			Infrastructure - Housing Solar Panels	20	1,750	35,000	2	Investment	
			Infrastructure Access road	1	200,000	100,000	2	Investment	
			Communication and media plan	1	22,500	22,500	3	Operational budget	
			Training of Trainers (ToT) forTraining cnter	1	75,000	75,000	3	Operational budget	
			Manuals and resource materials	1	50,000	50,000	3	Operational budget	
			Training videos and online tutorials	1	50,000	50,000	3	Operational budget	**817,500**

Access to feed

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Access to feed	AF_1	Raw materials	Mapping of local raw materials	1	5,000	5,000	1	Operational budget	
			Characterization of local raw materials	20	200	4,000	1	Operational budget	
			Analysis of raw materials	100	100	10,000	1	Operational budget	
			Quality control equipment	1	3,000	3,000	1	Operational budget	
			Infrastructure Access road	1	200,000	200,000	2	Investment	
			Raw materials storage	1	57,500	57,500	3	Investment	**279,500**
	AF_2	Feed mill	Ali'Lab (feed mill container)	5	35,900	179,500	1	Investment	
			Feed formulation	1	5,000	5,000	1	Operational budget	
			Borehole for feed mill container	5	25,000	125,000	2	Investment	
			Feed storage	1	57,500	57,500	3	Investment	
			French expertise	1	15,000	15,000	3	Operational budget	
			Analysis of raw materials	100	100	10,000	3	Operational budget	
			Quality control equipment	1	3,000	3,000	3	Investment	
			Solar panel for Ali'Lab	5	15,000	75,000	3	Investment	**470,000**
	AF_3	Trial Feedlot	Feedlot infrastructure (AF)	30	1,000	30,000	1	Investment	
			Handling and weighting	1	50,000	50,000	1	Investment	
			Technical consultancy for feedlot -design & plans	1	50,000	50,000	1	Operational budget	
			Animals	30	400	12,000	3	Investment	**142,000**
	AF_4	Trial dairy farm	Milking parlour	1	50,000	50,000	1	Investment	
			Barn and equipment	30	1,000	30,000	1	Investment	
			Technical consultancy for feedlot -design & plans	1	50,000	50,000	1	Operational budget	
			Bore hole and watering point	1	30,000	30,000	1	Investment	
			Lactating cows	30	500	15,000	3	Investment	**175,000**

Animal Health

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Animal Health	AH_1	Vaccination campaigns	Vaccination parks in Lata Nna zone	4	11,000	44,000	1	Investment	
			Vaccination parks	6	11,000	66,000	1	Investment	
			Cars (4*4) for vaccination campaigns	4	50,000	200,000	1	Investment	
			3 vaccination campaigns	1	230,000	230,000	1	Operational budget	
			Quality control of the vaccines	1	20,000	20,000	1	Operational budget	
			3 vaccination campaigns	1	230,000	230,000	2	Operational budget	
			Quality control of the vaccines	1	10,000	10,000	2	Operational budget	
			3 vaccination campaigns	1	230,000	230,000	3	Operational budget	
			Quality control of the vaccines	1	10,000	10,000	3	Operational budget	
			Quality control of the vaccines	1	10,000	10,000	3	Operational budget	
			3 vaccination campaigns	1	230,000	230,000	4	Operational budget	**1,280,000**
	AH_2	Strengthen the veterinary network	Motorbikes and equipment for veterinary clinics and LGAs	41	8,550	350,550	1	Investment	
			Studies, trainings, consultations	1	20,000	20,000	1	Operational budget	
			French expertise	1	20,000	20,000	1	Operational budget	
			Studies, trainings, consultations	1	20,000	20,000	2	Operational budget	
			French expertise	1	20,000	20,000	2	Operational budget	
			Studies, trainings, consultations	1	10,000	10,000	3	Operational budget	
			Studies, trainings, consultations	1	10,000	10,000	4	Operational budget	**450,550**
	AH_3	Awarenes s and extension	Preparation of the extension services	1	20,000	20,000	1	Operational budget	
			Communication, meetings, and media plan	1	50,000	50,000	2	Operational budget	
			Communication, meetings, and media plan	1	50,000	50,000	3	Operational budget	
			Communication, meetings, and media plan	1	50,000	50,000	4	Operational budget	**170,000**
	AH_4	Improvement of epidemiological knowledge	One epidemiological study	1	30,000	30,000	1	Operational budget	
			One epidemiological study	1	30,000	30,000	2	Operational budget	
			French expertise	1	20,000	20,000	2	Operational budget	
			Ring tests with French reference lab	1	5,000	5,000	2	Operational budget	
			One epidemiological study	1	30,000	30,000	2	Operational budget	
			Ring tests with French reference lab	1	5,000	5,000	2	Operational budget	
			One epidemiological study	1	30,000	30,000	3	Operational budget	
			French expertise (Animal Health)	1	20,000	20,000	3	Operational budget	
			One epidemiological study	1	30,000	30,000	3	Operational budget	
			One epidemiological study	1	30,000	30,000	3	Operational budget	
			One epidemiological study	1	30,000	30,000	3	Operational budget	**260,000**

Reproduction and Genetic

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Reproduction and Genetic	R&G_1	Semen Production Center	land acquisition	0	0	0	1	Investment	
			Technical consultancy for SPC -design & plans	1	50,000	50,000	1	Operational budget	
			Continous technical and operationnal support	5	90,000	450,000	1	Operational budget	
			Infrastructure - Lab & Bull Housing & Other	1	1,000,000	1,000,000	2	Investment	
			Borehole for SPC	1	35,000	35,000	2	Investment	
			Bull housing equipment	1	150,000	150,000	2	Investment	
			Semen Production Equipment & Software	1	500,000	500,000	3	Investment	
			Semen Production Training	1	40,000	40,000	3	Operational budget	
			Liquid Nitrogen plant	1	300,000	300,000	3	Investment	
			Distribution pickup	5	50,000	250,000	3	Investment	
			Semen production consumables	100,000	1	50,000	3	Operational budget	
			Maintenance	2	15,000	30,000	3	Operational budget	**2,855,000**
	R&G_2	Foundation Of A Semen Production Center	Small warehouse and office	1	50,000	50,000	1	Investment	
			Continous technical and operationnal support	1	45,000	45,000	1	Operational budget	
			Substation Equipment	1	50,000	50,000	2	Investment	
			AI Equipment	80	3,000	240,000	2	Investment	
			Ultrasound scanners	20	10,000	200,000	2	Investment	
			Training of AI Technicians	1	180,000	180,000	2	Operational budget	
			Small warehouse and office	3	50,000	150,000	3	Investment	
			Substation Equipment	3	50,000	150,000	3	Investment	**1,065,000**
	R&G_3	Structuring Ai Substations For Effective Distribution	AI - Communication - etc	1	30,000	30,000	1	Operational budget	
			Imported Semen for Year 2 & 3 AI programs	50,000	1	50,000	2	Operational budget	
			Synchronisation	26,000	5	130,000	2	Operational budget	
			Ai consumables	60,000	1	30,000	2	Operational budget	
			AI - Communication - etc	1	40,000	40,000	2	Operational budget	
			Imported Semen for Year 2 & 3 AI programs	50,000	2	100,000	3	Operational budget	
			Synchronisation	38,000	5	190,000	3	Operational budget	
			Ai consumables	60,000	1	30,000	3	Operational budget	
			AI - Communication - etc	1	30,000	30,000	3	Operational budget	
			Imported Semen for Year 2 & 3 AI programs	50,000	2	100,000	4	Operational budget	
			Synchronisation	38,000	5	190,000	4	Operational budget	
			Ai consumables	60,000	1	30,000	4	Operational budget	**950,000**
	R&G_4	Ai Deployment	Bulls for SPC	20	10,000	200,000	3	Investment	
			Semen for Nucleus Farms	10,000	30	300,000	3	Operational budget	**500,000**
	R&G_5	Genetic Improvement Program	Infrastructure	600	1,000	600,000	1	Investment	
			equipment	1	500,000	500,000	2	Investment	
			Cows	600	400	240,000	2	Investment	
			Infrastructure	600	1,000	600,000	3	Investment	
			Cows	600	400	240,000	3	Investment	**2,180,000**

Traceability

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Treacibility	TRA_1	Traceability	LITS Workshop	2	41,500	83,000	1	Operational budget	
			Technical consultancy -design of LITS	1	50,000	50,000	1	Operational budget	
			Operationnal support for design - implementation - deployment	5	90,000	450,000	1	Operational budget	
			LITS Software	1	1,200,000	1,200,000	2	Investment	
			Identification office for Market	8	20,000	160,000	2	Investment	
			Central Identification office in Illorin	1	200,000	200,000	2	Investment	
			Tablets for registering animals	100	500	50,000	2	Operational budget	
			Communication and media plan	1	22,500	22,500	2	Operational budget	
			Training of LITS Technicians	1	75,000	75,000	2	Operational budget	
			Workshops for LITS system deploimentt	5	75,000	375,000	2	Operational budget	
			Manuals and resource materials	1	50,000	50,000	2	Operational budget	
			Training videos and online tutorials	1	50,000	50,000	2	Operational budget	
			Visual Ear Tags for Cattle in Lata	50,000	1	37,500	3	Operational budget	
			Visual Ear Tags for cattle in vaccination campaigns & market in Kwara	1,000,000	0.75	750,000	3	Operational budget	
			Printer for marking Tags Locally	2	80,000	160,000	3	Investment	
			Database Maintenance	3	48,000	144,000	3	Operational budget	**3,857,000**

Milk Value Chain

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Milk Value Chain	MKVC_1	Develop milk collection network and cold chain	Solar panels for Milking Parlour	1	20,000	20,000	1	Investment	
			Workshop with ARMTI	1	30,000	30,000	1	Operational budget	
			Consultation process on Lata zone	6	1,500	9,000	1	Operational budget	
			Step 1: milk can coolers + solar panel	10	8,500	85,000	1	Investment	
			Step 1: cans 20-30 l	100	150	15,000	1	Investment	
			Step 1: Milk tank 3000 l + solar panel	1	10,000	10,000	2	Investment	
			Step 1: Scooter + insulated box (tricyles)	1	2,500	2,500	2	Investment	
			Step 1: Water point for drinkable water	1	45,000	45,000	2	Investment	
			Step 1: rehabilitation of the Lata MCC	1	10,000	10,000	2	Investment	
			Monitor the milk production. Local training and 1 visit per month	1	22,000	22,000	2	Operational budget	
			Monitor the milk production. Local training and 1 visit per month	2	22,000	44,000	3	Operational budget	
			Workshop with ARMTI	1	30,000	30,000	3	Operational budget	
			Step 2: milk can coolers + solar panel	15	8,500	127,500	3	Investment	
			Step 2: cans 20-30 l	50	150	7,500	3	Investment	
			Step 2: Milk tank 3000 l + solar panel	3	10,000	30,000	3	Investment	
			Step 2: Scooter + insulated box (tricyles)	1	2,500	2,500	3	Investment	
			Step 2: Water point for drinkable water	3	45,000	135,000	3	Investment	
			Step 2: Construction of the Lata MCC	3	20,000	60,000	3	Investment	
			Monitor the milk production. Local training and 1 visit per month	1	22,000	22,000	4	Operational budget	**707,000**
	MKVC_2	Improve processing capacity	Consultation for the organisation of the processing unit	1	10,000	10,000	1	Operational budget	
			Equipment for the small processing units and works for the processing room	1	10,000	10,000	1	Investment	
			Training and support for processing	1	15,000	15,000	2	Operational budget	
			French expertise on processiong	1	20,000	20,000	2	Operational budget	
			Training and support for processing	1	10,000	10,000	3	Operational budget	
			Feasibility study of a mini dairy unit	1	100,000	100,000	3	Operational budget	
			Creation of a mini dairy unit and utilities	1	8,000,000	8,000,000	4	Investment	**8,165,000**
	MKVC_3	Strengthen good hygiene practices	Review of the existing materials and risk analysis.	1	30,000	30,000	1	Operational budget	
			Conception of the good hygiene practices guides (GHP).	1	20,000	20,000	1	Operational budget	
			Training and dissemination on GHP	3	2,000	6,000	2	Operational budget	
			Germ controls and feed-back on practices.	1	1,000	1,000	2	Operational budget	
			Training and dissemination on GHP	3	2,000	6,000	3	Operational budget	
			Germ controls and feed-back on practices.	1	1,000	1,000	3	Operational budget	
			Training and dissemination on GHP	1	2,000	2,000	4	Operational budget	
			Germ controls and feed-back on practices.	1	1,000	1,000	4	Operational budget	**67,000**

Meat Value Chain

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Meat Value Chain	MVC_1	Slaughterhouse Improvement	Technical consultancy for SPC -design & plans	1	50,000	50,000	1	Operational budget	
			Small Cold chamber with PV panels & meat cutting and processing area	1	200,000	200,000	2	Investment	
			Improved infrstrauctures	1	500,000	500,000	2	Investment	
			Incinerator	1	75,000	75,000	2	Investment	
			Effluent disposal - Solid waste and blood disposal	1	75,000	75,000	2	Investment	
			Boring hole and water storage - chlorinisation	1	100,000	100,000	2	Investment	
			Technical consultancy for SPC -design & plans	1	50,000	50,000	2	Operational budget	
			Improved infrstrauctures	1	500,000	500,000	2	Investment	
			Small Cold chamber with PV panels & meat cutting and processing area	1	200,000	200,000	3	Investment	
			Improved infrstructures	1	500,000	500,000	3	Investment	
			Incinerator	1	75,000	75,000	3	Investment	
			Effluent disposal - Solid waste and blood disposal	1	75,000	75,000	3	Investment	
			Boring hole and water storage - chlorinisation	1	100,000	100,000	3	Investment	
			Technical consultancy for SPC -design & plans	2	50,000	100,000	3	Operational budget	
			Small Cold chamber with PV panels & meat cutting and processing area	2	200,000	400,000	4	Investment	
			Improved infrstructures	2	500,000	1,000,000	4	Investment	
			Incinerator	2	75,000	150,000	4	Investment	
			Effluent disposal - Solid waste and blood disposal	2	75,000	150,000	4	Investment	
			Boring hole and water storage - chlorinisation	2	100,000	200,000	4	Investment	**4,500,000**
	MVC_2	Market Infrastructure Improvement	Infrastructure	1	250,000	250,000	1	Investment	
			Technical consultancy for markets -design & plans	1	50,000	50,000	1	Operational budget	
			Bore hole and water storage and water throughs	1	100,000	100,000	1	Investment	
			Agrovet stores	1	50,000	50,000	1	Investment	
			Infrastructure	1	250,000	250,000	2	Investment	
			Technical consultancy for markets -design & plans	1	50,000	50,000	2	Operational budget	
			Bore hole and water storage and water throughs	1	100,000	100,000	2	Investment	
			Agrovet stores	1	50,000	50,000	2	Investment	
			Infrastructure	2	250,000	500,000	3	Investment	
			Technical consultancy for markets -design & plans	2	50,000	100,000	3	Operational budget	
			Bore hole and water storage and water throughs	2	100,000	200,000	3	Investment	
			Agrovet stores	2	50,000	100,000	3	Investment	
			Infrastructure	1	250,000	250,000	4	Investment	
			Technical consultancy for markets -design & plans	1	50,000	50,000	4	Operational budget	
			Bore hole and water storage and water throughs	1	100,000	100,000	4	Investment	
			Agrovet stores	1	50,000	50,000	4	Investment	**2,250,000**
	MVC_3	Training On New Fattening Methods -	Preparation of the extension services	1	22,500	22,500	1	Operational budget	
			Training of Trainers (ToT) Program for extension officers	1	75,000	75,000	1	Operational budget	
			Workshops for new fattening techniques - industry leaders	5	75,000	375,000	1	Operational budget	
			Manuals and resource materials	1	50,000	50,000	1	Operational budget	
			Training videos and online tutorials	1	50,000	50,000	1	Operational budget	
			Communication and media plan	1	22,500	22,500	2	Operational budget	**595,000**
	MVC_4	Contractualization	Stakeholder meetings for contract dev.	1	37,500	37,500	1	Operational budget	
			Legal consultation for contracts	1	25,000	25,000	1	Operational budget	
			Drafting and printing contracts	1	37,500	37,500	1	Operational budget	**100,000**
	MVC_5	Demonstration Feedlot	Feedlot infrastructure	1	500,000	500,000	1	Investment	
			Handling and weighting	1	50,000	50,000	1	Investment	
			Technical consultancy for feedlot -design & plans	1	50,000	50,000	1	Operational budget	**600,000**

Infrastructures

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Water and transportation Infrastructures	GWM_1	Groundwater mobilization and small scale irrigation	Groundwater survey & potential assessment	1	200,000	200,000	1	Operational budget	
			Workshops and consultations	3	25,000	75,000	1	Operational budget	
			Watering & Irrigation boreholes (2 to 5 ha demo farm)	2	55,000	110,000	1	Investment	
			Workshops and consultations	1	25,000	25,000	1	Operational budget	
			Watering & Irrigation boreholes (2 to 5 ha tests in Lata)	5	55,000	275,000	2	Investment	
			Irrigation training	1	50,000	50,000	2	Operational budget	
			Watering standard systems	10	30,000	300,000	2	Investment	
			Pumps and solar system maintenance training	1	50,000	50,000	2	Operational budget	
			Irrigation plots, groundwater based for demo farm	5	25,000	125,000	2	Investment	
			Irrigation plots, groundwater based (test in Lata)	10	25,000	250,000	2	Investment	
			Pumps and solar system maintenance training	1	20,000	20,000	2	Operational budget	
			Macro basin (8,000 m3)	1	65,000	65,000	2	Investment	
			Watering & Irrigation boreholes (2 to 5 ha tests in Lata)	8	55,000	440,000	3	Investment	
			Watering standard systems	20	30,000	600,000	3	Investment	
			Irrigation training	1	50,000	50,000	3	Operational budget	
			Irrigation training	1	50,000	50,000	3	Operational budget	
			Pumps and solar system maintenance training	1	20,000	20,000	3	Operational budget	
			Macro basin (8,000 m3)	5	65,400	327,000	3	Investment	
			Watering standard systems	20	20,000	400,000	4	Investment	**3,432,000**
	RD_1	Improvement of dirt roards	Workshops and consultations	3	25,000	75,000	2	Operational budget	
			Dirt roads improvement Master Plan Study	1	100,000	100,000	2	Operational budget	
			Dirt roads improvement works	10	80,000	800,000	2	Investment	
			Dirt roads improvement works	15	80,000	1,200,000	3	Investment	
			Dirt roads improvement works	15	80,000	1,200,000	4	Investment	**3,375,000**
	SWM_1	Surface water mobilization and irrigation	Surface water mobilization potential study	1	250,000	250,000	1	Operational budget	
			Small dams studies	5	150,000	750,000	1	Operational budget	
			Small irrigation schemes studies (50 - 100 ha)	3	100,000	300,000	2	Operational budget	
			Small dam construction (Seed Production Unit)	1	750,000	750,000	2	Investment	
			Pumps and solar system maintenance training	1	50,000	50,000	2	Operational budget	
			Pumps and solar system maintenance training	1	10,000	10,000	2	Operational budget	
			Small irrigation schemes works (SPU)	1	225,000	225,000	2	Investment	
			Assistance / training to irrigation management	1	50,000	50,000	2	Operational budget	
			Small dam construction (Demo Farm)	1	50,000	50,000	2	Investment	
			Small irrigation schemes works (Demo Farm)	1	150,000	150,000	2	Investment	
			Pumps and solar system maintenance training	1	10,000	10,000	3	Operational budget	
			Assistance / training to irrigation management	2	20,000	40,000	3	Operational budget	
			Small dam construction	1	200,000	200,000	4	Investment	
			Small irrigation schemes works	1	200,000	200,000	4	Investment	
			Assistance / training to irrigation management	3	50,000	150,000	4	Operational budget	**3,185,000**

Empowerment (Women & Youth)

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Women & Youth Emporwerment	WE_0	Free Up Time	Promotion of improved wood stoves	2	25,000	50,000	1	Operational budget	
			Dissemination of improved wood stoves	50	40	2,000	1	Operational budget	
			Scaling up improved wood stoves	150	40	6,000	2	Investment	**58,000**
	WE_1	Litteracy and Vocational Training	Training of trainers (ToT) various activities	1	30,000	30,000	1	Operational budget	
			Training on small ruminants livestock	2	7,500	15,000	1	Operational budget	
			Entrepreneurship training of trainors	1	75,000	75,000	1	Operational budget	
			Entrepreneurship training of women	1	5,000	5,000	1	Operational budget	
			Demand driven technical training	5	1,500	7,500	1	Operational budget	
			Emerging Income Generating Activities Training of Trainors	2	20,000	40,000	1	Operational budget	
			Workshop with young Lata-Nna farmers	1	15,000	15,000	1	Operational budget	
			Workshop with young Fulanis	1	15,000	15,000	1	Operational budget	
			Entrepreneurship training of trainors (ToT)	1	75,000	75,000	1	Operational budget	
			Workshop with young Lata-Nna farmers	1	5,000	5,000	1	Operational budget	
			Workshop with young Fulanis	1	5,000	5,000	1	Operational budget	
			Training small business	5	5,000	25,000	1	Operational budget	
			Training small business	10	5,000	50,000	1	Operational budget	
			Emerging Income Generating Activities Training of Trainors	2	20,000	40,000	1	Operational budget	
			Various technical training of trainors	2	25,000	50,000	1	Operational budget	
			Training of trainers (ToT) various activities	1	30,000	30,000	2	Operational budget	
			Training on vegetable growing	2	15,000	30,000	2	Operational budget	
			Food Processing Training	1	10,000	10,000	2	Operational budget	
			Training on poultry	2	15,000	30,000	2	Operational budget	
			Training on bee keeping	1	15,000	15,000	2	Operational budget	
			Training on fishpond management	2	15,000	30,000	2	Operational budget	
			Entrepreneurship training of women	1	5,000	5,000	2	Operational budget	
			Demand driven technical training	10	1,500	15,000	2	Operational budget	
			Vocational training centre	1	150,000	150,000	2	Investment	
			Metal carpentry tools & equipment	1	15,000	15,000	2	Investment	
			Engine mechanics (thermal and electric) tools & equipment	1	15,000	15,000	2	Investment	
			Wood carpentry and furnitures tools & equipment	1	15,000	15,000	2	Investment	
			Electronic devices tools & equipment	1	10,000	10,000	2	Investment	
			FabLab tools & equipment	1	25,000	25,000	2	Investment	
			Demand driven technical training	10	1,500	15,000	2	Operational budget	
			Training on bee keeping	1	15,000	15,000	3	Operational budget	
			Entrepreneurship training of women	1	5,000	5,000	3	Operational budget	
			Demand driven technical training	20	1,500	30,000	3	Operational budget	
			Demand driven technical training	10	1,500	15,000	3	Operational budget	
			Entrepreneurship training of women	1	5,000	5,000	4	Operational budget	
			Demand driven technical training	20	1,500	30,000	4	Operational budget	
			Demand driven technical training	10	1,500	15,000	4	Operational budget	**977,500**
	WE_2	Active Women Cooperatives Enhencement	Fish ponds construction	2	7,800	15,600	2	Investment	
			Fingerlings & feed	2	500	1,000	2	Operational budget	
			Women Small Business Collective Activities	1	2,500	2,500	2	Operational budget	
			Electric Grain Mill	1	2,500	2,500	2	Investment	
			Bee keeping equipment	1	1,500	1,500	2	Operational budget	
			Acquisition of hives and bee swarms	1	1,500	1,500	2	Operational budget	
			Collective Kitchen Premises	1	20,000	20,000	3	Investment	
			Collective Kitchen Equipments	1	10,000	10,000	3	Investment	
			Bee keeping equipment	4	1,500	6,000	3	Operational budget	
			Acquisition of hives and bee swarms	4	1,500	6,000	3	Operational budget	
			Fish ponds construction	3	7,800	23,400	3	Investment	
			Fingerlings & feed	3	500	1,500	3	Operational budget	
			Women Small Business Collective Activities	2	5,000	10,000	3	Operational budget	
			Electric Grain Mill	3	2,500	7,500	3	Investment	
			Bee keeping equipment	5	1,500	7,500	4	Operational budget	
			Acquisition of hives and bee swarms	5	1,500	7,500	4	Operational budget	
			Women Small Business Collective Activities	2	5,000	10,000	4	Operational budget	**134,000**
	WE_3	Micro-Business	Women Micro Credit Activities	10	200	2,000	1	Operational budget	
			Workshop for manual metal mesh manufacturing	1	5,000	5,000	1	Investment	
			Starting kit of galvanazed iron wires for fences (10 km)	4	1,500	6,000	1	Operational budget	
			Starting kit of galvanazed iron wires for fences (10 km)	16	1,500	24,000	1	Operational budget	
			Micro credits for young Lata-Nna farmers	20	150	3,000	1	Operational budget	
			Micro credits for young Fulanis	20	150	3,000	1	Operational budget	
			Women back yard gardens (0.20 ha)	3	1,000	3,000	2	Investment	
			Women Micro Credit Activities	20	200	4,000	2	Operational budget	
			Micro credits for young Lata-Nna farmers	50	300	15,000	2	Operational budget	
			Micro credits for young Fulanis	50	300	15,000	2	Operational budget	
			Women back yard gardens (0.20 ha)	7	1,000	7,000	3	Investment	
			Women Micro Credit Activities	30	200	6,000	3	Operational budget	
			Micro credits for young Lata-Nna farmers	50	150	7,500	3	Operational budget	
			Micro credits for young Fulanis	100	150	15,000	3	Operational budget	
			Women back yard gardens (0.20 ha)	10	1,000	10,000	4	Investment	
			Women Micro Credit Activities	30	200	6,000	4	Operational budget	
			Micro credits for young Lata-Nna farmers	50	150	7,500	4	Operational budget	
			Micro credits for young Fulanis	100	150	15,000	4	Operational budget	
			Women back yard gardens (0.20 ha)	30	1,000	30,000	5	Investment	
			Women Micro Credit Activities	60	200	12,000	5	Operational budget	
			Micro credits for young Lata-Nna farmers	100	150	15,000	5	Operational budget	
			Micro credits for young Fulanis	100	150	15,000	5	Operational budget	**226,000**

Environment (including Governance)

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Environment	Enviro_1	Natural Resources Management	Ecoconstruction Audit & Recommendations	1	55,000	55,000	1	Operational budget	
			Biodiversity inventory of Lata-Nna Reserve	1	50,000	75,000	1	Operational budget	
			Participatory Pastoralism Survey / Monitoring / Devlopment	1	60,000	60,000	1	Operational budget	
			Bocage Landscape design study	1	30,000	30,000	1	Operational budget	
			Bocage Landscape sensitization workshop	1	30,000	30,000	1	Operational budget	
			Bocage landscape implementation (ha)	100	1,800	180,000	2	Investment	
			Agro-meteo-environment automatic stations	5	2,500	12,500	2	Investment	
			LoRa Network	1	15,000	15,000	2	Investment	
			Bocage landscape implementation (ha)	200	1,800	360,000	3	Investment	
			Bocage landscape implementation (ha)	500	1,800	900,000	4	Investment	**1,717,500**
	Enviro_2	Integrated Waste Management	Methanization unit feasibility study	1	40,000	40,000	1	Operational budget	
			Training on methanization process and plant management	1	30,000	30,000	1	Operational budget	
			Lata waste collect system study	1	25,000	25,000	1	Operational budget	
			Lata waste collect system training of trainers	1	25,000	25,000	1	Operational budget	
			Methanisation unit construction (demo-farm site)	1	150,000	150,000	2	Investment	
			Training on methanization process and plant management	2	10,000	20,000	2	Operational budget	
			Methanisation unit processing tests	2	20,000	40,000	2	Operational budget	
			Lata waste collect system training of agents	1	10,000	10,000	2	Operational budget	
			Lata -Nna Waste collection system	1	50,000	50,000	2	Investment	
			Plastic and waste incinerator	1	15,000	15,000	2	Investment	
			Biogas purification process unit	1	2,500	2,500	3	Investment	
			Methane gas compressor	1	5,000	5,000	3	Investment	
			Steel gas bottles	50	100	5,000	3	Investment	**417,500**
	Enviro_3	Governance	Socio-economic base-line survey	1	75,000	75,000	1	Operational budget	
			LIW approch evaluation and guide lines	1	25,000	25,000	1	Operational budget	
			Workshop for the co-construction of the governance of the Reserve	2	25,000	50,000	1	Operational budget	
			Reporting tools	5	1,000	5,000	1	Investment	
			Community House Construction	1	45,000	45,000	1	Investment	
			Community House Equipment	1	15,000	15,000	1	Investment	
			Reporting focal persons (3 person.months during 5 years)	180	125	22,500	1	Operational budget	
			Reporting / communication	5	250	1,250	1	Operational budget	
			Cooperatives promotion	2	25,000	50,000	1	Operational budget	
			Workshop for the co-construction of the governance of the Reserve	2	10,000	20,000	2	Operational budget	
			Digitalization	1	30,000	30,000	2	Investment	
			Digitalization training	1	20,000	20,000	2	Operational budget	
			Public Multi Media System	1	10,000	10,000	2	Investment	
			Reporting / communication	5	250	1,250	2	Operational budget	
			Cooperatives promotion	2	10,000	20,000	2	Operational budget	
			Cooperatives propotion	1	10,000	10,000	3	Operational budget	
			LIW approch worksite evaluation	1	35,000	35,000	3	Operational budget	
			Workshop for the co-construction of the governance of the Reserve	1	10,000	10,000	3	Operational budget	
			Reporting / communication	5	250	1,250	3	Operational budget	
			Workshop for the co-construction of the governance of the Reserve	1	10,000	10,000	3	Operational budget	
			Reporting / communication	5	2,500	12,500	4	Operational budget	
			Socio-economic end-line survey	1	50,000	50,000	5	Operational budget	
			Reporting / communication	5	250	1,250	5	Operational budget	**520,000**

Technical Assistance

Components	# Sub Comp	Subcomponents	Activities	Quantity	Unit budget	Total budget	Year	Category	Tot.Sub Comp (€)
Technical Assistance	TA_1	Project Management	Worksite facility (accomodation & offices)	1.00	150,000	150,000	1	Investment	
			Project Management	0.70	1,047,640	733,348	1	Operational budget	
			Project Management	1.30	1,047,640	1,361,932	2	Operational budget	
			Project Management	1.30	1,047,640	1,361,932	3	Operational budget	
			Project Management	1.00	1,047,640	1,047,640	4	Operational budget	
			Project Management	0.70	1,047,640	733,348	5	Operational budget	**5,388,200**
	TA_2	Project National Coordination	Project Management	1	380,000	380,000	1	Operational budget	**380,000**

Annex 2. Some proposed partnerships with French companies for grazing and reproduction improvement.

This is a selection of some French companies with experiences in Africa.

Ceva Santé Animale is recognized as an expert in the field of cattle reproduction. Pioneer in the development of progesterone intravaginal devices (PRID), the company has developed over the time a very comprehensive product range to cover the needs of cattle reproduction specialists.

Ceva has collaborated over the years with scientists and veterinary practitioners in increasing the knowledge in the field of cattle reproduction. This has resulted in the publication of scientific papers in different journals. Regularly the company has been involved in educational programs that have contributed to expand that knowledge among cattle veterinarians. As part of those activities Ceva launched the website www.reprology.com. The website gathers together all the data and publications available to the public and professionals on the subject of control of reproduction in cattle, sheep and goats.

- **PRID® Delta:** Latest development in progesterone intravaginal devices for cattle. The use of PRID® Delta allows synchronization of estrus in cycling cattle and induction and synchronization of estrus in non-cycling cattle
- **ENZAPROST® T** (Dinoprost): A natural injectable prostaglandin eliminates physiological and pathological corpora lutea by its luteolytic effect. Its uterotonic effect can also be used to treat uterine pathologies such as endometritis.
- **CYSTORELINE®** (Gonadoreline) is a hormone that can trigger ovulation in cycling animals. It can be used in Ovsynch protocols to synchronize heat and to improve conception rates.
- **SYNCRO PART® PMSG** (eCG = equine chorionic gonadotropin), the product mimics the effects of natural gonadotropins (FSH and LH), triggering the final maturation of the follicles and their ovulation. It is used in combination with PRID® Delta when treating animals in anoestrus.
- **SYNCROSTIM®500 IU** Equine serum Gonadotrophin (eCG, formerly known as PMSG) 500 IU / Solvent vial contains: Benzyl alcohol 16.5 mg/ml. (eCG, formerly known as PMSG)

Training seminars (**Reprology®, Reprosession®, Ceva University®**) combining interactive clinical cases for vets or livestock rearing subjects for producers, are available at all times to livestock breeding professionals.
The specialized **Reprology.com** website (accessible from January 2010) gathers together all the data and publications available to the public and professionals on the subject of control of reproduction in cattle, sheep and goats.

Warning: the information provided on the products depends on national registrations. Access to technical information is restricted to authorized persons.

https://www.ceva-africa.com/en

SYNETICS

Synetics the European leader in bovine and goat genetics.

A unique cooperative by the extent of its genetic offer, within the combined large Holstein program and all the other 19 breeds. This brings value to herders by creating products and tailor-made solutions meeting a wide range of needs for sustainable farming. With us as your partner you can get the best out of your herd, for this we offer you our exclusive service in the areas of mating and genotyping.

It's the inner values that count – not only for humans, but also for your animals. Because only those who really know their herd genetically can use the full potential and achieve the maximum breeding progress. With the help of genomic breeding values in our mating program for your female animals, you can now make more targeted decisions and optimize your management strategy.

We focus on the development of your herd; our consultants have excellent knowledge and in combination with our bulls will create a successful future together. Together we will work out a concept for your herd, analyse the advantages and development possibilities of your herd.

With our herd genotyping program, we provide our customers with the opportunity to obtain genomic information from their animals directly after the animals are born.

Genomic selection provides the possibility to increase efficiency and profitability of farms. New management strategies are developed in close cooperation with the farm and Synetics staff.

Genotyping your heifers allows you to know your animals better and very quickly (at 3 to 6 months of age). This means improving technical performance, such as accelerating genetic progress and improving sorting, selling females, or culling cows. Furthermore, it also means optimizing mating with the help of our Synetics mating program.

There are several possibilities to adjust the mating to the individual needs of the farm, e.g. the choice of semen (sexed semen, crossing...).

https://www.synetics.world/

IMV Technologies embodies half a century of innovation in artificial insemination in cattle. Each year, more than 100 million cows are bred using IMV Technologies bovine artificial insemination products, across more than 150 countries. Today, we are more determined than ever to deliver cutting-edge products, services and technical innovations to help industry artificial insemination technicians, and other breeders, improve their performance and facilitate regulatory compliance.

We provide professionals in the bovine industry with products for:

- Artificial insemination of cattle with frozen semen
- Artificial insemination of cattle with fresh semen
- Embryo transfer

Discover our full range of products for semen production centers, AI technicians, veterinarians and for cattle herders :

- **Semen Collection and Processing Equipment**: They provide advanced equipment for the collection, processing, and storage of semen, ensuring genetic materials for artificial insemination.
- **Biotechnological Solutions**: IMV offers innovative solutions for animal reproduction, including synchronization protocols, embryo transfer technologies, and genetic evaluation services.
- **IMV Imaging**: This division focuses on advanced imaging solutions for reproductive management, offering tools and technologies for ultrasound and other imaging techniques to monitor and enhance reproductive health.
- **Training and Support**: They provide training programs for technicians and veterinarians to ensure best practices in semen handling and reproductive management, fostering knowledge transfer and skill development in the field.
- **Consulting Services**: IMV Technologies also offers consulting services to help farms and organizations optimize their reproductive strategies and improve herd performance.

Their focus on quality and innovation positions IMV Technologies as a leader in the field of reproductive technologies in agriculture.

https://www.imv-technologies.com/

Annex 3. Cattle feed equipment that could be provided by French companies

Feed mill

Ferma Lab : French company that provide on the market Ali'Lab (with picture and technical data below.

www.fermalab.fr

Analysis of raw materials

Capinov : French reference laboratory for chemical analysis

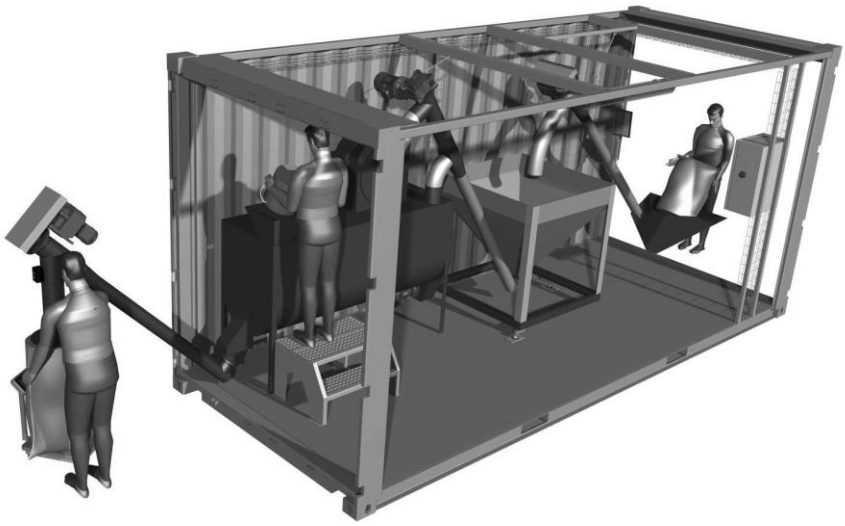
feed formulation and training on field

MG2Mix : French company with formulation service and ruminant service with 15 years of experience on African conditions, data base of 300 raw materials and forages from southwest Saharan area.

mapping and screening of availability of raw materials in the lata region

Feed avenue : Nigeria subsidiary of French company (MG2Mix) implant in Nigeria for 5 years with local employee that can easily make the mapping (almost already made).

Picture of Ali'Lab



Ali'Lab data

Container size

- Dimensions :
  - HEIGHT = 2890 MM
  - WIDTH =2440 MM
  - LENGHT = 6060 MM
  - WIEGHT : 4000 KG
- MAXIMAL POWER NEEDED : 13.5kW :

Feed consumption in the reserve

Milk production		
Number of animals		10,000
Dry period intake	kg/j	5
Number of days	90	
Total feed	T/an	4,500
Rest of the year	kg/j	2
Number of days	275	
Total feed	T/an	5500
Total dairy feed	T/an	10,000
Fattening program		
Number of animals		6,000
Fattening feed	kg/j	5
Number of days	90	
Total fattening feed	T/an	2,700
Feed for LATA		
Total feed for LATA	T/an	12,700
Ali'Lab		
Capacity	T/h	1
Running hours	h/d	9
Number of days	d/week	6

Number of week	week/year	52
Total capacity	T/an	2,808
Nombre d'Ali'lab		4.5
Storage capacity		
Minimum advance stock	day	6
Feed production	T/d	40.7
Storage capacity	T	244.2

SERAP : Milk Can Cooler

https://www.groupeserap.com/milk-tanks_milk-coolers_milk-can-cooler.phtml

MILK CAN COOLER

Chilled water milk can cooler

DESCRIPTION

- Holds up to 8 30L or 40L cans
- Reinforced plastic reservoir that is light and robust
- Operation in 2 milkings with cooling of each one from 35°C to 8°C in under 2h
- Copper ice accumulation exchanger.
- High-performance injected polyurethane foam insulation providing outstanding isothermal properties

The cans can be transported by tricycles or scooters. The milk can be cooler stay in the MCPs.

https://www.groupeserap.com/milk-tanks_milk-coolers_closed-milk-coolers-from-550-to-30000-liters-capacities_firstsc-milk-cooler.phtml

FIRST.SC MILK COOLER

FIRST.SC

DESCRIPTION

- Direct expansion closed milk cooler with automatic washing.
- Capacity: 3,000 to 10,000 litres.
- Performance: 2, and 4 milkings.
- Manufactured in AISI 304 stainless steel and compliant with the most stringent food-processing requirements.
- High-performance injected polyurethane foam insulation providing outstanding isothermal properties.
- R 22 or R 404A refrigeration unit.
- Compliant with international standard ISO 5708.
- Compliant with European CE directives.

Not marketed in Europe.

ADVANTAGES

Small-capacity cooler with integrated automatic wash system perfectly suited to emerging countries characterised by difficult operating environments (power stability and quality issues).
RL20 electronic control unit with OPTIWASH automatic washing system (stop, cooling on, agitation on, washing on, post-rinsing).

OPTION

Emergency cooling ensures that milk is cooled and kept at the right temperature in all conditions.

Boccard

https://www.boccard.com/markets/food-nutrition/

Annex 4. Irrigation matters

Irrigation of fodder – Fodder Water Requirements

As for any other crop, fodder needs water to grow. The driving force behind the plant's growth is evapotranspiration. This phenomenon uses soil's water.

For the Lata-Nna grazing reserve, we have several sources of data to estimate the fodder water requirements.

The fodder water requirement, ETc (mm/day) is determined from the expression:

$$ET_c = K_c * ET_o$$

where Kc is the crop coefficient and ETo is the Reference Evapotranspiration (mm/day). The value of the crop coefficient Kc depends on the stage of growth and different crops have different, Kc values.

A comparison of the ETc and the Effective Rainfall (Pe) is used to determine the irrigation deficit to be provided from the identified water sources. The daily Net Irrigation Water Requirement, NIWR (mm/day) is determined from the expression:

$$NIWR = [ET_c - P_e - G_e - W_b]$$

where ETc is the crop water requirement (mm/day), Pe is is the effective rainfall (mm/day), Ge is the ground water contribution (mm/day), and Wb is the stored soil water contribution (mm/day).

Groundwater storage contribution is often regarded as negligible. The contribution from the soil water can easily be found if depth of the root zone and soil characteristics is known: Wb. When the contribution of Ge and Wb is estimated to be negligible, the relation becomes:

$$Wat\_Req1 = [ET_c - P_e]$$

This approach is the standard one. For a permanent fodder cropping, the crop coefficient value is approximatively 0.90.

A second approach is also possible: remote sensing systems gives estimation of the "Actual Evapo Transpiration and interception". It represents the water vapor vertical flux emitted by the vegetal cover plus the evaporation of the intercepted water (AET+Int). In dry season, this quantity of emitted water comes from the soil water reserve (Ge).

If we replace the existing vegetation (bush, trees, crops…) by fodder crop, we can imagine the estimated AET+Int will be at least partly mobilized by the newly installed fodder crop.

For our next estimation, we estimate that 65% of the AET+Int is used as a soil water reservoir by the fodder. The estimation of the fodder net water requirement becomes:

$$Wat\_Req2 = [ET_c - P_e - 65\%.(AET + Int)]$$

The second approach seems to better fit to what we can observe on the terrain: during dry season, the vegetation continues to grow without rains during 3 to 4 months. Remote sensing data shows there is evapotranspiration during dry months, it means there is water that is used by the plants during that period and this water, or a part of it (for the purpose of this estimation, we took 65% of the estimated available soil water) and we can assume fodder will also benefit from this soil water.

The following table resumes the figures: Wat_Req_1 is the first estimation (classical approach) while Wte_Req_2 is the result of the second approach.

Table 7 : Monthly fodder water requirements (mm/month)

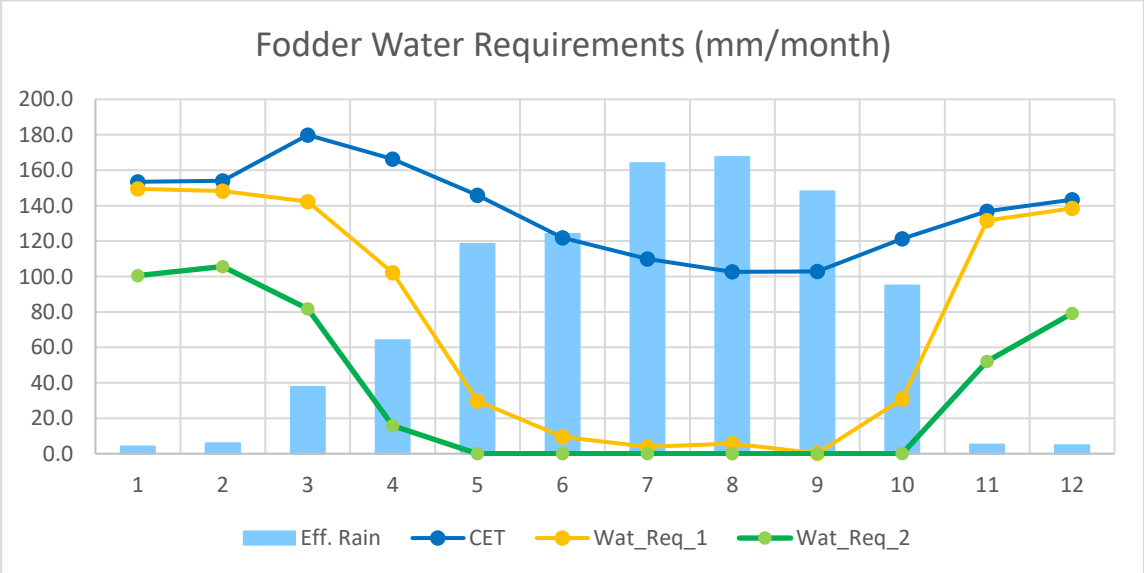
Month	Month	PET	CET	Eff. Rain	Wat_Req_1	Wat_Req_2
Jan	1	170.5	153.5	4.0	149.5	100.6
Fev	2	171.2	154.1	5.8	148.2	105.6
Mar	3	199.9	179.9	37.6	142.3	81.8
Apr	4	184.8	166.3	64.1	102.2	15.7
May	5	162.0	145.8	118.4	29.8	0.0
Jun	6	135.4	121.9	124.1	9.4	0.0
Jul	7	122.1	109.9	163.9	3.8	0.0
Agu	8	114.0	102.6	167.5	5.7	0.0
Sep	9	114.2	102.8	148.0	0.2	0.0
Oct	10	134.8	121.3	94.9	30.8	0.0
Nov	11	152.0	136.8	5.2	131.6	52.1
Dec	12	159.3	143.3	4.8	138.5	79.3
YEAR	**YEAR**	**1,820**	**1,638**	**938**	**892**	**435**

With:

- PET : Potential Evapo Transpiration
- CET: Crop Evapo Transpiration
- Eff. Rain: Effective Rains
- Wat_Req_1 : Water requirement , classical method
- Wat_Req_2: Water requirements according to the second approach.

The values are monthly averages computed with time series ranging from the 1/1/2009 to 31/12/2022.

The difference is significant, the second approach that considers the soil water reservoir represents 50% of the requirements calculated without soil water reservoir.



The averages values will serve as refence values for the next estimations and calculations.

Important note: the total (average value) of required irrigation water (net requirement, at the soil of the field level) is about 450 mm per season (dry season). For other crops (cash crops) like tomatoes, vegetables (high value crops) net water requirement are often more important: 600 to 800 mm. An irrigation project necessitates important investments (water resource mobilization – dam or bore holes – water conveyance to the fields, irrigation systems on the field) and there are a lot of situation where high value crops doesn't reach the economical threshold to ensure a profitable and economically viable irrigation system.

The profitability of the investments will depend on the way the fodder is transformed into milk or meat.

On the field irrigation system

As the fodder crop' s net water requirements are estimated, the next step is to assess the irrigation system that would be more convenient.

For fodder production, two options can be envisaged:

1. Gravity water fed irrigation
2. Sprinkler irrigation

Drip irrigation is not suited for fodder production, especially on sandy soils as the wet bulb is too thin and too deep.

Gravity water fed irrigation

Two major techniques are often used: furrow or basin irrigation.

Basin irrigation

This technique is ancestral and very well adapted to water gravity feed systems. From a canal, a distributary canal is conceived to convey the water directly to a plot or a part of it.

That is an easy way to apply water at field level, even if the land preparation requires a lot of labor. In terms of irrigation efficiency, it could be a better solution than furrow technique, the required knowledge is less important than for furrow irrigation: when the basin is full of water, the irrigation operator close its water entrance and open the entrance of the next basin.

Figure 21: Basin irrigation (paddy field on left, oasis on the right)

This technique is widely used for paddy irrigation all over the world and in a large portion of the oasis in North Africa and Middle East (Alfalfa).

Furrow irrigation

It consists of creating in the field parallel furrows (commonly 25 cm depth and 50 cm width) that are water fed during the irrigation operation.

Figure 22 : Furrow irrigation

It requires a lot of labor to drive the water (opening and closing the entrances of the furrows) and there are always water losses at the end of the furrow. A good land leveling (investment: labor or machines works) is necessary to ensure regular slopes of the furrows. The irrigation operator (the farmer / the herder) must have a good knowledge of the technique.

For both systems, the major inconvenient is the low irrigation efficiency, about 60% (meaning that 40% of mobilized water is lost)

SPRINKLER IRRIGATION

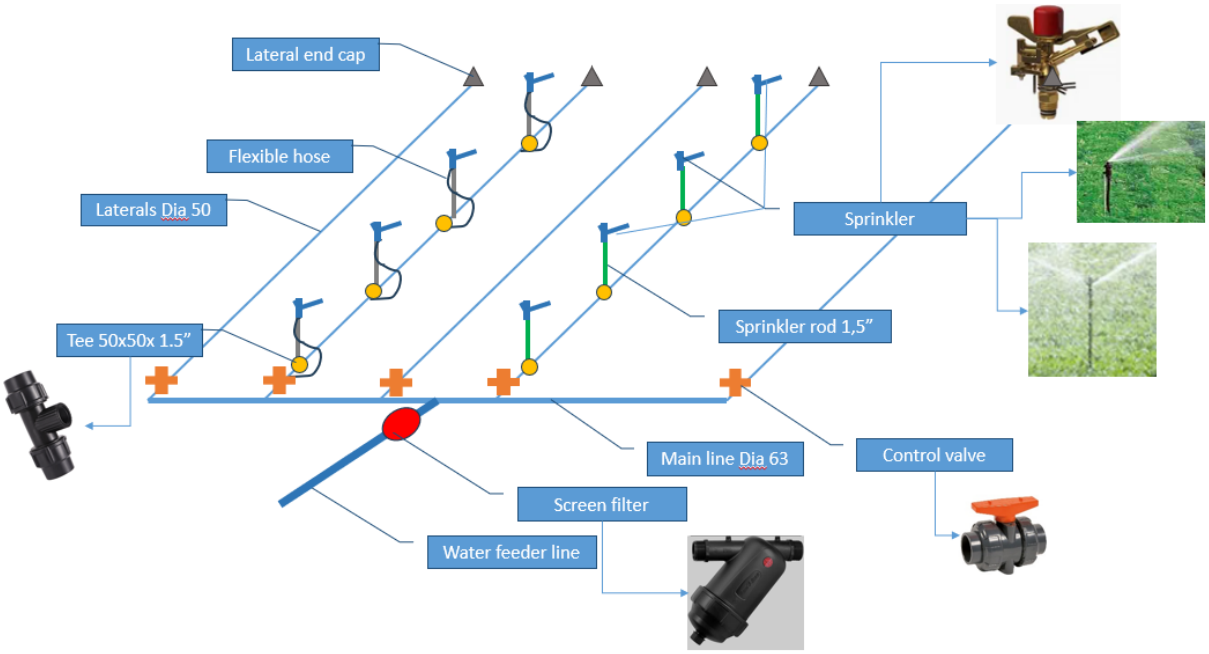
We could envisage Centre Pivot irrigation, but this technology is much more suited to large areas, for fields areas bigger than 25 ha which would, in the context of Lata-Nna, it would require a collective water management and also important water resource in terms of available flow.

Water gun for irrigation requires 4 to 5 bars pressures (at least) and that is high energy consuming. This technology won't be convenient.

The most suited technology for a bocage landscape (also available in open field systems) is the sprinkling one, using pipes and sprinklers installed on the plot. The required pressure is about 2 bars.

The sprinkler system can cover the entire plot, or only a part of it provided it is moved regularly to cover by rotation all the plot.

Figure 23: Total covered plot

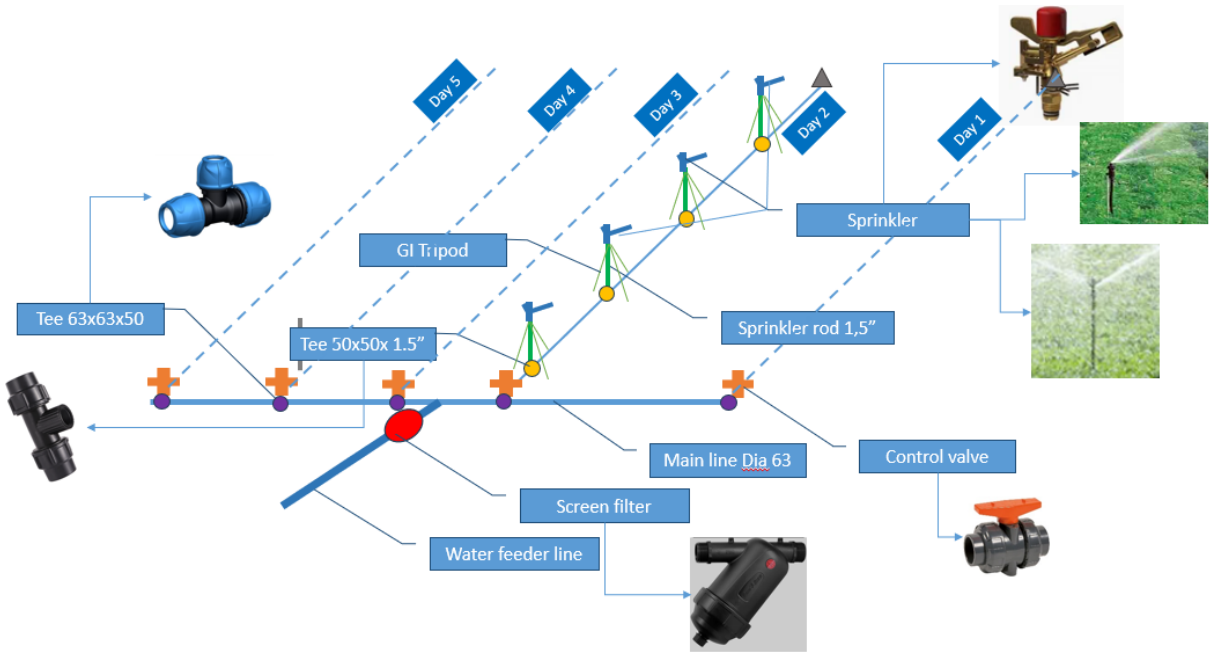


This system requires less labor than the "movable lateral" one. It costs roughly 7.6 k€/ha[10].

Reaching cheapest systems is possible if the "fixed sprinkling system" is replaced by one movable ramp with only one lateral.

[10] According to Nigerian unit prices estimation (a few prices related to fittings were collected in Europe).

Figure 24: Partially covered plot, movable lateral



The movable lateral system requires regular labor, but it is less expensive than the first one. It costs about 2.3 k€/ha.

Note that the main line can be replaced by a flexible hose to avoid the numerous control valves and the connections operations.

Figure 25 : Sprinkler irrigation layout with flexible hose

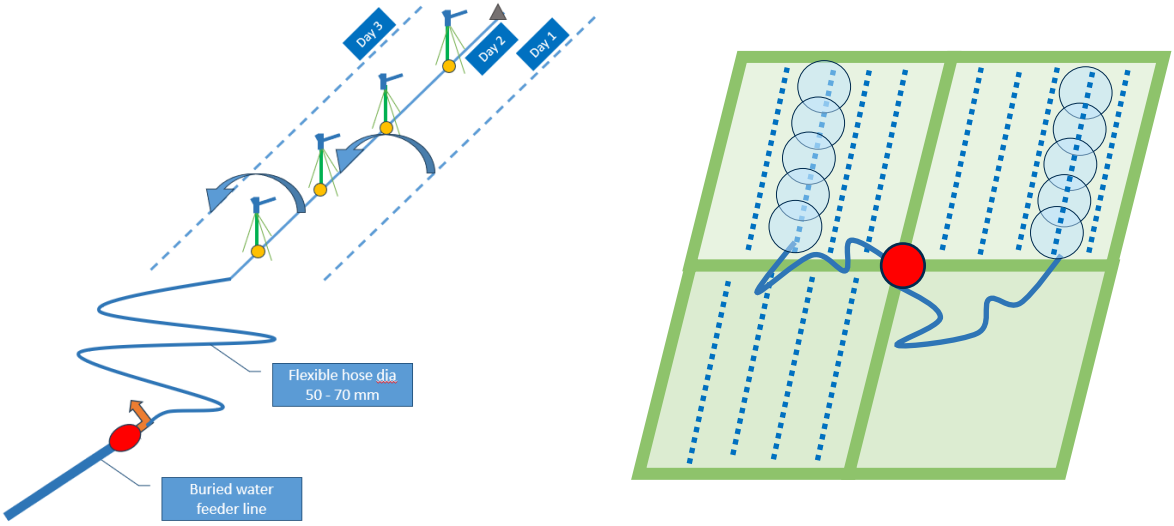


Table 8: Sprinkler full plot covered vs partial covered plot

Full covered system	Partially covered system – movable lateral
Less or no labor (valves opening and closing)	More labor (valves opening and lateral moving)

Cost : +/- 7.6 k/ha Depreciation (7 years) : 1,087 €/ha.year	Cost : +/- 2.0 to 2.4 k/ha Depreciation (7 years) : 267 to 337 €/ha.year

Groundwater mobilization

The concept is simple: the water mobilization is ensured by a borehole equipped with solar pump, a surface water tank serves as a buffer, an electrical pump feeds an irrigation pipes network equipped with sprinklers at the plot. At plot level, a full sprinkler system can be used (no need to move any part of the laterals) or a movable lateral equipped with sprinklers is used (cheapest solution).

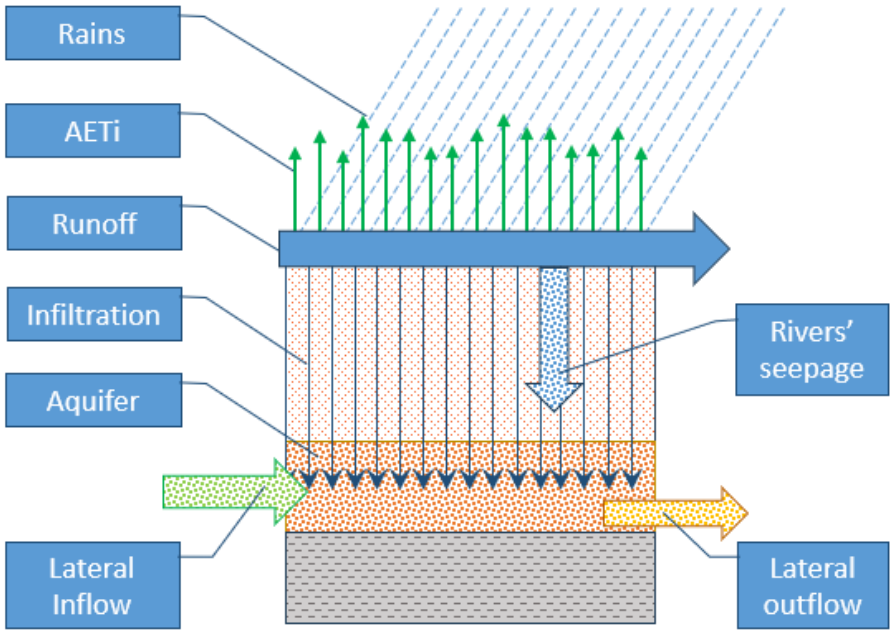
TENTATIVE AQUIFER WATER BALANCE

The groundwater potential is not easy to determine without a specific study that would be carried out by a specialized company using very specific technologies. Such a study is planned for the year 1 of the Project. However, on a feasibility study level, it is possible to draw a simple water balance model using satellites' remote measured data.

The FAO water portal offers such possibilities as it is possible, for a specific area (a polygon representing the Lata Grazing Reserve on a map) to download the following data at monthly steps:

- Precipitations (P, Rains in mm/month)
- Runoff (Run, in mm/month)
- Actual Evapotranspiration and Interception (AETi, in mm/month)
- Seepage from the rivers network
- Lateral groundwater in and out flows.

Figure 26: Basic water balance for aquifer recharge



At a first glance, we can do a rough estimate of the water balance if we don't consider the seepage from the rivers and the groundwater in and out flows. Then, the aquifer recharge is obtained with the formula:

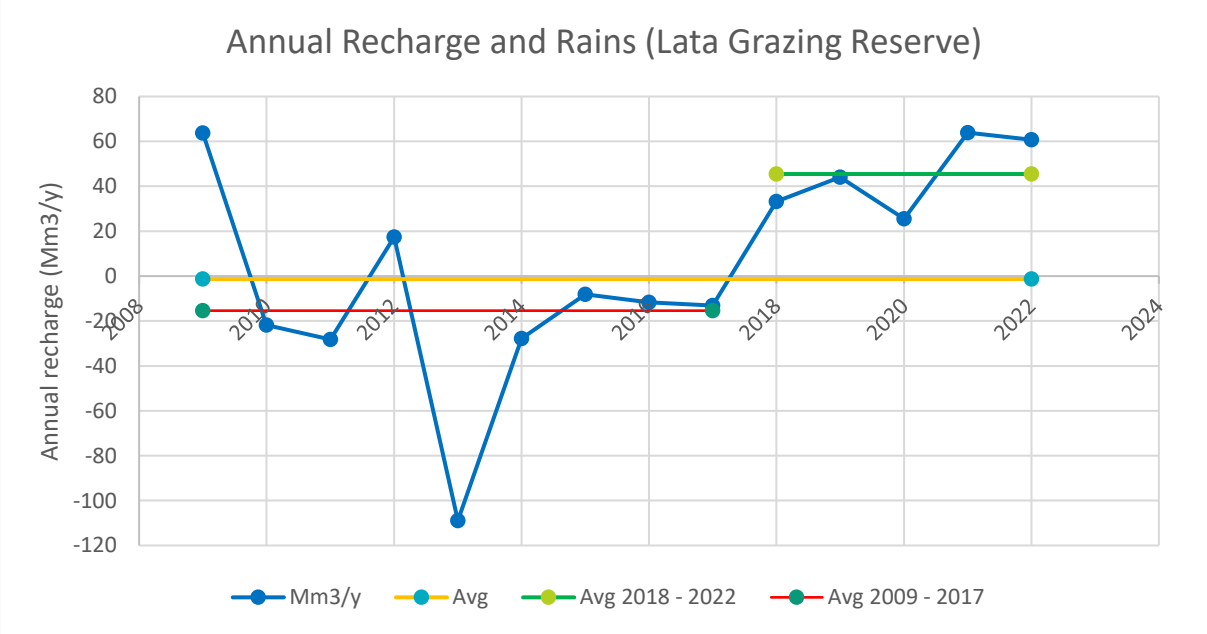
$$Rech = P - Run - AETi$$

This gives the Table 9 : Estimation of the Lata Grazing Reserve Groundwater Recharge with the available data ranging from 2009 to 2022:

Table 9 : Estimation of the Lata Grazing Reserve Groundwater Recharge

Year	Rains(mm/y)	Runoff (mm/y)	AETi (mm/y)	Recharge (mm/y)	Mm3/y
2009	1,463.4	7.9	1,152.2	303.3	64
2010	1,281.2	190.3	1,194.5	-103.7	-22
2011	1,125.5	36.4	1,223.5	-134.5	-28
2012	1,357.2	96.6	1,177.6	83.0	17
2013	796.8	17.6	1,297.8	-518.6	-109
2014	1,233.0	27.0	1,338.2	-132.3	-28
2015	1,144.7	7.8	1,175.8	-38.8	-8
2016	1,358.4	109.3	1,305.1	-56.0	-12
2017	1,189.0	17.7	1,233.5	-62.1	-13
2018	1,341.6	26.9	1,156.8	157.9	33
2019	1,466.2	154.2	1,102.0	210.0	44
2020	1,218.7	76.2	1,021.0	121.4	26
2021	1,279.8	36.2	939.4	304.2	64
2022	1,265.3	29.0	947.1	289.3	61
Min	796.8	7.8	939.4	-518.6	-108.9
Avg	**1,221.2**	**56.1**	**1,146.9**	**-6.4**	**-1.3**
Max	1,466.2	190.3	1,338.2	304.2	63.9

Figure 27 : Evolution of the water balance



This first water balance indicates the aquifer would be subject to a negative recharge during the period 2009 – 2022, but positive recharge is also observed since 2018.

Even if this water balance is not complete (groundwater fluxes and rivers recharge) it gives an idea of the challenges regarding the groundwater mobilization.

Note that, if there is no recharge for one year, it doesn't mean there is no water in the aquifer: the water table level will decrease more or less but using a bore hole will remain possible. If a cattle of 50.000 heads would be watered permanently on the Reserve, it would consume 0.73 million m3 of water per year.

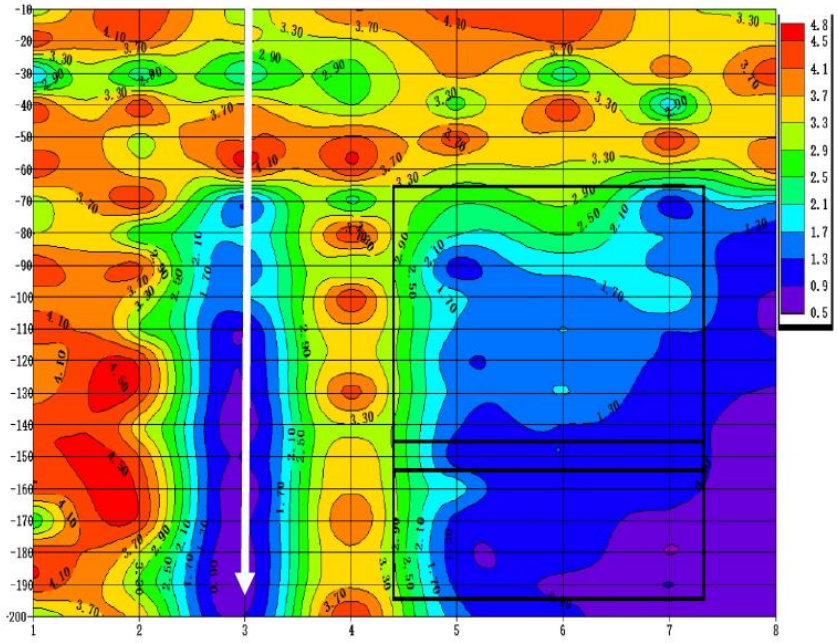
HYDROGEOLOGICAL SURVEY

During March 2024, ADEQ INT. HYDROGEOPHYSICAL AND DRILLING SERVICES carried out a pre-drilling feasibility survey with geophysical/hydrogeological investigation for a borehole groundwater development at the premises of L-PRESS in LATA Area.

The report concluded:

The frequency system data were presented in 2D model producing the subsurface profile maps as attached here and the resistivity method (VES) gives it output in 1D as shown in this report. it shows the characteristics of low-resistance anomaly compared with surrounding rock and the Blue color indicates the area of low-resistance anomaly, that is, the area where groundwater is likely to exist.

Figure 28; 2D Model of profile with expected presence of groundwater.



The survey indicates:

"Near monitoring points 5.0 ~7.0 at a depth of 150 to 70 meters, anomalies have been detected in the area marked with a black box and also near monitoring points 5.0~7.0, at depth of 190 – 150 meters. Those are the depth where groundwater is expected to be".

The report recommended "*depth of 100-120 m deep for the intending purpose and usage of the borehole (watering cattle*[11] *and people) on this site or premises. Based on the field observation and the interpretation of the data obtained, borehole drilling within the studied premise is SLIGHTLY feasible The groundwater potential is expected to be of low-medium/Average yield, therefore if high yield borehole is required It is advisable to drill an industrial borehole up to a depth of field 130m and above.*

However, the well may be terminated by the driller/site geologist by his/her can did observation and discretion within a favorable geological formation.

The well yield must be ascertained through a pumping test after."

The bore hole was drilled with a diameter of 200 mm, increasing the yield of a bore hole in such a site could be done using a diameter of 400 mm.

[11] The required quantity is not indicated in the report.

BORE HOLES AND TANK

Typically, as the L-PRES project proceeded for 3 spots in the Lata Grazing reserve, a bore hole is drilled (diameter 200 mm), an electrical pump with solar panels (9.5 HP) are installed, the water is lifted into a tank (volume of about 30 m3) at the top of a steel tower structure (approx. 8 m heigh) and a pipe provides water to taps for human and animal needs (taps for human, water trough for animals) according to the following picture:

Figure 29 : Typical L-PRES watering point

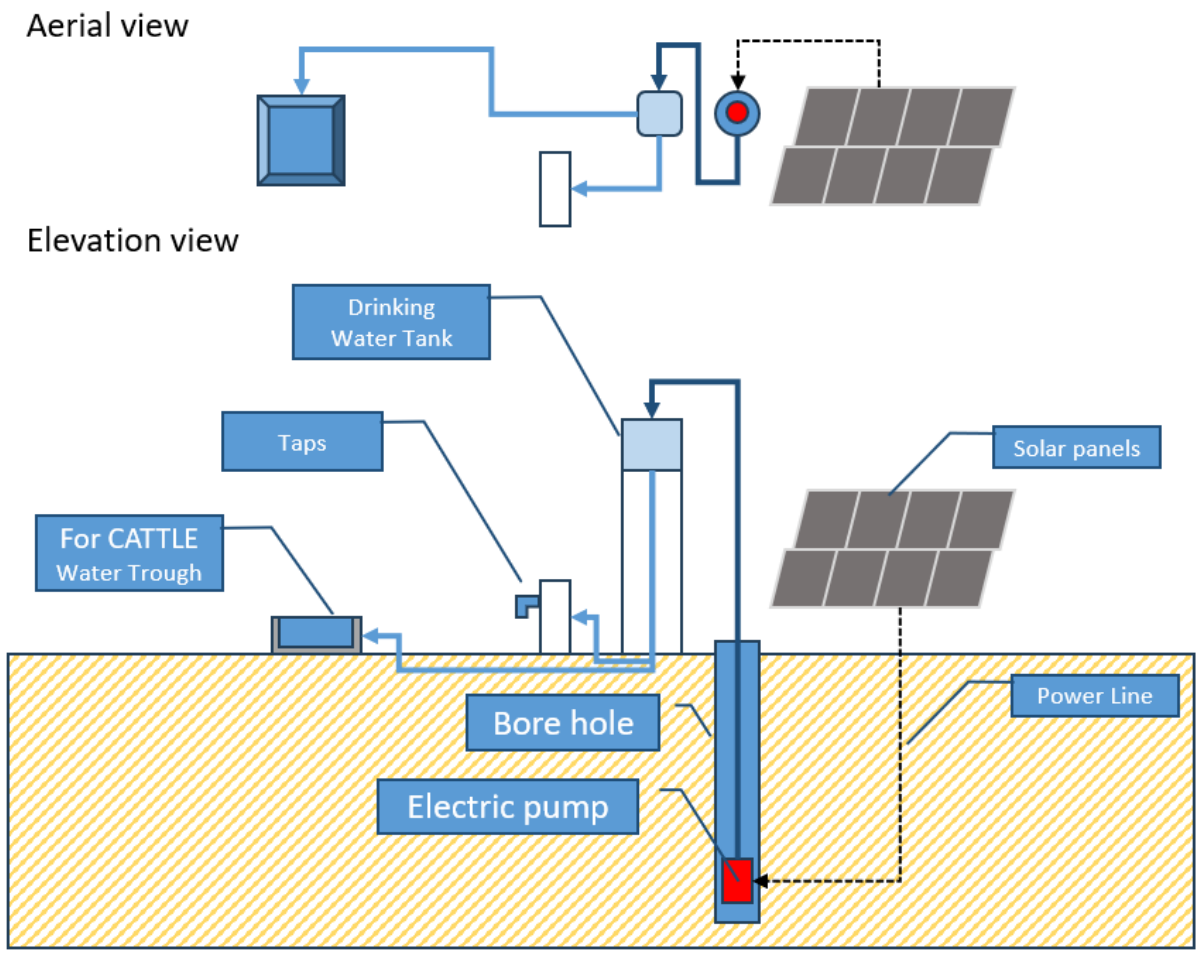


Figure 30 : Watering point, Lata-Nna reserve, L-PRESS project funded.

The **water flows** recorded for the 3 bore holes range from **3 to 5 m3 per hour (0.8 to 1.4 L/s).**

In terms of cost, the infrastructure can be divided in 4 portions which costs represent respectively:

Table 10 : Costs of a watering point[12]

Designation	%	Amount (Nairas)	Amount (€)
Bore hole	20.1%	12,685,000	8,386
Pump/solar panels	16.7%	10,500,000	6,941
Tank	61.6%	38,800,000	25,650
Taps	1.6%	1,000,000	661
Total	**100.0%**	**62,985,000**	**41,637**

It is obvious the tank and its metallic support represent the mayor part of the investment. The height of the tank (8 m) is deemed necessary to feed several taps through pressurized pipes. The volume of the tank (about 30 m3) is also an important factor of the total cost. Note that the pressure at the taps is less than 8 water meters equivalent due to the head losses.

For irrigation purposes, such a high reservoir is not necessary: feeding a pipe water network for sprinkler irrigation requires a more powerful pump, so, a lower but bigger reservoir is needed. This reservoir can be locally earth made (with PEHD liner) or it can be a flexible PVC tank, both solutions are cheaper than a metallic tank. Then, a surface pump could feed an irrigation pipe network.

[12] According to L-PRESS figures, April 2024 prices, equipped bore hole in Lata Reserve.

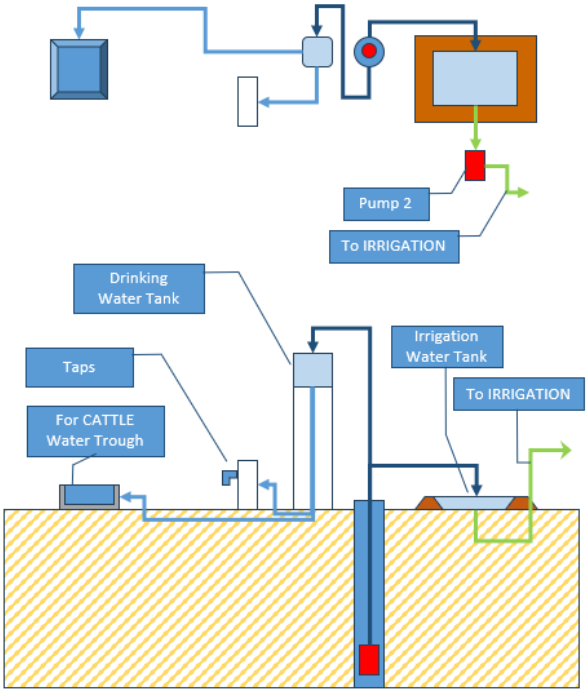
Figure 31 : Example of surface tanks.

Plastic fexible tank

Pond like plastic lined tank

A smaller reservoir can serve human needs. The watering point could be represented as follow:

Figure 32: Equipped borehole for irrigation (multipurpose)



Surface water mobilization

There Is no permanent lake in the Reserve. The diagnostic phase has clearly stated about surface water resources during the dry season: all testimonies of the riparian population are the same: the rivers dry up, leaving only a few ponds that can barely water a few animals.

Surface water mobilization requires the construction of reservoir dams[13]: small dams or bigger dams. These structures are earth made and must include a security hydraulic structure called spillway. The spillway is often an expensive structure. To this, water intake and discharge gates must be added.

For the same water capacity, big reservoir dams are often less expensive than small dams (amount per m3 of available water). Another factor favors the big dams: it is the evaporation losses. These losses are more significant in shallow reservoirs: if evaporation during the dry season is about 1 meter, it could represent one-third of the volume of a 3-meters deep reservoir (small dam), while evaporation would only represent one-tenth of the volume of a reservoir with a depth of 10 meters (big reservoir).

Watering the cattle with one big dam won't be a pertinent solution as the cows would have to move from the place they are grazing to the water reservoir, this could represent long distances). The cows will expend energy on movement instead of conserving it to produce milk or meat. Irrigation would be then the main goal of a dam construction.

Let's envisage several small dams: that option implies to find an appropriate site for each dam: sufficient river flows during the rainy season (runoff) good geological conditions (stability of the dam and appurtenant structures and a site where the water storage is efficient). Meeting these 3 conditions on a same site is often challenging.

In this study, both cases are evaluated, one unique big dam and one small dam. We shall compare the cost of the dams within the fodder area it could serve.

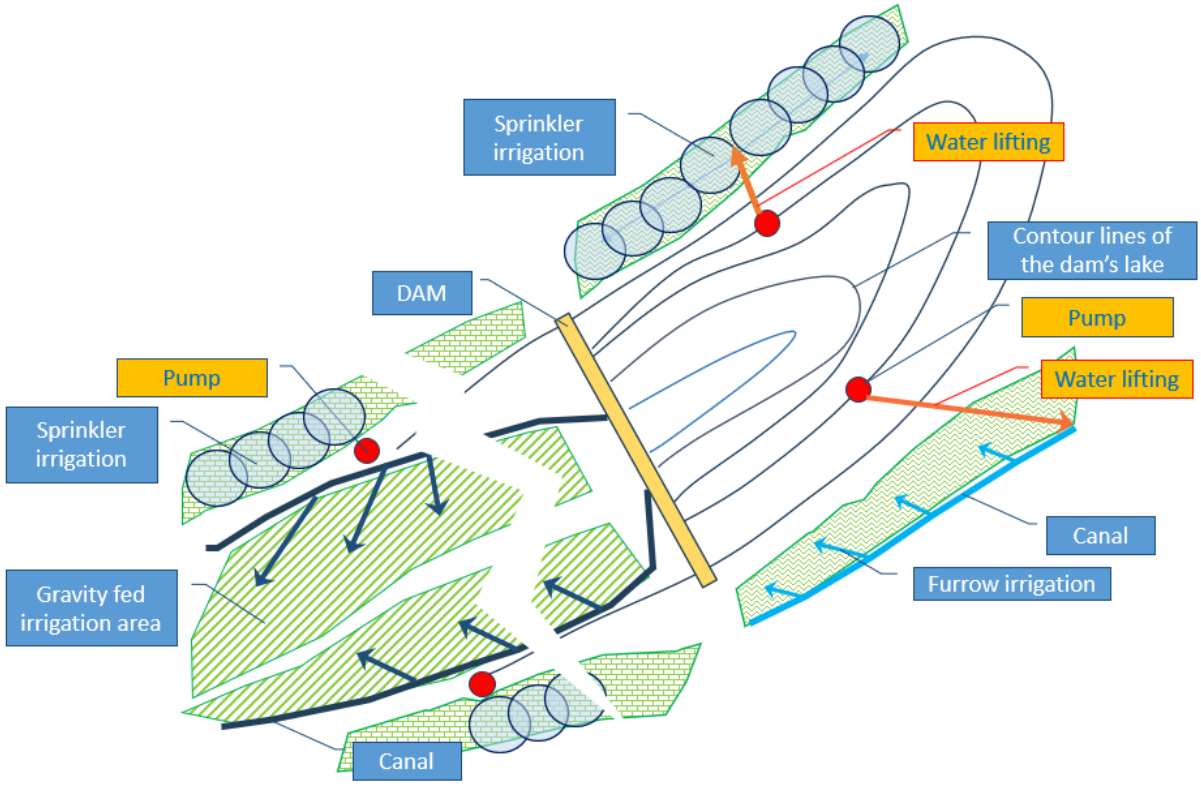
One Large Dam Option

A dam is built to retain the water flows of a river. After construction, the dam will create a lake on its upstream face. There is a relation of the water level in the lake and the area of the lake. There is also a relation between the water level and the volume of water the dam can retain. Those relations (dam's curves) are determined by the site's topography where the dam will be built.

Basically, a dam could ensure a water storage for two kinds of irrigation systems: a gravity fed irrigation system (area with a level below the level of water of the dam) and an irrigated area ensured by pressurized pipe irrigation system (for areas with a level over the level of water in the dam).

[13] Deviation weirs (less expensive than reservoir dams) are not appropriate as there is no water to deviate during dry season.

Figure 33 : Irrigation scheme layout and dam



The site we choose for this example is not far from the center of the Reserve, in its North West zone. The site seems to be convenient as there is a river with a significant catchment area (it determines the volumes of water the dam can retain). The dam site also allows for gravity-fed irrigation (without energy expenditure) of a significant arable area.

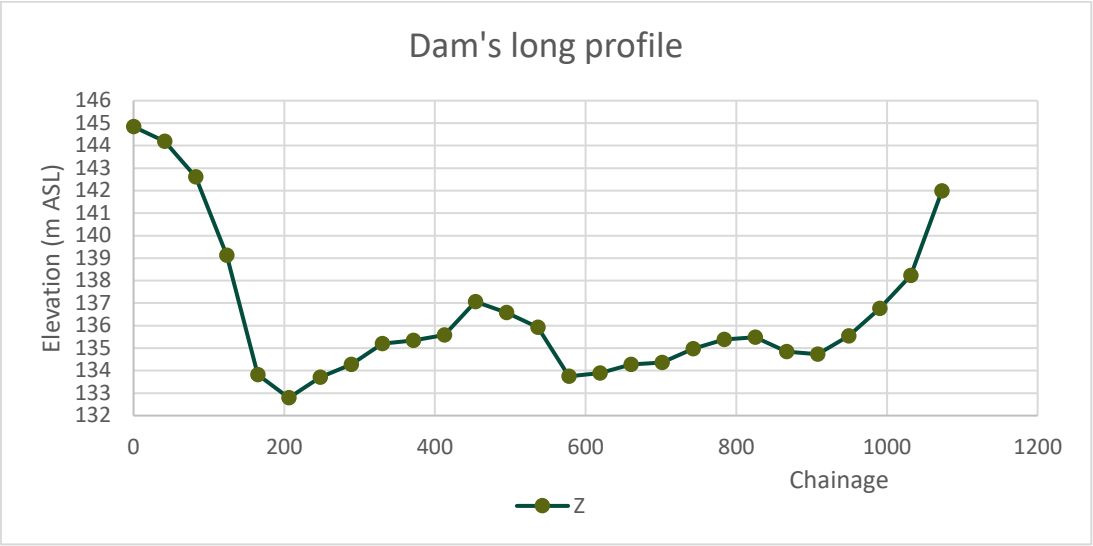
The dam

The lake of the dam must contain sufficient water and doesn't have a too large area (to avoid too much evaporation), the lake formed by the dam must have at least a depth of 3 to 4 meters. The dam itself can be made of one or two earthen materials (the proximity of adequate material is often an important factor of construction cost).

The long profile of the axis of the dam was determined using the "Profile Tool" of QGIS[14] and the SRTM DTM. The following chart is its representation:

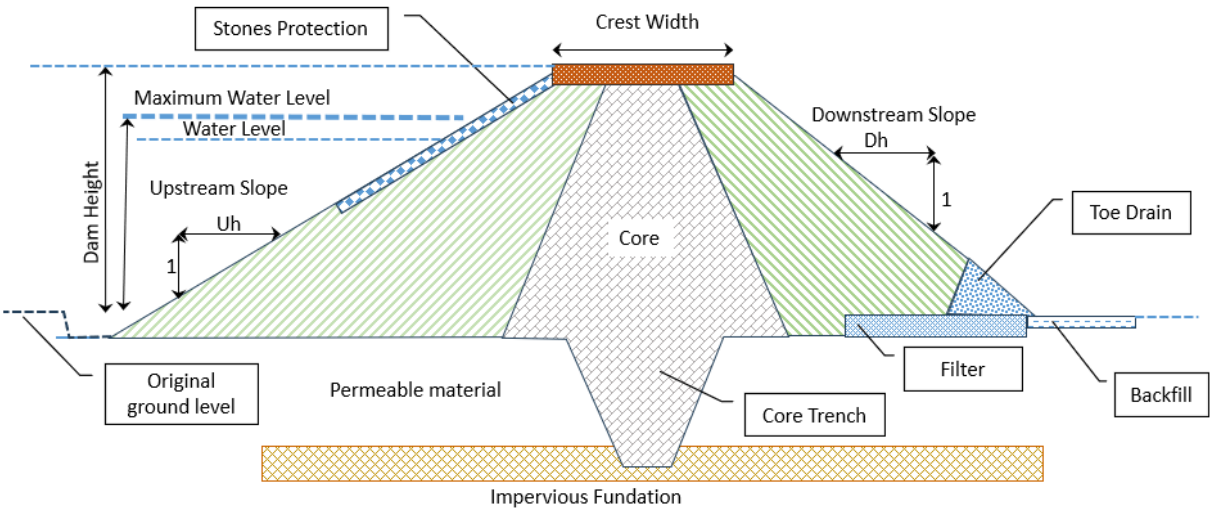
[14] License free geographical information system

Figure 34: Long profile of the dam's axis



A typical cross section of an earthen dam is represented below:

Figure 35: Example of an earthen dam cross section



For this example, we choose dimensions that are often used for a pre-feasibility study.

Table 11 : Summary of main data of the Big Dam Option

Characteristics	Values	Units
Maximum water level	8	m
Dam Height	9.5	m
Reservoir capacity	7.7	Mm3
Crest Width	6	m
Upstream slope	3	Uh/1v
Downstream slope	2.5	Dh/1v

The maximum volume of water this dam can retain on that site is about 7.7 millions cubic meters.

A one dam option would imply to position the dam roughly at the center of the Reserve in order to give all the Fulani population the same advantage in terms of distances from the settlement to the dam.

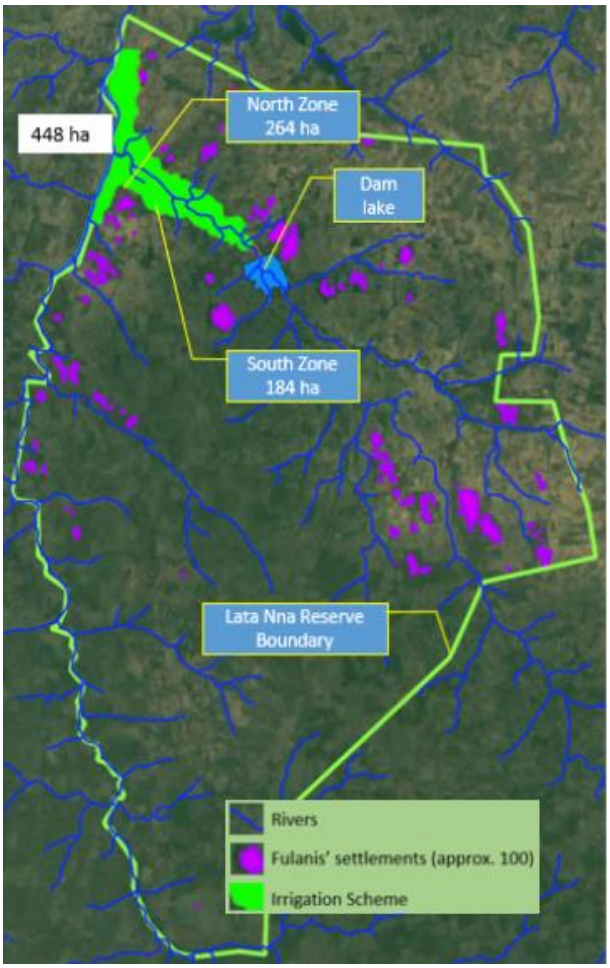
The dam must also be built on a river with a significant catchment area. The command area downstream the dam must also be an important area for the fodder production.

The analysis of satellites' images indicates the Fulanis' settlements are mostly located in the North part of the reserve and also mostly not too far from the boundaries of the Reserve.

The map shown on the right represents such a situation: the dam is roughly at the top center of the Reserve, on a position close to the major part of the Fulanis' settlements.

With this configuration, a command area of approximately 450 ha could be irrigated by gravity.

Using additional pumps would allow to increase the irrigated area.



Once the site is determined, a water balance model can be developed to assess the performances of the infrastructure.

Water balance and dam capacity

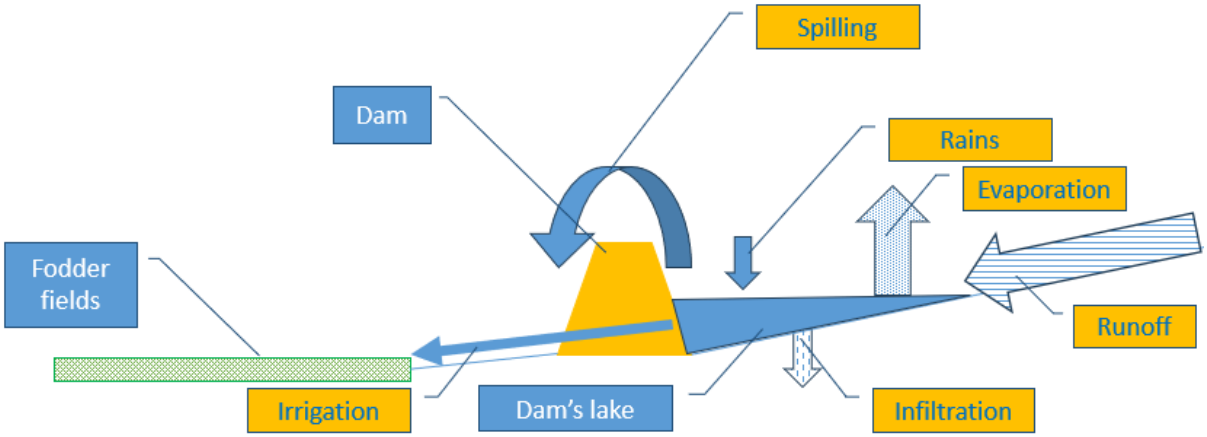
The water balance involves the input and outputs of water at the dam level.

Inputs: the upstream runoff of the catchment area provide the water that could be stored in the dam's lake. Direct rains contribute also to the positive term of the balance.

Several water outputs must be considered:

- Evaporation : a part of the water contained in the lake is evaporated
- Infiltration : a part of the water infiltrates in the subsoil of the lake
- The water spilling over the dam (when the lake is full and floods occur)
- Water uses (for this example, it is the water used for irrigation but this output can be divided according to different uses of water: multi purposes dam such as drinking water, watering of the cattle, irrigation…)

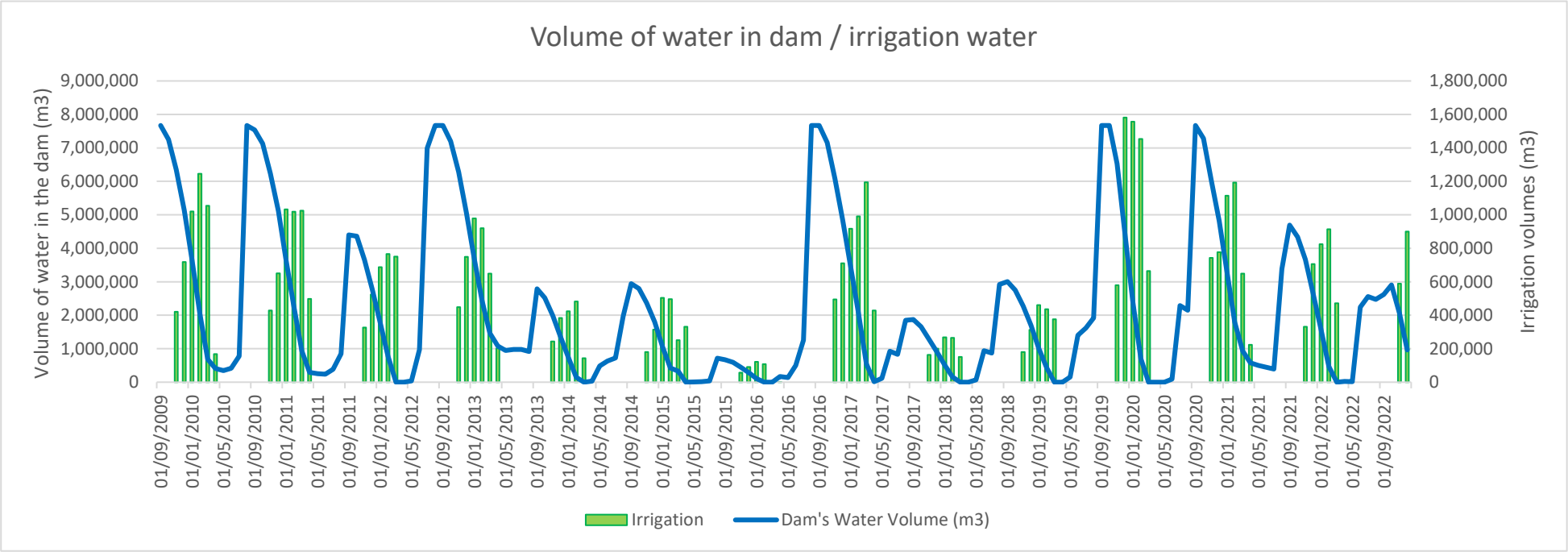
Figure 36 : Dam's water balance



The model uses time series (it could be monthly, weekly or daily series), monthly time series are used for this assessment.

The next chart illustrates the way the water volume varies with a time series ranging from 2009 to 2022.

Figure 37 : Modeling of a high-capacity dam



Applied to the period 2009 to 2022, the model of the water management shows significant variations of the volume of the water in the dam and consequently, the possible areas of fodder to be irrigated. The next page gives a summary of these factors.

Figure 38: Area of possible irrigated fodder

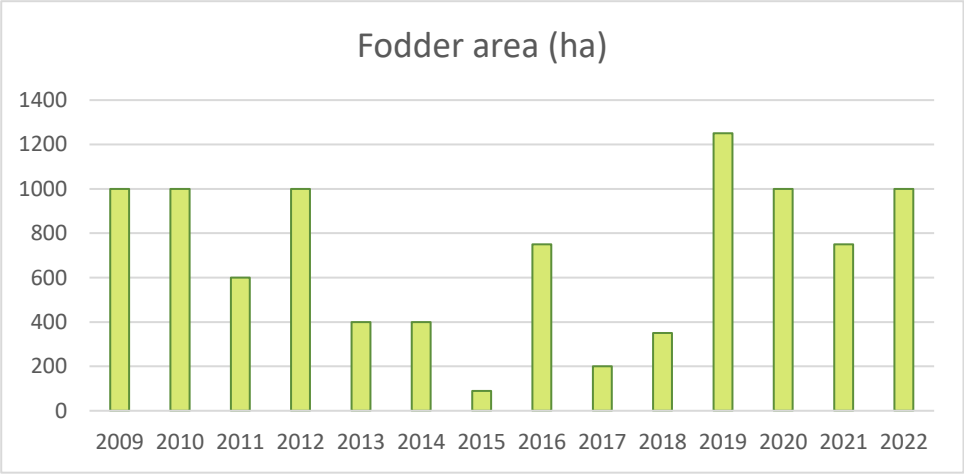


Table 12: Irrigated fodder area, main indicators

Indicators	Fodder area (ha)
Minimum	90
Average	699
Maximum	1,250
Centile 20%	380

The observed variations are summarized in the previous Table 12, the Centile 20% indicates that an area of 380 ha would receive enough water 8 years on 10. It is generally the threshold used in irrigation projects. This area is not far from the 450 ha that could be irrigated without pumping.

Note that this approach is based on historical data, without considering the possible impacts of the climatic changes. For that region of Africa, rains are not supposed to be subject to significant modification (in terms of annual quantities) but as the temperature is supposed to increase, it will be the same with evapotranspiration and if the mobilization of the surface water remains the same, the yields (productivity per ha) would decrease as the water requirements will increase.

- The major drawback of such a dam is that it delivers highly variable amounts of water from year to year. In case of a vegetable production project (like tomatoes or onions) it is unacceptable as the total foreseen production is not realized.
- For fodder production, and depending on the species that would be chosen, the lack of irrigation water doesn't mean the vegetal will die. Its grow will be considerably decreased but, the grass could restart a normal grow with the next rainy season. Note that during such a period, over-grazing must be avoided.
- This point is very important as it indicates that, in case the fodder is the main feed of the cattle, the herders must have an alternative to feed the cattle (stored hay, concentrates, possibility to move the cattle to another region[15]…).

Cost estimates:

The geometry of the dam (its cross section) and the long profile of its axis allows to compute the "visible" volume of the dam. According to BRLi recent experience (Uganda) one m3 of visible volume leads to a global cost of 20 US$/m3. This cost covers the earth works and necessary appurtenant structures such as the spillway, a crest covered with compacted laterite, water intake etc.

The volume of the visible part of the dam is: 106,200 m3 and its cost estimate is: 2,124,000 US$

On average, this infrastructure would allow to grow about 700 ha of fodder.

Associated irrigation scheme

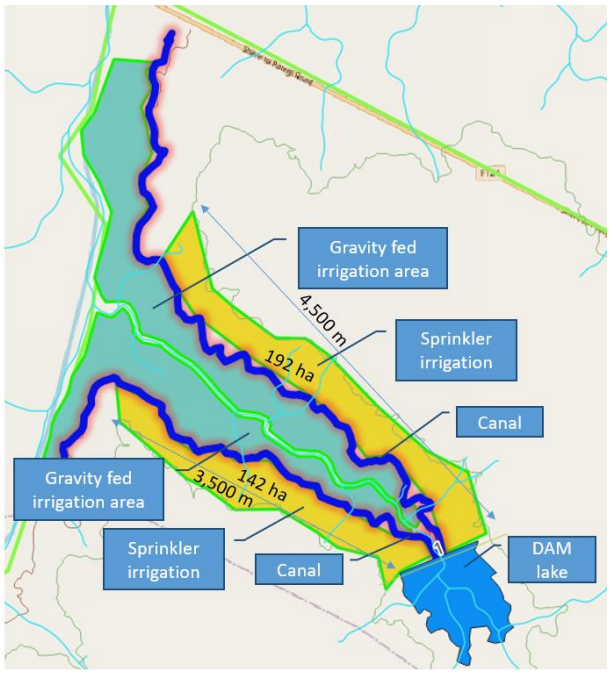
The irrigation scheme can be set directly downstream the dam along the river. Due to the level of the dam, **the gravity fed command area will have an area of about 403 ha** (between level 131 and below). Two main canals will convey the irrigation water from the dam to the perimeter. **A complementary area of 297 hectares is developed on both sides of the gravity-fed perimeter**; the crops planted on this area will need to be irrigated by pumping water from the main canals (level from 131 to 144).

For the gravity fed irrigation area, secondary canals will distribute water to the fields that have to be properly leveled.

For the pumping area, solar pumps are installed in small reservoirs linked to the main canal. They feed pressurized pipes linked to a module of sprinkler irrigation system (modules of 2 ha, length of 800 m and width of 25 m). The requested power for the pumps is about 4 kW per module.

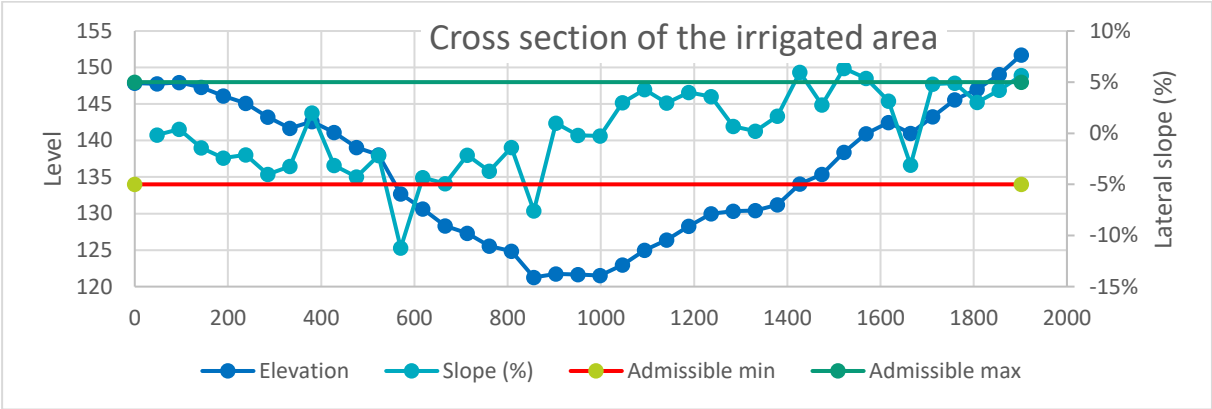
[15] Which is not the target of the Project.

Figure 39 : Dam and its associated irrigation scheme



It is also checked the transversal slope of the terrain of the irrigated area is compatible with gravity fed irrigation (max 5%). The chart below shows a cross section of the valley of the irrigated area and, except for 2 or 3 spots, the slopes are acceptable.

Figure 40 : Cross section of the valley downstream the dam (irrigated area)



Cost estimates:

Table 13 : Dam and irrigation scheme cost estimate

Designation	Unit	Qty	Unit price	€	Live span	Cost/year	Cost %	Cost/ha
Dam cost	U		-	2,123,988	30	70,800	14.3%	3,034
Main canals	m	8400	150	1,260,000	20	63,000	12.7%	1,800
IS schemes (tertiaries and field leveling)	ha	403	2,000	806,400	10	80,640	16.3%	1,152
Sprinkler modules	ha	297	3,800	1,127,840	7	161,120	32.6%	1,611
Solar generators	kw	573	1,500	859,708	15	57,314	11.6%	1,228
Pumps	kw	573	750	429,854	7	61,408	12.4%	614
Total				**6,607,791**		**494,281**	**100%**	**9,440**

Note:

1. The costs per ha refer to the entire area (700 ha).
2. The cost per year is given in order to compare the balance of the main infrastructures (dam and canals) with the equipment (irrigation sets, solar pumps…).

A breakdown of the cost can be established to analyze the differences of gravity fed irrigation and pressure irrigation.

Table 14 : Costs per type of irrigation

Designation	Cost (€)	Cost/ha (€/ha)
Dam gravity fed irrigation	1,223,417	3,034
Dam pressure irrigation	900,571	3,034
Main canals gravity fed area	725,760	1,800
Main canals pressure irrigation	534,240	1,800
Gravity fed Irrigated area	806,400	2,000
Pressure Irrigated Area	2,417,402	8,145
Total gravity fed irrigation	**2,755,577**	**6,834**
Total pressure irrigation	**3,852,213**	**12,979**

The difference of cost is due to the supplementary equipment needed for the pipe pressurized irrigation area: solar panel, pumps, conveyance pipes and irrigation equipment.

Small Dam

Several sites were identified on map, they have a small catchment area and for further analysis we shall consider the runoff is sufficient to fill the dams. Among these sites, the Site 5 is chosen to carry out deeper analysis.

Figure 41 : Several small dams' sites

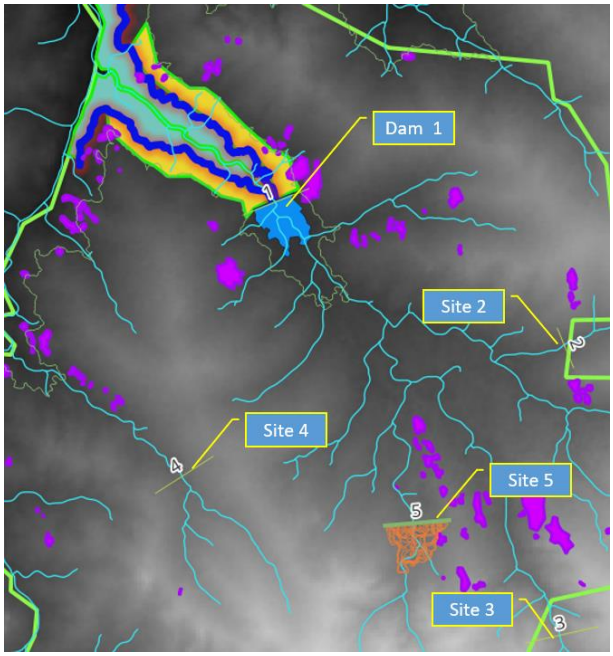
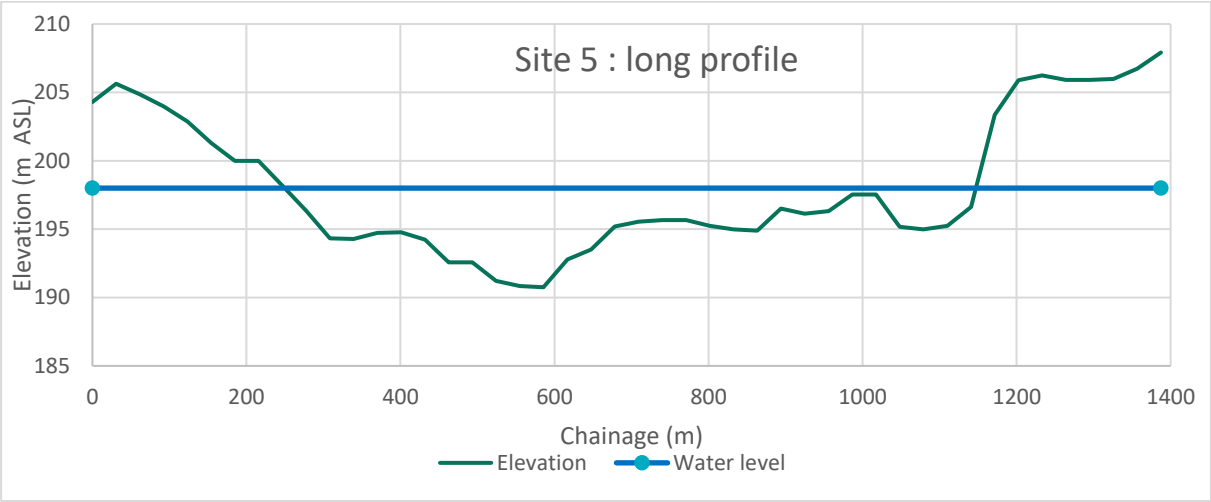


Figure 42 : Long profile of Site 5



As we did for Dam 1, we used the same water balance to check the capacities of a dam that would be built on the site 5 with different levels of water capacity ranging from 3 m (below 3 m the water losses due to evaporation are too high) to 6 m (6 m of water is no more a “small dam” and the catchment area couldn’t be sufficient to fill it regularly).

Water Depth (m) (1)	Dam Capacity (m3) (2)	Fodder Area (ha) (3)	# Herds (4)	(Evap+Seepage)/Uses (%) (5)	Dam volume (earth) (m3) (6)	Dam Cost (€) (7)	IS Cost (8)	Total Cost (9)	Cost/ha (€/ha) (10)
3	76,613	12	25	137.4%	12,690	253,793	63,000	316,793	26,399
4	147,133	30	25	114.2%	22,238	444,755	157,500	602,255	20,075
5	266,164	65	25	84.3%	38,679	773,579	341,250	1,114,829	17,151
6	424,617	120	25	57.4%	57,262	1,145,243	630,000	1,775,243	14,794

Table 15 : Small dam costs in relation with its capacities

This model includes the consumption of 1,500 m3 of water as cattle watering (it is not really significant in terms of fodder area impact).

1. Water depth in the dam's reservoir
2. Capacity of water of the dam's reservoir
3. Area of fodder that can be irrigated
4. Number of herds of 50 cattle that can be watered
5. Ratio of water lost by evaporation and seepage
6. Visible volume of dam (minimum earth quantity necessary to build it)
7. Dam cost estimate
8. Irrigation scheme cost (main canal, secondaries and leveling)
9. Total cost (7)+(8)
10. Unit cost

Comparison between the 3 alternatives

This annex aims to give various information to compare and to facilitate a choice between different kind of water mobilization according to different criterion.

The comparison concerns fodder irrigation purposes.

For cattle watering, we advise to use standard boreholes (drilling 8') scattered in the Reserve.

STUDIES AND IMPLEMENTATION

Dams

Dams require deep studies that take a few months to be achieved: a global study of the area must be carried out to choose an appropriate site and in a second time, a feasibility and detailed study has to be done.

The construction of a dam lasts a few months (at least 6 to 9 if everything is going according to the plans).

The investment is important and if the success of the experience is not met in terms of water uses, it could be a negative experience.

Bore holes

A general study of the area (all the Reserve) must be carried out. It could take a few weeks (2 months). For each site a survey is done before the construction (a few days) to estimate the best place for drilling.

The investment is progressive depending of the number of bore holes are built. Refining the approach is possible in the next year in case some elements are not convenient.

WATERING THE CATTLE

One big dam

The water reserve of a big dam is important and could water a large part of the cattle of the Reserve. However, has it would concern one site, most of the cattle would have to long distances walk daily from their settlement to the dam. This decreases the milk and meat potential production. As an important number of cattle would use this water, the risk of overgrazing around the dam' site is high.

Small dams

If a few small dams are built (let's say 5, provided sites are deemed suitable) the distance the cattle would walk would be reduced comparing to the situation of one big dam. The risk of overgrazing around the dams' site still remains.

Bore holes

Water drilling can be better distributed than one or five dams within the Reserve. If the goal is to establish 100 to 200 water points, these points will naturally be closer to the livestock that will benefit from them, and unlike the water from the dams, this water can be consumed by nearby Fulani families. The risk of overgrazing is low as soon as the number of water points is sufficient (by the 3rd or 4th year of the Project).

IRRIGATION OF FODDER GRASS

One big dam

A huge dam, as it was presented above, could irrigate significant areas of fodder. In the example we evaluated, an area of 700 ha (with yearly fluctuations linked to the rains and possibly only 300 ha when the rains are not sufficient). The available water varies from one year to another.

This area must be equipped with canals and pumping systems. The management of the dam, the irrigation scheme and the pump stations (event if it is small modular solar pump station) will require a strong organization of the herders/fodder producers both in terms of irrigation operations (collective use of an important infrastructure) and maintenance. This could be a great challenge.

In a year of water scarcity (dam not full of water in October), deciding which plots to irrigate or not could lead to complex problems that are difficult to resolve.

The harvested fodder would be transported from the irrigation site to the Fulani settlements, possibly for long distances.

Small dams

Small dams could be conceived for 50 to 60 ha of irrigated fodder areas. The irrigation infrastructures would be similar to the ones required for a big dam but, as the irrigation scheme would be smaller, their management would be less difficult to implement at community level. The available water varies from one year to another, in that case, scarcity of water could lead to conflicts among the herders.

However, if the cost is not a premium factor of decision, a small dam could be a good solution if it is used by a structure such as a seed production unit of a demo farm as it allow to irrigate much more areas than groundwater with the same budget.

Bore holes

With bore holes, it is difficult to estimate the available flow for irrigation after watering the cattle. If 4 to 8 families (4 to 8 herds) use the bore hole, we estimate that 2 ha of fodder could be irrigated using sprinkler irrigation technique. Managing the watering point is easier as it would concern a few families.

The produced fodder would be available not far from the Fulani settlements.

The production of water is quite similar from one year to another, not depending on the rains.

However, introducing a costly technology for fodder irrigation in the specific context of Lata Reserve with Fulani is risky: the adoption of the fodder cultivation, with intrants and water for irrigation is a challenge. Then, we could advise to start with trials and to develop the concept if it is demand driven.

ENVIRONMENTAL ISSUES

One big dam

A single large dam associated with a vast irrigated area can lead to issues such as the development of waterborne diseases, restricted access to pastures for livestock, the displacement of Fulani camps, etc.

Small dams

With small dams and smaller irrigated areas, these problems are less significant.

Bore holes

For water drilling, none of these issues arise.

CONCLUSIONS:

Single Large Dam

A single large dam associated with a vast irrigated area is a risky undertaking: significant investments, potential delays in the delivery of the infrastructure, which would delay the realization of the Project's initial benefits, and risks of the community not taking ownership of the management. In fact, it would be more of a full-scale irrigation project, which would likely find better profitability in producing crops other than fodder, which is not the Project's objective.

Multiple Small Dams

This option could not be developed in many sites within the reserve. At this stage of the study, it is believed that 3 to 5 sites might have favourable characteristics, with a potential of around 50 hectares of irrigated fodder per dam. The investment amounts would not be too high, and the sequential production of these dams would allow for a quick feedback loop from the first structure, enabling decisions on building others and refining the design, as well as the management of the irrigated areas.

Bore holes

This is the most relevant solution: it can be implemented quickly on a modular design basis, allows for the distribution of livestock across the entire Reserve (avoiding overgrazing), provides potable water for both people and animals, and allows for the rapid testing of the benefits of irrigating fodder crops.

RECOMMENDATIONS:

Consequently, we recommend the implementation of multiple wells (eventually 150 to 200, depending on their capacity and the water demand) equipped to water animals and provide drinkable water to the families, with the surplus water used for irrigating fodder plots.

In parallel, the construction of 3 small dams (provided that detailed studies yield positive conclusions) would be carried out to provide additional irrigated parcels.

Annex 5. Women and Youth Empowerment

Women empowerment

The role of women in the dairy supply chain is well known and described in the “strengthening dairy supply chain”.

The Project will aim to ensure the integration of women in the dairy sector, and even strengthen their participation.

IMPROVED WOOD COOKING STOVES

As a lot of rural women in West Africa, **Fulani women face time-consuming domestic tasks such as fetching potable water, grinding grain, or collecting firewood for cooking**.

The project will contribute to better access to potable water by increasing the number of water points (boreholes for livestock watering and small-scale irrigation).

One potential action is the **development of improved cooking stoves use**. The introduction and use of improved cooking stoves will reduce the consumption of firewood, with the beneficial effect of freeing up time for women responsible for collecting firewood on the one hand and reducing pressure on the environment on the other hand. Such stoves have proven their effectiveness in Benin, a neighboring country of Kwara State, where an NGO (Eco-Benin[16]) has specialized in their distribution in collaboration with companies that finance them as part of carbon offset activities.

Figure 43: An example of improved cooking stove (Eco Benin)

Source : Eco Benin

Dissemination of gas cooking stoves.

Another option would be the use of LPG gaz. The Project could encourage and facilitate the use of bottled LPG gas and the acquisition of gas stoves (through credit). Transportation of LPG gas bottle could rely on young men using motorized tricycles.

GRAIN ELECTRICAL GRAIN MILLING MACHINES

[16] https://www.ecobenin.org/category/eco-benin/

Since the water points are equipped with solar generators, the Project could consider equipping some of these water points with electric grain mills. This would represent a very low additional investment (**electric grain mill machines that would be used out of the irrigation peak demand period : at least 5 months per year).**

Figure 44: An example of small electrical milling machine)

2 in 1 wet and dry grinding: steel grinding disc for dry grinding; Sanding disc for wet grinding. You can grind soaked soybeans and rice into a pulp that can be used as soy milk and rice cakes. Moreover, the convenient input hopper ensures a smooth input speed and smooth operation. Super Smash Function: With its powerful 1500W motor, the commercial shredder can reach high speeds and grind continuously, enabling a huge grinding capacity. A sharp blade grinds all kinds of food into a fine powder. Additionally, the high-quality motor effectively reduces vibrations from the casing, extends working time, and prolongs the machine's lifespan. Durable Material: The hopper is made of stainless steel and is characterized by its durability. This heavy-duty grinder features a solid iron casing that can withstand prolonged use. The surface is sanded to ensure a good appearance. Adjustable Thickness: This machine is suitable for all needs. The adjustment knob can be used to set the strength for spices, corn, coffee beans, grains, wheat, and nuts. Multifunctional Grinder: The powder machine can process various dry and wet materials, including ① Grains (soybeans, corn, barley, wheat, oats, rye, peas, coffee beans) ② Spices (fennel, pepper, cinnamon, rosemary) ③ Herbs. Ideal for processing everyday materials. Particularly suitable for commercial use.

BACK YARD GARDENS

Fulani women often cultivate small vegetable gardens, with the harvested produce used by the family and sometimes sold at the market. Depending on the availability of water[17] from the newly created boreholes and their proximity to Fulani camps, it may be possible to supply these gardens with water. The harvests could provide additional food and serve as a supplementary source of income. These gardens should be fenced to prevent potential damage by the cattle.

SMALL MILKING MACHINES

With the development of the dairy sector, small milking machines could be acquired in the future.

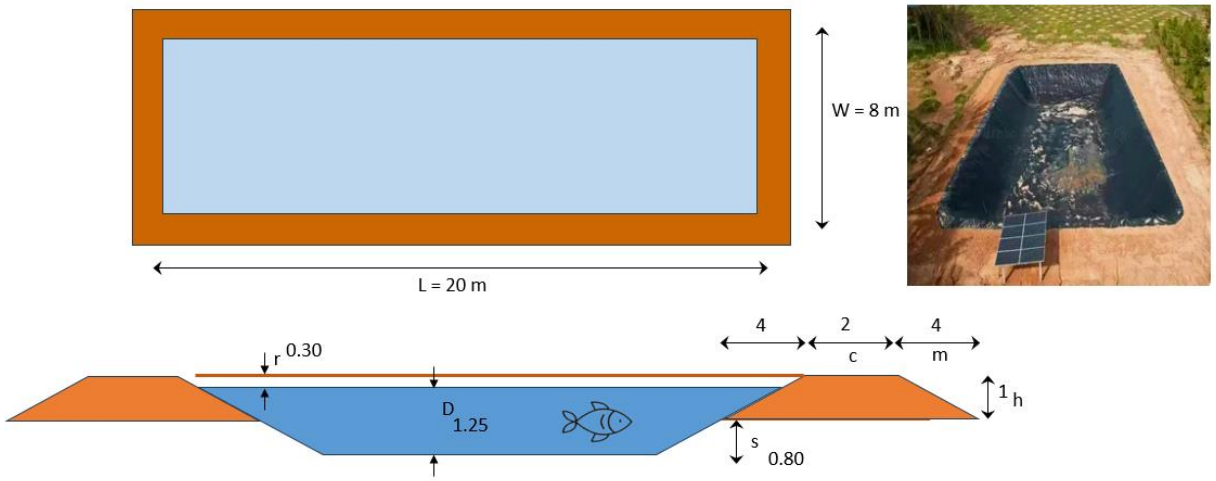
FISH FARMING

During the rainy season, outside the irrigation period, certain water points could be equipped with ponds to raise fish over a 5 to 7-month period. The most preferred fish for farming are catfish and tilapia. They can be fed using residues and concentrated feed (with the establishment of a revolving fund, for instance, through microcredit) and will reach a marketable size of 1 to 1.5 kg in 5 to 6 months.

The setup would complement a standard water point, with the only additional investment being the construction of a fish pond.

[17] The availability of groundwater is only known after the bore hole is drilled and specific tests are made.

Figure 45: An example of 250 water m3 fishpond



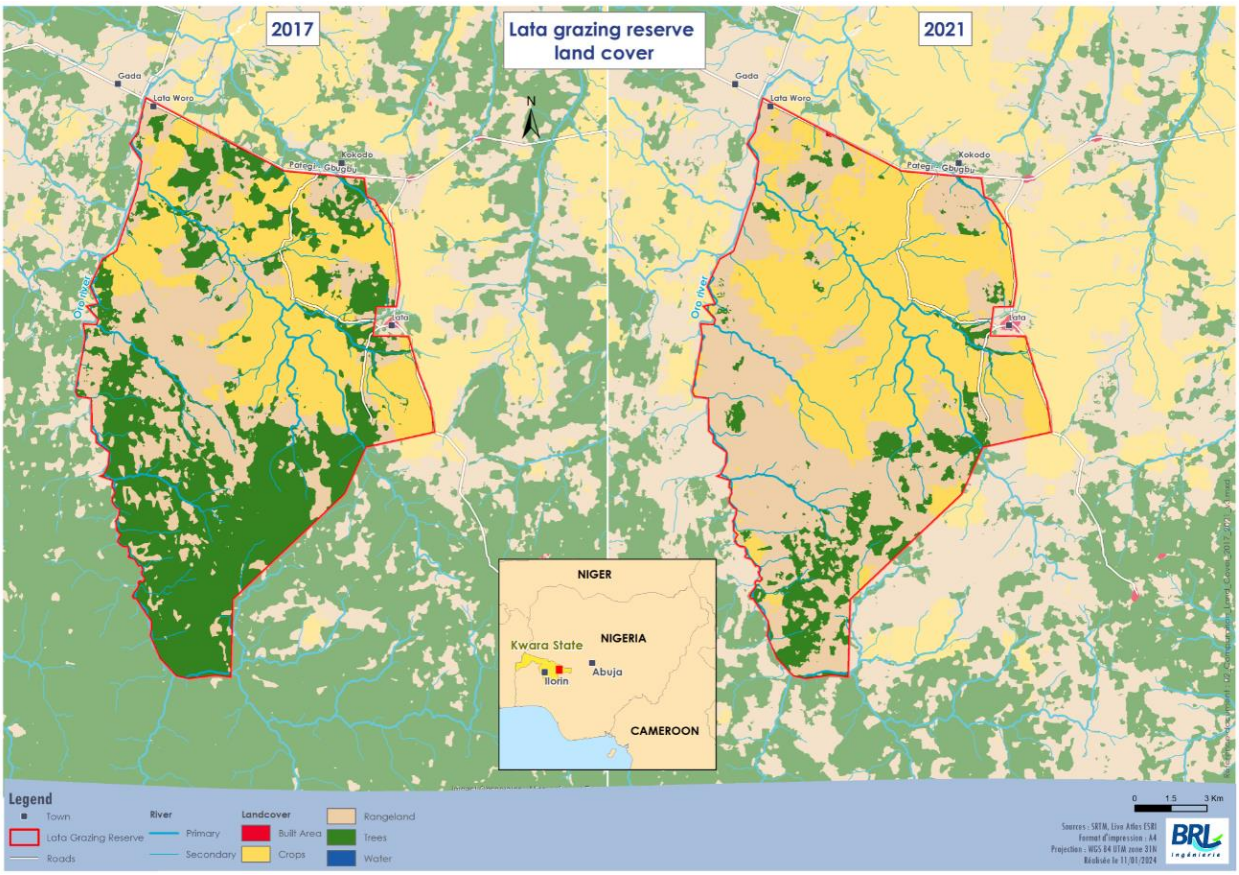
A fishpond with a capacity of 250 m³ could yield 2,500 kg of fish or even more, depending on the quality and quantity of the feed provided.

Annex 6. Environment matters

Biodiversity participatory inventories

The diagnostic report clearly showed that forest areas are in decline within the Reserve. As shown on the figure below (Figure 46) the forest cover (in green) as decreased drastically between 2017 and 2021. Meetings with both local populations and Kwara state government representatives have confirmed deforestation has happened massively in the reserve in the past years. The depletion of the forest cover has been pointed as a big issue by herders, as it removes an important source of food for animals, eating leaves, especially during the dry season. Deforestation seems to be caused by several factors: logging (mainly illegal), transformation and intensification of the agrarian systems, grazing and bush burning.

Figure 46: Lata grazing reserve forest cover evolution between 2017 (left) and 2021 (right)



Source: BRL, 2023

However, forest areas represent a significant asset in terms of biodiversity, both for the trees—which have the capacity to sustainably provide firewood, fruits, and other useful products—and for a variety of plants, some of which are used by Fulani women for their medicinal properties. Consequently, a biodiversity participatory inventory (an inventory that will not only identify the species but also document their local uses and benefits) or baseline assessment should be conducted at the start of the Project to enable monitoring of these environmental aspects.

Local trees can also provide seeds adapted to the environment for the creation of live hedges and other bocage-type landscapes that the Project will promote and fund.

The issue is quite similar regarding pastures: it is known that the majority of them are infested with an invasive weed. The Project aims to eliminate this invasive plant and introduce more productive forage crops. This must be done while ensuring the preservation of local forage plants on a minimum area, as these may have properties that imported plants lack, particularly in terms of resilience to drought or disease.

A participatory inventory (which could include creating a herbarium with both scientific and vernacular names in Fulani) involving herders should be conducted for these locally grazed plants. Their palatability will be assessed based on local knowledge. It is also worth considering the establishment of a local seed bank at the Seed Production Center to meet potential future needs.

A Complementary Approach to Pasture Improvement

The improvement of pastures, particularly through the introduction of high-performing forage species, presents a significant opportunity to enhance the productivity of pastoral systems. However, to ensure sustainability and maximize positive impacts, it is crucial to integrate a complementary approach that considers local and ecological dynamics. The **"Participatory Inventory and Agroecological Implementation"** method addresses this need by combining local knowledge with modern innovations.

This approach serves as a strategic tool to map existing resources, identify opportunities provided by local species, and understand the specific needs of pastoral communities. By incorporating soils, microclimates, and traditional practices into the planning process, it ensures a smooth transition between existing forages and newly introduced species.

As a complement to pasture improvement, this method guarantees the preservation of plant diversity, enhances resilience to climatic challenges, and fosters community ownership of innovations. Thus, it represents a foundational pillar for modernizing pastoral systems while ensuring their ecological and social sustainability.

Participatory Inventory of Forage Resources

The participatory inventory, conducted with local communities (Fulani), aims to identify and map forage resources for sustainable management. This approach includes:

- Community Engagement:
  - Organizing meetings to collect local knowledge about forage plants and their evaluation criteria (palatability, seasonal adaptation, etc.).
  - Collaborating with traditional leaders and local authorities to ensure inclusive participation.
- Data Collection and Analysis:
  - Conducting interviews and free-listing exercises to rank forage species based on their importance for different seasons (dry and wet seasons) and livestock types (cattle, goats, sheep).
  - Involving local inhabitants in identifying species in situ during visits to grazing areas.
- Integration of Participatory Mapping:
  - Mapping key grazing areas identified by locals, associating soil types (sandy, clayey, loamy soils, etc.) with the distribution of recognized forage species.
  - Using geographical tools (GPS, GIS) to record locations and produce detailed maps.
  - Correlating soil type data with species distribution to identify specific habitats favorable to certain forage resources.
- Participatory Validation:
  - Presenting maps and results to communities for validation and adjustments as needed.
  - Strengthening community ownership by training locals in map reading and interpretation.

This initial phase provides a robust foundation for forage resource management by combining local knowledge with scientific tools.

Bocage landscape implementation

The creation of bocage landscapes in The Lata-Nna Reserve represents a transformative approach to supporting livestock farming. These natural barriers improve pasture management, reduce erosion, and enhance biodiversity, providing a sustainable environment for grazing. By integrating tree planting and hedgerows, bocages offer shade and forage for livestock while fostering economic opportunities for local communities. This initiative promotes resilience and sustainability in the livestock sector.

Figure 47 Typical bocage landscape

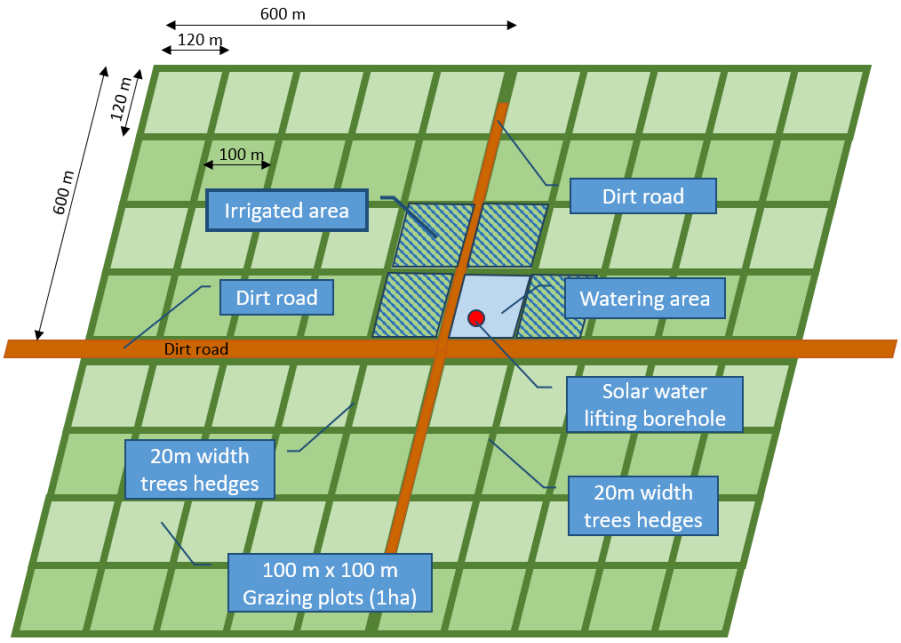
Agroecological Implementation for Sustainable Pastoralism

Agroecological implementation focuses on sustainable practices that integrate forage diversity and ecosystem resilience. Key steps include:

- Preserving Forage Diversity:
  - Promoting local species adapted to the climatic conditions and soils identified during mapping (e.g., *Pennisetum pedicellatum* on sandy soils, *Faidherbia albida* on clayey soils).
  - Introducing multi-species mixtures combining grasses, legumes, and shrubs for better ground cover and balanced livestock nutrition.
- Agro-Silvo-Pastoral Systems:
  - Integrating forage trees (*Pterocarpus erinaceus*, *Faidherbia albida*) into grazing areas to provide supplementary feed during dry seasons while enhancing soil quality through nitrogen fixation.
  - Encouraging the planting of perennial forage species adapted to poor or eroded soils to stabilize the land.
  - Incorporate the planting of commercially valuable trees, such as cashew trees or those whose fruits or bark have recognized economic value.
- Training and Awareness:
  - Training herders on sustainable exploitation of forage resources, including conservation techniques (hay, silage) and grazing cycle management.
  - Raising awareness of the risks of systems reliant on imported species that compromise biodiversity and increase economic and ecological vulnerabilities.
- Integrated and Adaptive Management:
  - Using mapping data to define grazing areas suited to each season, minimizing land-use conflicts and overgrazing.
  - Incorporating local crop residues (maize, sorghum) to complement feed during shortages.
- Participatory Monitoring and Evaluation:
  - Engaging local communities in monitoring vegetation cover and pasture health.
  - Adjusting practices based on herders' observations and local climatic changes.

Integrating the mapping of forage species and soil types during the participatory inventory phase is essential for sustainable management. By combining this mapping with agroecological implementation, pastoral systems can be strengthened to address climatic, economic, and social challenges. This approach ensures resilient pastoralism, preserves biodiversity, and improves the livelihoods of rural communities.

Figure 48 Bocage like landscape layout



A biogas processing unit ?

A biogas unit is a highly beneficial investment for a demonstration farm with 60 cattle and a nearby village of 3,000 inhabitants. With each cow producing approximately 30 kg of manure daily, the farm generates around 1,800 kg of organic waste per day. This manure can be fed into a biogas digester to produce renewable energy in the form of methane, which can be used for cooking, heating, or even electricity generation.

Figure 49 Biogas principle

For the village, the biogas unit offers multiple advantages. It reduces dependency on firewood, which helps preserve local forests and mitigates deforestation. It also improves air quality by replacing traditional biomass stoves that emit harmful smoke. Moreover, biogas provides a clean, steady source of energy, enhancing the quality of life for the local population.

On the farm, the byproduct of the biogas process—digestate—is a valuable organic fertilizer that can be used to enrich soils and improve crop yields. This creates a closed-loop system, reducing the need for chemical fertilizers and supporting sustainable agriculture.

Additionally, the biogas unit serves as a demonstration model, showcasing sustainable energy practices and inspiring adoption in surrounding communities. Its integration highlights the potential for renewable energy solutions to support rural development and combat environmental challenges.

Figure 50 Biogas processing unit

Annex 7. Economic Analysis Figures

Global assesment detailed

Scenario	
Additional investment cost for sensitivity	0%
Change in O&M costs	0%
Variation in cost of accompanying measures	0%
Variation in farm profits for sensitivity	0%
Change in externalities	0%

ALL IN Euro

Investment cost sensitivity	80,204,300				
TRI	16%				
VAN 25 years	31,097,406				
Present value invest	55,384,131				
Present value O&M	3,586,454				
Present value of profits	93,661,619	avarage annual benefit W	16,415,828	avarage annual benefit W	5,933,503
Present value of positive externalities	-				
Present value of socio-environmental measure	3,593,627				

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	Années																										
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
1. Investments (euros)																											
Demo Farm	140,000	480,000	197,500	-	-																						**817,500**
Animal Health	1,000,550	420,000	450,000	290,000	-																						**2,160,550**
Forages Improvement	1,192,500	2,705,500	1,375,500	550,000	-																						**5,823,500**
Access to Feed	496,500	325,000	245,000	-	-																						**1,066,500**
Reproduction and Genetic	1,225,000	2,845,000	3,160,000	320,000	-																						**7,550,000**
Groundwater mobilization	385,000	1,135,000	1,487,000	400,000	-																						**3,407,000**
Surface water mobilization	1,025,000	1,585,000	50,000	550,000	-																						**3,210,000**
Dirt Roads Improvement	-	975,000	1,200,000	1,200,000	-																						**3,375,000**
Milk Value Chain	229,000	131,500	553,500	8,025,000	-																						**8,939,000**
Meat Value Chain	1,772,500	1,972,500	1,950,000	2,350,000	-																						**8,045,000**
Livestock Tracability	583,000	2,182,500	1,091,500	-																							**3,857,000**
Technical Assistance	1,263,348	1,361,932	1,361,932	1,047,640	733,348																						**5,768,200**
renewal dirt road												250,000	1,350,000	1,450,000	1,450,000												**4,500,000**
renewal Machinery									200,000	507,500							200,000	507,500									**1,415,000**
renewal Borohole													235,000	605,000	780,000	700,000											**2,320,000**
renewal solar																			10,000		75,000						**85,000**
renewal equipment									1,118,050	1,600,500	1,771,000	8,175,000															**12,664,550**
renewal irrigation scheme									375,000		200,000					375,000		200,000									**1,150,000**
Total investments	**9,312,398**	**16,118,932**	**13,121,932**	**14,732,640**	**733,348**	**-**	**-**	**-**	**1,693,050**	**2,108,000**	**1,971,000**	**8,425,000**	**1,585,000**	**2,055,000**	**2,230,000**	**1,075,000**	**200,000**	**707,500**	**10,000**	**-**	**75,000**	**-**	**-**	**-**	**-**	**-**	**76,153,800**
Total Invest. Discounted	*9,312,398*	*14,788,011*	*11,044,468*	*11,376,301*	*519,522*	*-*	*-*	*-*	*849,685*	*970,582*	*832,572*	*3,264,964*	*563,523*	*670,297*	*667,320*	*295,128*	*50,374*	*163,484*	*2,120*	*-*	*13,382*	*-*	*-*	*-*	*-*	*-*	*55,384,131*
2. Operating expenses (euros)																											
Barrages	-	-	4,000	4,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	**118,000**
Dirt Roads	-	2,500	16,000	30,500	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	**1,039,000**
Machinery	-	-	4,000	14,150	14,150	14,150	*14,150*	14,150	14,150	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	*14,150*	**329,450**
Buildings	-	8,600	26,900	37,863	45,113	45,113	*45,113*	45,113	45,113	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	*45,113*	**1,065,838**
Bore hole	-	1,800	9,175	16,775	20,875	20,875	*20,875*	20,875	20,875	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	*20,875*	**487,000**
Solar	-	400	400	1,900	1,900	1,900	*1,900*	1,900	1,900	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	*1,900*	**44,500**
Equipment	-	22,401	92,421	131,741	302,741	302,741	*302,741*	302,741	302,741	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	*302,741*	**6,906,865**
Irrig. Scheme/Equip	-	-	5,625	5,625	8,625	8,625	*8,625*	8,625	8,625	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	*8,625*	**201,000**
																											-
Total O&M expenses	**-**	**35,701**	**158,521**	**242,554**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**443,404**	**10,191,653**
Total discounted O&M	*-*	*32,753.21*	*133,423.95*	*187,295.81*	*314,118.22*	*288,181.85*	*264,387.02*	*242,556.90*	*222,529.26*	*204,155.29*	*187,298.43*	*171,833.42*	*157,645.34*	*144,628.75*	*132,686.93*	*121,731.13*	*111,679.93*	*102,458.66*	*93,998.77*	*86,237.40*	*79,116.88*	*72,584.29*	*66,591.10*	*61,092.75*	*56,048.39*	*51,420.54*	*3,586,454*
3. Accompanying socio-environmental measures (euros)																											
																											-
Women Emporwerment	226,500	202,600	147,400	76,000	42,000																						**694,500**
Youth Emporwerment	321,000	275,000	37,500	37,500	30,000																						**701,000**
Environment	658,750	593,750	438,750	912,500	51,250																						**2,655,000**
Governance	-	-	-	-	-																						-
																											-
Total suport measures	**1,206,250**	**1,071,350**	**623,650**	**1,026,000**	**123,250**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4,050,500**
Total discounted suport measures	*1,206,250*	*982,890*	*524,914*	*792,260*	*87,313*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*3,593,627*
4. Profits without project (euros)																											
Cash crop Fulgani incomes into the reserve	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	2,068,732	**53,787,027**
Cash crops villagers incomes into the reserve	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	3,218,027	**83,668,709**
Milk production incomes into the reserve	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	242,424	**6,303,030**
Growing incomes into the reserve	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	230,667	**5,997,333**
Milk production incomes out of the reserve	-	-	2,424	6,061	12,121	24,242	48,485	72,727	96,970	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	121,212	**2,323,636**
Growing incomes out of the reserve	-	-	-	-	-	23,067	46,133	69,200	92,267	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	115,333	**2,191,333**
																											-
Total profit with project	**5,759,850**	**5,759,850**	**5,762,274**	**5,765,911**	**5,771,971**	**5,807,159**	**5,854,468**	**5,901,777**	**5,949,086**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**5,996,395**	**154,271,070**
Total Discounted earnings	*5,759,850*	*5,284,266*	*4,849,991*	*4,452,341*	*4,089,010*	*3,774,255*	*3,490,828*	*3,228,474*	*2,985,646*	*2,760,907*	*2,532,942*	*2,323,800*	*2,131,927*	*1,955,896*	*1,794,400*	*1,646,239*	*1,510,311*	*1,385,606*	*1,271,198*	*1,166,237*	*1,069,942*	*981,598*	*900,549*	*826,192*	*757,974*	*695,389*	*63,625,769*
5. Profits with project (euros)																											
Cash crop Fulgani incomes into the reserve	2,566,132	2,566,132	2,566,132	2,566,132	2,566,132	2,566,132	2,566,132	2,281,006	1,995,880	1,710,755	1,425,629	1,140,503	855,377	570,252	285,126	-	-	-	-	-	-	-	-	-	-	-	**25,661,318**
Cash crops villagers incomes into the reserve	3,991,761	3,991,761	3,991,761	3,991,761	3,991,761	3,991,761	3,991,761	3,564,072	3,136,383	2,708,695	2,281,006	1,853,317	1,425,629	997,940	570,252	-	-	-	-	-	-	-	-	-	-	-	**40,487,858**
Milk production incomes into the reserve	242,424	242,424	484,848	606,061	1,309,091	1,430,303	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	2,254,545	**49,406,061**
Growing incomes into the reserve	230,667	230,667	1,540,669	2,195,670	2,865,618	3,520,619	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	4,845,568	**107,495,278**
Fishing into the reserve																											-
Milk production incomes out of the reserve	24,242	24,242	48,000	83,636	143,030	261,818	523,636	785,455	1,047,273	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	1,309,091	**25,195,879**
Growing incomes out of the reserve	-	-	-	-	-	681,057	1,362,114	2,043,171	2,724,229	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	3,405,286	**64,700,428**
Fattening	-	-	255,492	766,477	1,277,462	1,788,447	2,299,432	2,810,417	3,321,402	3,832,386	4,343,371	4,854,356	5,365,341	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	5,876,326	**107,306,818**
Total profit with project	**7,055,226**	**7,055,226**	**8,886,902**	**10,209,736**	**12,153,094**	**14,240,137**	**17,843,189**	**18,584,235**	**19,325,280**	**20,066,326**	**19,864,497**	**19,662,667**	**19,460,838**	**19,259,008**	**18,546,194**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**17,690,816**	**426,811,532**
Total Discounted earnings	*7,055,226*	*6,472,684*	*7,479,928*	*7,883,790*	*8,609,558*	*9,255,112*	*10,639,311*	*10,166,213*	*9,698,707*	*9,239,094*	*8,390,978*	*7,619,929*	*6,919,004*	*6,281,877*	*5,549,883*	*4,856,802*	*4,455,782*	*4,087,873*	*3,750,342*	*3,440,681*	*3,156,588*	*2,895,952*	*2,656,837*	*2,437,465*	*2,236,207*	*2,051,566*	*157,287,387*
Annual cash flow (5+6-4-3-2-1)	**-**	**9,223,272**	**-**	**15,930,607**	**-**	**10,779,475**	**-**	**11,557,368**	**5,081,121**	**7,989,574**	**11,545,317**	**12,239,054**	**11,239,741**	**11,518,527**	**11,453,698**	**4,797,868**	**11,436,039**	**10,764,209**	**9,876,395**	**10,176,017**	**11,051,017**	**10,543,517**	**11,241,017**	**11,251,017**	**11,176,017**	**11,251,017**	**11,251,017**	**182,144,510**

TRI	**15.6%**

Discounted cash flows	**-**	**9,223,272**	**-**	**14,615,236**	**-**	**9,072,869**	**-**	**8,924,409**	**3,599,594**	**5,192,675**	**6,884,095**	**6,695,182**	**5,640,847**	**5,303,450**	**4,838,166**	**1,859,332**	**4,065,909**	**3,511,055**	**2,955,476**	**2,793,704**	**2,783,417**	**2,436,324**	**2,383,025**	**2,188,207**	**1,994,147**	**1,841,770**	**1,689,697**	**1,550,181**	**1,422,184**	**1,304,756**	**31,097,406**
NPV in keuros (over 25 years)		31,097,406																									
Discounted benefits/Discounted costs		1.69																									

BRL INGÉNIERIE

Gross margins used

The change rate used is 1 € = 825 Nairas (October 2023)

GROSS MARGIN FOR MAIZE PRODUCTION

	Production costs (Naira/ha)						Gross revenue (Naira/ha)			Gross margin (Naira/ha)
	Mechanisation *(A)*	Inputs *(B)*	External workforce *(C)*	Cost Water *(D)*	**Total (MDL/ha) (A+B+C+D)**	Unit	Quantity *(E)*	Unit price *(F*	**Total (MDL/ha) (E*F)**	*(E*F)-(A+B+C+D)*
Corn	35 000	35 000	22 500		**92 500**	T	2,5	220 000	**550 000**	**457 500**
Corn	35 000	35 000	22 500		**92 500**	T	3,0	220 000	**660 000**	**567 500**

GROSS MARGIN FOR MILK PRODUCTION

	Current system	Improved Reproduction Performances	Imrpoved Genetics
	Only improved feeding and forages	Achieved through better feeding, breeding and animal health	F1 Crossbreds – Local x Holstein & Good management
% of lactating cows	30%	60%	70%
Sold Milk per lactation (L)	625	625	2 100
Total milk sold (L/ha)	575	1 150	3 756
Income/ha (Naira)	140 000	280 000	900 000
Herd Size	50	50	50
Land needed for milking animals only (ha)	9	9	9
Yearly Milk Production (liters)	8 000	15 000	50 000
Yearly Milk Income (Naira)	1 900 000	3 600 000	12 000 000
Total Expected costs	1 700 000	2 400 000	6 000 000
Expected Yearly Revenue (Naira)	200 000	1 200 000	6 000 000

GROSS MARGIN FOR CATTLE GROWING

	Current	Improved Performances	Improved Genetics

		Achieved through better feeding (grazing) and animal health	**F1 Crossbreds** – Local x Holstein & Good management
Herd size	50	50	
Weight at Birth *(kg)*	25	25	35
Pre-Weaning ADG *(kg/day)*	0,2	0,5	0,65
Weaning Age (8 month)	240	240	90
Weight at Weaning *(kg)*	73	145	94
PostWeaning ADG *(kg/day)*	0,25	0,5	0,5
18 month Weight *(kg)*	150	299	322
2 Year old Weight *(kg)*	196	390	414
Age of animal sale	2 Years old	18 months	18 months
Price per KG *(Naira)*	1 100	1 375	1 500
Sales price *(Naira)*	80 300	330 000	135 000
Yearly Youngstock Sale Income *(Naira)*	1 300 000	7 400 000	8 400 000
Total Expected costs *(Naira)*	200 000	1 800 000	2 500 000
Expected Yearly Revenue *(Naira)*	**1 100 000**	**5 600 000**	**5,900,000**

GROSS MARGIN FOR FATTENING

	Fattening with concentrates	**Fattening with Improved grazing**
Starting Weight - 18 month year old animal (kg)	150	150
Fattening Duration (days)	90	110
Average daily gain (kg)	0,8	0,7
Weight gain (kg)	72	77
End Weight - At sales (kg)	**222**	**227**
Forage Yield (TDM/HA)		7,5
Yearly DMI/UBT (TDM)		2,5
Nbr of UBT/HA		3
UBT/animal		0,7
Nbr of Animals/ha		4,3
Yearly costs/ha (Naira)		119 000
Forage costs per animal (Naira)		**27 767**
Quantity of Concentrates / day (kg)	3	0,1
Total quantity of concentrates (kg)	270	11
Price per kg (Naira)	200	500
Concentrate costs per animal (Naira)	**54 000**	**5 500**
Health cost per animal (Naira)	10 000	10 000
Sales costs per animal (Naira)	5 400	5 400

	Fattening with concentrates	Fattening with Improved grazing
Total fattening costs (Naira)	**69 000**	**49 000**
Animal Buying Price/kg (Naira)	1100	1100
Animal buying price/head (Naira)	160 000	160 000
Animal Selling Price/kg (Naira)	1375	1375
Animal selling price/head (Naira)	310 000	310 000
Gross Profit per animal (Naira)	**150 000**	**150 000**
Profit per animal (Naira)	**81 000**	**101 000**

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Société anonyme au capital de 3 183 349 euros
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