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# ASSESSMENT OF LIVESTOCK MIGRATION ROUTES, SOCIO-ECONOMIC IMPACTS, VALUE CHAINS AND SUSTAINABILITY IN GREATER UPPER NILE, SOUTH SUDAN

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## Table of contents

LIST OF ABBREVIATIONS AND ACRONYMS.....	5
ACKNOWLEDGEMENT.....	6
EXECUTIVE SUMMARY.....	7
Background.....	7
Key findings.....	7
Conclusions and proposed interventions.....	13
CHAPTER ONE: INTRODUCTION.....	16
1.1 Background and Context Overview.....	16
1.2 Approach and Methodology.....	17
1.3 Objectives.....	17
1.4 Assessment Locations and Demographic Scope.....	19
1.5 Data Collection.....	19
1.6. Ethical Standards and Child Protection.....	20
1.7 Data Analysis.....	20
1.8 Assessment Limitations.....	20
CHAPTER TWO: LITERATURE REVIEW.....	22
2.1. Livestock migrations.....	22
2.2. Socio-economic impact of livestock migrations.....	24
2.3. Livestock value chains along livestock migration routes.....	25
2.4. Sustainability of livestock migrations.....	26
CHAPTER THREE: LIVESTOCK MIGRATION ROUTE MAPPING.....	28
3.1. Overview of Livestock Migration Routes.....	28
3.2. Summary Migration Routes across the Assessment Counties.....	28
3.4. County Migratory corridors, findings, and analysis.....	30
3.4.1. Akobo Migration Routes.....	30
3.4.2. Fashoda Migration routes.....	31
3.4.3. Ulang Livestock Migration Routes.....	32

3.4.4.	Renk Migration routes .....	34
3.4.5.	Rubkona Livestock Migration Routes .....	37
3.5.	Challenges Along Migration Routes .....	38
CHAPTER FOUR: SOCIAL ECONOMIC IMPACT ANALYSIS .....		39
4.1	Overview of the socioeconomic impact of livestock migration .....	39
4.2	Households’ primary income sources .....	39
4.3	Conflicts and disputes during livestock migration .....	40
4.4	Livestock sales and access to animal health inputs .....	40
4.5	Impact of livestock migration on children access to education.....	40
4.6	Women and youth in the livestock sector .....	41
CHAPTER FIVE: LIVESTOCK VALUE-CHAINS MAPPING .....		42
5.0	Overview of livestock value chains .....	42
5.1.1	Purpose of livestock rearing.....	43
5.1.2.	Livestock products and by-products .....	44
5.1.3	Livestock feeding practices .....	44
5.1.4	Livestock markets.....	45
5.1.5	Livestock Product Pricing .....	46
5.1.6	Support for livestock product value addition .....	46
5.1.7	Primary Market Access Challenges .....	47
5.1.8	Impact of Climate on Livestock Market.....	48
5.1.9	Technology & Infrastructure .....	48
5.1.11.	Support & Training.....	50
5.1.12.	Livestock Waste Management .....	51
5.1.12.	Access to financial support and challenges .....	52
5.1.13.	Policy & Regulation .....	54
CHAPTER SIX: SUSTAINABILITY ANALYSIS .....		59
5.1	Overview of sustainability analysis.....	59
5.2.	Findings of Sustainability Analysis .....	59
5.2.1	Perceived Sustainability of Livestock Practices .....	59

5.2.2	Sustainable Grazing Measures .....	60
5.2.3	Changes in Pasture Availability .....	61
5.2.4	Household Water Conservation Practices .....	62
5.2.5	Livestock Waste Disposal Methods.....	63
5.2.6	Alternative Feed Sources Used During Drought or Flooding .....	63
5.2.7	Access to Climate Adaptation Information .....	64
5.2.8	Effects of Climate Change on Livestock Productivity .....	65
5.2.9	Traditional Knowledge and Practices in Sustainability .....	66
5.2.10	Participation in Community-Based Conservation Programs .....	67
5.2.11	Sustainable Breeding Practices.....	68
5.2.12	Veterinary Extension/ Animal Health Services Usage .....	68
5.3.13	Financial Support for Sustainable Livestock Practices .....	69
5.2.14	Improvements for Enhancing Sustainability .....	70
5.3	Assessment of Livestock Migration on Household Nutrition .....	71
5.3.1	Food Consumption Patterns Across Locations .....	71
5.3.2	Main Food Items Consumed During Non-Lean Seasons.....	71
5.3.3	Impact of Livestock Migration on Child Feeding Practices .....	72
5.3.4	Food Sources for Children Under Five .....	73
CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS .....		74
7.1	Conclusion .....	74
7.2	Recommendations .....	74
Annexes.....		79
Annex A: Household Assessment Questionnaire .....		79
Annex B: Men’s FGD guide .....		89
Annex C: Women FGD Guide .....		91
Annex D: Youth FGD Guide.....		93

## LIST OF ABBREVIATIONS AND ACRONYMS

ACRA	Agency for Child Relief Aid
ADA	African Development Aid
AFAA	Alliance for Action Aid
AMR	Antimicrobial Resistance
CAHWs	Community Animal Health Workers
DDG	Digital Data Gathering
FCDO	Foreign, Commonwealth & Development Office
FGD	Focus Group Discussion
GIS	Geographic Information System
GUN	Greater Upper Nile
HH	Household
ICPALD	IGAD Centre for Pastoral Areas and Livestock Development
IFAD	International Fund for Agricultural Development
IGAD	Inter-Governmental Agency for Development
KII	Key Informant Interview
M&E	Monitoring and Evaluation
MARF	Ministry of Animal Resources and Fisheries
MSD	Market Systems Development
NAP	National Action Plan
NGO	Non-Governmental Organization
PSEAH	Protection from Sexual Exploitation, Abuse and Harassment
PVP	Private Veterinary Practitioners
SP	Stock Person
SPOCI	Stop Poverty Communal Initiative
SWOT	Strengths, Weaknesses, Opportunities, and Threats
THRIVE	Transforming Household Resilience through Inclusive Economic Development in South Sudan
USD	United States Dollars
VSF Suisse	Vétérinaires Sans Frontières Suisse

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As we move forward, we look forward to continued collaboration in implementing the recommendations outlined in the report. Together, we can create sustainable solutions to improve livestock-based livelihoods, promote economic growth, and enhance food security for pastoralist communities in South Sudan.

Once again, thank you for your invaluable contributions.

Sincerely,

**Jason Nyaga**

**Lead Consultant - Assessment of Livestock Migration Routes, Socioeconomic Impacts, Value Chains and Sustainability in the Greater Upper Nile Region, South Sudan**

**Ranto and Associates Ltd**

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## EXECUTIVE SUMMARY

### Background

Livestock migration constitutes a critical adaptive mechanism for pastoralist communities in the Greater Upper Nile (GUN) Region of South Sudan, facilitating strategic access to pasture, water resources, and market systems during periods of climatic stress, resource scarcity, and insecurity. This practice is widely adopted across pastoral zones in Asia and Africa, and drives livestock productivity, household food security, and economic resilience, while also preserving socio-cultural identities. In the GUN region, where livelihoods are livestock-based and highly sensitive to seasonal and conflict-induced disruptions, migration remains a central pillar of survival and economic continuity. However, empirical data on livestock migration patterns, associated socio-economic impacts, and value chain performance in this context remain limited, thus highlighting the imperative for evidence-based assessments such as this study.

### Key findings

#### Livestock Migration Routes Mapping in Greater Upper Nile

Livestock migration routes in the Greater Upper Nile (GUN) region of South Sudan follow well-established seasonal patterns primarily dictated by access to pasture and water. During the dry season, herders move toward lowland areas including swamps and riverbanks, while the rainy season prompts shifts to higher grounds to avoid effects of flooding on livestock and waterborne livestock diseases such as fasciolosis (liver fluke infestation). The use of GIS tools and participatory community mapping in this assessment enabled accurate documentation of these routes, generating actionable insights for policymakers and development actors. To facilitate access to shared resources and reduce conflicts over migration routes, some communities, especially around Renk County, have established local governance structures and community-led negotiations to facilitate cross-border movements of livestock from Sudan into South Sudan, especially during the dry seasons.

The timing of the livestock migrations in the assessed counties varies according to locations, seasonal patterns, but the most common period is between January and March. The primary factors influencing the livestock migration cited by respondents were the availability of pasture, access to water, and prevailing climatic conditions. The assessment indicated that the livestock migration pattern in Akobo County follows certain specific and well-defined migratory routes that incorporate pastoral mobility, access to pastures and water resources. The Nyadit-Binyang route (64.09 km) and the Denjok-Binyang route (57.7 km) are the longest distances covered by herders looking for pastures and water. Seven in-county migration

corridors were identified, with the majority terminating in Binyang, including Nyandit, Walgak, Dengjok, Gakdong and Bilkey.

In Fashoda, two livestock migration corridors were identified, including Fashoda to Paw paw (15.37 km) and Fashoda to Komolalum (7.78 km). The distances covered by the migrating livestock are remarkably shorter in comparison to other assessment locations.

In Ulang County, six in-county livestock migration corridors were identified. A noteworthy pattern in Ulang is the web-like structure of livestock migration, where various starting points, like Ying Payam and Weetut, offer connections to varied endpoints via intersecting paths.

Despite the diversity in route typologies, common migration challenges persist across the region, including cattle raiding, conflicts over resources, disease outbreaks, wildlife threats, and poor infrastructure. Establishing formalized resource-sharing agreements and Memorandum of Understanding (MoUs), coupled with integrated planning, infrastructure investment, and conflict resolution mechanisms, is essential to strengthening the resilience of migration systems and safeguarding pastoral livelihoods in the GUN region.

### Emerging migration patterns

During the assessment, shifts in traditional livestock migration routes were observed, primarily driven by insecurity and natural resources (pasture and water) scarcity. In contrast, Fashoda has maintained relatively stable migration patterns, with consistent movements between grazing areas and riverbanks over time. Rubkona however, exhibits more complex migratory behavior. Herders navigate multi-nodal routes such as Rotriak–Toch–Unity–Rubkona–Toan and Ngop–Thorbor–Ding Ding–Rubkona–Bridge–Thoan. These intricate pathways underscore the critical role of localized pasture availability and changing weather conditions in shaping migration choices.

Collectively, these emerging patterns highlight the interconnected influence of environmental variability, seasonal pressures, and security dynamics in determining the structure and direction of livestock migration across the region and the borders.

### Major challenges and opportunities along these migratory routes

In Akobo, livestock migration is hindered by sporadic livestock raids, often attributed to livestock rustlers from neighboring communities, along with frequent livestock disease outbreaks and the threat of predators (wild animals) during movement through established corridors.

Environmental variability further disrupts migration in Rubkona, Ulang, and Renk. Prolonged droughts and flash floods have altered traditional migration patterns and intensified vulnerability. In Rubkona, communities reported increased exposure to livestock diseases and water shortages during extended dry spells. In Renk, insecurity and inadequate infrastructure, such as the absence of functional bridges, present additional barriers to safe livestock movement.

In Fashoda, herders voiced concern over livestock theft, particularly during peak migration periods. These thefts, often involving neighboring pastoralist communities, heighten tensions and insecurity along key migratory corridors.

### **Social-economic impact assessment**

The assessment revealed that livestock migration is associated with a significant decline in household incomes for more than two-thirds of the respondents (68.62%). This impact is particularly pronounced in Akobo (91.35%) and Ulang (81.13%), where seasonal movements disrupt livelihoods and reduce economic stability.

In contrast, the impact of migration in Fashoda was less severe; 46.63% reported income losses, while 30.19% revealed an increase in income, which was attributed to market integration and diversified livelihoods.

### **The impact of migration on livelihoods, markets, social cohesion, and gender dynamics**

The assessment found that 75.36% of respondents sell their livestock directly to processors or end consumers, while the rest use intermediaries to reach the markets, indicating a strong preference for disintermediation. This tendency was especially pronounced in Akobo (98.98%) and Ulang (84.80%), which reflects a combination of limited trust in intermediaries, traditional trading norms, and emerging improvements in local market access. These findings highlight both an opportunity and a challenge for livestock value chain development: while direct sales can increase producer margins, they may also limit market reach, standardization, and potential for aggregation. Strengthening cooperative models and enhancing linkages between producers, buyers, and service providers could improve efficiency while maintaining producer autonomy.

### **Opportunities for enhancing the socio-economic benefits of migration**

Across study sites, participants emphasized the need for improved infrastructure and the formalization of livestock migration routes to address climate variability and socio-economic

stressors. In Akobo and Fashoda, focus group discussions highlighted priorities such as investments in water infrastructure (e.g., boreholes), sustainable agro-pastoral practices, and expanded veterinary/ animal health extension services to support livestock health, welfare and productivity under shifting climatic patterns.

Participants highlighted that veterinary support must go beyond basic extension and include preventive care (such as routine vaccination and deworming), emergency disease response, veterinary drugs supply chain improvements, cold chain systems for vaccine storage, and the deployment of trained Animal Health Workers to underserved areas including migratory corridors. Private sector driven animal health service delivery using cost recovery models is a sustainable approach.

In Rubkona, Renk, and Fashoda, communities called for integrated development initiatives targeting road networks, livestock markets, processing facilities, and natural resource management. Respondents stressed that well-maintained infrastructure, safe grazing and watering points, and consistent access to veterinary inputs and animal health services are essential to ensuring safe and predictable livestock movement.

Furthermore, community-led planning and formal recognition of migration corridors were seen as essential strategies to reduce intercommunal tensions, enhance social cohesion, and build the resilience of livestock-based livelihoods in the region.

### **The socio-economic challenges**

Pastoralist communities in the Greater Upper Nile Region face a complex set of socio-economic challenges. 32.5% of households rely primarily on livestock for income, though this varies by location. Key constraints include limited access to veterinary services, particularly preventive care, disease surveillance, and clinical treatment, which undermines livestock health, welfare and productivity. Additional challenges include exposure to conflict, climate-induced shocks, weak market systems, and inadequate financial inclusion, with women and youth being disproportionately affected.

### **Livestock value chain mapping**

The assessment confirmed that milk is the predominant livestock product across all surveyed locations, cited by 84.8% of respondents. This reliance is especially high in Ulang (98.53%) and Rubkona (92.05%), reflecting strong local engagement in milk production. Meat ranks second (11.25%), with the highest responses in Fashoda (23.92%) and Renk (20.34%), where meat consumption and sales feature more prominently in household economies.

Livestock by-products such as hides, skins, hooves, and horns were also reported, albeit in lower frequencies. These reflect localized adaptations to market demands and resource availability (pasture and water), with Akobo and Fashoda contributing notable volumes of hides and skins, while Renk and Rubkona report intestines, hooves, and horns as minor commercial outputs

### Key actors identified in the livestock value chains

The assessment identified various actors in the project locations, including producers, livestock inputs suppliers/traders, meat processors, and extension service providers, including Animal Health Workers, non-governmental organizations (NGO) workers providing livestock-based interventions, county veterinary and agriculture departments, veterinary services and livestock directors, and government representatives. Traders, comprising border agents and small-scale retailers, manage the livestock markets. Most livestock markets and auction centers are highly concentrated locally, with some cross-border markets, such as those in Akobo and Renk, which can enhance regional integration. Processors of livestock-based products and value-addition actors, on the other hand, continue to be severely underrepresented due to a lack of processing technology, storage and marketing facilities, and livestock infrastructure, such as abattoirs/slaughter slabs and milk aggregation centers or milk bars. The value chain shows a greater opportunity for improving livestock infrastructures (slaughter slabs and milk aggregation centers), creating a market network and linkages, and adding financial resources to tap into the economic potential of the available livestock population.

### Livestock value chains, gaps, challenges, and opportunities for improvement.

The livestock sector in South Sudan's Greater Upper Nile region plays a central role in rural livelihoods, food security, and income generation for the livestock-dependent households. However, its value chains remain constrained by structural weaknesses that hinder productivity, limit market access, and reduce economic returns, particularly for women and youth.

The assessment identified critical infrastructure deficits, such as the absence of cold chain facilities, abattoirs/slaughter slabs, milk aggregation centers, veterinary clinics/ facilities, and all-weather roads that undermine the efficiency of livestock trade and processing. These gaps contribute to significant post-harvest losses, especially for high-potential products like milk and meat. Furthermore, access to credit and functional market networks remains limited, restricting producers' ability to scale operations and engage competitively in regional trade.

Animal health services delivery in the assessment region is critically under-resourced with serious inadequately trained personnel, supervision, capacity gaps, and support from the state/national government. Public extension coverage is inconsistent, and animal health service providers often lack or have limited access to inputs, training, and logistical support to respond to animal health needs and welfare. Gaps in livestock disease surveillance, reporting and cold chains pose serious risks to livestock health and welfare, particularly during seasonal migrations when animals are most vulnerable.

Women and youth remain underrepresented in high-value segments of the value chain. Their participation is largely restricted to milk handling and small-scale retailing, with limited access to finance, training, and cooperative leadership roles. Addressing these equity gaps is essential to achieving inclusive growth and improving household resilience.

Strategic investment in animals' health service delivery systems, infrastructure development, inclusive financing, and market coordination mechanisms can unlock the full potential of the livestock sector. THRIVE interventions that integrate gender and youth empowerment, while strengthening service delivery and private sector engagement, will be critical for building sustainable, conflict-sensitive, and climate-resilient livestock economies in the region.

### **The economic potential of the identified value chains**

Assessment findings indicate that milk and meat present the highest economic potential among livestock products in the Greater Upper Nile region. THRIVE project investment in milk aggregation infrastructure and promotion of hygienic handling practices could significantly boost household incomes while advancing women's economic empowerment, as they are key players in milk production and marketing. Strengthening cold chains, improving milk and meat processing capacity, and supporting cooperative models will further enhance value retention and resilience at the community level.

Equally important is investment in private sector led animal health services, which are foundational to unlocking productivity gains. Improved access to preventive care, vaccination campaigns, and mobile veterinary outreach, especially during migration, can reduce livestock morbidity, improve reproductive performance, and extend the productive lifespan of livestock. These gains translate directly into higher yields, improved access to animal source foods and more stable incomes for producers.

THRIVE project could also support business training and inclusive enterprise development, particularly for women and youth, which can amplify these economic benefits. Tailored support in financial literacy, marketing, and cooperative governance would enable

marginalized groups to move beyond subsistence roles and into higher-value segments of the livestock economy. Together, these interventions form a pathway for inclusive growth and greater resilience across the livestock value chain.

### **Sustainability analysis and recommendations for resilience**

The assessment identified environmental, socio-economic, and cultural factors that have a major influence on the livelihoods of the pastoralist communities' management. The main challenges identified include overgrazing and climate-induced pressure on the grazing land and water sources. For the sustainability of THRIVE interventions, the study recommends strengthening institutional frameworks, promoting community-led livestock production, including rangeland management and restoring practices, supporting early warning and early action initiatives like construction and repairs of water pumps, haffirs/ponds, water-pans, improving conflict resolution mechanisms along the livestock migration routes, and supporting water conservation interventions.

### **The impact of climate change, conflicts, and other risks**

In Akobo, the community mapping exercises through FGDs indicated that the recent flooding annual patterns on the Sobat river and sometimes diminished rainfall have led to the shifting from the traditional livestock migration routes. Livestock producers observed that the unpredictable seasons and rainfall patterns have led to persistent water scarcity and pasture regrowth along the migratory routes.

### **Conclusions and proposed interventions**

Even though communities have used traditional migration routes for ages, the unfolding climate change phenomenon, security challenges, conflict, land disputes, and cases of insecurity are increasingly distorting migration patterns. Increased restrictions on migration routes, combined with land-use changes, have exacerbated the difficulties faced by pastoralists. A clear understanding of these phenomena remains crucial in designing effective interventions for pastoral-dependent livelihoods, such as in the Greater Upper Nile.

Proposed interventions for the THRIVE program include the following:

- The project should consider supporting and scaling targeted initiatives that build social cohesion and proactively mitigate resource-based conflicts, like facilitating peace conferences and livestock resource management agreements/MoUs with the pastoralist communities along the key livestock migration routes identified by this

assessment. These actions should be aimed at fostering community-led actions for social cohesion and conflict resolution.

- Strengthen resilient livestock market systems through strategic infrastructure development. The project should support and facilitate the development of critical livestock/product market infrastructure, including livestock sales yards, milk collection/aggregation centres, and hygienic slaughter slabs, to expand market access and improve the efficiency of livestock trade and processing within the value chain. These should be linked to existing cooperatives or VSLAs for operationalization and support for long-term sustainability. This model facilitates regular trade, improved quality products through quality control measures, and provides a centralised point for the provision of additional services and functions like training and equipment provision. This is central to THRIVE’s market system strengthening efforts.
- The project should also support initiatives to improve and expand access to quality veterinary extension services, robust livestock disease surveillance and reporting mechanisms, and efficient cold chain logistics for veterinary vaccines. The entry point is through the support of private veterinary practitioners (PVP), veterinary input wholesalers and government stakeholders in aligning their capacities and market linkages. This will systematically scale up the capacity and reach of community-based animal health service providers who offer last-mile livestock extension services, particularly in remote and migratory corridors, to ensure timely, sustainable and effective animal health interventions that bolster livestock productivity and household resilience.
- Support and scale climate-resilient fodder production and preservation initiatives, alongside innovative water conservation techniques (e.g., borehole drilling, rainwater harvesting systems). These interventions are crucial for fostering sustainable livestock management practices and enhancing the adaptive capacity of pastoralist communities to climatic shocks.
- Deepen and support women's economic empowerment within livestock value chains, especially milk, meat, and PVP. Proactively increase women’s meaningful involvement in higher-value segments of the livestock economy by enhancing their access to direct market connections, tailored business and stock-keeping training, and inclusive financial services/loans through the cooperatives or VSLA models. This directly contributes to THRIVE’s objective of women's economic empowerment and fosters more inclusive economic growth.

- Advocate for an enabling policy environment for sustainable livestock development in South Sudan. Engage in strategic advocacy within South Sudan to foster a favorable regulatory environment that supports equitable land tenure reforms, robust livestock value chain growth, and sustainable livestock migration practices. This aligns with THRIVE's overarching objective of promoting sustainable and inclusive economic development.

The sustainability of such programs should be anchored on bolstering key value chains, encouraging sustainable livestock production interventions, and improving conflict and community cohesion among the pastoralists. Furthermore, water scarcity problems affecting livestock migration can be lessened with water conservation techniques such as borehole drilling and rainfall-gathering systems.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background and Context Overview

The THRIVE program aims to bolster resilience in conflict and climate-affected communities in Greater Upper Nile (GUN). Targeting eight priority counties in Upper Nile, Unity, and Jonglei States over four years, THRIVE will reach 120,000 households with gender-responsive and inclusive livelihoods development, market system strengthening, financial inclusion, women's economic empowerment, climate adaptation, and social cohesion activities. Led by GOAL, in partnership with Mercy Corps, CAFOD, VSF Suisse, and our local implementing partners, the consortium boasts over ten decades of combined experience in GUN working along the triple nexus to foster sustainable and inclusive economic development and build household resilience, by leveraging our core expertise and experience in community-centered approaches, market systems development, financial inclusion, peacebuilding, agro-ecology, and women's and youth economic empowerment. THRIVE's program design is grounded in evidence from recognized global approaches and the consortium's deep experience and understanding of the South Sudan context, especially in the project locations in Greater Upper Nile region.

Assessing livestock migration routes, socio-economic impacts, livestock value chains, and sustainability in the GUN region of South Sudan was critical for understanding the agro-pastoralist economy and its broader project implications.

Livestock migration plays an important role in sustaining livelihoods for the pastoralists, enhancing food security, and fostering community resilience across the Horn of Africa and beyond (FAO, 2021). Due to the heavy overreliance on livestock for economic and cultural practices in South Sudan, this assessment comprehensively analyzed the key factors influencing migration patterns and their consequences.

A study by The International Fund for Agricultural Development (IFAD) (2020) proposed an interdisciplinary approach in understanding livestock migration, considering environmental, economic, and socio-political dynamics in the agro-pastoralist areas. Conflicts, socioeconomic inequality, and climate change pose a growing threat to these livestock movements within the region (UNDP, 2021).

Additionally, increased demand for grazing land and water resources has led to conflicts between different pastoralist communities and between herders and agricultural communities. Socio-political instability, such as cattle raiding, and the introduction of land tenure policies that restrict access to traditional grazing lands further complicate migration

dynamics. These factors bring to play the need to re-evaluate migration practices and policies that will ensure the sustainability of pastoralist livelihoods.

## 1.2 Approach and Methodology

Data collection was done between 20<sup>th</sup> January and 15<sup>th</sup> March 2025 in the THRIVE program locations including the following phases: (i) the preparatory phases with an inception meeting with VSF-Suisse and THRIVE partners to understand the tools and review of relevant documents; (ii) field data collection; (iii) data analysis; (iv) validation of preliminary findings and (v) report writing. The assessment team utilized a multi-pronged approach and tools to understand the livestock migration routes and patterns across the THRIVE program locations incorporating the use of Geographic Information Systems (GIS), participatory community mapping exercises and literature review perspectives. These tools were instrumental in visualizing shifts in movement patterns and pinpointing areas where pastoralists encounter the most significant challenges.

The assessment used a participatory approach to ensure that the affected communities, local leaders, local authorities, development and humanitarian partners were actively engaged in the assessment. Specific questions on gender roles, specific challenges faced by men and women along the livestock migration routes were also explored during the assessment. Given that disputes over grazing land and water access are common, the study explored conflict resolution mechanisms employed by local communities. These include traditional governance structures, negotiations led by elders, and interventions from governmental and non-governmental entities.

## 1.3 Objectives

### Specific objectives

#### 1. Livestock Migration Route Mapping

- Identify, map and document key livestock migration routes in the Greater Upper Nile region.

Under this, a detailed county map of livestock migration routes was to be developed with the communities in the THRIVE intervention areas showing both historical and current livestock movement patterns, and any new changes exacerbated by environmental and political factors.

- Analyze patterns, seasonal variations and drivers of livestock migration

The study was to examine the increasing pressures such as prolonged droughts, erratic rainfall patterns, floods, land degradation, and conflicts over grazing land that have inadeptly disrupted traditional migration pathways.

Additionally, the study sought to highlight emerging migration patterns in the THRIVE intervention counties, including shifts toward alternative grazing areas, changes in livestock migration frequency, and adaptations made by pastoralists in response to restricted movement.

- Identify challenges and opportunities along these migratory routes

## 2. Social-economic impact assessment

- Assess the socio-economic impacts of livestock migration on households and communities, with a focus on vulnerable livestock-dependent groups.
- Analyze the impact of migration on livelihoods, markets, social cohesion and gender dynamics.
- Identify opportunities for enhancing the socio-economic benefits of migration.

Under this, the study investigated the socio-economic challenges and opportunities of these migration shifts, particularly their impact on household income, food security, and market access. The study aimed to comprehend social inclusion, with a gender lens and offer practical solutions for improving resilience and livestock management.

## 3. Livestock value chain mapping

- Identify key actors in the livestock value chains, including producers, service providers, traders, and processors.
- Map and document the different livestock value chains, highlighting gaps, challenges, and opportunities for improvement.
- Assess the economic potential of each segment of the value chain.

## 4. Sustainability analysis

- Evaluate the sustainability of current practices in livestock production, migration and value chains.
- Analyze the impact of climate change, conflicts, and other risks on these practices.
- Recommend strategies for enhancing sustainability and resilience

## 5. Business Development

- Develop comprehensive business plans for the identified livestock value chains and opportunities.

- Integrate social inclusion, gender empowerment, market system development, and disaster risk reduction strategies into the business plans.

#### 1.4 Assessment Locations and Demographic Scope

Five counties in the Greater Upper Nile (Akobo, Ulang, Fashoda, Renk and Rubkona) where THRIVE project is being implemented were purposively sampled. The counties were chosen based on prevailing security situations, THRIVE partners' expertise and understanding of historical livestock migration patterns in their areas of operation and vulnerability to market pressures, resource-based conflicts, and climate-related shocks. The demographic focus was on pastoralist households, traders, local authorities, and other livestock value chain stakeholders.

#### 1.5 Data Collection

Data collection was done between January and March 2025 by a team of one lead consultant and a livestock specialist backed by 5 data collection supervisors and a total of 18 enumerators across the assessment sites.

In each assessment site, women, youth, and men Focus Group Discussions (FDGs) were organized with key informant interviews (KIIs) done with key stakeholders including local government representatives, and the county veterinary department on the opportunities and difficulties associated with livestock movement and value chains. A total of 17 FDGs were carried out across the assessment sites. Attention was paid to gender-sensitive facilitation by having separate discussions for women, youth, and men. Other gender considerations included scheduling discussions to accommodate participants' availability and ensuring all participants had a safe space to voice their opinions.

For the household questionnaires, random route selection and a focus on stratified sampling based on local knowledge of the study's geographic area, livestock ownership and livestock migration patterns were used. A total of 1,845 household interviews were collected resulting in a representative sample size.

Consent was sought from participants during the KII, household (HH) questionnaires and FDGs.

To gather quantitative data for this assessment, open-source KoBo Toolbox software was used. The data collection tools were pre-tested through piloting exercises and standardized to guarantee consistency and dependability.

The information was also triangulated with a literature review on livestock migration and its socioeconomic effects.

## 1.6. Ethical Standards and Child Protection

The assessment followed a strict commitment to ethical research norms during data collection. Verbal and signed consent explained the participants were used to ensure voluntary participation, guaranteeing anonymity and confidentiality.

The assessment teams received training on the best ethical methods, such as maintaining integrity in data collecting and documentation, and mitigation measures were implemented to prevent respondents from experiencing discomfort. Following VSF Suisse's Protection from Sexual Exploitation and Abuse (PSEA) policy, suitable reporting procedures were also established, and child safety measures were implemented.

## 1.7 Data Analysis

The assessment gathered information mostly through qualitative data collection methods (focus group discussions, semi-structured interviews, and direct observations). The data collected was compiled by scheme and results were verified for consistency. Numeric data were quantified and calculated for percentage or rating as required. Statements collected from the different respondents were triangulated to avoid establishing lessons learned based on individual perceptions and biases.

The RAO software was used for data handling and analysis. GIS coordinates were recorded for spatial analysis during collection, and data obtained through the KoBo Collect App was directly entered.

The following steps were followed during the data analysis process:

1. Initial specification of the assessment's scope
2. Recognizing the extent of the evaluation
3. Standardizing and cleaning the dataset iv) carrying out data screening and verification
4. Analyzing both quantitative and qualitative data
5. Utilizing GIS software to create visualizations and perform spatial analysis
6. Summarizing the main conclusions, findings, and suggestions

## 1.8 Assessment Limitations

Since this assessment was designed and carried out in specific areas in Greater Upper Nile, the results drawn from may not be representative of the region and by extension the whole of South Sudan. The sampled assessment sites and the qualitative nature of the data collection tools incited us to discuss trends rather than generalizable facts. Other limitations encountered by the team is the scarcity of documents and availability of resource persons at

the county Department of Agriculture and Livestock, eruption of armed conflict in Ulang County, poor road networks, inadequate transport, weak communication infrastructure, increased logistical costs, and delays in data collection execution in some areas.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1. Livestock migrations

According to Adriansen (2008), livestock migration can be termed as cumulative measure of movement of livestock within a given period across open rangelands. This can be associated with the movement of all or some few people managing and depending on mobile livestock. Livestock migration is an integral part of pastoral communities' life in South Sudan, as herders move with their livestock during dry periods to access good grazing land elsewhere or away from waterlogged/flooded areas (Idris et. al. 2018). Maintained access to such land directly benefits livestock health and milk and meat yields (Pendle, 2017).

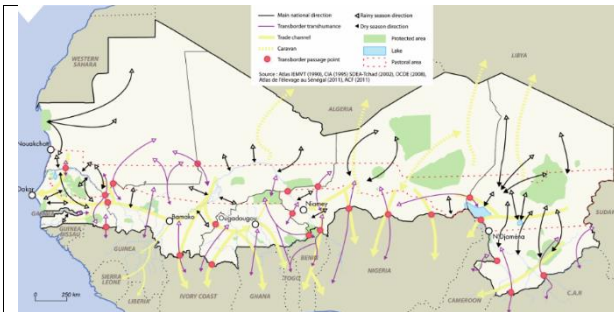
The traditional routes of migration have changed over time in South Sudan to support the efficient use of natural resources though prolonged conflicts have made rivers and grazing lands to be abandoned for decades, becoming no-man's land (USAID, 2015:45). After the December 2013 conflict in South Sudan, FAO observed long-distance displacement of livestock from the conflict affected areas into agricultural areas of the Greater Equatoria region, depicting abnormal livestock migrations (Green, 2015). Due to the concentration of a high number of livestock in condensed areas for prolonged periods, the abnormal migrations led to the spread of foot and mouth disease, foot rot, East Coast Fever and liver fluke infestation (FAO 2015; 2024). This is worsened by limited access to animal health services, animal health inputs, extension services, inadequate veterinary vaccine cold chain system and storage facilities. A schematic map by Malo et al. (2024) showed that abnormal cattle migrations in Central Equatoria State of South Sudan are significantly influenced by natural resources-related communal conflicts and the safety of pastoralists from neighboring states (Jonglei and Lakes State). An annual southward migration occurs between January and April, mostly determined by pasture and water availability. These migrations are closely associated with “cattle camps” in South Sudan, where pastoralists come together to protect their animals at night and serving as resting points for the animals.

The international border created between South Sudan and Sudan in 2011 cuts through some important grazing and watering land containing crucial migration routes, especially for Sudanese pastoralists during the dry seasons. Livestock migrations in Sudan traverse long distances (up to 400 km or more) along a north-south transect, between six distinct ecological zones and into South Sudan (Behnke et al. 2020).

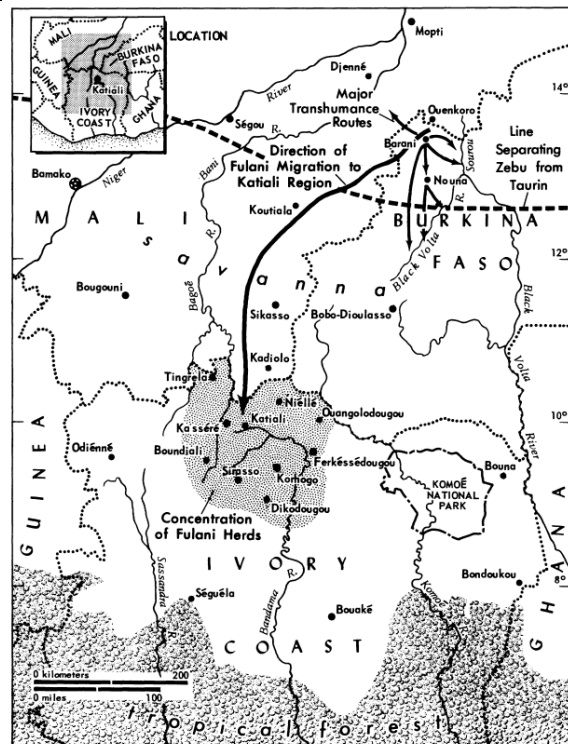
GPS tracking has been used to track herd mobility to show the pattern and the frequency of the movements.



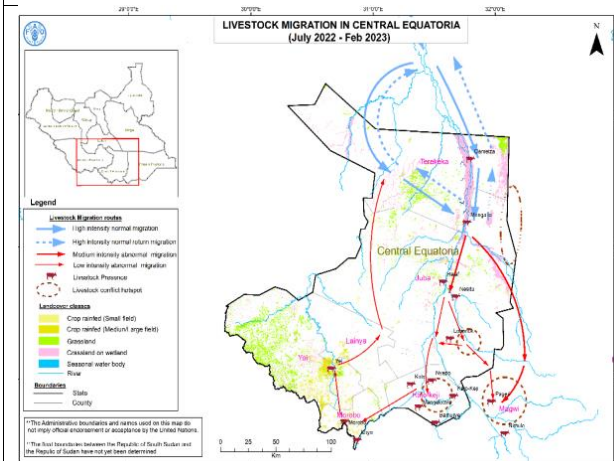
Geographers have depicted livestock migrations as axes of seasonal or annual movement circuits depicted by broad arrows on maps (Barral 1974; Stenning 1960; Gallais 1967, 1975; Benoit 1979; Beauvilain 1977; Bassett 1986; Gomez 1979; Touré et al. 2012)



Summary of recent national and transborder herd movements and commercial cattle trade channels in Sahel Countries; Toure et.al. 2012



Fulani transhumance migratory routes, northwestern Burkina Faso to the Katiali region, northern Ivory Coast; Bassett et. Al. (1986)



Livestock migration in Central Equatoria July 2022-February 2023; Malo et al. (2024)

Previous studies on rangeland ecology examined the temporal variability of rainfall and livestock populations using spatially aggregated data. Despite this broad approach, emerging ecological theories remained closely linked to African pastoral systems. The postulation was that pastoral mobility enabled livestock to respond flexibly to shifting rainfall patterns, thereby sustaining higher livestock numbers by pastoralists under variable climatic conditions (Scoones 1994).

Recognizing the pronounced temporal and spatial rainfall fluctuations and forage availability emphasized by no-equilibrium rangeland ecology led to the argument that livestock migration serves as a critical adaptive strategy. This view suggests that livestock migrations in Africa almost always align with intra- and inter-annual climatic variability and enhance the resilience of pastoral communities in African dryland ecosystems (Boone et al. 2008; Turner et al. 2016a).

## 2.2. Socio-economic impact of livestock migrations

According to Adriansen (2008), the recognition of the role of domestic livestock as wealth stores, producer of products and agents of environmental change is growing. This is not only important for the pastoral communities but also for all rural people to reduce their vulnerability to inter-annual rainfall variability. Migrating livestock are viewed as Mobile wealth stores, which is not new to dryland regions of Africa and the world, though the broader recognition of their importance was often ignored due to the prevalent environmental concerns about migrating domestic livestock.

Traditionally in South Sudan, the conflicts arising during livestock migrations were mitigated, contained and settled through traditional conflict resolution mechanisms.

Pastoral migrant Arab pastoralist communities traversing from Sudan into northern counties of South Sudan have been supported by VSF Suisse among other peace actors through peace conferences and Animal Health Service for Peace Models which have aimed at inclusive sharing of dry season grazing areas and water resources and animal health services in a peaceful environment. This also recognized and promulgated common court laws, traditional administration, and customary practices in organizing grazing and water access along the border locations in Unity, Warrap, Northern Bahr el Ghazal, Upper Nile and Ruweng Administrative Area. Joint cross-border monitoring and follow-up committees were also established to monitor the implementation of access to grazing and sharing of other resources along the migration routes.

Communities in arid and semi-arid regions in Africa are the most vulnerable concerning climate change and utilize strategies at the household and community level to reduce the vulnerability to climate change, including mobility, livelihood diversification, wealth stores and innovation Agrawal et al. 2018)

Communities through which the herder passes often blame in-migrant livestock-keeping groups for environmental damage (Salerno et al.2018). This is true as far as allegations of environmental destruction are used for political gain by officials and resident farming communities together.

In a study by Salerno et al. (2018), most of the key informants, district officials (93%) allude to positive economic impacts of agro-pastoralists moving to their area, through increased agricultural production, availability of livestock products, and tax revenue, among others. This is in addition to its contribution towards social protection, safety nets, maintaining soil fertility through manure, nutrient cycling, further contributing towards agro-ecology, biodiversity and climate smart production practices (VSF International, 2016).

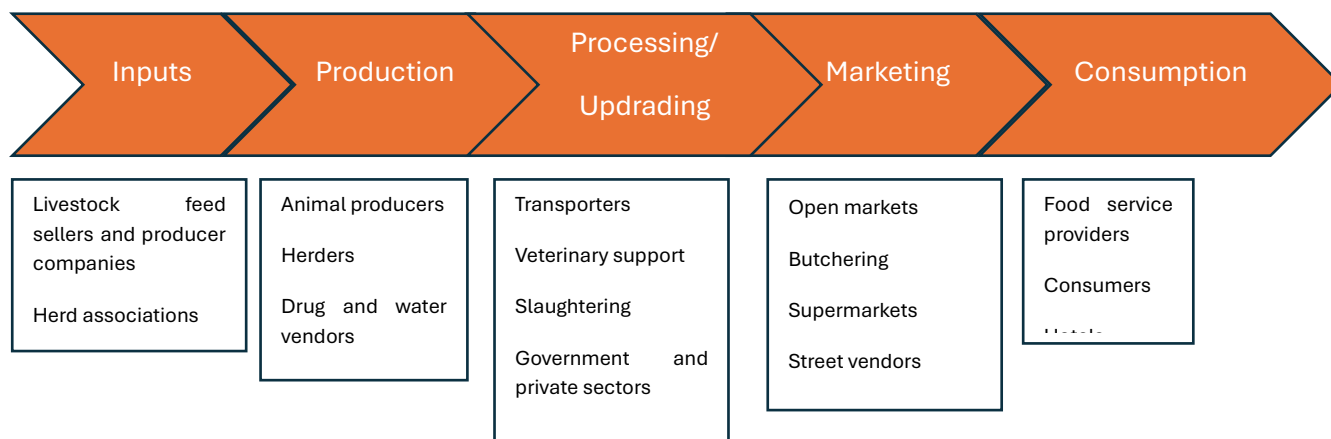
A study by Baier et al. (1980) in Niger noted that extended periods of drought are often accompanied by unfavorable shifts in the terms of trade for pastoral communities. This deterioration may be exacerbated by the weakening of economic linkages between pastoralism and the broader regional economy, contributing to elevated livestock losses during drought events. Furthermore, the negative impact of these market shifts has been shown to disproportionately affect small-scale herders, who often cannot avoid distress sales of livestock. In comparison to larger producers, their limited resilience also constrains post-crisis herd recovery. As a result, these structural and economic challenges, combined with broader regional transformations, have made a return to full-time pastoralism less viable for many marginalized herders. The recovery difficulties observed in the 1970s thus reflected not the overall decline of pastoralism but rather the gradual exit of a segment of producers for whom the risks of continued engagement in mobile livestock rearing outweighed the potential benefits.

### 2.3. Livestock value chains along livestock migration routes

During livestock migrations, numerous nodes along the corridors emerge including markets and various actors (traders, processors, input dealers) on meat, live animals, milk, feeds, drugs among other products (Ng'asike et al. 2019). The study explores the practical norms in livestock value chains within trade corridors with the interaction of formal and non-formal institutions.

According to a study conducted by the IGAD Center for Pastoral Areas & Livestock Development (ICPALD) in 2015, milk is the most economically important livestock product with an estimated value of 2.07 billion United States Dollars (USD), equivalent to 73% of the total gross value for livestock and three times more important than meat. Average milk production per cow per day stands at 1.4-2 liters in South Sudan (FAO, 2019; Mohamed-kheir et al, 2008).

In Africa, a large rift exists between formal (state-sanctioned) norms and real (informal) practices in communities (Olivier de Sardan 2015). In the absence of formal norms or hybrid forms of governance and the resilience of the practical norms, it's hard to dismiss this short-term coping mechanism (Menkhaus 2007).



Graphical presentation of common livestock value chains along livestock migration corridors; Nyokabi et al. (2015)

The social relations and institutional complexity among various livestock market actors and service providers along the value chains influence livestock and products either into or off the markets. The fewer the mediators/brokers, and the transition markets maximize the profit margins.

#### 2.4. Sustainability of livestock migrations

Previous studies on the grazing behavior of wild ungulates in East Africa (McNaughton 1979; McNaughton & Georgiadis 1986; Seagle & McNaughton 1992) noted that mobile grazers typically subject specific rangeland sites to intense grazing for brief periods, followed by intervals of minimal or no use. This cyclical pattern of use and recovery resembles rotational grazing systems and is considered to enhance ecological sustainability (Savory & Butterfield, 1999).

Over the past several decades, there have been questions on the sustainability of pastoralism from the cumulative land loss, water resources and the required variety of pasturage and forages to maintain large herd sizes. This has led to reduced livestock migrations in terms of distances covered (for example Maasai from Northeast Tanzania used to move to Zambia but have reduced the movements) or sedenterization by either remaining in one region and increasingly becoming dependent on cultivation with a depleted herd or abandoning pastoralism in totality (e.g., 30% of Somalis and 20% Afar from Ethiopia are settled).

The widespread transition toward agro-pastoralism across the East Africa region, characterized by the partial settlement of pastoral households, has introduced significant gender-related transformations. This shift alters traditional household structures and redistributes labor responsibilities, often placing greater demands on women who remain in settled areas while men continue to migrate with livestock in search of pasture. A primary consequence for women is the added responsibility of managing crop production in fields and home gardens near the settlement. Additionally, the physical separation from livestock has diminished women's customary access to and control over livestock products,

particularly milk, historically, a central element of both family nutrition and female-managed resources. In many cases, men now take over the commercialization of milk, diverting it from household consumption.

Conflicts (intercommunal violence and civil unrest in South Sudan) disrupt livestock migrations and grazing patterns, affecting the sustainability of the traditional practice, disrupting grazing intensity and distribution (Malo et al. 2024).

## CHAPTER THREE: LIVESTOCK MIGRATION ROUTE MAPPING

### 3.1. Overview of Livestock Migration Routes

The livestock migration routes in the GUN of South Sudan have developed into a well-established seasonal pattern, heavily dependent on the availability of pasture and water resources. In the dry seasons, pastoral communities move their livestock along the rivers, Toiches/swamps, and areas where water sources are available and reliable. During the rainy seasons, the communities move to higher ground to evade flooding and consequent parasitic/liver fluke infestation and waterborne diseases that affect the livestock, thereby threatening their health and welfare. To facilitate access to shared natural resources and reduce conflicts over migration routes, some communities, especially around Renk County, have established local governance structures and community-led negotiations to facilitate cross-border movements of livestock during the dry seasons. This assessment utilized Geographic Information Systems (GIS) and participatory mapping exercises to identify and give an overview of the livestock migratory routes. These maps provide important information on how migration routes are right now, which is bound to assist policymakers, NGOs, and development partners in coming up with long-term sustainable solutions on pastoralism in the region. Strengthening livestock migration corridors through improved critical value chain support, conflict resolution mechanisms, and climate adaptation strategies will be essential in ensuring the long-term resilience of pastoralist communities in the Greater Upper Nile Region

### 3.2. Summary Migration Routes across the Assessment Counties

The following map below (Figure 1) illustrates seasonal cattle migration routes across Akobo, Fashoda, Renk, Rubkona, and Ulang. The migration paths, marked by directional arrows, show a complex network of movement primarily from southern and central grazing zones (such as Akobo and parts of Jonglei) towards northern pastures near the borders with Sudan (including areas like Renk and Rubkona). These routes reflect pastoralists responses to seasonal changes, pasture availability, and water sources, often involving cross-county and cross-border livestock migration. Migration flows both to and from grazing areas are mapped, suggesting cyclical patterns that are essential for livestock survival during dry and wet seasons. The use of rivers, protected areas, and borderlands as navigation points highlights the geographical constraints and strategic decisions made by pastoral communities.

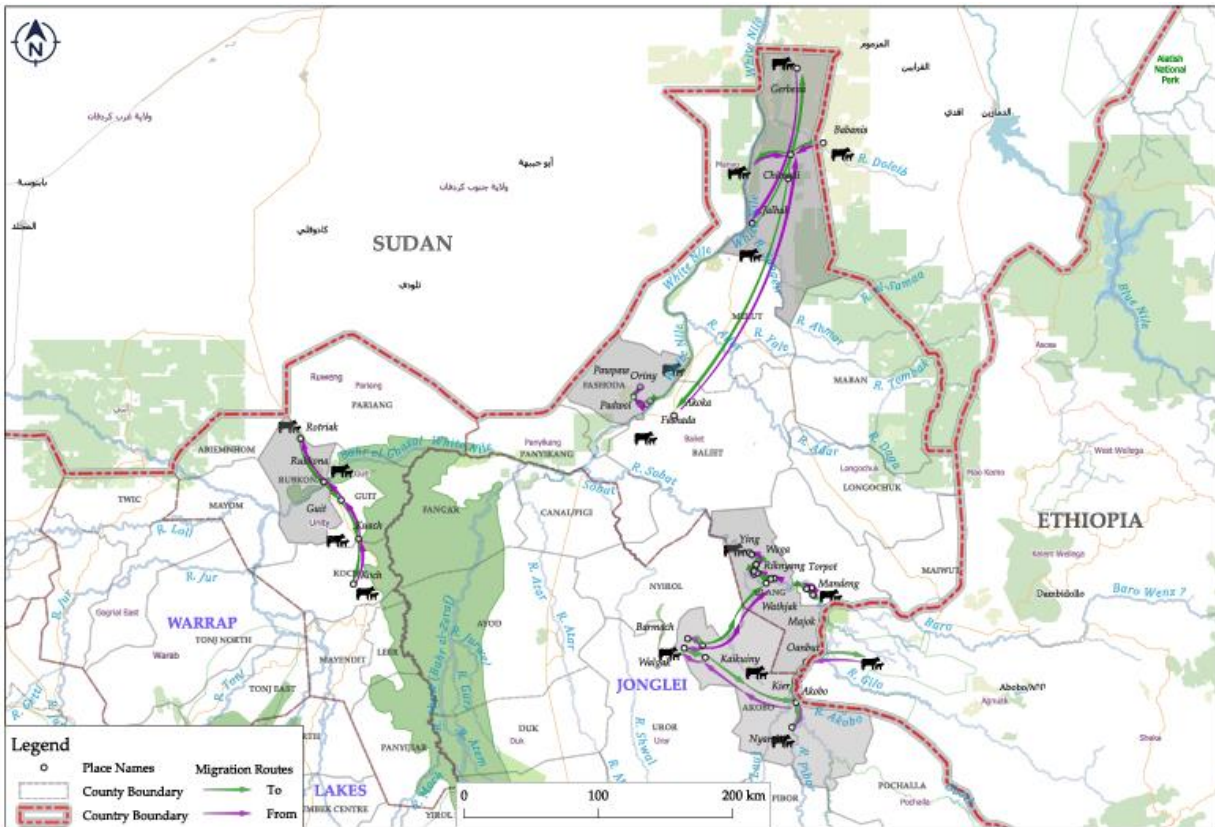


Figure 1: Livestock migration in across the assessment locations

### 3.3. Livestock Migration timing

Results from the assessment indicate that the timing and migration patterns vary significantly between locations and seasons. Most of the long-distance livestock movements occur between January and March of every year, with Akobo (391 HHs, 31.01%) and Ulang (406 HHs, 32.20%) having most of the HH migrating with their livestock during that period. This is attributable to resource constraints, including grazing land, water and weather conditions that force them to relocate early in the year when it's normally the dry season across the GUN. September is the migration peak period in Fashoda (77.95%), most likely related to the start of the dry season and pasture availability. In contrast, April-June finds considerable migration in Fashoda (92 HHs, 39.48%) and Renk (77 HHs, 33.05%), and October-December is noticeable in Fashoda (42 HHs, 41.18%) and Renk (31 HHs, 30.39%), indicating that these localities may have climatic or socioeconomic variables driving movement. The Pearson chi-square test ( $\chi^2 = 914.8097$ ,  $p = 0.000$ ) shows a substantial variance in migration timing among regions, emphasizing the impact of specific environmental and economic variables on migration decisions

### 3.4. County Migratory corridors, findings, and analysis

#### 3.4.1. Akobo Migration Routes

Table 1 Akobo Migration routes

No	Starting from	Mode of transport	Passing through	End points	Distance covered
1.	Nyadit	Walking	Nyadit, Denjok, Gakdon, kier, Lire, Wunbut, Wanding, Rummyiri, Mading, Wechgai, Malou,	Binyang	64.09 Km
2.	Denjok	Walking	Denjok, Gakdon, kier, Lire, Wunbut, Wanding, Rummyiri, Mading, Wechgai, Malou,	Binyang	57.7 Km
3.	Gakdong	Walking	kier, Lire, Wunbut, Wanding, Rummyiri, Mading, Wechgai, Malou	Binyang	46.49 Km
4.	Bilkey	Walking	Denjok, Gakdon, kier, Lire, Wunbut, Wanding, Rummyiri, Mading, Wechgai, Malou,	Binyang	58.26 Km
5.	Walgak	Walking	Walgak, Buong, Pulbuoy, Makuei, Thulup,	Barmach	13.53 Km
6.	Walgak	Walking	Walgak, Buong, Pulbuoy, Makuei, Thulup,	Tuargany	12.97 Km
7.	Walgak	Walking	Walgak, Kaikuiny, Duachan, Akobo, Denjok, Gakdon, kier, Lire, Wunbut, Wanding, Rummyiri, Mading, Wechgai, Malou,	Birnyang	336.88 Km

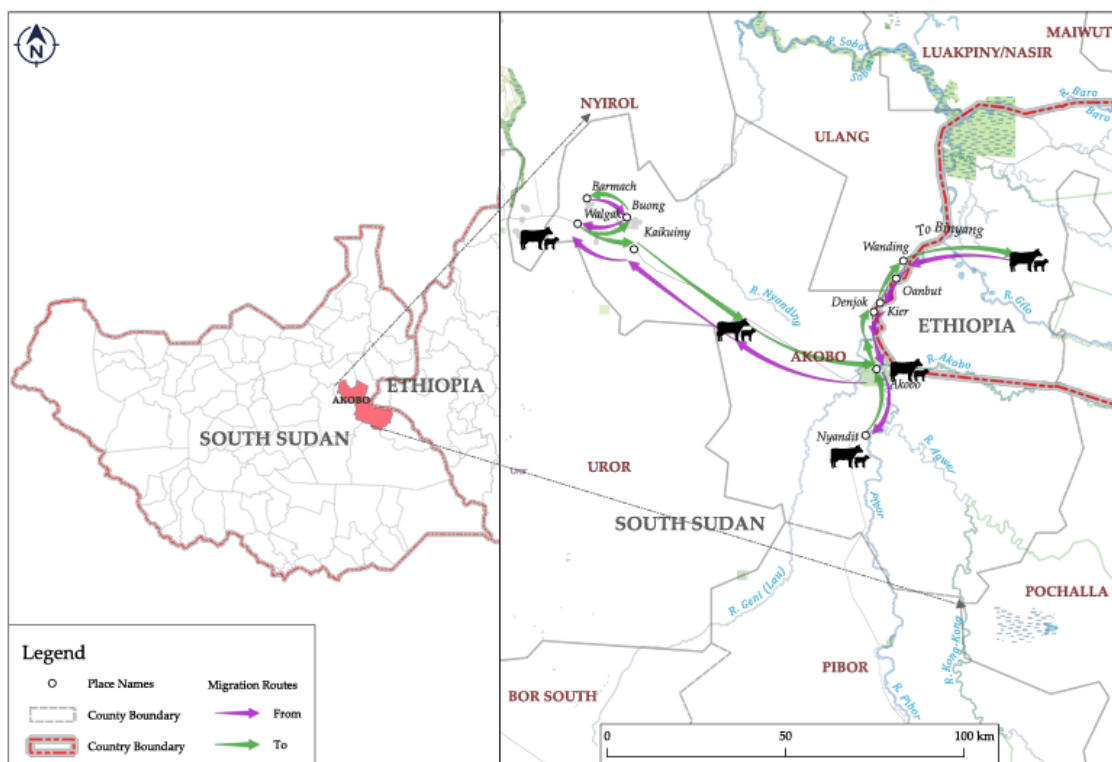


Figure 2: Geographic Map of Akobo Livestock Migration

### Analysis of Livestock Migration Routes in Akobo

The assessment indicated that the livestock migration patterns in Akobo County follows certain and well-defined migratory routes that incorporates pastoral mobility, in search of pastures and water resources. The Nyadit-Binyang route (64.09 km) and the Denjok-Binyang route (57.7 km) are the longest distances covered by herders looking for pastures and water. Other essential routes are Gakdong-Binyang (46.49 km) and Bilkey-Binyang (58.26 km) to the same destination demonstrate the existence of a network of dependent interlinked livestock migration pathways. The Walgak-Barmach (13.53 km) and Walgak-Tuargany (12.97 km) routes indicates more localized livestock migration which demonstrates seasonal migration from one zone to another within a close distance to grazing areas. The Walgak-Birnyang route, which is 336.88 km long, is one of the longest migration routes and indicates a straight-line migration in response to drought and the seasonal variation of pasture availability.

#### 3.4.2. Fashoda Migration routes

Table 2 Fashoda Migration Routes

No	Starting from	Mode of transport	Passing through	End points	Distance covered
1.	Fashoda	Walking	Padwal, oriny	Paw paw	15.37 Km
2.	Fashoda	Walking	pap	Komolalum	7.78m

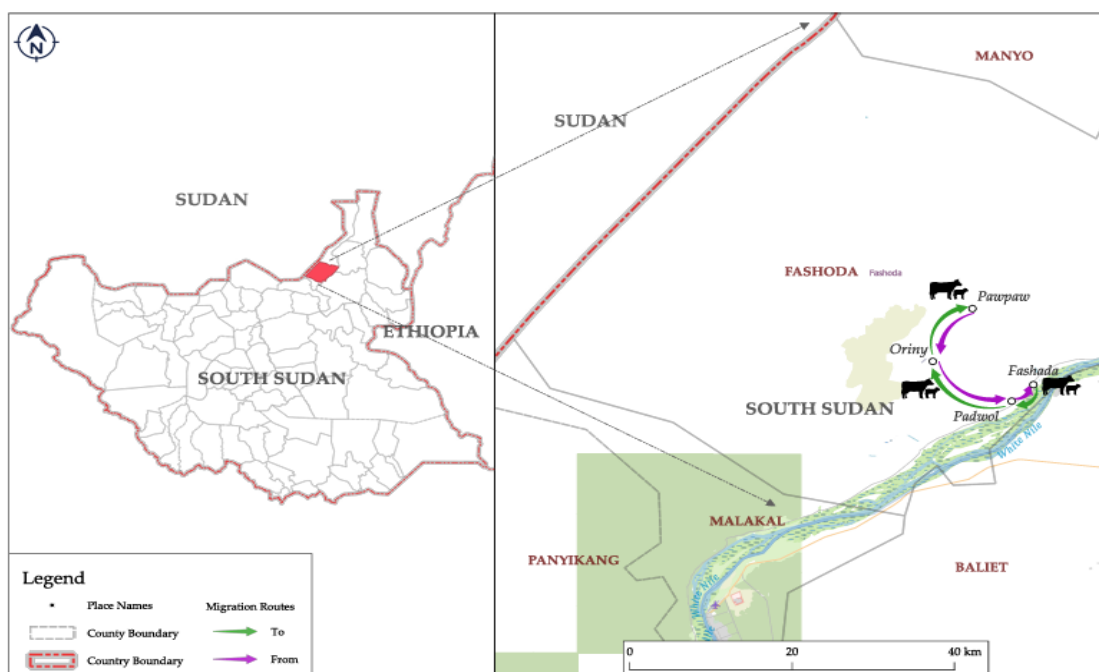


Figure 3: Geographic Map of Fashoda Livestock Migration

## Analysis of Livestock Migration Routes in Fashoda

According to the assessment, the migration routes originating from Fashoda rely on walking as the primary mode of transport network, highlighting limited accessibility and transport infrastructure within the region. The first route extends for 15.37 kilometers, beginning at Fashoda and passing through Padwal and Oriny before reaching Paw Paw. The second, shorter route, covering about 7.78 kilometers, starts from Fashoda, passes through Pap, and ends at Komolalum. The significant distance traveled on foot underscores the resilience required of migrants and emphasizes the necessity for infrastructural development to facilitate safer and more efficient movement across these rural locations.

### 3.4.3. Ulang Livestock Migration Routes

Table 3 Ulang Migration routes

Ulang								
No	Starting from	Mode of transport	Passing through	Endpoints	Months of Migration while going and coming back	Duration of Migration, while going and coming back	Challenges encountered while going and coming back	Distance covered
1	Ying Payam	Walking	Maboul, dura, Rath, Kuaemat	Torktel	Dec and come back in May	1 day for the two journeys	Diseases, cattle raiding,	16.65 Km
2	Barmach	Walking	Wechdengnyang, thotok	Waajak	Dec and come back in May	1 day to and fro	Diseases, cattle raiding,	10.34 Km
3	Wuntieth	Walking	Bullbong, tharwang, roothat, kwowo, mareng	Yomding	Dec and come back in May	2 days to and fro	Diseases, cattle raiding, revenge killings	19.76 Km
4	Ulang	Walking	Nyaakar, Torkiel, Mariat	Majok	Dec and come back in May	1 day to and fro	Diseases, cattle raiding, revenge killings	12.17 Km
5	Ying	Walking	Rinyang, Wupiet, Waga,	Jioker	Dec and come	1 day to and fro	Diseases, cattle raiding,	12.55 Km

					back in May		revenge killings	
6	Weetut	Walking	Kurege, Madeng, Topuot	Matsr	Dec and come back in May	1 day to and fro	Diseases, cattle raiding, revenge killings	12.38 Km

### Analysis of Migration Routes in Ulang

The livestock migration pathways in Ulang exhibit expansive livestock movement reliant on community movement in pursuit of grazing areas and water. The most outstretched route covers 19.76 km (Wuntieth to Yomding), through Bullbong, Tharwang, Roothat, Kwowo, and Mareng. This migration route is key to herders who need a safer, viable grazing zone over longer distances. The moderately long route also exhibits the seasonal migration patterns where the pastoralists take longer periods in some areas before moving to the next grazing lands that are available.

Shorter corridors, like the 10.34km (Barmach to Waajak) and (Wechdengnyang and Thotok), give alternative livestock migration routes that could be regularly used for grazing in a short period or in accessing water. Other migration routes, like Ulang to Majok (12.17 km) and Ying to Jioker (12.55 km), also enable the herder to go through the main resource areas without disrupting the migration. These migration routes are important in times of drought and when the local resources are depleted, thereby allowing the herders to adjust their migration based on pasture and water availability. It is important to note that these shorter routes run the risk of intensifying competition, as multiple grazing groups may congregate on the same grazing fields, potentially leading to conflict.

Another noteworthy pattern in Ulang is the web-like structure of livestock migration, where various starting points, like Ying Payam and Weetut, offer connections to varied endpoints via intersecting paths. For example, the 16.65-kilometer migration route from Ying Payam to Torktel and the 12.38-kilometer path from Weetut to Matsr posit that the herders have multiple options based on the environmental conditions and pasture and water availability. These livestock migration patterns indicate the interdependence of the pastoral communities in navigating resource-constrained areas. However, challenges like land encroachment, climate-induced disruptions, and conflicts with other land users need coordinated planning and policy support. Streamlining these livestock migratory routes through better resource management, conflict resolution mechanisms, and infrastructure development can help Ulang's pastoral communities make a living.

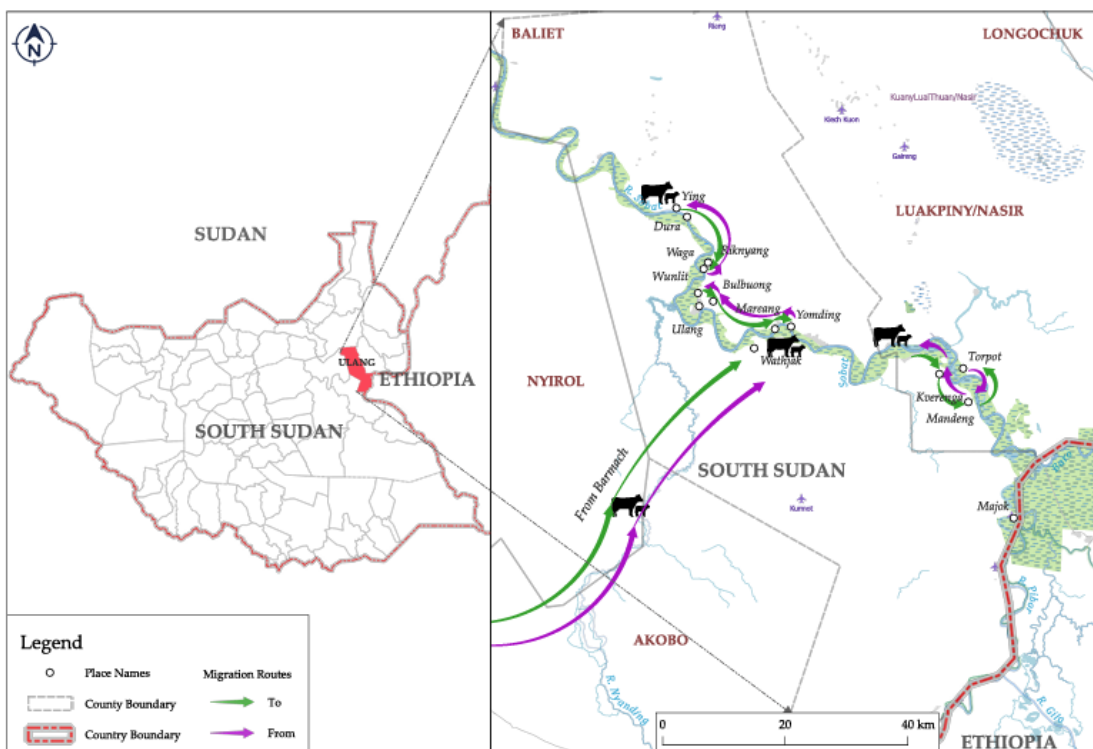


Figure 4: Geographic Map of Ulang Livestock Migration

### 3.4.4. Renk Migration routes

Table 4 Renk Migration routes

Renk								
No	Starting from	Mode of transport	Passing through	Endpoint	Months of Migration while going and coming back	Duration of Migration, while going and coming back	Challenges encountered while going and coming back	Distance Covered
1	Chimedi	walking	Dungali, Jalhak, Paloch	Akoka county, Melut county	March going and August coming	months	Hunger/lack of food on the way to destination Insufficient drinking water for both livestock and herders. Resistance/land dispute by some communities to allow herders pass to their destination.	506. 42 Km



							<p>Diseases and pests' attack/outbreak on the way to destination</p> <p>High taxation and fine impose by some local authorities when requesting for a path and settlement</p> <p>Long distance moves to and from final destinations.</p> <p>Lack of ready market for livestock products such as milk.</p> <p>Attack by wildlife such as snakes, wild predators.</p>	
2	Chime di payam (Chemedi, Babnes, Atam)	walking	Majak, Daba, Faran, Tebek, Mousur, Combo, Korajes	River Nile (Bangdid, Banyj ang, Mobok, Jalhaks)	March going and June going	4 months	<p>Insufficient drinking water for both livestock and herders.</p> <p>Resistance/land dispute by some communities to allow herders to pass to their destination.</p> <p>Diseases and pests' attack/outbreak on the way to the destination</p> <p>High taxation and fines imposed by some local authorities when requesting a permit and settlement.</p> <p>Long-distance moves to and from final destinations.</p>	28.12km
3	Chime di	walking	Direct route, Atahm	Babans	August is going and March coming	8 months	<p>Insufficient drinking water for both livestock and herders.</p> <p>Resistance/land dispute by some communities to allow herders pass to their destination.</p> <p>Diseases and pests' attack/outbreak on the way to destination</p> <p>High taxation and fine impose by some local authorities when requesting for a path and settlement</p> <p>Long distance moves to and from final destinations.</p>	54.43 Km
4	Jalhaks	Walking	Jebel-chimed, Dungalwi, Chemedi, Babne	Jerbena	July going and April coming	6 months	<p>Insufficient drinking water for both livestock and herders.</p> <p>Resistance/land dispute by some communities to allow herders to pass to their destination.</p>	467.12km

			S, Koleng			<p>Diseases and pests' attack/outbreak on the way to the destination</p> <p>High taxation and fines imposed by some local authorities when requesting a permit and settlement.</p> <p>Long-distance moves to and from final destinations.</p>
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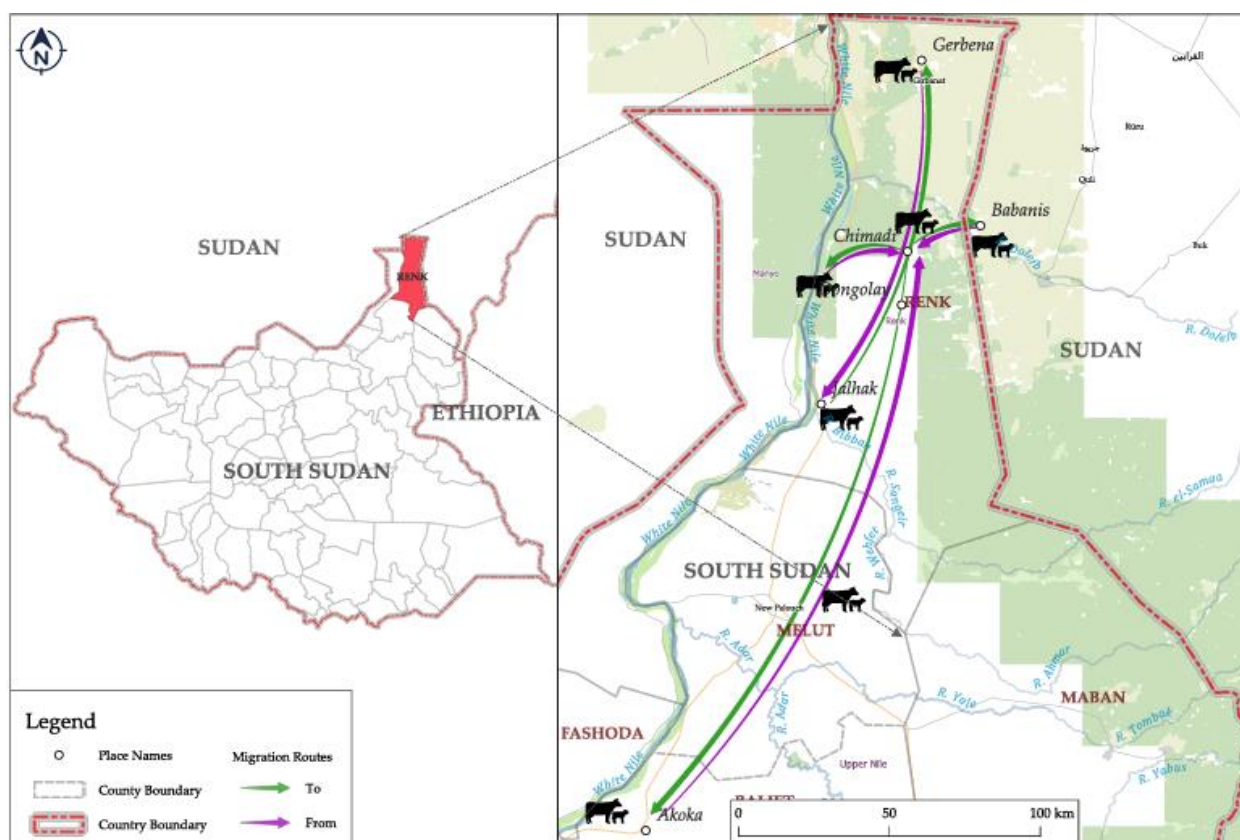


Figure 5: Geographic Map of Renk Livestock Migration

### Analysis of Migration Routes in Renk

In Renk County, the migratory corridors are diverse and differ from the other routes in terms of distance, routes, and reasons for the migration.

The shortest migration distance is about 28.12 km (Chimedi to Akoka via Dungali). This is the most preferred route by the herders for seasonal grazing during dry periods. The shorter migration routes also suggest localized livestock migration patterns in this area.

Longer migration routes Chimedi to River Nile (506.42 km) and Babanis (467.26 km) depict long-distance livestock migrations, which are important in accessing water points and better grazing fields, particularly during extended dry periods. The livestock migration routes indicates that herders in Renk are dependent on a mix of regional and cross-border livestock migration strategies to keep their livestock in health.

### 3.4.5. Rubkona Livestock Migration Routes

Table 5 Rubkona Migration routes

No	Starting from	Mode of transport	Passing through	End points	KM Covered
1	Rotriak	Walking	Diengyian ,Rubkona, Guit ,and Kuach .	Koch	141.31 km
2	Kuerbona	Walking	Diengyian ,Rubkona ,Guit ,and Kuach .	Koch	149.59 Km
3	Guit	Walking	Kuach, and toch Thiang	Koch	83.71 Km

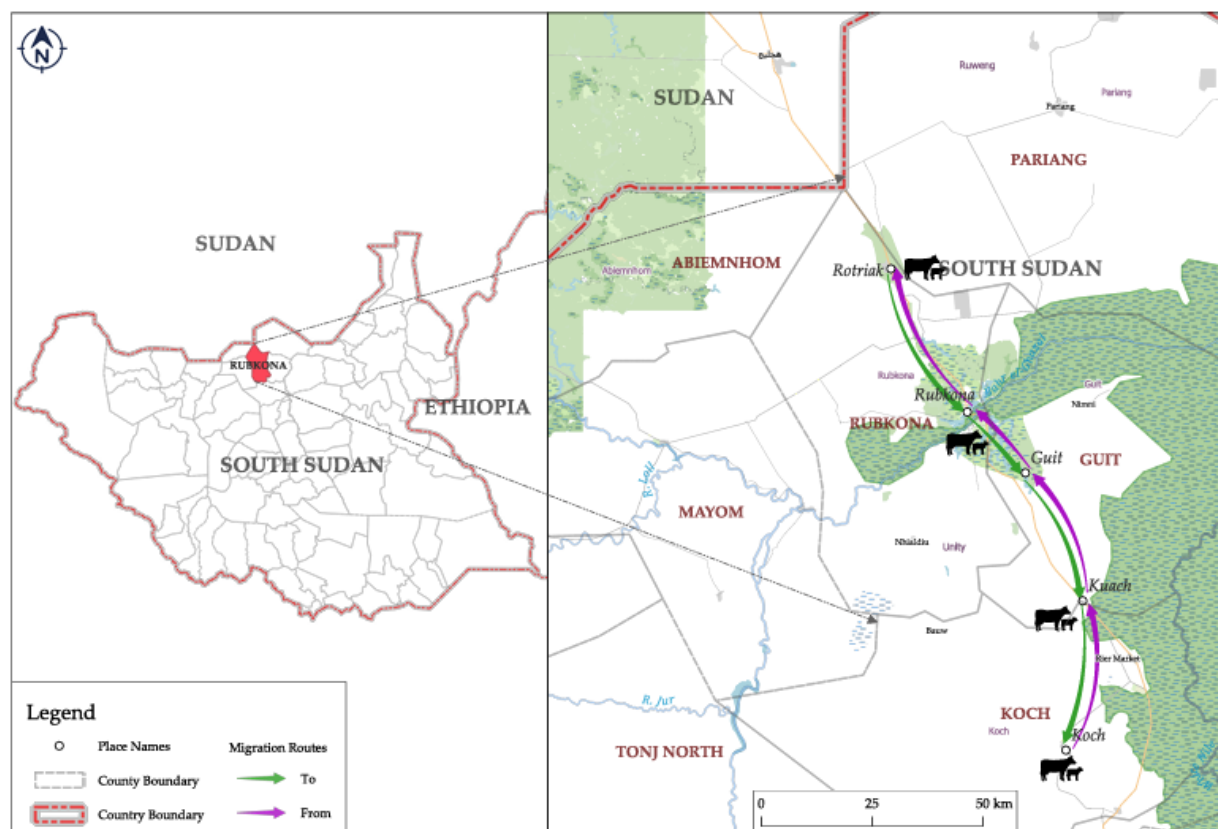


Figure 6: Geographic Map of Rubkona Livestock Migration

### Historical and current livestock migration patterns for Rubkona

Rubkona is geographically at the center of three major livestock migration routes that join at Koch. Looking at its strategic position within Unity State's livestock migration network, two closely related routes—originating in Rotriak (141.31 km) and Kuerbona (149.59 km)—pass through the same four intermediate waypoints (Diengyian, Rubkona, Guit, and Kuach) before joining at Koch. The resemblance of these pathways points to well-worn routes regularly used by populations migrating from northeast toward Koch, following existing dirt roads and seasonal paths that connect Rubkona's villages to regional market towns. A third route (83.71 km) that is even shorter starts at Guit, going through Kuach and Toch Thiang, exhibiting a more direct northeast axis of migration. In general, these three livestock migration routes exhibit Rubkona's role as both a departure hub and a waypoint for displaced individuals, traders, and pastoralists navigating Unity State's sparsely settled terrain. The distances (80–150 km) are within a multi-day walking range, highlighting the importance of rest stops and water sources at each intermediate settlement. The overlap of routes through Guit and Kuach further marks these Bomas/villages as critical nodes for coordinating services and monitoring population flows.

### 3.5. Challenges Along Migration Routes

Multifaceted challenges affect pastoral security and the efficiency of livestock migration. In Akobo, these challenges include sporadic cattle raiding (69.38%), conflicts (45.31%) and sporadic livestock disease outbreaks, with herders enumerating risks of wild animal attacks and theft as they traverse established corridors. The participatory mapping exercises highlighted that while these challenges are evident, the consistent availability of water helps mitigate some of the negative impacts. Fashoda (46.39%) and Renk (21.91%) herders expressed concerns about disputes over grazing land and water points, especially by the neighboring pastoralists from Ethiopia and Sudan, respectively; the act of theft intensifies during the peak of livestock migration. Disputes are local and happen when herders assemble around viable water sources, where overlapping grazing rights mostly degenerate into tension. These findings demonstrate an urgent need for adaptive planning and risk management strategies across the region.

The findings highlighted that even though conflicts are not so widespread, the competitive nature of seeking the natural resource at times leads to conflict, especially when alternative grazing routes are lacking. This enumerates the importance of formalized arrangements among stakeholders to utilize and manage shared resources effectively.

## CHAPTER FOUR: SOCIAL ECONOMIC IMPACT ANALYSIS

### 4.1 Overview of the socioeconomic impact of livestock migration

Migration has a significant impact on socio-economic conditions in pastoralist communities, as highlighted by the assessment findings. Livestock migration, practiced by 82.6% of the surveyed households, is essential for accessing water and pastures, thereby sustaining livelihoods through trade, employment, and income generation, particularly among households that directly depend on livestock as their primary income source, at 32.5%. The economic benefits of migration, however, are countered by notable challenges, including market disruptions, conflicts over grazing and water resources, livestock diseases, and barriers to education for children due to seasonal movements. Gender-specific barriers are also evident, with women playing crucial but underrecognized roles in livestock management, highlighting the necessity of targeted financial inclusion and capacity-building initiatives. Addressing these factors through improved market access, conflict mitigation, and gender-focused empowerment programs can enhance the positive socio-economic impacts of livestock migration. Children in pastoral settings can be supported through referrals or options for mobile/ pastoral schools and learning spaces.

### 4.2 Households' primary income sources

The principal HH income sources across the assessed locations were agriculture (39%) and livestock keeping (32%). Trade (11%) and fishing (11%) also play some significant role in HH incomes, while employment (4%) and handicraft (1.5%) are the least common. Ulang county (42.3%) had the most livestock-reliant HHs, while Fashoda county (9.6%) had the least livestock-dependent HHs

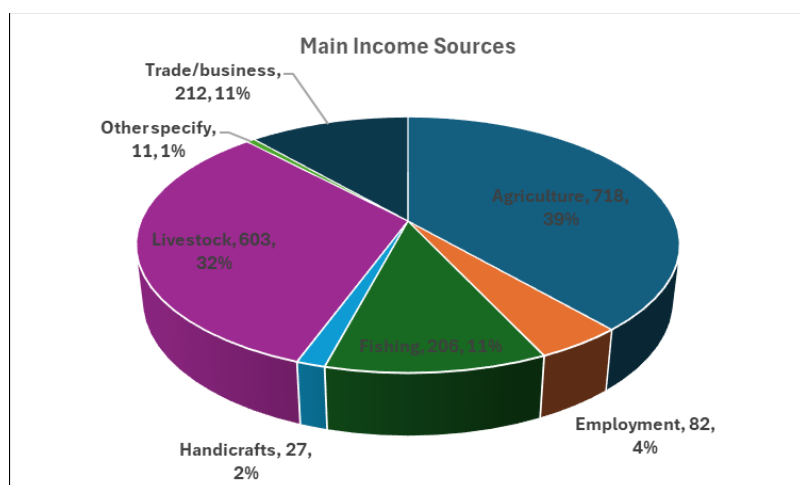


Figure 7: HH primary income sources

### 4.3 Conflicts and disputes during livestock migration

Most of the respondents (67.36%) agree that conflicts always arise during livestock migrations with the neighboring communities; Akobo County (24.84%) having the highest rates of conflicts while Renk (10.61%) has lowest conflict incidences.

Local leaders and elders' mediations and informal agreements forms the bulk (61.47%) of conflict resolution according to the respondents. This was particularly evident in Fashoda (76.87%) as well as Akobo County (69.29%). Overall, law enforcement involvement accounted for 15.64% of the cases with Renk (42.24%) and Rubkona (42.24%) having the highest confidence on law enforcement personnel as well as the associated formal government-controlled justice systems.

### 4.4 Livestock sales and access to animal health inputs

Majority of the respondents (75.36%) sell their livestock directly, noticeably in Akobo (98.32%) and Ulang (84.8%). Reliance on middlemen is prevalent in Rubkona (35.15%) and Renk (18.87%). The livestock are mostly sold in the local markets (95.28%); highest in Ulang (99.75%) and Akobo (99.24%). This is attributable to either established local demand or restricted transit choices. National or regional markets plays smaller roles, with only 0.28% of the HHs accessing national markets and 4.45% HHs utilizing regional markets. Respondents in Renk (10.70%) and Rubkona (8.87%) are the most engaged with regional markets, presumably due to improved market linkages.

Most HHs access livestock inputs through NGOs (22.19%) support and private sectors (22.19%). Akobo County mostly relies on NGOs' support 60.41%, while Fashoda (35.22%) and Renk (33.22%) primarily depend on the private sector. Although community-based services are available, they account for 15.09% in the assessed HHs, with Renk (20.72%) and Akobo (19.54%) relying on them most.

### 4.5 Impact of livestock migration on children access to education

Most of the respondents agrees that migrating with livestock has had a major impact on children's access to education, with 85.73% of them opining that migration disrupts schooling. The greatest impact is seen in Ulang, where 98.03% and similarly in Rubkona (86.54%) and Renk (78.69%) have significant disruption rates. In contrast, Fashoda has the lowest percentage of affected respondents, at 74.05%.

#### 4.6 Women and youth in the livestock sector

The FGDs reveal the importance of livestock and high interest by youths in all the study locations. Livestock ownership is a social prestige (status in the community), wealth and in dowry payments. Being born in a pastoral setting, the youths feel that it's an integral part of their daily livelihoods. In all the assessed locations, women's role is mostly supportive and mostly deal with livestock products (milk, meat, hide and skin processing) and feel the need for training on maximizing their incomes. The main challenge faced by youths in Fashoda is lack of resources and capital, while in Akobo, cattle raiding is the most prevalent problem. Women in Fashoda feel having less decision-making power on use of income from livestock and products sales.



## CHAPTER FIVE: LIVESTOCK VALUE-CHAINS MAPPING

### 5.0 Overview of livestock value chains

#### 5.0.1. Livestock Value Chain Geographic Map

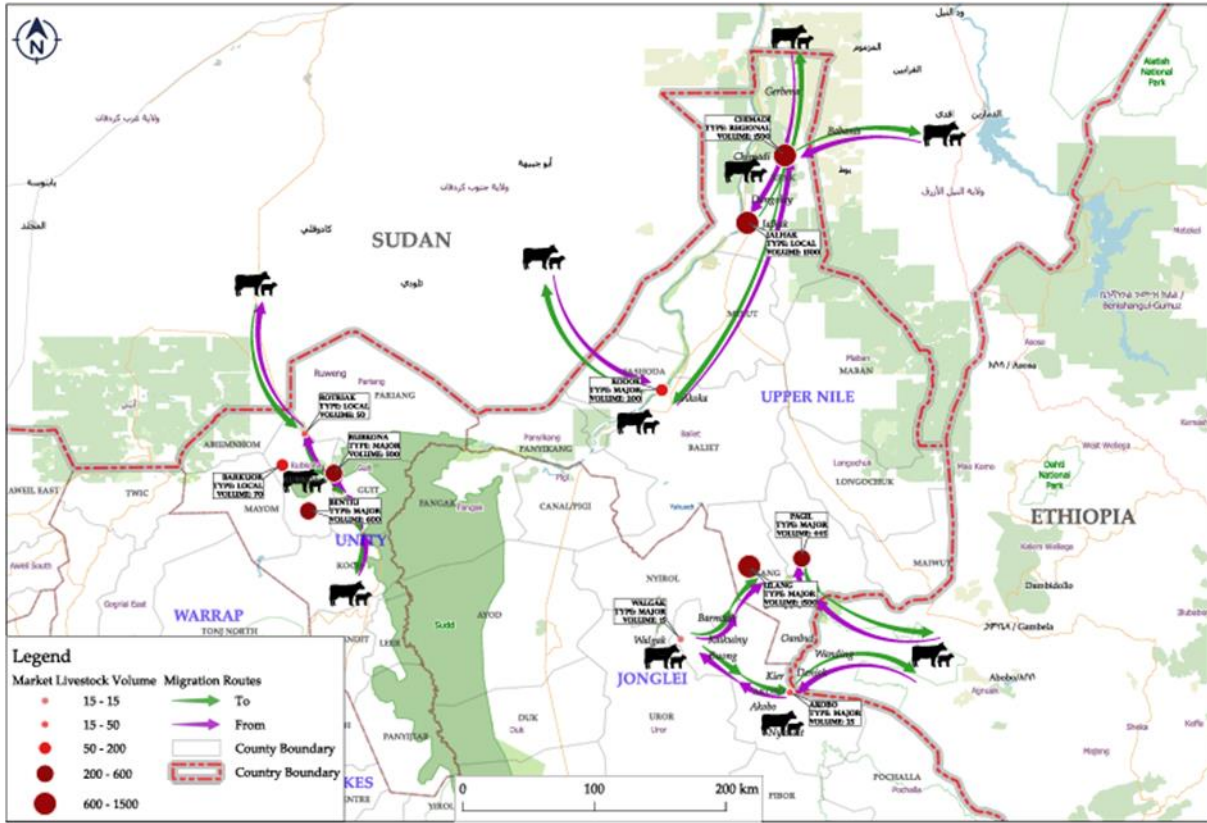


Figure 8: Geographic Map of livestock value chains across the assessment locations

The assessment identified and ranked livestock products in the assessed locations, including Fashoda, Akobo, Rubkona, Renk, and Ulang Counties. Milk is the most important livestock product for most of the respondent HH (84.8%) notably in Ulang County (98.53%) followed by Rubkona County (92.05%). Meat is the second important product (11.25%) across the assessed locations, with Fashoda County (23.92%) and Renk County (20.34%) recording the highest concurrence. Other livestock products and uses like drought power (1.5%), hides/skins (0.5%), and other non-specified products (1.95%) are marginally significant. Strategic investment in dairy/milk production is vital, beginning with improved milk aggregation infrastructure, which can lead to a significant boost in household incomes. This direct link between milk production and income generation highlights its potential to drive

economic growth at the grassroots level. Women play a crucial role in milk production, processing and marketing, and their empowerment through increased participation in the dairy value chain can have a transformative effect on household resilience and overall economic development.

The Pearson chi-square test ( $\chi^2 = 272.1684$ ,  $p = 0.000$ ) indicates a statistically significant difference in preferences for livestock products among locals, implying that economic, geographic, and cultural variables impact these differences.

### 5.1.1 Purpose of livestock rearing

The main reason for keeping livestock varies from one county to the next; the most common reasons given by the respondents include social and traditional purposes, subsistence-related purposes. Respondents in Akobo cited social purpose (higher priority 4) with little emphasis on dairy/milk or meat production purposes. In Fashoda County, respondents usually prioritize rearing livestock for milk/dairy purposes in preference for meat or other social reasons. In other locations, the respondents prioritized a combination of milk/dairy and meat production. Respondents in Renk preferred livestock rearing for meat and livestock sale. Overall, social and other subsistence-related uses account for the largest portion of responses, while milk and sales play a smaller role. The Pearson  $\chi^2$  test (16) = 31.3700,  $Pr = 0.012$ , indicates a statistically significant variation in the reasons for rearing livestock across locations.

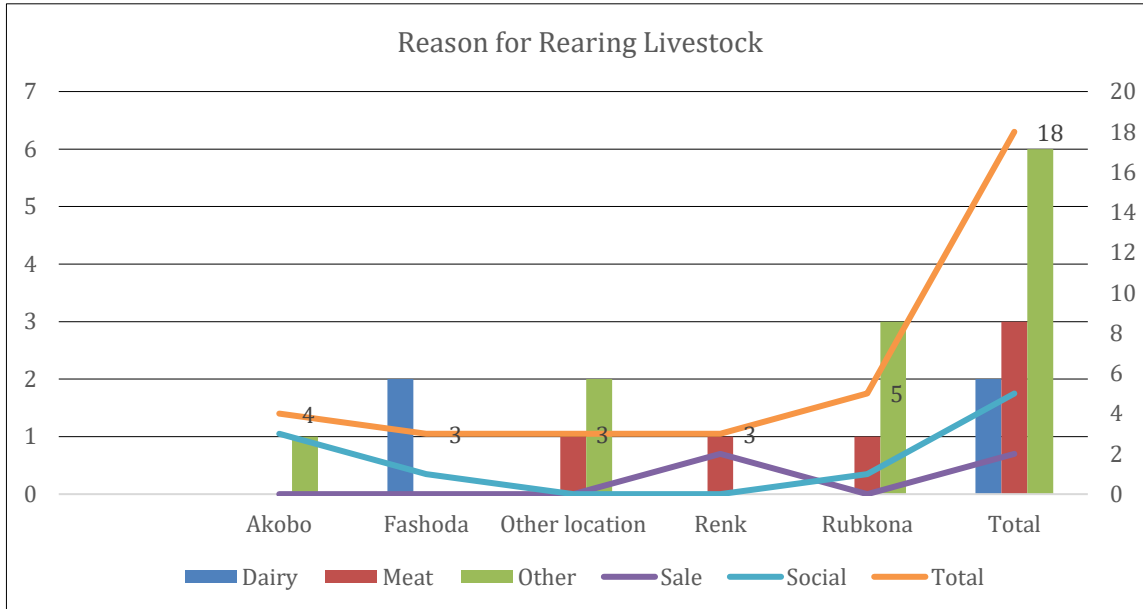


Figure 9: Roles in the Livestock Value Chain

### 5.1.2. Livestock products and by-products

According to the findings of this assessment, milk is the main livestock product (84.8%) across the various locations, particularly so in Ulang (98.53%) and Rubkona (92.05%), where the reliance on milk/dairy production is equally higher. Rearing livestock for meat (11.25%), is predominant in Fashoda (23.92%) and Renk (20.34%). Draught power (1.5%), hides/skins (0.5%), and other specified products (1.95%) have marginal significance across the assessment locations.

As represented in Figure 10 below, hides and skins are the most common by-products, followed by animal intestines, animal fat, and horns across the assessment locations. The variation of the by-products denotes a localized adaptation to available resources and market demand.

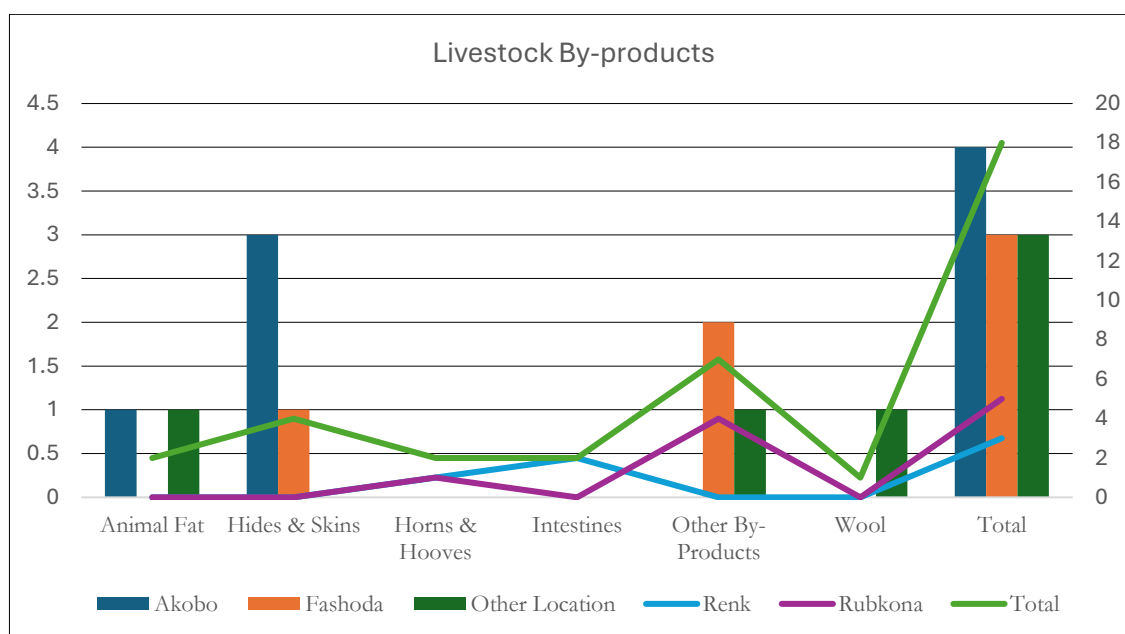


Figure 10: Livestock By-Products

### 5.1.3 Livestock feeding practices

Free grazing is the most common method for livestock feeding practices across the assessment locations, as shown in Figure 11 below. Mixed feeding practices were also enumerated by the respondents.

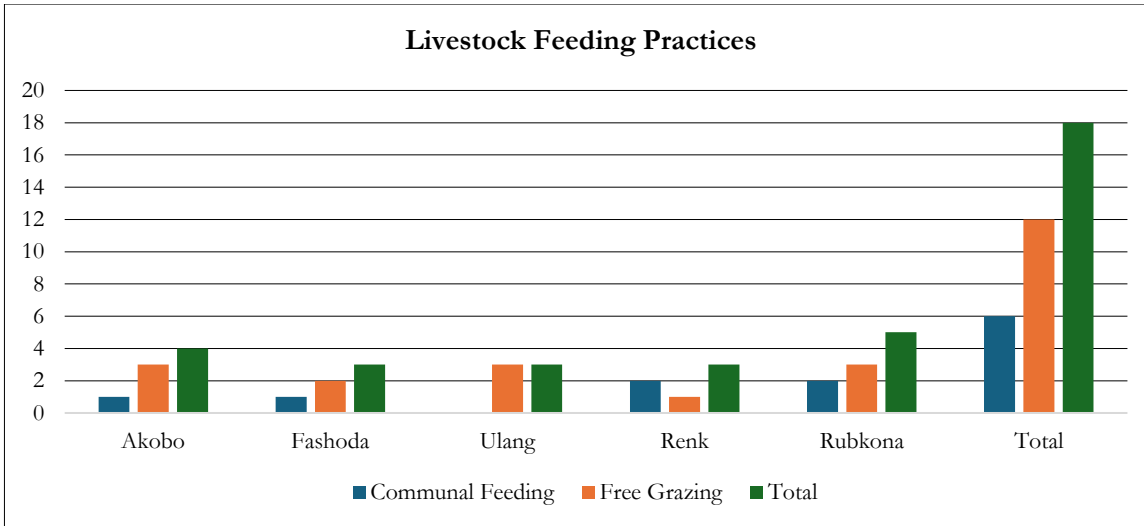


Figure 11: Livestock Feeding Practices

### 5.1.4 Livestock markets

Table 6 below shows active livestock trading zones in the assessed locations with distinct market sizes and trader composition/trading range. The key market in Fashoda County is in Kodok while Bentiu is the main market in Rubkona County. An estimated 100 to 600 livestock are sold per day at livestock markets. In Ulang County, the livestock markets are in Ulang and Pagij and operate on different market days with high livestock numbers being sold 1,000, including small ruminants, on selected market dates.

Rubkona has four operational markets, two of which are large and operate daily. The livestock markets are accessible to both national and international traders, including Sudanese/Arab traders, demonstrating cross-border integration of the markets.

Renk livestock markets stand out with high volumes of livestock trades ranging estimated between 1,000 and 1,500 heads of livestock per market day, demonstrating their position as the regional livestock trading hub. However, the designation of certain high-volume markets, for instance, Jalhak as a local market and Chimedis as a regional market, suggests an incoherence of market categorization that can have implications for planning and investment priorities.

Table 6: Livestock markets

No	Location	Name of the market	Type of market (Major or not)	Volumes of livestock (Approximate)	Traders are from	Market days
1	Akobo	Akobo	Major	25 cows Daily	Ethiopia, Akobo, Sudanese traders	Every Day
2	Akobo	Walgak	Major	15 cows Daily	Ethiopia, Akobo, Sudanese Traders	Every Day
3	Fashoda	Kodok Cattle Market	Major	100-200 animals	All from Payams of Fashoda County and from outside the county	Everyday
4	Ulang	Ulang	major	Cattle 1000, goat & sheep: 300 - 500	Barmach , Ulang centre	Monday, Wednesday and Friday
5	Ulang	Pagij	major	Cattle: 200-360 Goat: 60 Sheep: 25	Wicteeth, Ulang centre	Tuesday, Thursday and Saturday
6	Rubkona	Rotriak	Not	50 cattle	Locals +	Everyday
7	Rubkona	Barkuor	Not	70 cattle	Mix Arabs and locals	Tuesday and Thursday
8	Rubkona	Rukbona	Major	500 cattle	Mix Arabs and Local	Everyday
9	Rubkona	Bentiu	Major	600 cattle	Mix Arabs and Locals	Everyday
10	Renk	jalhak	local	1000-1500	Chimed,jalhak,jerbena	All days
11	Renk	chimedi	regional	1000-1500	Renk,chimedi,jalhak	All days

### 5.1.5 Livestock Product Pricing

The findings of this study indicate that various factors determine the cost of livestock products, with seasonal fluctuations influencing pricing across different locations.

In Fashoda County, the pricing of livestock products was commonly determined by market-based conditions (33.33%), that is, the supply and demand by the consumers. In some instances, like in Renk County, product quality, as perceived by the consumer, also determined its retail price.

### 5.1.6 Support for livestock product value addition

The study findings indicated that the support value addition initiatives for livestock products from development partners or cooperative societies is bare minimal across the surveyed locations. 66.7% of the respondents cited no support, and only 33.3% of them having had received some level of assistance. The highest level of support was recorded in Fashoda and

Renk Counties; in these two locations, respondents affirmed having received aid to support value addition initiatives. In contrast, respondents in Ulang reported receiving no support whatsoever, as shown in Figure 7 below.

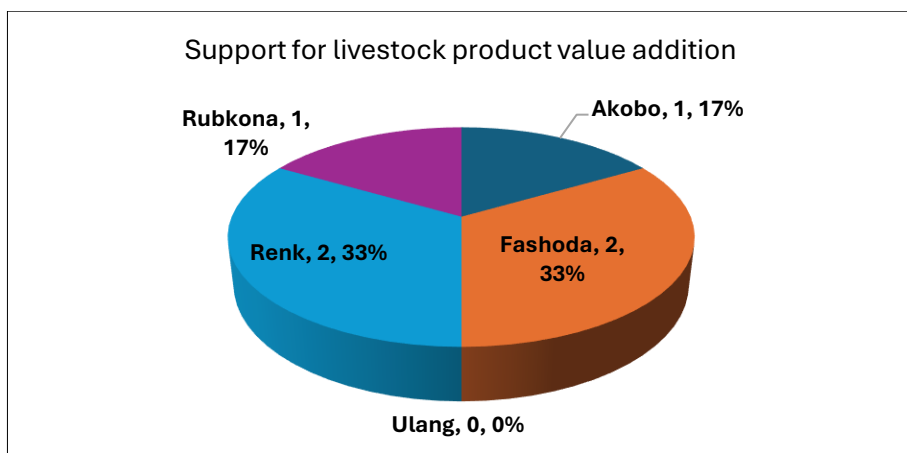


Figure 12: Support for livestock product value addition

### 5.1.7 Primary Market Access Challenges

The assessment identified market access constraints, like insufficient linkage between different market actors, weak communication systems, and inadequate road infrastructure across the various locations, most notably in Rubkona.

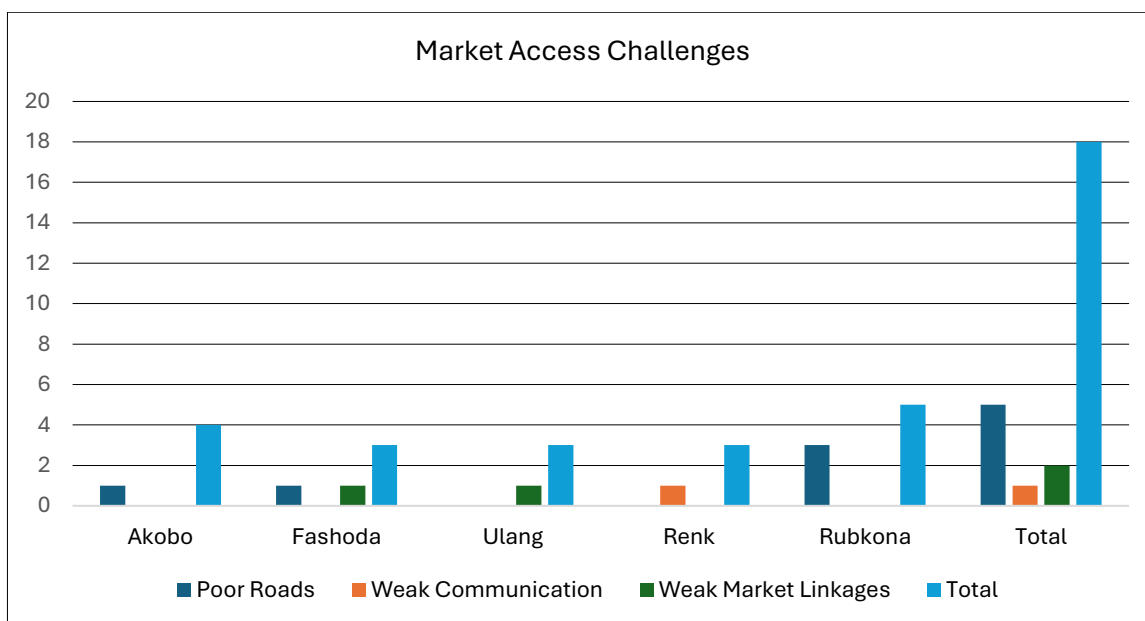


Figure 13: Market Access Challenges

### 5.1.8 Impact of Climate on Livestock Market

The study findings indicate that climate change effects have impacted the livestock market and related products through varied livestock productivity, unpredictable market prices, and the availability of livestock products. Some respondents indicated increased mortality rates from diseases and low pasture availability, leading to high costs of livestock production. In Rubkona and Ulang, respondents reported increased livestock prices as an indirect cause of climate-induced effects. This could also be attributed to the conflict in Sudan, where Renk was serving as a key cross border market hub for cross-border livestock trade.

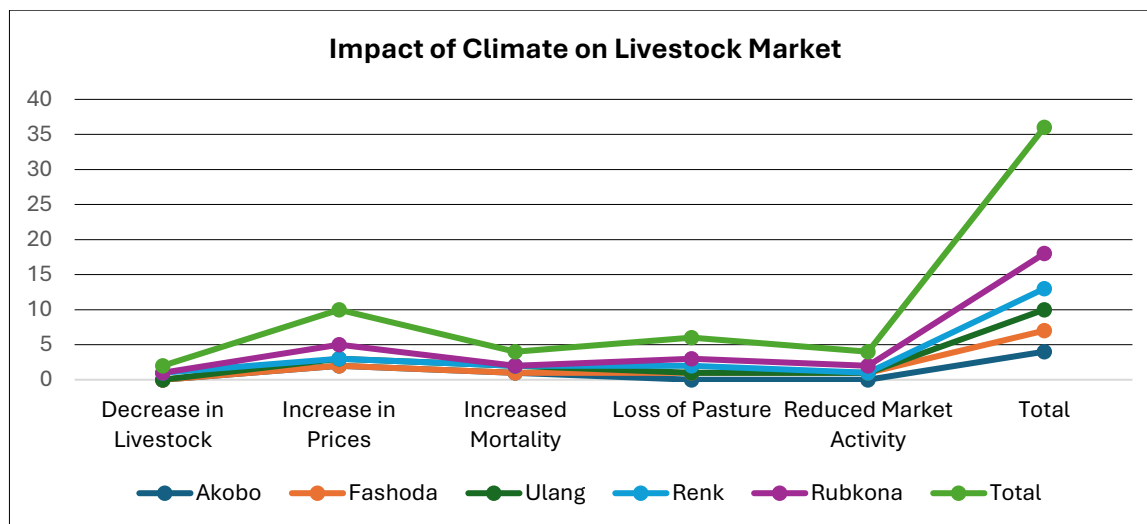


Figure 14: Impact of Climate on Livestock Market

### 5.1.9 Technology & Infrastructure

#### Livestock production and processing technologies:

The assessment indicates that livestock production and processing technologies are limited to traditional or alternative methods, with a low utilization rate of modern processing and cooling technology. This result denotes a critical gap in cold-chain infrastructure and modern preservation technologies, which are essential for maintaining product quality and reducing post-harvest losses.

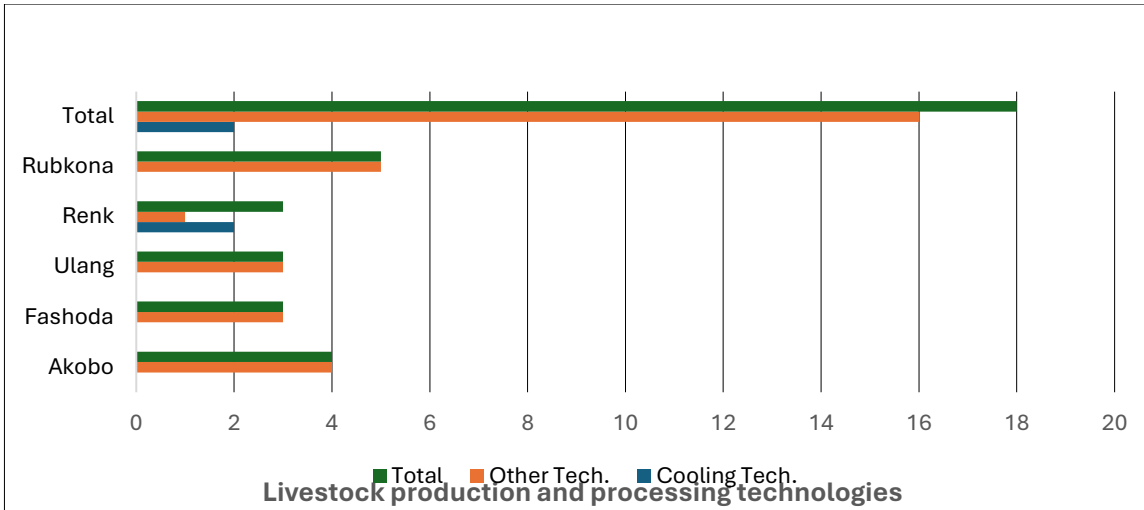


Figure 1 Livestock production and processing technologies

### 5.1.10 Livestock infrastructure gaps

The findings from the assessment indicate critical gaps in livestock infrastructure, including unorganized livestock markets, milk aggregation centers, and abattoirs. These differ across the various locations; for example, gaps in livestock markets in Akobo exist, while the participants in Fashoda and Akobo identified milk aggregation centers and abattoir gaps in their respective counties. Focus Group Discussions Participants in Renk County noted several concerns, including holding areas for the livestock, abattoirs, and milk collection centers.

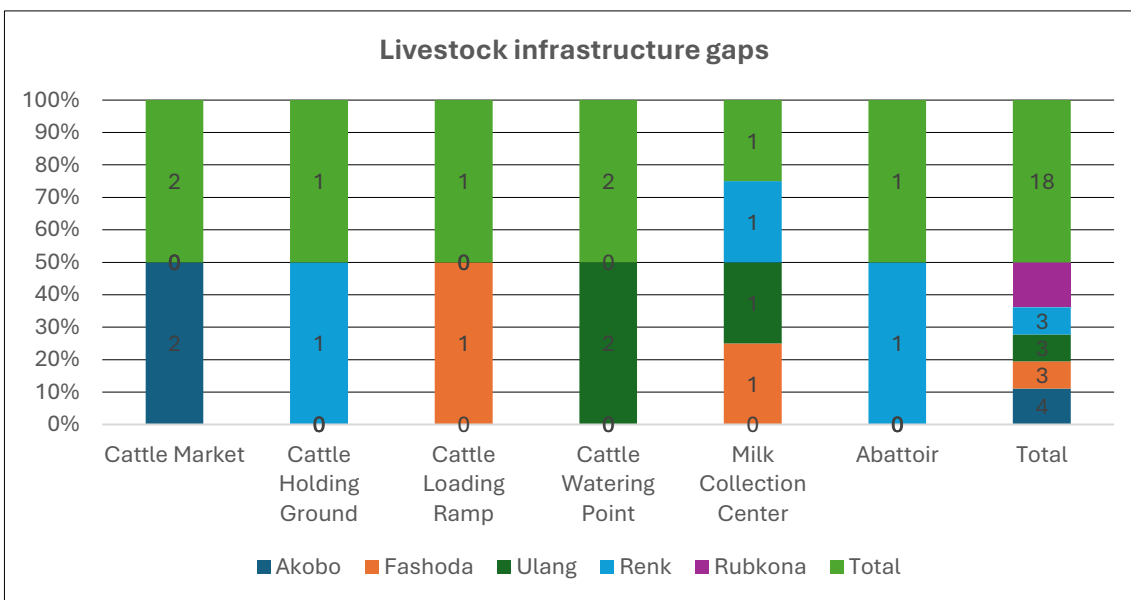


Figure 16: Livestock infrastructure gaps

### 5.1.11. Support & Training

#### Training received on livestock management

Participants in Akobo and Fashoda indicated that they had not received any training on livestock management. Respondents in other assessment locations had received a variety of training on animal production from NGOs, governments, and other development partners. Remarkably, Rubkona demonstrated a higher number (44.44%) affirming to have received some training on livestock production, followed by Renk (22.22%). The Pearson  $\chi^2$  test ( $Pr = 0.016$ ) indicates a statistically significant difference regarding training received in the various locations.

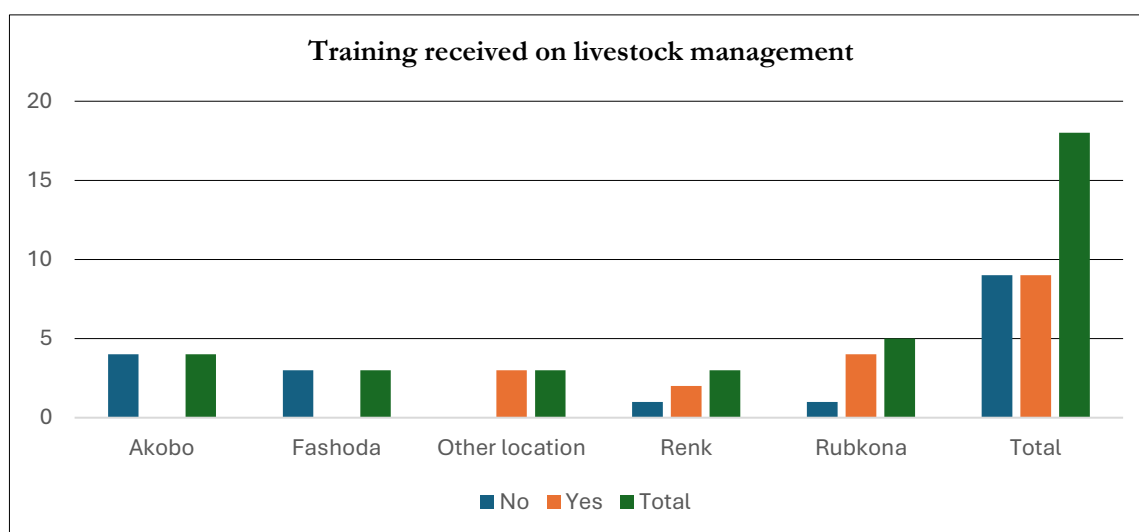


Figure 17: Training received on livestock management

#### Additional training requirement

Figure 15 below indicates training requirements for the livestock producers across the various assessment locations. The training needs in the study locations show no single dominant gap; however, there is a need for a wider aspect of training on livestock management and processing. The Pearson chi-squared test ( $p = 0.324$ ) denotes no statistically significant relationship between location and specific training requirements, indicating that these gaps may be widespread rather than location-specific.

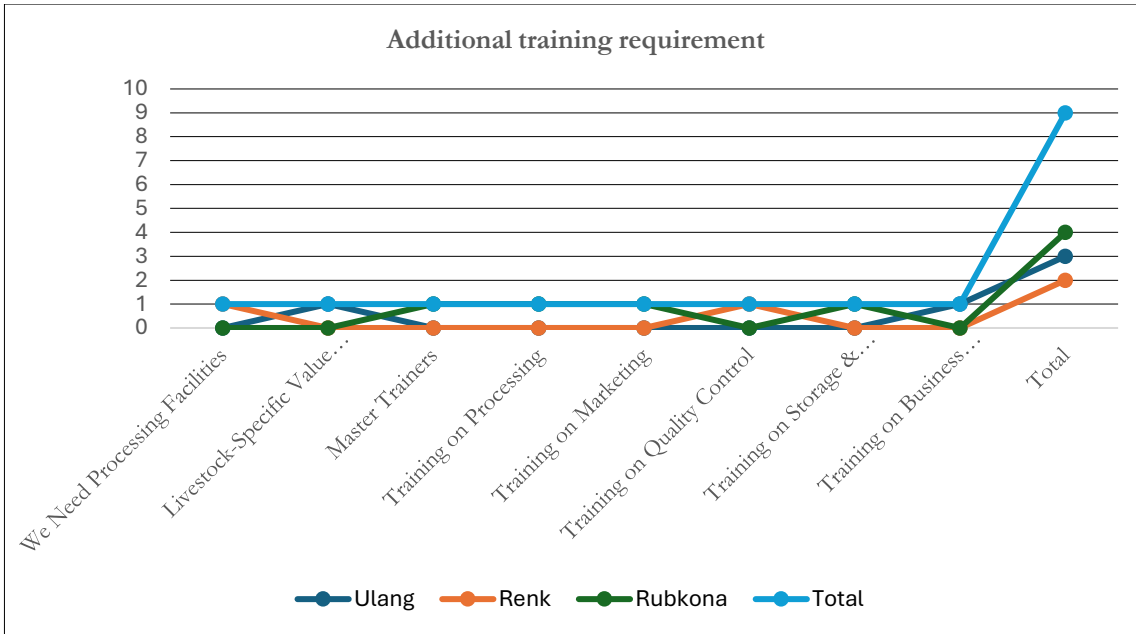


Figure 2 Additional training requirement

**Government-supported animal health service providers**

According to the Key informant interviews conducted in the various locations with representatives from the County Veterinary Department, Akobo County (4) has the lowest number of government supported Animal Health Auxiliaries (AHAs) and CAHWs. Rubkona, Fashoda, and Ulang have 17, 7, and 10 AHAs, respectively. These variations may reflect disparities in government prioritization, available resources, or regional demand for veterinary services. The KII report indicates that all the areas assessed lacked veterinary surgeons/doctors under the County Veterinary and Agriculture Departments. Each location had at least one government-supported Stock Person (SP).

**5.1.12. Livestock Waste Management**

**Livestock waste disposal and management**

Respondents utilize a variety of methods to dispose of animal waste, including composting, pest repellent in cattle camps, and use in agricultural fields. Livestock manure is aggregated in the cattle camps, dried, and then burned during the night to repel mosquitoes and other biting midges around their sleeping areas. Some indiscriminate livestock waste disposal in the assessment locations raises serious environmental concerns in Fashoda and Akobo

(100% and 75%, respectively), especially around slaughter slabs/houses.

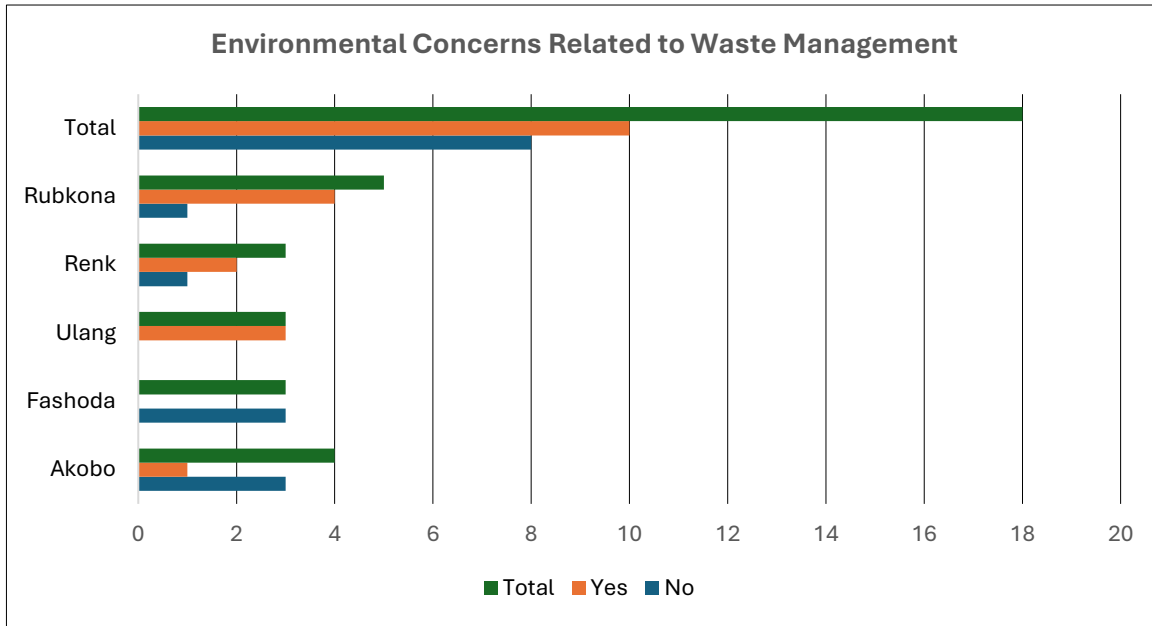


Figure 19:3 Environmental Concerns Related to Waste Management

### 5.1.12. Access to financial support and challenges

#### Access to financial support for livestock activities

The assessment findings indicate minimal financial support for the livestock sector in all the locations as shown in Figure 22 below. 88.89% of the respondents confirmed a lack of access to financial support. Ulang, Akobo, and Rubkona had no access to financial support for livestock activities. The participants in Renk and Fashoda had received some financial support concerning livestock activities.

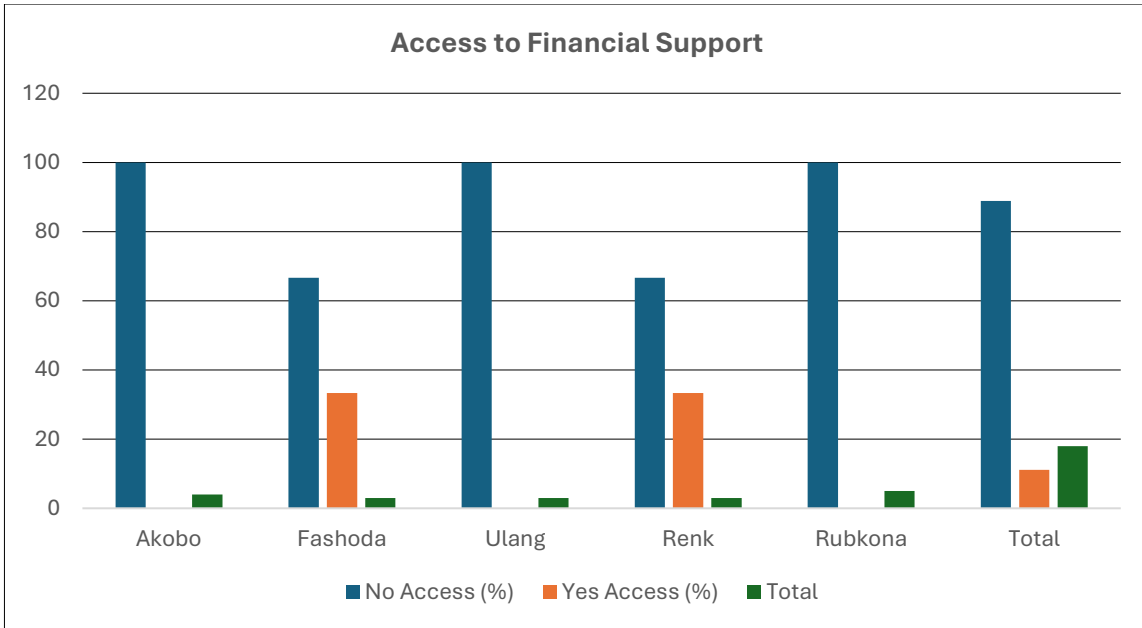


Figure 40: Access to Financial Support

Other sources (83.33%) accounted for the primary funding sources for livestock activities in the surveyed locations. Only 16.67% of the respondents relied on savings to support their livestock production activities. As shown in Figure 21 below, the respondents in Fashoda, Ulang, and Rubkona depended on other sources, with Renk having the highest number of respondents relying on savings with a proportion rate of 66.67%.

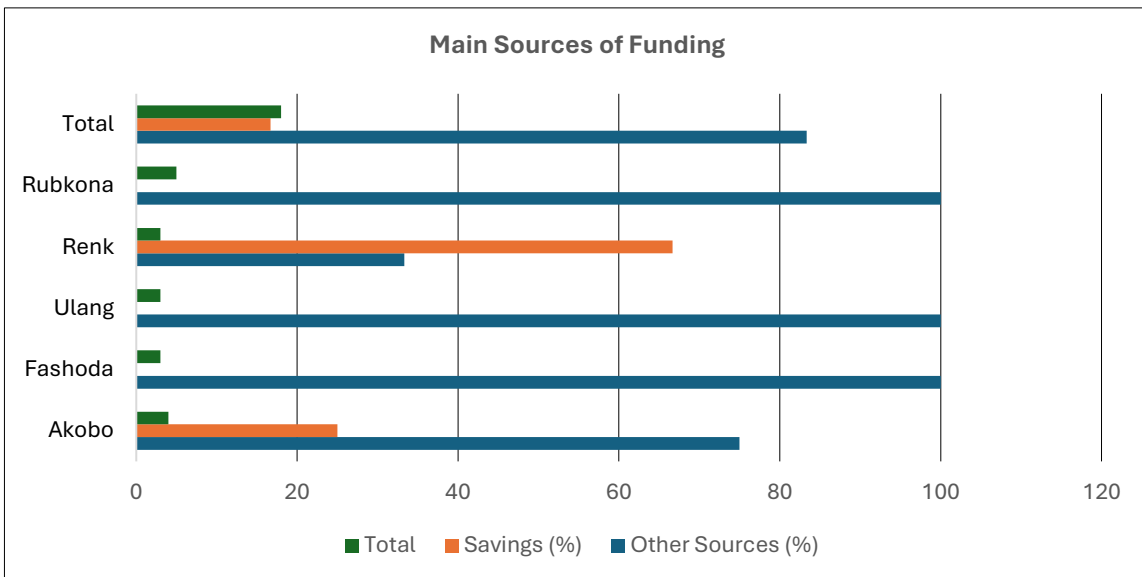


Figure 5: Main Sources of Funding

### Financial Challenges in Livestock Production

The main challenges identified include a lack of credit access, unregulated taxation/levies, and insufficient market access. These findings indicate a wider array of economic shortfalls. The location with the highest respondents reporting financial difficulties is Rubkona; some of the difficulties cited include livestock deaths/ mortalities and lack of financial resources. This shows the need for targeted strategies like access to credit, better access to markets, animal health support and enabling environments to unlock financial constraints in livestock production.

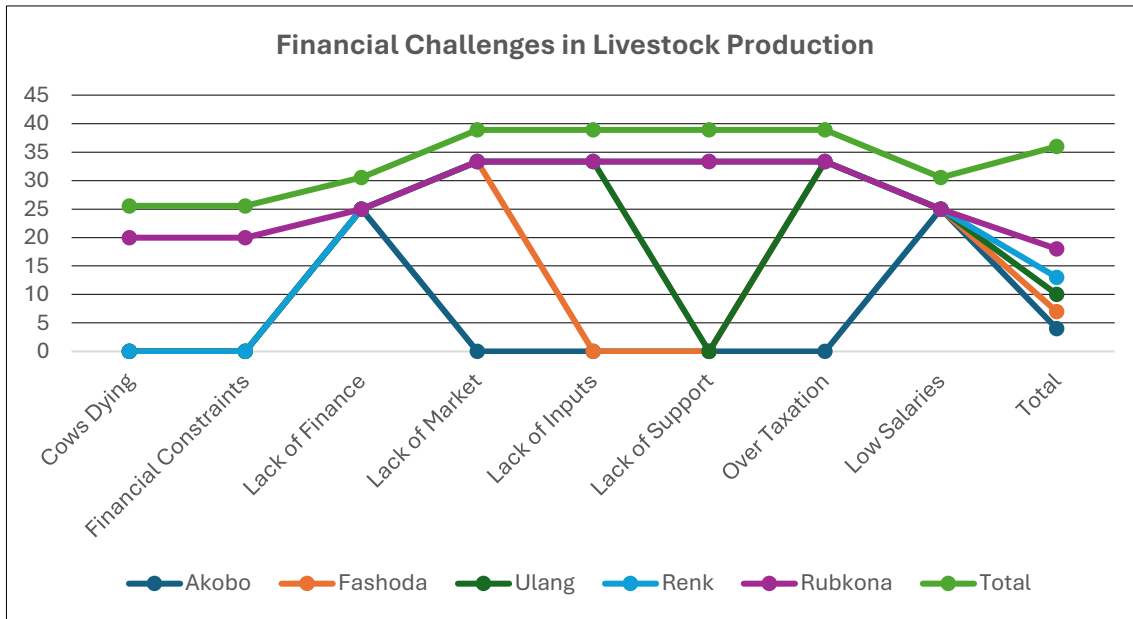


Figure 6: Financial Challenges in Livestock Production

### 5.1.13. Policy & Regulation

#### Awareness of Government Policies on Livestock Production

The analysis in Figure 23 below, on the awareness of the government policies and regulations on livestock production, demonstrates the existence of the variation across locations. 72.22% of the respondents affirmed their awareness regarding the policies, while 27.78% of the respondents reported a lack of awareness. Rubkona demonstrated the highest level of awareness, with 28.46% confirming their awareness. Akobo had the highest percentage of respondents unaware of government policies, with 60.00% confirming their lack of awareness. In contrast, 100% of the Fashoda respondents affirmed their awareness of the government policies.

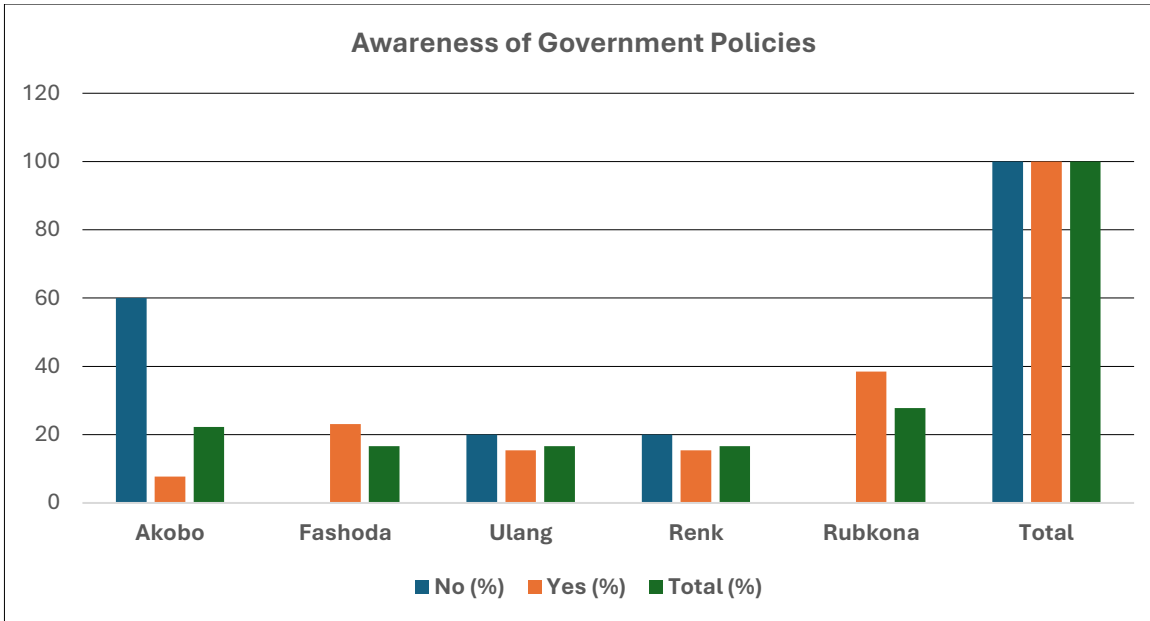


Figure 7: Awareness of Government Policies

The findings in Figure 24 indicate varying levels of familiarity with different policies and regulations among respondents. Overall, awareness of fisheries-related policies appears more widespread, with 47.06% of respondents (8 out of 17) indicating familiarity with at least one fisheries policy. Notably, Rubkona had the highest awareness of fisheries policies (50.00%), while Akobo exhibited the most familiarity with other sector-specific policies (66.67%). Meanwhile, Ulang had the only respondents familiar with all fisheries policy categories (100.00%). The low familiarity with South Sudan’s national policies (only 1 respondent) suggests a potential gap in broader policy awareness beyond fisheries.

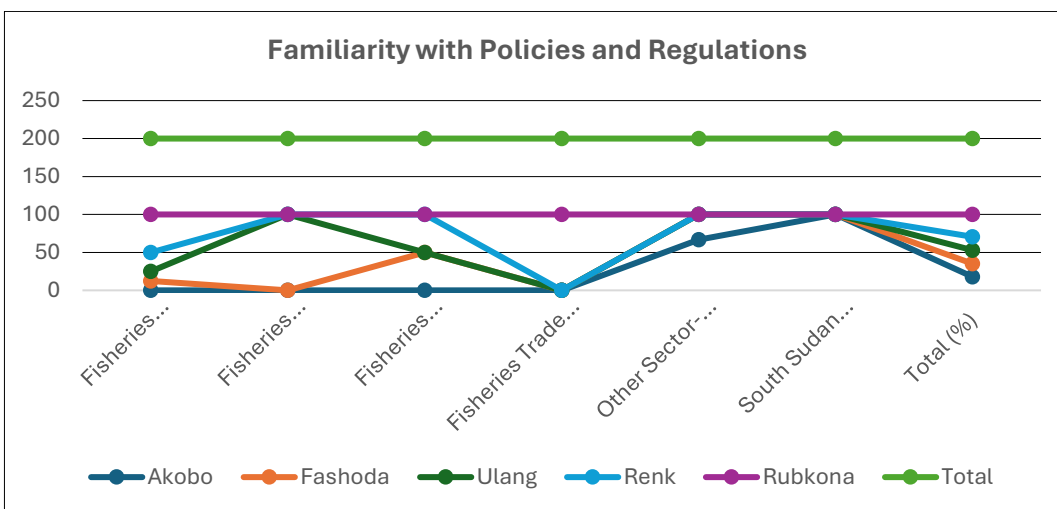


Figure 8: Familiarity with Policies

### Analysis of Policy Dissemination

As shown on Figure 25 below, government policies on livestock are uneven across the assessed locations. Key stakeholders in Fashoda, Renk, and Ulang affirmed full dissemination others in Akobo reported non-dissemination at 100%. Rubkona exhibits a mixed response, with 60% of respondents indicating that the policy was not disseminated. In general, 61.11% appreciated adequate dissemination, with 38.89% of the respondents reporting a lack of awareness. The statistically significant chi-square result ( $Pr = 0.012$ ) shows a strong link between the locations and how people thought the policy was spread. This means that the policies need to be spread more specifically in Rubkona

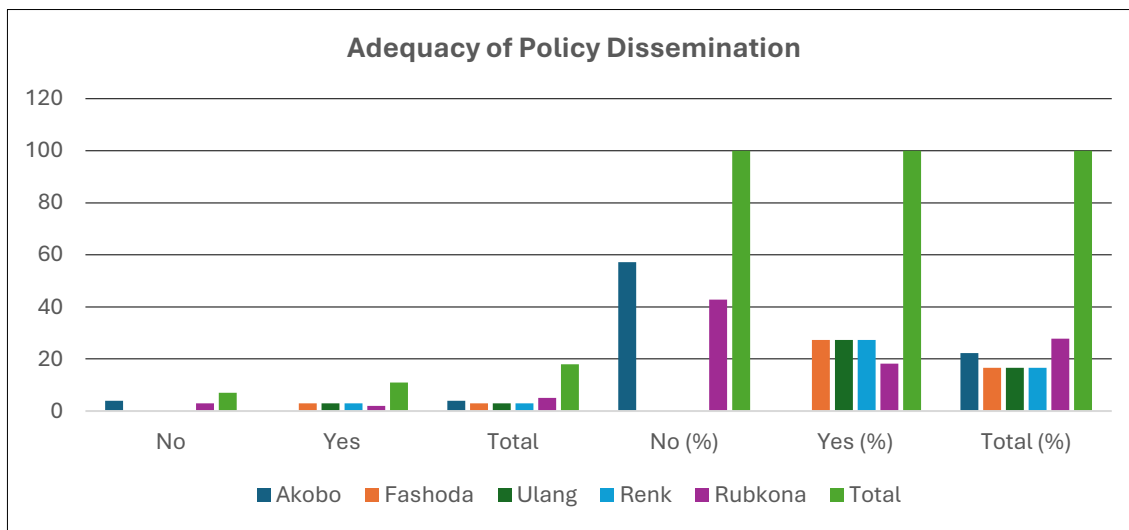


Figure 9: Familiarity with Policies

### Analysis of Licensing and Permits

The assessment findings as shown on Figure 26 below, indicate that as much as more than half (55.56%) of the respondents possess the required licenses and permits for their livestock production activities; a large proportion (44.44%) are operating without the required licenses and permits. Akobo had the highest (75%) number of respondents requiring licenses and permits attributable to the cross-border trade with Ethiopia. Rubkona had the highest number of respondents (80%) operating without licences. However, Fashoda, Ulang, and Renk show that two-thirds of respondents hold relevant permits.

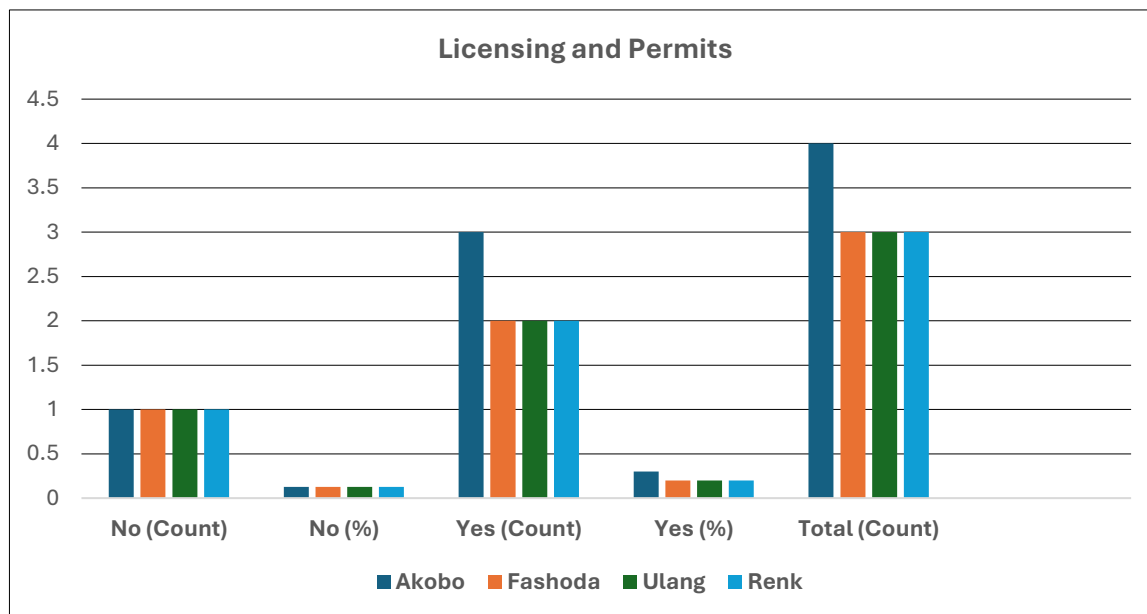


Figure 10: Licensing and Permits

### Analysis of Livestock Support needs

In Akobo, KII respondents emphasized salary support, capacity building, and access to veterinary drugs and vaccines as some of the support requirements from government, NGO and other development partners. In Fashoda, the findings highlighted gaps indicating a need for infrastructural development and financial assistance. In Ulang, the respondents prioritized animal health support. Rubkona, on the other hand, was more concerned with financing and training.

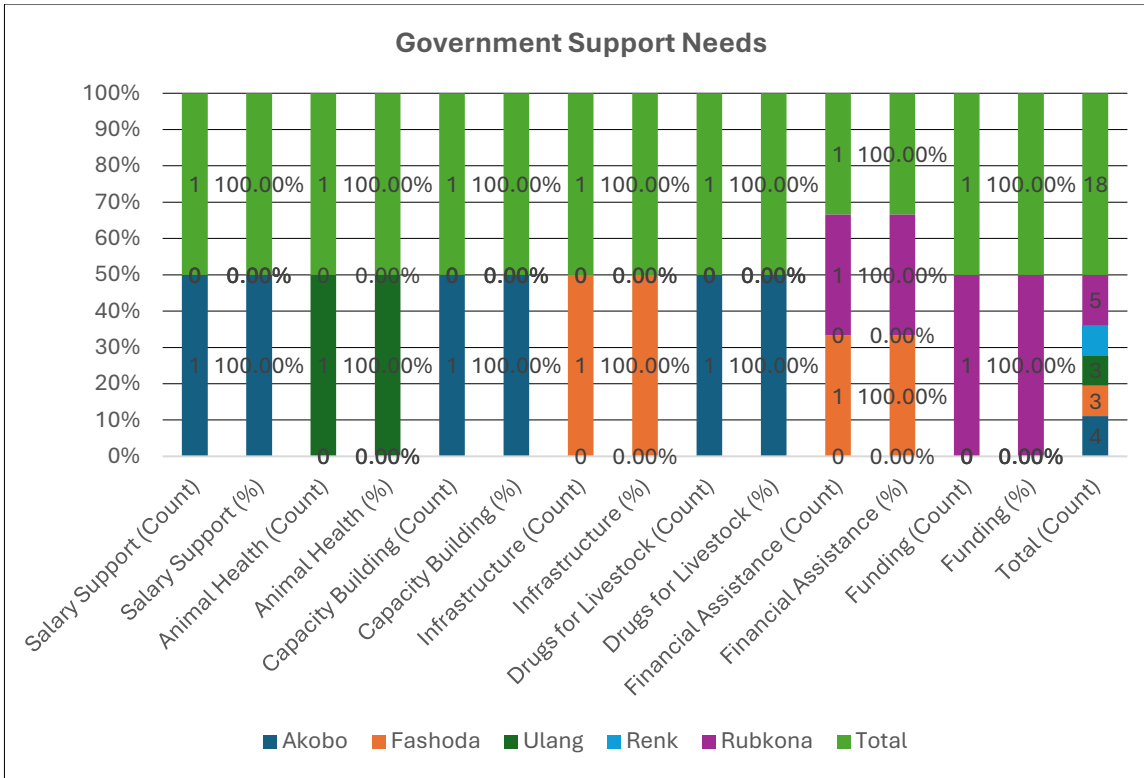


Figure 11: Government Support Needs

## CHAPTER SIX: SUSTAINABILITY ANALYSIS

### 5.1 Overview of sustainability analysis

As a result of this study, major sustainability factors such as environment, economic, and social factors have been identified to influence, sustainable livestock management, as well as market access, climate resilience and social inclusion. On the same wavelength, the assessment established that livestock migration continues to be a critical economic activity for the pastoral communities, and it is worth noting that livestock migration continues to face climate change, water insufficiencies, conflicts associated with grazing land disputes and competition over limited pasture and watering areas. Other confounding factors to the livestock economy, including lack of financial support, weak market linkages and social exclusion, have emerged to restrict the sector economy.

### 5.2. Findings of Sustainability Analysis

#### 5.2.1 Perceived Sustainability of Livestock Practices

Table 7 shows that livestock practice sustainability is perceived to vary by location. A sizable amount (43.95%) of respondents says their livestock methods are highly sustainable, with Ulang having the highest percentage (73.28%), followed by Rubkona (42.46%) and Renk (36.07%). In contrast, 15.59% of respondents believe their behaviors are unsustainable, with Fashoda (23.12%) and Akobo (19.64%) expressing the most concern. A sizable proportion (34.52%) assessed their practices as somewhat sustainable, implying that while they see promise for sustainability, there are still obstacles. Akobo (51.53%) and Rubkona (41.85%) got the most responders in this category, indicating moderate sustainability concerns.

The Pearson chi-square test ( $\chi^2 = 449.91$ ,  $p = 0.000$ ) shows a statistically significant association between location on the one hand and perceived sustainability on the other. This suggests that views vary due to regional characteristics such as market availability, climate conditions, and livestock management practices.

Table 7: Perceived Sustainability of Livestock Practices by Location

Perception of Sustainability	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
Not sustainable	77 (19.64%)	86 (23.12%)	39 (12.79%)	37 (11.38%)	42 (10.29%)	281 (15.59%)
Not sustainable (Somewhat)	0 (0.00%)	1 (0.27%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (0.06%)
Not sustainable (Very)	0 (0.00%)	0 (0.00%)	1 (0.33%)	0 (0.00%)	0 (0.00%)	1 (0.06%)
Somewhat sustainable	202 (51.53%)	119 (31.99%)	109 (35.74%)	136 (41.85%)	56 (13.73%)	622 (34.52%)
Somewhat sustainable (No response)	2 (0.51%)	22 (5.91%)	0 (0.00%)	1 (0.31%)	1 (0.25%)	26 (1.44%)
Somewhat sustainable (Other)	1 (0.26%)	2 (0.54%)	0 (0.00%)	5 (1.54%)	1 (0.25%)	9 (0.50%)
Very sustainable	103 (26.28%)	142 (38.17%)	110 (36.07%)	138 (42.46%)	299 (73.28%)	792 (43.95%)
Very sustainable (No response)	1 (0.26%)	0 (0.00%)	1 (0.33%)	0 (0.00%)	0 (0.00%)	2 (0.11%)
Very sustainable (Somewhat)	6 (1.53%)	0 (0.00%)	45 (14.75%)	7 (2.15%)	9 (2.21%)	67 (3.72%)
<b>Total</b>	<b>392 (100%)</b>	<b>372 (100%)</b>	<b>305 (100%)</b>	<b>325 (100%)</b>	<b>408 (100%)</b>	<b>1,802 (100%)</b>

Pearson chi-square test ( $\chi^2 = 449.91, p = 0.000$ )

### 5.2.2 Sustainable Grazing Measures

As shown in Table 8, rotational grazing was seen to be the most applied measure for underscoring sustainable grazing, as demonstrated by 55.44% of respondents, with Akobo (64.97%), Ulang (61.76%), and Rubkona (56.00%) having the most significant adoption rates. This implies that many livestock keepers understand the value of moving livestock across grazing sites to facilitate grassland regeneration.

However, a minority (25.25%) of respondents reported taking no action on the sustainable grazing measures, with Renk (44.22%) and Fashoda (32.80%) having the most significant percentages of livestock caretakers who do not practice sustainability. This could suggest a lack of information, resources, or access to appropriate grazing pastures.

Only 4.22% of respondents fence their pastures, with Rubkona (11.69%) claiming the most extensive use of this approach. The comparatively low adoption of fencing could be attributed to high prices or communal grazing customs. The Pearson chi-square test ( $\chi^2 = 787.30, p = 0.000$ ) shows a substantial correlation between location and grazing patterns, indicating that regional considerations impact sustainability decisions. This emphasizes the need for focused interventions, such as promoting low-cost fencing alternatives and raising community understanding of sustainable grazing practices.

Table 8: Sustainable Grazing Measures by Location

Grazing Measure	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
Fencing pastures	0 (0.00%)	23 (6.18%)	13 (4.29%)	38 (11.69%)	2 (0.49%)	76 (4.22%)
Rotational grazing	256 (64.97%)	189 (50.81%)	120 (39.60%)	182 (56.00%)	252 (61.76%)	999 (55.44%)
None (No measures taken)	135 (34.26%)	122 (32.80%)	134 (44.22%)	57 (17.54%)	7 (1.72%)	455 (25.25%)
Other (Specify)	0 (0.00%)	4 (1.08%)	3 (0.99%)	0 (0.00%)	0 (0.00%)	7 (0.39%)
Other variations of rotational grazing	2 (0.51%)	22 (5.91%)	27 (8.91%)	17 (5.23%)	134 (32.84%)	202 (11.21%)
<b>Total</b>	<b>394 (100%)</b>	<b>372 (100%)</b>	<b>303 (100%)</b>	<b>325 (100%)</b>	<b>408 (100%)</b>	<b>1,802 (100%)</b>
Pearson chi-square test ( $\chi^2 = 787.30$ , $p = 0.000$ )						

### 5.2.3 Changes in Pasture Availability

In Table 9, the majority of respondents (58.22%) indicated a reduction in pasture availability, indicating severe environmental challenges for livestock grazing. This tendency is particularly prominent in Akobo (72.84%) and Rubkona (65.75%), suggesting that these areas may be undergoing substantial pasture degradation as a result of overgrazing, climate change, or land-use changes.

In contrast, 35.86% of respondents reported an increase in pasture availability, with Ulang (51.72%) and Fashoda (44.62%) having the highest percentages. This could imply localized gains as a result of seasonal fluctuations, improved grazing management, or restoration efforts.

A small respondent population (5.92%) reported no substantial change in pasture availability, with Renk (14.38%) claiming the most stability. This implies that some locations may have more robust ecosystems or predictable grazing patterns.

The Pearson chi-square test ( $\chi^2 = 166.00$ ,  $p = 0.000$ ) reveals a substantial correlation between location and corresponding pasture availability trends. This relationship highlights the necessity for underscoring regionally conceptualized interventions to redress pasture degradation within impacted areas. Implementing land management policies, boosting fodder cultivation, and strengthening sustainable grazing methods could offset these difficulties.

Table 9: Observed Changes in Pasture Availability

Pasture Change	Availability	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
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No change	7 (1.78%)	15 (4.03%)	44 (14.38%)	33 (10.09%)	8 (1.96%)	107 (5.92%)
Yes, decreasing	287 (72.84%)	191 (51.34%)	170 (55.56%)	215 (65.75%)	189 (46.32%)	1,052 (58.22%)
Yes, increasing	100 (25.38%)	166 (44.62%)	92 (30.07%)	79 (24.16%)	211 (51.72%)	648 (35.86%)
<b>Total</b>	<b>394</b> <b>(100%)</b>	<b>372 (100%)</b>	<b>306</b> <b>(100%)</b>	<b>327</b> <b>(100%)</b>	<b>408</b> <b>(100%)</b>	<b>1,807</b> <b>(100%)</b>
Pearson chi-square test ( $\chi^2 = 166.00$ , $p = 0.000$ )						

#### 5.2.4 Household Water Conservation Practices

Table 10 shows a nearly even split in water conservation activities at the household level, with 50.36% of respondents practicing conservation strategies and 49.64% not. Nonetheless, there are significant geographical variances. Akobo (77.61%) and Fashoda (59.03%) have the most considerable proportions of households not implementing water conservation, indicating a lack of awareness, availability to adequate technologies, or a lesser perceived need for conservation measures in these locations. Renk (60.31%), Rubkona (63.19%), and Ulang (67.65%) have higher rates of water conservation strategy adoption, indicating increased awareness or a greater need to manage water resources efficiently. This could be due to concerns about water scarcity, community activities, or focused interventions to encourage conservation behaviors.

The Pearson chi-square test ( $\chi^2 = 219.16$ ,  $p = 0.000$ ) indicates a strong correlation between location and water conservation habits, emphasizing the importance of context-oriented interventions. The promotion of water-efficient technologies and community awareness programs interspersed with a raft of behavioral change activities could holistically help to enhance conservation habits, especially within the purview of low-adoption locations like Fashoda and Akobo.

Table 10: Household Water Conservation Practices

Water Conservation Practice	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
No	305 (77.61%)	219 (59.03%)	129 (39.69%)	120 (36.81%)	132 (32.35%)	905 (49.64%)
Yes	88 (22.39%)	152 (40.97%)	196 (60.31%)	206 (63.19%)	276 (67.65%)	918 (50.36%)
<b>Total</b>	<b>393</b> <b>(100%)</b>	<b>371 (100%)</b>	<b>325</b> <b>(100%)</b>	<b>326 (100%)</b>	<b>408</b> <b>(100%)</b>	<b>1,823</b> <b>(100%)</b>
Pearson chi-square test ( $\chi^2 = 219.16$ , $p = 0.000$ )						

### 5.2.5 Livestock Waste Disposal Methods

Evaluation findings in Table 11 revealed that open disposal is the most common method for managing livestock waste, with 70.43% of respondents adopting it across all sites. This trend is most noticeable in Ulang (96.57%), Akobo (91.35%), and Rubkona (71.69%), indicating a lack of established waste management systems in these areas. The excessive reliance on open disposal presents environmental and health concerns, as well as the possibility of water contamination.

Composting, on the other hand, is more widespread in Fashoda (33.51%) and Renk (19.08%), implying that these communities are more aware of and employ sustainable waste management strategies.

Composting and open disposal (5.96%), as well as composting integrated with other methods (e.g., other stated methods at 4.61%), represent partial transitions to increasingly sustainable practices.

The Pearson chi-square test ( $\chi^2 = 654.37$ ,  $p = 0.000$ ) shows a significant correlation between location and livestock waste disposal practices, emphasizing the importance of tailored interventions. Composting training blended with educational programs and accompanying incentives for sustainable waste management could holistically minimize reliance on open disposal while concurrently improving public health and environmental results.

Table 11: Livestock Waste Disposal Methods

Disposal Method	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
Composting	20 (5.09%)	124 (33.51%)	54 (19.08%)	52 (16.00%)	5 (1.23%)	255 (14.33%)
Composting & Open Disposal	3 (0.76%)	23 (6.22%)	58 (20.49%)	17 (5.23%)	5 (1.23%)	106 (5.96%)
Composting & Other Methods	0 (0.00%)	1 (0.27%)	5 (1.77%)	0 (0.00%)	0 (0.00%)	6 (0.34%)
Open Disposal	359 (91.35%)	136 (36.76%)	131 (46.29%)	233 (71.69%)	394 (96.57%)	1,253 (70.43%)
Open Disposal & Composting	10 (2.54%)	31 (8.38%)	11 (3.89%)	21 (6.46%)	4 (0.98%)	77 (4.33%)
Other (Specify)	1 (0.25%)	55 (14.86%)	24 (8.48%)	2 (0.62%)	0 (0.00%)	82 (4.61%)
<b>Total</b>	<b>393 (100%)</b>	<b>370 (100%)</b>	<b>283 (100%)</b>	<b>325 (100%)</b>	<b>408 (100%)</b>	<b>1,779 (100%)</b>

Pearson chi-square test ( $\chi^2 = 654.37$ ,  $p = 0.000$ )

### 5.2.6 Alternative Feed Sources Used During Drought or Flooding

The survey findings in Table 12 below show that many respondents (53.86%) had no alternate feed sources, indicating that cattle are increasingly susceptible to associated climate shocks.

This trend is especially noticeable within Akobo (97.71%), Renk (49.37%), and Rubkona (52.76%), respectively, where many herders do not use alternate feeding methods. However, purchased feed (13.89%) and stored fodder (14.22%) comprise the most commonly used adaptive techniques, with Fashoda (28.84%) and Ulang (15.44%) adopting stored fodder more frequently. Rubkona (22.39%) and Renk (19.62%) have a higher proportion of herders who rely on purchased feed, indicating a growing need for livestock feed in these areas.

A noticeable trend is the increased usage of combination techniques in Ulang, with 36.52% of respondents using both commercial feed and stored fodder. This shows that households in Ulang are more aggressive in obtaining alternate feed suppliers than other areas. The Pearson chi-square test ( $\chi^2 = 992.30$ ,  $p = 0.000$ ) shows a significant correlation between geography and alternate feed sources, highlighting the necessity for region-specific treatments. Strategies such as boosting fodder storage, increasing access to low-cost commercial feeds, and supporting feed production projects could all assist to reduce livestock losses and boost resilience during extreme weather events.

Table 12: Alternative Feed Sources Used During Drought or Flooding

Alternative Sources	Feed	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
None		384 (97.71%)	189 (50.94%)	156 (49.37%)	172 (52.76%)	76 (18.63%)	977 (53.86%)
Purchased feed		2 (0.51%)	41 (11.05%)	62 (19.62%)	73 (22.39%)	74 (18.14%)	252 (13.89%)
Stored fodder		4 (1.02%)	107 (28.84%)	27 (8.54%)	57 (17.48%)	63 (15.44%)	258 (14.22%)
Stored fodder & Purchased feed		3 (0.76%)	13 (3.50%)	47 (14.87%)	3 (0.92%)	149 (36.52%)	215 (11.85%)
Other (Specify)		0 (0.00%)	9 (2.43%)	6 (1.90%)	2 (0.61%)	5 (1.23%)	22 (1.21%)
Purchased feed & Stored fodder		0 (0.00%)	3 (0.81%)	1 (0.32%)	4 (1.23%)	38 (9.31%)	46 (2.54%)
<b>Total</b>		<b>393 (100%)</b>	<b>371 (100%)</b>	<b>316 (100%)</b>	<b>326 (100%)</b>	<b>408 (100%)</b>	<b>1,814 (100%)</b>

Pearson chi-square test ( $\chi^2 = 992.30$ ,  $p = 0.000$ )

### 5.2.7 Access to Climate Adaptation Information

The findings reported in Table 13 show a significant gap in access to climate adaptation information, with 53.56% demonstrating a lack of access. This limited access shows potential impediments to knowledge absorption, including poor dissemination channels, a lack of outreach activities, and low literacy levels. Akobo had the highest proportion of respondents without access (72.52%), followed by Renk (57.05%) and Ulang (47.79%), indicating that these communities may need focused initiatives to promote climate communication and

understanding.

In contrast, Fashoda (52.42%), Rubkona (58.59%), and Ulang (52.21%) had significantly higher access to climate adaptation information, which could be attributable to closeness to government institutions, NGOs, or community networks that support climate-related awareness activities.

The Pearson chi-square test ( $\chi^2 = 88.47$ ,  $p = 0.000$ ) shows a strong link between location and access to climate adaptation knowledge. This highlights the necessity for institutionalizing site-specific solutions to close the information lacuna. Improving access must engender the prioritization of stakeholder investment in community awareness-related activities, localized training programs that enhance community capacity building, resilience, and adaptive capacity among vulnerable communities, and harnessing the opportunity presented by digital dissemination platforms.

Table 13: Access to Climate Adaptation Information

Access to Climate Information	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
No	285 (72.52%)	177 (47.58%)	178 (57.05 %)	135 (41.41%)	195 (47.79%)	970 (53.56 %)
Yes	108 (27.48%)	195 (52.42%)	134 (42.95 %)	191 (58.59%)	213 (52.21%)	841 (46.44 %)
<b>Total</b>	<b>393 (100%)</b>	<b>372 (100%)</b>	<b>312 (100%)</b>	<b>326 (100%)</b>	<b>408 (100%)</b>	<b>1,811 (100%)</b>
Pearson chi-square test ( $\chi^2 = 992.30$ , $p = 0.000$ )						

### 5.2.8 Effects of Climate Change on Livestock Productivity

The findings in Table 14 show that climate change has primarily resulted in a drop in livestock productivity, with 80.55% of respondents reporting lower productivity. This tendency is especially noticeable in Akobo (95.69%) and Ulang (87.75%), indicating that these areas are highly vulnerable to climate-related difficulties such as floods, drought, pasture deterioration, and water scarcity. In contrast, 16.12% of respondents indicated increased productivity, with Fashoda (26.88%) and Rubkona (23.31%) having the most significant rates. This could be attributed to adaptive techniques such as enhanced feed storage, changing livestock breeds, or increased access to animal health services. Only 3.32% of respondents reported no influence from climate change, highlighting the extensive impact on pastoral systems.

The Pearson chi-square test ( $\chi^2 = 138.29$ ,  $p = 0.000$ ) shows statistically significant differences in responses across locales, emphasizing the necessity for region-specific climate adaptation methods. Targeted interventions, such as water resource management, pasture restoration, and climate-resilient livestock practices, are critical for mitigating these effects and preserving livestock-dependent livelihoods.

Table 14: Effects of Climate Change on Livestock Productivity

Climate Change Effect	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
Decreased	377 (95.69%)	254 (68.28%)	234 (76.72%)	231 (70.86%)	358 (87.75%)	1,454 (80.55%)
Increased	11 (2.79%)	100 (26.88%)	55 (18.03%)	76 (23.31%)	49 (12.01%)	291 (16.12%)
No effect	6 (1.52%)	18 (4.84%)	16 (5.25%)	19 (5.83%)	1 (0.25%)	60 (3.32%)
<b>Total</b>	<b>394 (100%)</b>	<b>372 (100%)</b>	<b>305 (100%)</b>	<b>326 (100%)</b>	<b>408 (100%)</b>	<b>1,805 (100%)</b>

Pearson chi-square test ( $\chi^2 = 138.29$ ,  $p = 0.000$ )

### 5.2.9 Traditional Knowledge and Practices in Sustainability

Table 74 shows that traditional knowledge and practices are widely viewed as crucial for sustainability, with 54.32% of respondents saying they are "very important". This view is particularly prevalent in Ulang (78.92%) and Akobo (58.38%), where indigenous knowledge could play an important role in resource management, climate adaptation, and community resilience.

Furthermore, 33.85% of respondents evaluated traditional practices as "somewhat important," particularly in Fashoda (42.47%) and Renk (47.80%), implying that while these communities understand their worth, contemporary methods may be included alongside traditional approaches.

Only 11.83% of respondents thought traditional knowledge was "not important," with Renk having the highest proportion (15.72%), showing a decreased dependence on Indigenous customs in some locations. The Pearson chi-square test ( $\chi^2 = 172.31$ ,  $p = 0.000$ ) demonstrates statistically significant differences among places, showing the diverse relevance of traditional knowledge in various socio-ecological systems. These findings highlight the need for context-specific policies that combine traditional wisdom with modern sustainability measures in order to improve environmental conservation, water resource management, and climate resilience.

Table 15: Role of Traditional Knowledge in Sustainability



Traditional Knowledge Importance	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
Not important	42 (10.66%)	44 (11.83%)	50 (15.72%)	42 (12.92%)	37 (9.07%)	215 (11.83%)
Somewhat important	122 (30.96%)	158 (42.47%)	152 (47.80%)	134 (41.23%)	49 (12.01%)	615 (33.85%)
Very important	230 (58.38%)	170 (45.70%)	116 (36.48%)	149 (45.85%)	322 (78.92%)	987 (54.32%)
<b>Total</b>	<b>394 (100%)</b>	<b>372 (100%)</b>	<b>318 (100%)</b>	<b>325 (100%)</b>	<b>408 (100%)</b>	<b>1,817 (100%)</b>

Pearson chi-square test ( $\chi^2 = 172.31, p = 0.000$ )

### 5.2.10 Participation in Community-Based Conservation Programs

The information on Table 75 indicates that the majority of respondents (68.64%) take part in community-based conservation activities, demonstrating a strong commitment to environmental stewardship at the local level. Participation is highest in Ulang (91.65%) and Rubkona (81.04%), indicating that these communities may have formed conservation projects or a stronger understanding of the benefits of environmental protection.

In contrast, Akobo (46.31%) and Fashoda (53.49%) have the lowest participation rates, with a significant segment of the population (46.51% in Fashoda and 53.69% in Akobo) not participating in these programs. This gap may reflect impediments such as a lack of access, awareness, or incentives to participate in conservation activities.

In particular, Renk demonstrates a balanced distribution, with 71.74% participating while 28.26% not participating, implying that, while attempts exist, there may still be an opportunity for more outreach.

The Pearson chi-square test ( $\chi^2 = 255.56, p = 0.000$ ) shows a substantial difference in participation across locations, indicating that contextual factors influence engagement levels. These findings emphasize the necessity of customized interventions for increasing conservation participation in low-involvement areas, such as awareness campaigns, incentives, or linking conservation efforts with livelihood benefits.

Table 16: Participation in Community-Based Conservation Programs

Participation in Conservation Programs	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
No	211 (53.69%)	173 (46.51%)	91 (28.26%)	62 (18.96%)	34 (8.35%)	571 (31.36%)
Yes	182 (46.31%)	199 (53.49%)	231 (71.74%)	265 (81.04%)	373 (91.65%)	1,250 (68.64%)
<b>Total</b>	<b>393 (100%)</b>	<b>372 (100%)</b>	<b>322 (100%)</b>	<b>327 (100%)</b>	<b>407 (100%)</b>	<b>1,821 (100%)</b>

Pearson chi-square test ( $\chi^2 = 255.56, p = 0.000$ )



### 5.2.11 Sustainable Breeding Practices

The results in Table 76 below revealed significant variety in sustainable breeding practices among localities, with Akobo (98.21%) and Ulang (0.49%) having dramatic variations in the number of respondents that do not use any breeding strategies. The most common tactics utilized across all regions are selective breeding (21.66%) and crossbreeding (17.62%), indicating a focus on genetic improvement for herd sustainability. Fashoda has a somewhat balanced distribution, with 35.48% utilizing selective breeding, 16.13% using crossbreeding, and 36.83% without using any method, indicating a combination of traditional and modern ways. Renk (46.58%) and Rubkona (22.09%) both have a large proportion of responders who do not practice sustainable breeding, indicating probable knowledge gaps or resource constraints.

Surprisingly, Ulang had the highest adoption rate of crossbreeding (41.18%), followed by Rubkona (22.70%), implying that these communities may have better access to enhanced breeding techniques. However, Akobo exhibits little crossbreeding, instead relying nearly entirely on natural selection or traditional breeding. The Pearson chi-square test ( $\chi^2 = 1,300$ ,  $p = 0.000$ ) reveals a substantial difference in breeding practices by location. This highlights the need for specialized interventions to encourage sustainable breeding across regions, particularly in places with lower adoption.

Table 17: Sustainable Breeding Practices

Breeding Practice	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
Crossbreeding	1 (0.26%)	60 (16.13%)	15 (4.89%)	74 (22.70%)	168 (41.18%)	318 (17.62%)
Selective breeding	5 (1.28%)	132 (35.48%)	53 (17.26%)	96 (29.45%)	105 (25.74%)	391 (21.66%)
No breeding method used	385 (98.21%)	137 (36.83%)	143 (46.58%)	72 (22.09%)	2 (0.49%)	739 (40.94%)
Other methods (Specify)	1 (0.26%)	43 (11.56%)	96 (31.27%)	84 (25.77%)	133 (32.60%)	357 (19.78%)
<b>Total</b>	<b>392 (100%)</b>	<b>372 (100%)</b>	<b>307 (100%)</b>	<b>326 (100%)</b>	<b>408 (100%)</b>	<b>1,805 (100%)</b>

Pearson chi-square test ( $\chi^2 = 1,300$ ,  $p = 0.000$ )

### 5.2.12 Veterinary Extension/ Animal Health Services Usage

Table 18 below shows that the regular usage of animal health and veterinary extension services varies significantly by area. Overall, 53.19% of respondents do not utilize these services on a regular basis, with Akobo (68.27%) and Ulang (67.08%) reporting the most outstanding non-usage rates. This shows that these places have limited access to animal health services or traditionally rely on indigenous animal health practices.

In contrast, Renk (61.84%) and Rubkona (68.71%) recorded the most significant percentage of respondents who use animal health service providers, indicating a greater appreciation for modern veterinary treatment or better access to animal health services. Fashoda has a well-balanced distribution, with 46.49% reporting regular usage.

The Pearson chi-square test ( $\chi^2 = 157.9381$ ,  $p = 0.000$ ) indicates a statistically significant variation between sites, indicating inequalities in veterinarian care access and adoption. This necessitates focused interventions to improve outreach, cost, and accessibility of animal health treatments, notably in Akobo and Ulang.

Table 18 Use of Veterinary Extension/Animal Health Services

Veterinary Service Usage	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
No	269 (68.27%)	198 (53.51%)	116 (38.16%)	102 (31.29%)	273 (67.08%)	958 (53.19%)
Yes	125 (31.73%)	172 (46.49%)	188 (61.84%)	224 (68.71%)	134 (32.92%)	843 (46.81%)
<b>Total</b>	<b>394 (100%)</b>	<b>370 (100%)</b>	<b>304 (100%)</b>	<b>326 (100%)</b>	<b>407 (100%)</b>	<b>1,801 (100%)</b>
Pearson chi-square test ( $\chi^2 = 157.9381$ , $p = 0.000$ )						

### 5.3.13 Financial Support for Sustainable Livestock Practices

Table 19 shows that access to financial support for sustainable livestock operations varies significantly by area. Overall, 64.04% of respondents said they did not have access to financial assistance, with the highest rates in Akobo (82.99%), Fashoda (69.19%), and Renk (72.79%). This indicates a lack of financial services, inadequate awareness, or barriers to credit and grants in these areas. Rubkona (53.85%) and Ulang (51.23%) had the largest proportion of respondents receiving financial assistance, indicating that they have better access to funding channels for sustainable livestock management. This could be due to increased institutional support, donor interventions, or better-developed financial infrastructure in certain areas.

The Pearson chi-square test ( $\chi^2 = 162.2993$ ,  $p = 0.000$ ) indicates a statistically significant variation among sites, underscoring the necessity for initiating targeted financial inclusion programs for bridging access gaps, particularly within Akobo, Renk and Fashoda. Expanding microfinance initiatives, the scope of subsidies, and accompanying credit facilities can help to improve livestock sustainability and climate resilience in these regions.

Table 19: Access to Financial Support for Sustainable Livestock Practices



Financial Access	Support	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
No		327 (82.99%)	256 (69.19%)	222 (72.79%)	150 (46.15%)	199 (48.77%)	1,154 (64.04%)
Yes		67 (17.01%)	114 (30.81%)	83 (27.21%)	175 (53.85%)	209 (51.23%)	648 (35.96%)
<b>Total</b>		<b>394 (100%)</b>	<b>370 (100%)</b>	<b>305 (100%)</b>	<b>325 (100%)</b>	<b>408 (100%)</b>	<b>1,802 (100%)</b>

Pearson chi-square test ( $\chi^2 = 162.2993$ ,  $p = 0.000$ )

### 5.2.14 Improvements for Enhancing Sustainability

Table 20 below shows that respondents picked improved policies (48.05%) and more significant funding (24.71%) as the most critical changes for sustainability. Akobo (80.96%) preferred better policies, whereas Rubkona (42.46%) and Fashoda (24.19%) demanded more outstanding financing. In Ulang (40.44%) and Renk (25.47%), a sizable proportion of respondents identified better policies and increased financing as critical solutions. The Pearson chi-square test ( $\chi^2 = 546.0610$ ,  $p = 0.000$ ) reveals significant variance in responses across sites, highlighting the importance of context-specific policy reforms and financial support systems for achieving sustainability. Akobo, Fashoda, and Renk require more robust policy interventions, whilst Rubkona and Ulang require both policy-driven and financial reforms.

Table 20: Improvements for Enhancing Sustainability

Improvement Category	Akobo (N, %)	Fashoda (N, %)	Renk (N, %)	Rubkona (N, %)	Ulang (N, %)	Total (N, %)
<b>Better policies</b>	319 (80.96%)	181 (48.66%)	139 (43.17%)	125 (38.46%)	111 (27.21%)	875 (48.05%)
<b>Better policies + More funding</b>	9 (2.28%)	35 (9.41%)	82 (25.47%)	14 (4.31%)	165 (40.44%)	305 (16.75%)
<b>Better policies + Other</b>	0 (0.00%)	1 (0.27%)	8 (2.48%)	0 (0.00%)	1 (0.25%)	9 (0.49%)
<b>More funding</b>	59 (14.97%)	90 (24.19%)	76 (23.60%)	138 (42.46%)	87 (21.32%)	450 (24.71%)
<b>More funding + Better policies</b>	5 (1.27%)	56 (15.05%)	12 (3.73%)	47 (14.46%)	37 (9.07%)	157 (8.62%)
<b>Other (Specify)</b>	2 (0.51%)	8 (2.15%)	5 (1.55%)	1 (0.31%)	7 (1.72%)	23 (1.26%)
<b>Total</b>	<b>394 (100%)</b>	<b>372 (100%)</b>	<b>322 (100%)</b>	<b>325 (100%)</b>	<b>408 (100%)</b>	<b>1,821 (100%)</b>

Pearson chi-square test ( $\chi^2 = 546.0610$ ,  $p = 0.000$ )

## 5.3 Assessment of Livestock Migration on Household Nutrition

### 5.3.1 Food Consumption Patterns Across Locations

Table 20 indicates significant variance in food consumption across Akobo, Fashoda, Renk, Rubkona, and Ulang, supported by the Pearson chi-square test ( $\chi^2 = 128.56$ ,  $p = 0.000$ ). This suggests that food options are not equally distributed across places. Ulang has the most significant consumption of milk, meat, and fresh vegetables at 239 (58.58%), while Rubkona has the lowest at 76 (23.53%). Porridge and wild fruits are consumed the most in Rubkona (247, 76.47%) and the least in Ulang (169, 41.42%).

Akobo and Renk exhibit similar distributions, with 108 (27.41%) and 108 (32.34%) choosing milk, meat, and fresh vegetables, respectively, whereas 286 (72.59%) and 226 (67.66%) choose porridge and wild fruits. These disparities may be caused by variables such as food availability, cultural dietary preferences, and economic constraints that limit access to different food sources.

Table 20: Food Consumption Patterns

Food Items	Akobo (n, %)	Fashoda (n, %)	Renk (n, %)	Rubkona (n, %)	Ulang (n, %)	Total (n, %)
Milk, meat, fresh vegetables	108 (27.41%)	157 (42.20%)	108 (32.34%)	76 (23.53%)	239 (58.58%)	688 (37.58%)
Porridge, wild fruits	286 (72.59%)	215 (57.80%)	226 (67.66%)	247 (76.47%)	169 (41.42%)	1,143 (62.42%)
<b>Total</b>	<b>394</b> <b>(100.00%)</b>	<b>372</b> <b>(100.00%)</b>	<b>334</b> <b>(100.00%)</b>	<b>323</b> <b>(100.00%)</b>	<b>408</b> <b>(100.00%)</b>	<b>1,831</b> <b>(100.00%)</b>

Pearson chi-square = 128.5592, p-value = 0.000 (significant).

### 5.3.2 Main Food Items Consumed During Non-Lean Seasons

Table 21 shows considerable variation in food consumption during non-lean seasons across five locations: Akobo, Fashoda, Renk, Rubkona, and Ulang, as indicated by the Pearson chi-square test ( $\chi^2 = 164.88$ ,  $p = 0.000$ ). This shows that food choices and availability vary by region. Renk has the highest proportion of homes that consume milk, meat, and fresh vegetables (269, or 80.54%), while Rubkona has the lowest at 121 (37.35%). Porridge and wild fruits are more regularly consumed in Rubkona (203, or 62.65%) than in Renk (65, or 19.46%). 276 households in Ulang (67.81%) prefer milk, meat, and fresh vegetables, whereas 131 (32.19%) eat porridge and wild fruits. Akobo and Fashoda have a more balanced consumption pattern, with about half of households choosing each food group. Food production, market access, and cultural preferences may all play a role in these variances.

Table 21: Main Food Items Consumed During Non-Lean Seasons

Food Items	Akobo (n, %)	Fashoda (n, %)	Renk (n, %)	Rubkona (n, %)	Ulang (n, %)	Total (n, %)
Milk, meat, fresh vegetables	194 (49.24%)	183 (49.19%)	269 (80.54%)	121 (37.35%)	276 (67.81%)	1,043 (56.96%)
Porridge, wild fruits	200 (50.76%)	189 (50.81%)	65 (19.46%)	203 (62.65%)	131 (32.19%)	788 (43.04%)
<b>Total</b>	<b>394</b> <b>(100.00%)</b>	<b>372</b> <b>(100.00%)</b>	<b>334</b> <b>(100.00%)</b>	<b>324</b> <b>(100.00%)</b>	<b>407</b> <b>(100.00%)</b>	<b>1,831</b> <b>(100.00%)</b>

Pearson chi-square = 164.8831, p-value = 0.000 (significant).

### 5.3.3 Impact of Livestock Migration on Child Feeding Practices

Table 22 shows that livestock migration yields a significant impact on how children under five are fed in all investigated sites, as proven by the Pearson chi-square test ( $\chi^2 = 99.56$ ,  $p = 0.000$ ). Overall, 88.11% (1,594 children) are affected by livestock migration, whereas only 11.89% (215 children) are unaffected. The impact is most significant in Ulang (96.32% or 393 children) and Akobo (96.19% or 379 children), implying that these areas may be heavily reliant on livestock for food supplies like milk. Renk, on the other hand, has the lowest percentage of affected youngsters (77.42% or 240), demonstrating that feeding practices remain largely steady despite livestock movements.

82.53% (307 children) and 84.62% (275 children) are affected in Fashoda and Rubkona, respectively. These findings underscore the importance of livestock in child nutrition, as well as the potential weaknesses in food security for young children in places where migration patterns disrupt access to vital foods. However, lactating livestock and small ruminants may often be left behind at homesteads to cater for household food needs during migration.

Table 22: Impact of Livestock Migration on Child Feeding Practices

Livestock Migration & Child Feeding	Akobo (n, %)	Fashoda (n, %)	Renk (n, %)	Rubkona (n, %)	Ulang (n, %)	Total (n, %)
No (Not Affected)	15 (3.81%)	65 (17.47%)	70 (22.58%)	50 (15.38%)	15 (3.68%)	215 (11.89%)
Yes (Affected)	379 (96.19%)	307 (82.53%)	240 (77.42%)	275 (84.62%)	393 (96.32%)	1,594 (88.11%)
<b>Total</b>	<b>394</b> <b>(100.00</b> <b>%)</b>	<b>372</b> <b>(100.00%)</b>	<b>310</b> <b>(100.00</b> <b>%)</b>	<b>325</b> <b>(100.00%)</b>	<b>408</b> <b>(100.00</b> <b>%)</b>	<b>1,809</b> <b>(100.00%)</b>

Pearson chi-square = 99.5564, p-value = 0.000 (significant).

### 5.3.4 Food Sources for Children Under Five

Livestock migration has a substantial impact on the nutrition of children under the age of five by impacting food availability, dietary diversity, and household food security. In pastoralist communities such as Akobo, Fashoda, Renk, Rubkona, and Ulang, the livestock movement has an impact on access to milk, meat, and other animal-based food sources that are critical to child nutrition. The findings show that food sources vary by location, with some youngsters relying on local food, some on food purchases, and a large proportion receiving food aid. Furthermore, the scarcity of fresh food poses a significant obstacle, notably in Akobo and Fashoda, where more than 60% of respondents acknowledged this problem.

Table 23: Food Sources for Children Under Five

Food Source Category	Akobo (n=134)	Fashoda (n=258)	Renk (n=96)	Rubkona (n=84)	Ulang (n=5)	Total (N=577)
Children mostly eat local food	19 (14.2%)	61 (23.6%)	21 (21.9%)	17 (20.2%)	2 (40.0%)	120 (20.8%)
Children rely on food purchases	1 (0.7%)	26 (10.1%)	37 (38.5%)	10 (11.9%)	0 (0.0%)	74 (12.8%)
Children depend on food aid	9 (6.7%)	8 (3.1%)	16 (16.7%)	9 (10.7%)	0 (0.0%)	42 (7.3%)
Lack of fresh food availability	105 (78.4%)	163 (63.2%)	22 (22.9%)	48 (57.1%)	3 (60.0%)	341 (59.1%)

## CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

### 7.1 Conclusion

A nexus of environmental, infrastructural, and socio-economic determinants determines livestock migration in the Greater Upper Nile region, according to the participatory mapping analysis. Seasonal variability, resource distribution, and climatic changes have led to both predictable and adaptive migration patterns, while challenges such as water scarcity, livestock disease outbreaks, livestock raiding, and sporadic conflicts continue to play a role. Different areas like Akobo, Rubkona, Renk, and Fashoda have different grazing fields and water availability, but all of them agree on the need to make planning and management more responsive to local needs. Some communities still use traditional routes because they are important to their culture, and they know how to use the resources there.

Additionally, the study findings pinpoint significant gaps in animal health services and infrastructure that harbor the risks connected to livestock migration. Communities are asking for a stronger support system, like formalized livestock migration corridors and better resource management, because the effects of climate change are linked to existing weaknesses. Overall, these insights point to the urgency for integrated interventions that address infrastructural deficiencies, foster sustainable pastoral practices, and enhance resilience among livestock keepers in the region.

### 7.2 Recommendations

#### Strengthening Livestock Migration Routes

- Improve migration corridors with access to private sector led animal health services using cost recovery models, grazing grounds, and water points for sustainable mobility.
- Use community-led resource management initiatives to arbitrate pasture and water access disputes, minimizing tensions between pastoralist groups.
- Integrating GIS-based migration monitoring with weather forecasts can improve early warning systems and climate adaptation techniques for pastoralists, enabling informed decision-making.
- Improve regional cooperation among agro-pastoralist groups to facilitate shared grazing methods and regional market access.

## Enhancing the Socio-Economic Impact of Livestock

- Use market linkages and cooperative structures to expand livestock markets and increase price stability, reducing the need for middlemen.
- Enable pastoralists to access financial services through tailored microfinance programs that offer inexpensive financing for livestock husbandry, trading, and infrastructure development.
- Encourage women to participate in livestock trading and resource management through targeted training and access to business development tools.
- Use alternate income-generating activities like agro-pastoral farming, handicrafts, and small-scale trading to lessen reliance on livestock.

## Improving Livestock Value Chain Efficiency

- **Improve Market Access and Infrastructure:** Prioritize the development of rural infrastructure including roads, structured market facilities, and regional trade linkages to reduce transaction costs and enhance market access. Establish livestock market hubs closer to pastoral communities and integrate them into broader regional economic networks.
- **Strengthen Veterinary Extension and Animal Health Delivery Systems:** Expand animal health coverage through private sector led inputs start-up support to private veterinary pharmacies/ outlets, training Animal Health Service Providers, and ensuring a consistent supply of veterinary drugs, supplies and equipment using cost recovery models. Establish mobile veterinary units to reach isolated migratory corridors, remote areas and promote livestock disease surveillance and reporting systems.
- **Promote Value Addition and Technology Adoption:** Facilitate the establishment of milk collection/ marketing centers, cold-chain storage, and small-scale processing units such as slaughter slabs, abattoirs and tanneries. Introduce appropriate technologies and offer targeted training on livestock products and by-products processing and preservation.
- **Enhance Women's and Youth's Economic Empowerment:** Implement gender-inclusive livestock programs by promoting women's access and youth access to credit, cooperative memberships, and decision-making platforms. Support women-led and youth led value chain enterprises, especially in milk and by-product processing.

- **Expand Access to Finance and Training:** Develop tailored financial products and savings schemes for pastoral communities. Partner with microfinance institutions and NGOs to scale access to loans. Simultaneously, offer continuous training on livestock management, business skills, and financial literacy.
- **Policy Dissemination and Regulatory Strengthening:** Enhance awareness and enforcement of livestock-related policies by conducting community-based outreach and building the capacity of local governance structures. Encourage compliance with licensing and improve transparency in permit processes.

## Ensuring the Sustainability of Livestock Practices

### 1.1.1. Environmental Sustainability Recommendations

- **Promote Climate-Smart Livestock Practices**—Promote adaptive livestock production and management strategies such as rotational grazing, fodder production and conservation, and climate tolerant/ drought-resistant breeds.
- **Enhance Water Resource Management**—Invest in boreholes, water pans/ micro-dams, rainwater harvesting systems, and irrigation infrastructure to mitigate water scarcity.
- **Ensure Land Rehabilitation Initiatives**—Encourage reforestation, controlled grazing, and community-led pasture and rangeland management programs to prevent land degradation.

**Initiate and Strengthen Early Warning Systems**—Establish climate monitoring systems that provide real-time information on droughts, floods, and livestock disease outbreaks to enable timely interventions.

## Economic Sustainability Recommendations

- **Promote Market Access and Trade Opportunities**—Develop livestock markets closer to pastoral communities and improve road infrastructure to reduce transportation expenses.
- **Support Financial Inclusion for Pastoralists**—Promote livestock insurance, microfinance schemes, and mobile banking solutions tailored to the needs of pastoral communities.

- **Strengthen Livestock Value Chains**— Support the establishment of meat processing plants, dairy/ milk facilities, and hide tanning industries to increase profitability and reduce reliance on live animal sales.
- **Improve Veterinary Services and Animal Health**—Expand veterinary/animal health service outreach programs using private sector led cost recovery models that will ensure consistent animal health inputs and veterinary vaccine supply, and train more community-based animal health workers.

### 1.1.2. Social Sustainability Recommendations

- **Promote Gender Equality in Livestock Management**—Implement policies that allow women greater control over livestock assets and income generation opportunities.
- **Empower Youth in the Livestock Sector**—Create youth-focused training programs on modern and climate resilient livestock production, management and entrepreneurship while providing access to start-up capital.
- **Strengthen Conflict Resolution Mechanisms**—Formalize traditional mediation structures, establish cross-community dialogue platforms, and involve local authorities in managing grazing disputes.
- **Enhance Education and Skills Development**—Expand access to mobile education services, accelerated learning programs, vocational training, and digital literacy programs for pastoralist youth.

### 1.1.3. Policy and Governance Reforms Recommendations

- **Improve Enforcement of Livestock Policies**—Strengthen national and local regulations on pasture management, livestock disease control, and livestock trade to ensure compliance and sustainability.
- **Increase Government Support for Pastoralist Communities**—Allocate more resources to infrastructure development, veterinary/animal health services, and climate adaptation programs.
- **Integrate Digital Innovations in Livestock Management**—Encourage the use of digital livestock trading platforms, digital livestock disease surveillance and reporting, market information systems, and mobile-based financial services.

- **Develop National Pastoralist Development Strategies**— Create a comprehensive national framework that integrates pastoralist interests into economic and development planning.

### Improving Nutrition and Food Security

- Improve livestock breeding, pasture production/management, and livestock disease control to increase welfare, animal source foods (meat, milk) output for a steady food supply.
- Support community-based nutrition programs that combine livestock product(s) distribution with food assistance initiatives.
- Increase food storage and preservation methods to increase food security and address seasonal shortages, especially for vulnerable people.

Implement school feeding programs with locally supplied livestock-oriented products to combat child malnutrition and enhance educational outcomes.

## Annexes

### Annex A: Household Assessment Questionnaire

Respondent Consent form:		
<p>Good morning/afternoon/evening. My name is [Your Name], and I work with VSF-Suisse. We invite you to participate in the "Assessment of Livestock Migration Routes, Socio-Economic Impacts, Value Chains, and Sustainability in the Greater Upper Nile Region, South Sudan." This assessment aims to evaluate the impact of livestock migration on communities, identify key value chain opportunities, and develop sustainable strategies for livestock-dependent households. Your participation is entirely voluntary, and you may withdraw at any time without consequence. The information you provide will be used strictly for research purposes, ensuring confidentiality and anonymity in all reports and publications.</p> <p>By accepting to be interviewed, you acknowledge that you have been informed about the assessment's purpose, benefits, and potential risks. You consent to participate in interviews related to this study. Your responses will contribute to evidence-based recommendations that enhance the region's livelihoods, market systems, and socio-economic resilience. You are free to ask if you have any concerns or require further clarification.</p> <p><b>[1] Consented</b> – Continue with the interview</p> <p><b>[2] Refused</b> – End the interview</p>		
Demographic session		
1.	What is the county	[1] Akobo [2] Rubkona [3] Renk [4] Fashoda [5] Panyikang
2.	What is the name the respondent?	
3.	What is the relationship of the respondent to the household head?	[1] Spouse [2] Household head [3] Relative [99] Other specify
4.	What is the age of the respondent?	[1] Under 20 years [2] 20–34 years [3] 35–49 years [4] 50–64 years

		[5] 65 years or older
5.	What is the sex of the respondents?	[1] Male [2] Female
6.	What is the marital status of the respondent?	[1] Single [2] Married [3] Widowed [4] Divorced/Separated
7.	What is the highest level of education attained by the household head?	[1] No formal education [2] Primary education [3] Secondary education [4] Tertiary education
8.	Does you household own livestock	[1] Yes [2] No
9.	Does your household rely on migration for livestock grazing?	[1] Yes [2] No
<b>Objective 1: Livestock Migration Routes Mapping</b>		
10.	What is the primary reason for migrating livestock?	[1] Seasonal changes [2] Conflict and insecurity [2] Market access [99] Other (Specify)
11.	How frequently do you migrate your livestock in a year?	[1] Once [2] Twice [3] More than twice
12.	Which months of the year do you usually migrate your livestock?	[1] January–March [2] April–June [3] July–September [4] October–December
13.	What is the average distance covered during migration?	[1] Less than 50 km [2] 50-100 km

		[3] More than 100 km
14.	What are the key challenges faced during migration?	[1] Water scarcity [2] Grazing land competition [3] Insecurity/conflict [99] Other (Specify)
15.	Do you encounter any restrictions on migration routes?	[1] Yes [1] No
16.	What restriction do you encounter?	
17.	What alternative strategies do you use when migration is not possible?	[1] Purchasing feed [2] Settling in one location [99] Other (Specify)
18.	Have traditional migration routes changed over time?	[1] Yes [2] No
19.	What factors have contributed to the changes in migration routes?	[1] Climate change [2] Government policies [3] Conflicts [99] Other (Specify)
20.	How do you access information on migration routes?	[1] Community elders [2] Government agencies [3] Other pastoralists [99] Other (Specify)
21.	Do you face conflicts with other communities during migration?	[1] Yes [2] No
22.	How are conflicts resolved?	[1] Community meetings [2] Law enforcement intervention [99] Other (Specify)
23.	What type of infrastructure is available along migration routes?	[1] Water points [2] Veterinary services [3] Markets [4] None

24.	How do you ensure livestock health during migration?	[1] Regular veterinary checks [2] Traditional remedies [99] Other (Specify)
25.	How has climate change affected migration	[1] Increased drought frequency [2] Reduced pasture availability [99] Other (Specify)
26.	What support do you receive for migration challenges	[1] Government support [2] NGO support [99] None
27.	Are there formal policies governing migration?	[1] Yes [2] No
28.	Do you pay any fees for access to grazing areas?	[1] Yes [2] No
29.	What are the benefits of livestock migration?	[1] Better grazing [2] Market access [3] Disease control [99] Other (Specify)
30.	What recommendations do you have for improving migration conditions?	
<b>Objective 2: Socio-Economic Impact Assessment</b>		
31.	What is your primary source of income?	[1] Livestock sales [2] Agriculture [3] Small business [99] Other (Specify)
32.	How has livestock migration affected your household income?	[1] Increased income [2] Decreased income [3] No change [99] Other (Specify)
33.	Do you sell livestock directly or through intermediaries?	[1] Directly [2] Through intermediaries

		[99] Other (Specify)
34.	What are the main markets for your livestock?	[1] Local market [2] Regional market [3] National market
35.	How do you access veterinary services?	[1] Government [2] Private sector [3] Community-based services
36.	Have you faced livestock diseases due to migration?	[1] Yes [2] No
37.	What are the most common diseases encountered?	[1] Foot and mouth disease [2] Trypanosomiasis [99] Other (Specify)
38.	How do you cope with livestock losses?	[1] Insurance [2] Savings [3] Government support [99] Other (Specify)
39.	Has migration affected access to education for children?	[1] Yes [2] No
40.	Has migration affected women's economic activities?	[1] Yes [2] No
41.	What are the primary roles of men and women in livestock management?	[1] Men: (Specify) [2] Women: (Specify)
42.	Do women participate in the livestock trade?	[1] Yes [2] No
43.	How has migration impacted community cohesion?	[1] Strengthened [2] Weakened [3] No effect
44.	Are there specific groups more vulnerable to migration challenges?	[1] Women [2] Children

		[3] Elderly [4] None
45.	What type of financial support do you access?	[1] Microfinance [2] Cooperatives [3] None
46.	What infrastructure improvements are needed in your area?	[1] Roads [2] Markets [3] Water points
47.	How does livestock migration impact food security?	[1] Improves [2] Worsens [3] No effect
48.	Are government policies supportive of pastoral livelihoods?	[1] Yes [2] No
49.	Do you receive extension services?	[1] Yes [2] No
50.	What recommendations do you have for improving socio-economic conditions?	
<b>Objective 3: Livestock Value Chain Mapping</b>		
51.	What is your primary livestock product?	[1] Meat [2] Milk [3] Hides/skins [4] Other (Specify)
52.	Where do you sell your livestock products?	[1] Local markets [2] Regional markets [3] Export markets
53.	What are the biggest challenges in selling livestock products?	[1] Low prices [2] Lack of market access [3] Poor infrastructure [99] Other (Specify)
54.	How do you transport livestock to markets?	[1] On foot

		[2] Vehicles [99] Other (Specify)
55.	Do you have access to cold storage facilities for livestock products?	[1] Yes [2] No
56.	What processing activities do you engage in?	[1] Slaughtering [2] Packaging [3] None
57.	Who are your main buyers?	[1] Individual consumers [2] Traders [3] Supermarkets [99] Other (Specify)
58.	Do you have access to credit for livestock trade?	[1] Yes [2] No
59.	What type of support would improve livestock trading?	[1] Better infrastructure [2] Access to finance [3] Training [4] Other (Specify)
60.	Do you use technology for market access?	[1] Yes [2] No
61.	Are there cooperatives supporting livestock value chain activities?	[1] Yes [2] No
62.	What role do intermediaries play in the livestock trade?	[1] Price setting [3] Transportation [99] Other (Specify)
63.	What type of training would help you in the livestock trade?	[1] Business management [2] Product quality improvement [99] Other (Specify)
64.	Do you experience price fluctuations in livestock markets?	[1] Yes [2] No

65.	How do you set prices for your livestock?	[1] Market rates [3] Negotiation [99] Other (Specify)
66.	What are the main costs associated with livestock trading? <b>Mark all that apply</b>	[1] Transportation [2] Market fees [3] Veterinary costs [99] Other (Specify)
67.	Do you have access to information about market trends?	[1] Yes [2] No
68.	How has climate change affected livestock product value chains?	[1] Reduced production [2] Increased costs [99] Other (Specify)
69.	What recommendations do you have for improving livestock value chains?	
<b>Objective 4: Sustainability Analysis</b>		
70.	How do you perceive the sustainability of your livestock practices?	[1] Very sustainable [2] Somewhat sustainable [3] Not sustainable
71.	What measures do you take to ensure sustainable grazing?	[1] Rotational grazing [2] Fencing pastures [3] None [99] Other (Specify)
72.	Have you observed changes in pasture availability over the years?	[1] Yes, increasing [2] Yes, decreasing [3] No change
73.	Do you practice water conservation techniques?	[1] Yes [2] No
74.	How do you manage livestock waste disposal?	[1] Composting [2] Open disposal

		[99] Other (Specify)
75.	What alternative feed sources do you use during drought?	[1] Stored fodder [2] Purchased feed [99] Other (Specify)
76.	Do you have access to climate adaptation training?	[1] Yes [2] No
77.	How has climate change affected livestock productivity?	[1] Increased [2] Decreased [3] No effect
78.	What role do traditional knowledge and practices play in sustainability?	[1] Very important [2] Somewhat important [3] Not important
79.	How do you mitigate conflicts over grazing land?	[1] Community negotiations [2] Government intervention [99] Other (Specify)
80.	Are there government policies supporting sustainable livestock practices?	[1] Yes [2] No
81.	Do you participate in community-based conservation programs?	[1] Yes [2] No
82.	What challenges do you face in implementing sustainable practices?	[1] Lack of resources [2] Lack of knowledge [99] Other (Specify)
83.	How do you ensure sustainable breeding practices?	[1] Selective breeding [2] Crossbreeding [3] None [99] Other (Specify)
84.	Do you use veterinary services regularly?	[1] Yes [2] No
85.	How do market conditions affect sustainable livestock management?	[1] Positively [2] Negatively

		[3] No effect
86.	Do you access financial support for sustainable livestock practices?	[1] Yes [2] No
87.	What improvements would help enhance sustainability?	[1] Better policies [2] More funding [99] Other (Specify)
88.	Are sustainable livestock practices promoted in your community?	[1] Yes [2] No
89.	What recommendations do you have for improving sustainability?	
90.	Household GPS location	
THANK YOU		

## Annex B: Men's FGD guide

<b>MEN FOCUS GROUP DISCUSSION FOR LIVESTOCK PRODUCT VALUE CHAIN</b>	
ASSESSMENT OF LIVESTOCK MIGRATION ROUTES, SOCIOECONOMIC IMPACTS, VALUE CHAINS AND SUSTAINABILITY IN THE GREATER UPPER NILE REGION, SOUTH SUDAN	
Facilitator Name:	
Interview Date:	
Interview Start Time:	
Interview End Time:	
Location	[1] Akobo [2] Rubkona [3] Renk [4] Fashoda [5] Panyikang
Date	
<b>Instructions</b>	
<b>Focus Group Discussion should not be longer than 60 minutes.</b>	
<p><b>Instruction:</b> After greetings, introduce yourself, state the objective of the assessment. Then, proceed with the questions. Ask all the questions as they appear and let the note-taker write answers in a separate document. To collect reliable data, please be patient with the respondents. At the end of the interview, please do not forget to THANK the respondents(s) for their time.</p>	
<b>Introduction and Consent</b>	
<p>Good morning/afternoon/evening. My name is [Your Name], and I am working with VSF-Suisse. We invite you to participate in the "Assessment of Livestock Migration Routes, Socio-Economic Impacts, Value Chains, and Sustainability in the Greater Upper Nile Region, South Sudan." This assessment aims to evaluate the impact of livestock migration on communities, identify key value chain opportunities, and develop sustainable strategies for livestock-dependent households. Your participation is entirely voluntary, and you may withdraw at any time without consequence. The information you provide will be used strictly for research purposes, ensuring confidentiality and anonymity in all reports and publications.</p>	
<p>By accepting to be part of the Focus Group Discussion, you acknowledge that you have been informed about the purpose, benefits, and potential risks of the assessment. You consent to participate in discussion related to this study. Your responses will contribute to evidence-based recommendations that enhance livelihoods, market</p>	

systems, and socio-economic resilience in the region. If you have any concerns or require further clarification, you are free to ask.

**[1] Consented** – Continue with the discussion

**[2] Refused** – End the discussion

#### Questions

1. **Migration Patterns:** What are the major livestock migration routes used in this region, and how have they changed over time?
2. **Challenges:** What are the main challenges you face during livestock migration (e.g., conflict, water shortages, disease outbreaks)?
3. **Livelihood Impact:** How does livestock migration affect your household income and overall well-being?
4. **Market Access:** What barriers do you face in selling livestock and livestock products at local or distant markets?
5. **Conflict & Social Cohesion:** Have there been disputes over grazing lands and water sources? How are they resolved?
6. **Climate Change:** How has climate variability (droughts, floods) affected livestock migration and productivity?
7. **Value Chain Gaps:** What challenges exist in the livestock value chain, such as market prices, transportation, or veterinary services?
8. **Animal Health:** What support do you receive (or need) for disease control and veterinary services?
9. **Sustainability:** What traditional practices or new solutions do you use to sustain livestock production in changing conditions?
10. **Technology & Innovation:** Are you using any modern technologies (e.g., mobile money, market information systems) for livestock trade?
11. **Women's Role:** What roles do women in your community play in livestock management, and how can their participation be improved?
12. **Policy & Support:** What kind of government or NGO support would help improve your livestock business?

## Annex C: Women FGD Guide

<b>WOMEN FOCUS GROUP DISCUSSION</b>	
ASSESSMENT OF LIVESTOCK MIGRATION ROUTES, SOCIOECONOMIC IMPACTS, VALUE CHAINS AND SUSTAINABILITY IN THE GREATER UPPER NILE REGION, SOUTH SUDAN	
Facilitator Name:	
Interview Date:	
Interview Start Time:	
Interview End Time:	
Location	[1] Akobo [2] Rubkona [3] Renk [4] Fashoda [5] Panyikang
Date:	
Instructions	
<p><b>Focus Group Discussion should not be longer than 60 minutes.</b></p> <p><b>Instruction:</b> After greetings, introduce yourself, state the objective of the assessment. Then, proceed with the questions. Ask all the questions as they appear and let the note-taker write answers in a separate document. To collect reliable data, please be patient with the respondents. At the end of the interview, please do not forget to THANK the respondents(s) for their time.</p>	
<b>Introduction and Consent</b>	
<p>Good morning/afternoon/evening. My name is [Your Name], and I am working with VSF-Suisse. We invite you to participate in the "Assessment of Livestock Migration Routes, Socio-Economic Impacts, Value Chains, and Sustainability in the Greater Upper Nile Region, South Sudan." This assessment aims to evaluate the impact of livestock migration on communities, identify key value chain opportunities, and develop sustainable strategies for livestock-dependent households. Your participation is entirely voluntary, and you may withdraw at any time without consequence. The information you provide will be used strictly for research purposes, ensuring confidentiality and anonymity in all reports and publications.</p> <p>By accepting to be part of the Focus Group Discussion, you acknowledge that you have been informed about the purpose, benefits, and potential risks of the assessment. You consent to participate in discussion related to this study. Your responses will contribute to evidence-based recommendations that enhance livelihoods, market systems, and socio-economic resilience in the region. If you have any concerns or require further clarification, you are free to ask.</p>	

[1] **Consented** – Continue with the discussion

[2] **Refused** – End the discussion

Questions

1. **Role in Livestock Management:** What roles do women play in livestock management, trade, and processing?
2. **Access to Resources:** Do women have equal access to land, water, credit, and veterinary services for livestock-related activities?
3. **Access and Control:** What are the types of livestock do women have full access and control over?
4. **Income & Financial Inclusion:** How do you benefit from livestock-related income, and what financial services (e.g., savings, loans) are available to you?
5. **Challenges Faced:** What are the most prominent challenges women face in participating in the livestock value chain?
6. **Decision-Making:** Are women included in decision-making on livestock trade, migration, and resource allocation in your household or community?
7. **Health & Nutrition:** How does livestock ownership affect household nutrition and food security?
8. **Market Participation:** What challenges do women face in accessing livestock markets, and what solutions do you propose?
9. **Climate Impact:** How do climate-related challenges (droughts, floods) impact women's responsibilities in livestock management?
10. **Training & Support:** What training or support do women need to improve their livestock farming and trade participation?
11. **Social & Cultural Barriers:** Are cultural norms preventing women from fully engaging in livestock value chains?
12. **Conflict & Migration Impact:** How do livestock migrations and conflicts affect women's workload and family responsibilities?
13. **Entrepreneurship Opportunities:** What opportunities exist for women to engage in value-added activities such as dairy processing, hide tanning, or fodder production?

THANK YOU

## Annex D: Youth FGD Guide

YOUTH FOCUS GROUP DISCUSSION	
ASSESSMENT OF LIVESTOCK MIGRATION ROUTES, SOCIOECONOMIC IMPACTS, VALUE CHAINS, AND SUSTAINABILITY IN THE GREATER UPPER NILE REGION, SOUTH SUDAN	
Facilitator Name:	
Interview Date:	
Interview Start Time:	
Interview End Time:	
Location	[1] Akobo [2] Rubkona [3] Renk [4] Fashoda [5] Panyikang
Instructions	
<p><b>Focus Group Discussion should not be longer than 60 minutes.</b></p> <p><b>Instruction:</b> After greetings, introduce yourself and state the objective of the assessment. Then, proceed with the questions. Ask all the questions as they appear and let the note-taker write answers in a separate document. To collect reliable data, please be patient with the respondents. At the end of the interview, please do not forget to THANK the respondents(s) for their time.</p>	
<p><b>Introduction and Consent</b></p> <p>Good morning/afternoon/evening. My name is [Your Name], and I work with VSF-Suisse. We invite you to participate in the "Assessment of Livestock Migration Routes, Socio-Economic Impacts, Value Chains, and Sustainability in the Greater Upper Nile Region, South Sudan." This assessment aims to evaluate the impact of livestock migration on communities, identify key value chain opportunities, and develop sustainable strategies for livestock-dependent households. Your participation is entirely voluntary, and you may withdraw at any time without consequence. The information you provide will be used strictly for research purposes, ensuring confidentiality and anonymity in all reports and publications.</p> <p>By accepting to be part of the Focus Group Discussion, you acknowledge that you have been informed about the assessment's purpose, benefits, and potential risks. You consent to participate in a discussion related to this study. Your responses will contribute to evidence-based recommendations that enhance the region's livelihoods, market systems, and socio-economic resilience. You are free to ask if you have any concerns or require further clarification.</p> <p><b>[1] Consented</b> – Continue with the discussion</p> <p><b>[2] Refused</b> – End the discussion</p>	

Questions

1. **Interest in the Livestock Sector:** Are young people interested in rearing and trading? Why or why not?
2. **Barriers to Entry:** What are the biggest challenges for youth entering the livestock industry (e.g., lack of capital, training, land)?
3. **Job Creation:** What employment opportunities exist for young people in the livestock value chain?
4. **Technology Use:** Young people use technology (e.g., digital marketplaces and mobile banking) in the livestock trade. If not, why?
5. **Skills & Training:** What types of training would help young people succeed in livestock-related businesses?
6. **Market Access:** How easily can young people access markets and fair pricing for their livestock products?
7. **Financial Inclusion:** Do young people have access to credit and financial services to invest in livestock businesses?
8. **Climate Resilience:** How are young people coping with the impact of climate change on livestock production?
9. **Entrepreneurship Opportunities:** What value additional businesses (e.g., meat processing, animal feed production) can youth explore?
10. **Role in Migration:** Do young people actively participate in livestock migration? If not, what discourages them?
11. **Women & Youth Inclusion:** How can the livestock sector be more inclusive for women and marginalized youth?
12. **Policy & Advocacy:** What policy or community support changes could encourage more youth to engage in livestock farming and trade?

THANK YOU