FINAL PROJECT REPORT

FSW-21: Piloting The Index-Based Livestock Insurance (IBLI)

Sudan

Project Duration – Nov'20 – Dec'24

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EBDAA Microfinance Bank is a Sudan-based financial institution that expands access to inclusive financial services for low-income and underserved communities, supporting economic resilience and livelihood development through tailored financial products.

Website: www.ebdaabank.com

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Acronyms

AGFUND	Arab Gulf Programme for Development
CBOS	Central Bank of Sudan
CSSPR	Commission on Social Safety and Poverty Reduction
ECMWF	European Centre for Medium-Range Weather Forecasts
eMODIS	Enhanced Moderate Resolution Imaging Spectroradiometer
ENSO	El Niño and Southern Oscillation
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database,
FCAS	Fragile and Conflict-Affected States
FGDs	Focus Group Discussions
GDP	Gross Domestic Product
GESI	Gender Equality and Social Inclusion
HoA	Horn of Africa
IBLI	Index-Based Livestock Insurance
ICPAC	IGAD Climate Prediction and Applications Centre,
ILO	The International Labour Organization
ILRI	International Livestock Research Institute
ISA	Insurance Supervisory Authority
MFIs	Microfinance institutions
MoARF	Ministry of Animal Resources and Fisheries
MoLSD	Ministry of Labour and Social Development
MT	Metric Tons
NDVI	Normalized Difference Vegetation Index)
NHIF	The National Health Insurance Fund
NPSIF	The National Pension and Social Insurance Fund
PPP)	Public–Private Partnership
PZCumNDVI	Pasture Z-Score Cumulative NDVI
SAF-A	Sustainable Agriculture Foundation Africa
SCBF	The Swiss Capacity Building Facility
SDG	Sustainable Development Goals
TLU	Tropical Livestock Unit
TSI	Total Sum Insured
UAIs	Unit Areas of Insurance
UNDP	United Nations Development Programme
UNECA	The United Nations Economic Commission for Africa
USD	United States Dollar
WFP	World Food Program

Executive Summary

Pastoralism sustains the livelihoods of approximately 8.1 million Sudanese and contributes around 60% of agricultural GDP. Recurrent droughts, rangeland degradation, market disruptions, and protracted conflict have progressively eroded pastoral resilience, leading to livestock losses, distress sales, food insecurity, and heightened competition over natural resources. While Sudan has established social protection mechanisms (e.g., the Zakat Fund and donor-supported cash transfers), coverage of climate-related livelihood risks remains limited, particularly for mobile pastoralists. Index-Based Livestock Insurance (IBLI) was selected as a complementary, market-linked risk-financing solution capable of delivering timely, objective payouts during droughts without the delays and costs associated with individual loss assessments. Drawing on more than a decade of operational and research experience from Kenya and Ethiopia, the Sudan IBLI pilot sought to adapt this model to a fragile, conflict-affected context under Sharia-compliant (takaful) insurance regulations. The intervention was intentionally designed around three interlinked feasibility pillars: **socio-economic, technical,** and **operational,** to ensure that the product was not only technically sound, but also socially relevant and institutionally deliverable.

A multi-phase feasibility process (2021–2022) assessed demand, affordability, delivery readiness, and index reliability. Socio-economic analysis confirmed livestock as the primary household asset and identified limited prior exposure to formal insurance products, with no previous implementation of Index-Based Livestock Insurance (IBLI) in Sudan. Awareness and understanding of insurance were generally low and shaped primarily by informal risk-sharing arrangements, humanitarian assistance, and familiarity with Sharia-compliant (takaful) principles rather than commercial insurance. Formal financial inclusion remains low (12–13%), though mobile phone penetration exceeding 70% highlighted potential for digital delivery.

Vulnerabilities were found to vary by **gender, age, ethnicity, and mobility patterns.** Women, particularly those managing small ruminants, face structural barriers to finance and decision-making; youth experience high unemployment but show greater openness to digital services; and ethnic and clan affiliations influence migration routes, access to grazing, trust in institutions, and exposure to conflict-related risks. These dynamics have direct implications for equitable targeting, subsidy design, and delivery mechanisms.

Technical Feasibility

Technical analysis established that approximately 38% of Sudan's land area is dominated by rangelands with clear wet and dry seasonality and normalized difference vegetation index (NDVI) signals that reliably proxy forage availability. Historical back-testing demonstrated that the index would have triggered significant payouts during major drought years (e.g., 2002, 2004, 2011, 2015), validating the robustness of the model. Three implementation scenarios were assessed: **retail with subsidies, social protection integration, and a hybrid public–private partnership (PPP).** The hybrid model was selected because it best balances immediate affordability constraints and humanitarian realities with longer-term market sustainability, enabling donor- and government-funded subsidies for vulnerable households while simultaneously testing private-sector underwriting, distribution, and claims infrastructure essential for scale.

Socio-Economic Feasibility

Following suspension due to the April 2023 conflict, the pilot was adaptively relocated from Greater Darfur and Kordofan to Al Gadarif and Kassala states. The IBLI product insured camels, cattle, sheep, and goats against drought using a PZCumNDVI index with a 20th percentile trigger and 1st percentile exit. Premiums were set at 12.6% of the insured value and fully subsidized for the pilot year.

A total of 762 households enrolled (25% women), covering 1,237 Tropical Livestock Units (TLUs) with a combined sum insured of approximately USD 169,000. Outreach and enrolment were implemented through community-based sensitisation and insurance literacy activities, led jointly by Shiekan Insurance, the Range and Pasture Directorate, Ebdaa Bank, and local leaders. These activities included group awareness sessions, targeted engagement with women pastoralists, and one-on-one registration support explaining how index

insurance works, how triggers are determined, and how payouts would be made. While insurance literacy was introductory in nature, it was sufficient to enable informed participation in a fully subsidized pilot.

Although no payouts were triggered due to favourable forage conditions in 2024, the dry run validated payout readiness. Payouts were designed to be made directly to individual policyholders through regulated financial channels (bank-based or mobile-enabled payment mechanisms where available), following index verification and regulatory approval. Internal system tests confirmed beneficiary records, payment workflows, and reconciliation processes, ensuring operational preparedness for future drought-triggered payouts.

The pilot demonstrated strong technical performance of the index, effective inter-institutional collaboration, and operational flexibility under rapidly changing security conditions. Community awareness campaigns achieved meaningful uptake despite limited prior exposure to insurance.

Macroeconomic instability and inflation reduced the number of animals that could be insured within fixed subsidy budgets. Insurance literacy gaps limited digital payment penetration in rural areas, and the constraints of operating in conflict-affected settings slowed trust-building and scalability. Gender-intentional design was present but requires deeper integration across product design and delivery.

The pilot confirms that IBLI is technically feasible, socially relevant, and operationally viable in Sudan when delivered through a hybrid PPP model. Scaling will require phased expansion, blended financing, stronger institutional capacity, and integration with resilience-building services. This is particularly important in the current aid environment, which is characterized by shrinking humanitarian and development financing, heightened global competition for donor resources, and significant reprogramming of assistance to Sudan since 2023, increasing the need for cost-effective, shock-responsive instruments.

Recommendation by stakeholder group:

- **Insurance Companies (e.g., Shiekan):** Invest in actuarial and index-insurance capacity, strengthen digital enrolment and payout systems, and progressively phase out partial premium contributions among better-off pastoralists as trust and willingness to pay increase.
- **Telecoms and Financial Service Providers:** Expand mobile money coverage and agent networks in pastoral areas to reduce transaction costs and enable remote premium payments and payouts.
- **Government Agencies (Insurance Regulator, Ministry of Animal Resources, Social Protection Institutions):** Clarify and streamline approval pathways for Sharia-compliant index insurance, embed IBLI within national disaster risk financing and social protection strategies, and support transparent targeting mechanisms to avoid local tensions.
- **Humanitarian and Development Actors:** Use IBLI as a bridge between emergency response and long-term resilience by financing premium subsidies in high-risk areas, bundling insurance with animal health, feed support, and climate advisory services, and aligning IBLI with existing safety net programs (e.g., Zakat Fund, cash transfers).
- **Donors and Development Finance Institutions:** Support a multi-year subsidy glide path, invest in continued index calibration and ground-truthing, and fund learning on gender, youth, and peacebuilding outcomes. Scenario-based financing (e.g., scaling to specific UAIs with defined beneficiary numbers and subsidy requirements) should guide investment decisions.

Building on the feasibility study and pilot experience, immediate priorities include consolidating operations in Al Gadarif and Kassala while preparing for cautious expansion to additional eastern and central pastoral zones as security allows. Key risks to scale include macroeconomic instability, conflict-related access constraints, misuse of subsidies, and the potential exploitation of insurance payouts by armed actors. To mitigate these risks, future phases should apply strict beneficiary verification, community-based oversight, transparent communication around payouts, and routing of payments through regulated financial channels rather than cash. Close coordination with humanitarian actors and local governance structures will be essential to monitor misuse, reduce the risk of coercion or diversion, and ensure that IBLI remains a protective, resilience-building instrument in conflict-affected settings.

1.0 Introduction

1.1 Background

This is a report for the project entitled, *Feasibility Study with Dry-Run and Pilot of Index-Based Livestock Insurance (IBLI) for Pastoralists in Sudan*[1], conducted by the International Livestock Research Institute (ILRI) and the Sustainable Agriculture Foundation Africa (SAF-A, formerly Syngenta Foundation East Africa) and supported by the Arab Gulf Programme for Development (AGFUND) and Swiss Capacity Building Facility (SCBF).

The Index-Based Livestock Insurance (IBLI) pilot in Sudan was conceived as an innovative, market-linked financial safety net to protect pastoralists from the devastating impacts of drought. Implemented between 2021 and 2024 by the International Livestock Research Institute (ILRI) and the Sustainable Agriculture Foundation Africa (SAF-A), in partnership with Shiekan Insurance Company and local financial institutions, the project demonstrated technical feasibility, operational adaptability under rapidly changing conditions, and the importance of deep community engagement in fragile environments.

Pastoral systems in Sudan underpin the livelihoods of an estimated 8.1 million people and contribute around 60% of agricultural GDP. Livestock production remains a cornerstone of the national economy and a critical source of income, food, and cultural identity for pastoral households. Yet, recurrent droughts, environmental degradation, and protracted conflict have steadily eroded pastoral resilience, leading to significant livestock losses, reduced incomes, and heightened food insecurity. Drawing on lessons from Kenya and Ethiopia, the Sudan pilot aimed to tailor a drought risk-financing solution to the country's unique socio-political and ecological realities, using satellite-derived NDVI (Normalized Difference Vegetation Index) as a proxy for forage availability and as the basis for timely, objective payouts.

In a conflict-affected environment such as Sudan, the challenges and needs of pastoralists are inseparably linked to the strength and capacity of institutions. Conflict disrupts seasonal livestock mobility, limits access to markets and grazing lands and constrains the delivery of essential services such as veterinary care and water provision. At the same time, it undermines the operational capacity of both public and private institutions to manage insurance schemes, process claims, and coordinate broader drought response measures. The IBLI pilot therefore had to address two intertwined priorities: delivering risk transfer tools to vulnerable communities and simultaneously strengthening institutional resilience to operate effectively in volatile conditions.

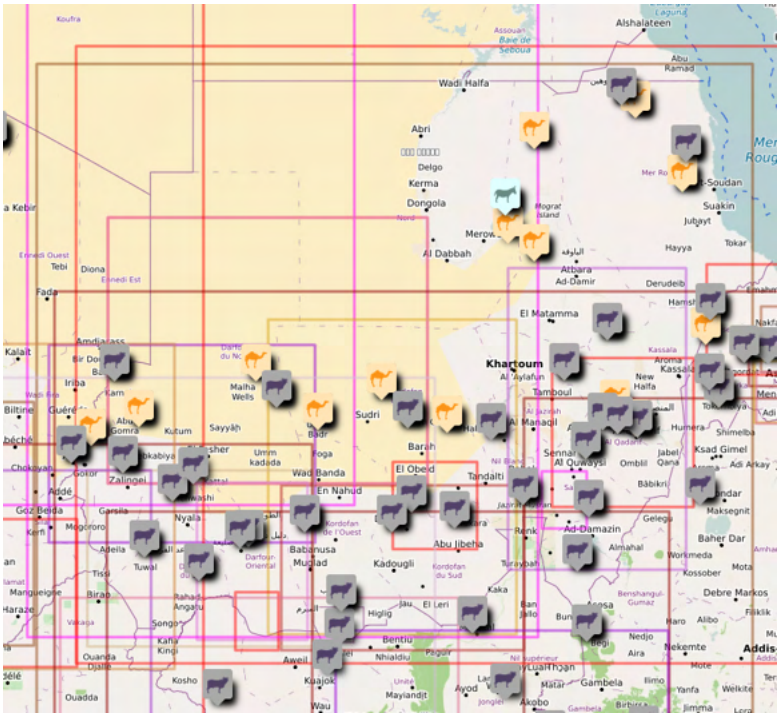


Figure 1: Map of Pastoralist and the different Migration routes in Sudan [2]

[1] SCBF and AGFUND project FSW-21

[2] View the interactive map via the live link: https://livestockdata.org/resources/pastoralist-map

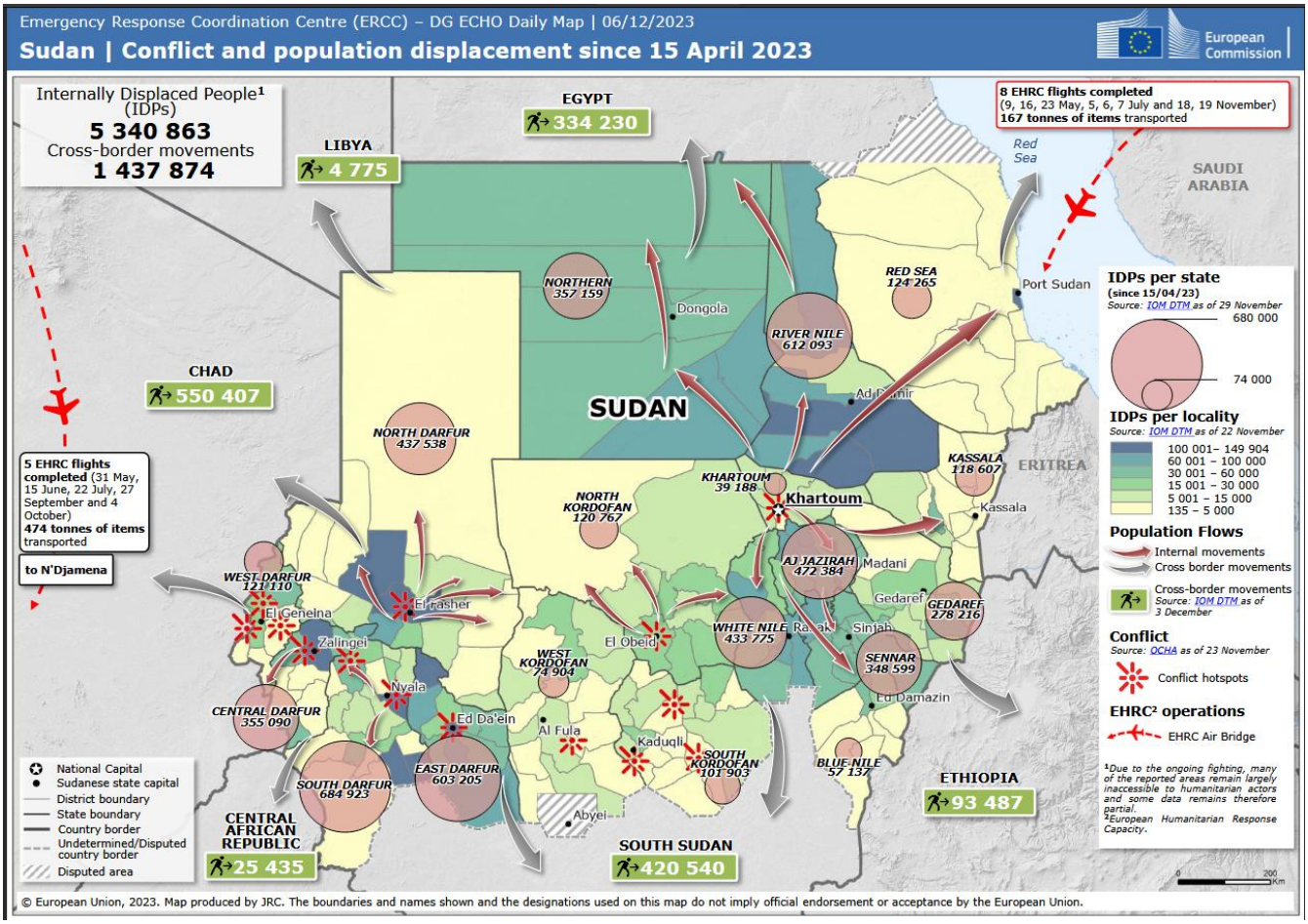


Figure 2: Sudan Conflict and Population Displacement[3]

The linkages between development, food security, and inclusive finance are particularly pronounced in Sudan's pastoral areas. Livelihood security in these systems depends on reliable access to markets, productive services, and natural resources, all of which are increasingly threatened by climate variability and conflict. Financial tools such as IBLI are not merely insurance products; they have the potential of being enablers of broader development outcomes. As a possible safety net during drought, evidence from Kenya and Ethiopia[4] shows that IBLI has led to the reduction in downsize risk, stabilizing household incomes, reduction in distress sales of productive assets, and encourage investment in improved production practices. In doing so, IBLI has the potential to strengthen food security, support inclusive financial participation for both men and women, and for long-term rural resilience.

1.1.1 Socio-Economic Assessment

The socio-economic assessment conducted during Stage 1 examined the livelihood characteristics, vulnerability patterns, and risk management strategies of pastoral households in the proposed pilot areas. Findings confirmed a high reliance on livestock as the primary productive asset, limited livelihood diversification, and strong exposure to climatic shocks, particularly drought. Household vulnerability was shaped by multiple intersecting factors, including gender, age, ethnicity, and mobility patterns, which influenced access to grazing resources, markets, and social support systems.

[3] https://reliefweb.int/map/sudan/sudan-conflict-and-population-displacement-15-april-2023-dg-echo-daily-map-06122023
[4] Sustainable Agriculture Foundation Africa, Final Report FSW-22, 2021; Jensen et al., 2017; Janzen & Carter, 2019

The Republic of the Sudan occupies a land area of 1,886,068 km2 making it the third-largest country in the continent. The country has an estimated population of 44.91 million of which about 65% live rurally, (UNDP, 2019a). Sudan's population is characterized by a high annual population growth rate of about 2.4% (2021 estimates). At this rate, the population is expected to double in the next three decades. Of the total population, 12.9% are unemployed, with youth unemployment at 26.7%. Out of the total employed, 40%[5] are considered vulnerable. There is an even population distribution, resulting from migration of labourers and internally displaced persons and this has led to varied population density between states, with the State of Khartoum being the most densely populated state-about 15 times the national average.

Sudan's economic potency in Eastern Africa is undisputed. The country is rich in fertile land and livestock, has a reasonable manufacturing base, large oil reserves, and a strategic market location at the intersection of sub-Saharan Africa and the Middle East (Babikir et al. 2015). However, Sudan's economic performance has been on the downturn in recent years – a trend attributed to long-lasting conflict and governance challenges. According to FAO (2020), the country has been facing macro- economic challenges since the secession of South Sudan in 2011. The biggest loss was in oil revenue that accounted for more than half of Sudan's government revenue and 95% of its exports. Consequently, the gross domestic product (GDP) fell by about 48% between 2010 and 2019. Sudan ranks 168th out of 189 countries in the Human Development Index, (DIRISHA feasibility forthcoming). The situation became grimmer in late 2017 following a sharp devaluation of the currency (SDG), as the lifting of international economic sanctions led to an increase in demand for imports, and consequently for US dollars. This resulted in high inflation rates-particularly an increase in prices of imported goods. The inflation rate rose from 13% in 2010 to about 51% in 2019, a stark contrast to the falling inflation rates in the 1990s. The reduced economic growth, and the resultant double-digit consumer price inflation, together with increased fuel prices, triggered violent protests in September 2013.

Food insecurity continues to pose a serious threat to the Sudan population. FAOSTAT (2018) puts the three-year average (2017-2019) of the malnourished population at 5.2 million representing a prevalence of 12.1%. Sudan is currently experiencing the world's largest humanitarian crisis, with an estimated 30.4 million people—approximately 64% of the population—requiring humanitarian assistance, including over 15 million children and widespread displacement affecting pastoralist communities[6].

1.1.1.1 Pastoral Livelihoods, economic importance of agriculture

Agriculture is a significant pillar in the economy of Sudan, accounting for about 43 percent of its labour force (ILO estimates of 2019) and contributes to about 30 percent of its GDP (World Bank). As one of the leading economic sectors in the country, the agriculture sector provides a significant share of the non-oil export earnings and household incomes. The loss of a major part of the national oil revenue in the wake of the secession of South Sudan prompted the government to support this sector more actively.

In addition to climatic shocks, **armed conflict represents a major risk to pastoral livelihoods** in the study areas. Conflict has disrupted traditional migration routes, restricted access to dry season grazing and water points, and increased competition over natural resources. These dynamics exacerbate livestock losses during drought periods and undermine customary risk-sharing mechanisms. Conflict-related displacement also affects herd composition, mobility patterns, and market access, with direct implications for both the accuracy of index measurements and the feasibility of insurance delivery. Any IBLI design in Sudan must therefore account for the interaction between climatic and conflict-related risks, including their effects on pastoral movement, grazing access, and household vulnerability.

Most of the Sudanese population depend on traditional rainfed agriculture-which covers an estimated 9 million hectares in area and semi-mechanized rainfed agriculture-on an estimated 6.7 million hectares. The latter produces about 45 percent of the country's requirements, (FAO, 2020). Despite being an important contributor

[5] https://data.worldbank.org/indicator/SL.EMP.VULN.ZS?locations=SD

[6] United Nations Office for the Coordination of Humanitarian Affairs (OCHA). 2025. *Sudan Humanitarian Needs and Response Plan 2025*.

to the economy, the sector remains highly vulnerable to natural shocks which exposes the predominant rainfed production system to risk.

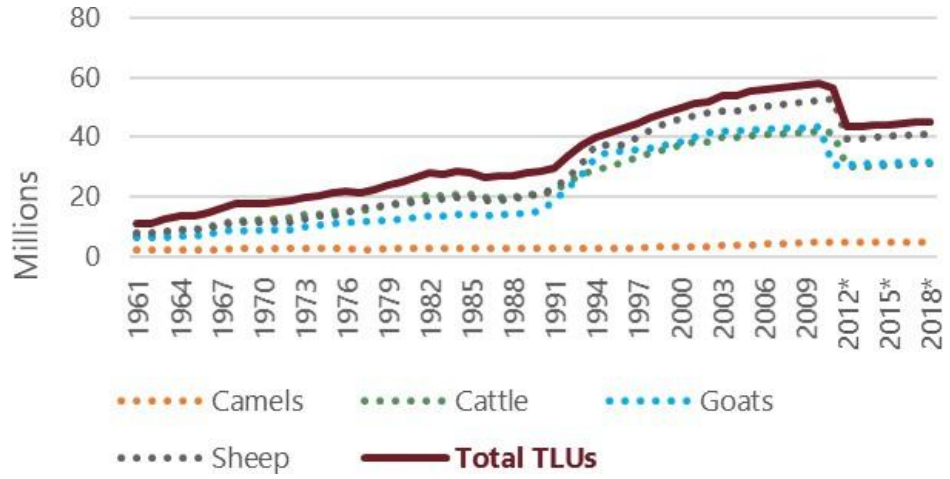
The livestock subsector plays a significant role in achieving food security and sustaining livelihoods (ICPAC and WFP 2018). Its contribution to the agricultural GDP and overall GDP is 60 percent and 21 percent respectively, (UNECA, 2017). According to UNECA (2017), there were about 8.1 million pastoralists out of a population of 40.9 million in mid-2015. In 2019, the livestock population was estimated at about 109 million heads, comprising about 31 million cattle, 40 million sheep, 32 million goats and 4.9 million camels (**Error! Reference source not found.**).

Table 1: The Sudan – Production and exports of live animals and meat in 2019 Reared Livestock Exports

Livestock Type	*Quantity ('000 heads)*	*Quantity ('000 heads)*	*Value ('000 USD)*
Cattle	31,489	65	*53,483*
Sheep	40,896	2,855	*373,496*
Goats	32,032	112	*11,986*
Camels	4,895	90	*119,439*
Meat(tonnes)			*36,219*
Total	*109,312*	*3,122*	*594,623*

Source: Central Bank of Sudan (CBOS) & Ministry of Animal Resources and Fisheries (MoARF)

Figure 3: Number of major livestock species in Sudan since 1961



Source: FAOSTAT 2020

Livestock is reared in almost all parts of the country. Livestock production systems in Sudan are either pure pastoralism or combined livestock and crop production systems. The majority of agriculture producers pursue traditional farming systems (defined by small scale farmers pursuing subsistence crop production) or livestock production or a combination of these two in areas of moderately sufficient rainfall. Pastoralism is mostly pursued by semi-nomadic households that spend the rainy season in northern semi-arid regions and the dry season in the southern savannah areas. Agro-pastoralism is a variation in which households also grow crops, but where livestock production remains the main livelihood and source of food (Babikir et al. 2015).

Given that the livestock depends mostly on natural rangelands, pastoralists efficiently use natural resources, moving their herds around the country in response to weather conditions and availability of forage. However, the rise of mechanized farming in Sudan has led to loss of rangelands and consequently loss of livelihoods.

Moreover, some of the states in Sudan have higher animal density than others. As they move for pasture and water, this leads to incidents of conflicts between farmers and the herders, due to occasional encroachments of farming areas.

1.1.1.2 Droughts

Natural disasters such as droughts, floods, pests, and locust attacks continue to plague Sudan, with drought being the main catastrophe for rural livelihoods. The impact of drought differs by geography. It is widespread in the western region, moderate in eastern and less severe in central. Sudan experienced a severe famine in 1984/85, while more localized droughts are reported to have occurred in 1989/90, 1997, 2000, 2003, 2008, 2009, 2011, and 2017 (National Council for Combating Desertification 2018). There were successive years of drought in certain states of the country from 1985 to 1993 that caused severe shortage of food and population displacement, which in turn led to tribal conflicts, and nutritional deficiencies.

Specifically, the drought of 1984 led to 8.5 million human deaths and an estimated 7.8 million livestock losses. Other droughts occurred in 1997, 2000, and 2011 with varying impact. When pastoral livelihoods are threatened by climatic shocks, pastoralists resort to migrating further in search of water and pastures as a coping strategy, (ICPAC and WFP 2018). Following the Sahelian drought of the 1970s, Sudanese pastoralists migrated to Central African Republic in search of water and pastures. The situation worsened in subsequent years of drought. Other key coping strategies include diversifying livestock herds and the use of savings.

1.1.1.3 Social Protection and Financial Inclusion

In the aftermath of President Omar al-Bashir's regime in April 2019, the new interim administration recognized more than ever that social protection is a key priority in uplifting the living conditions of the Sudanese people. The government's social welfare agenda since then has been anchored on four pillars: education, health care, housing, and social insurance. Although there has been this renewed effort in social protection, state-provide social protection is not entirely new in Sudan, (Machado, 2020).

Sudan's Ministry of Labour and Social Development (MoLSD) is the main institution responsible for social protection programmes in Sudan that oversees programmes such as:

i) Commission on Social Safety and Poverty Reduction (CSSPR) that was established in 2018 and is responsible for implementing government flagship initiatives – Shamel[7] and cash transfers with support from the World Bank and UNICEF.

ii) The Zakat Fund-Established and organized by the state. It is the most established and far-reaching source of social protection avenue, which had a coverage of up to 3.7 million families by 2018, registering an increase in coverage of about 48 percent. Additionally, direct support to poor households amounted to USD 9,003,373. Being one of the pillars of Islam, it provides unconditional cash transfers, health insurance for the poor, programmes supporting livelihoods – through transfer of assets and agricultural inputs such as goats and seeds, micro-finance loans and assistance during the period of Ramadhan.

iii) The National Health Insurance Fund (NHIF) established in 1994 is the main health insurance provider. In 1996 membership was made compulsory and in 2008, the state started to include the poor and vulnerable.

iv) The National Pension and Social Insurance Fund provides pensions and social insurance to the government, private and public sectors.

While national social protection programmes such as the Shamel Programme and Zakat Fund provide cash assistance to vulnerable populations, publicly available data does not disaggregate coverage by livelihood type, including pastoralists. Evidence from the IBLI feasibility assessment and pilot implementation indicates that pastoralist households remain largely underserved by formal financial protection systems due to

[7] The Shamel Programme is a national social protection initiative led by Sudan's Ministry of Social Development, designed to provide cash transfers and safety net support to vulnerable households.

geographic remoteness, mobility patterns, and limited access to financial services. The IBLI pilot specifically targeted previously uninsured pastoralist households, enrolling 762 pastoralists and covering 2,711.5 Tropical Livestock Units, demonstrating the significant protection gap in existing national programmes.

Safety nets in Sudan have often scaled up their initiatives during emergencies. For instance, the drought of 2011 saw safety nets scale up to mitigate its impact on poor and vulnerable households. To complement these initiatives, international organizations step in during emergencies. The United Nations and other international NGOs have been providing support towards food security and the agricultural sector. For instance, between 2012 and 2013, the World Food Programme (WFP) provided about USD 260.2 million in the form of food and USD 54 million in form of cash transfers to 7.9 million beneficiaries, (Annika Kjellgren et al, 2014). In October and December 2020, WFP partnered with USAID's Bureau for Humanitarian Assistance to provide 79,000 metric tons (MT) of food assistance and USD10 million in cash transfers to more than 2.6 million internally displaced persons (IDPs) and conflict-affected people especially in Darfur and state-controlled Blue Nile and South Kordofan.

Despite the existence of social protection mechanisms such as the Zakat Fund[8] and donor-supported cash transfer schemes, coverage for climate-related livelihood risks remains limited. This gap leaves pastoralists highly exposed to income shocks and distress sales of assets during drought. Gender and youth dynamics further shape vulnerability: women are critical actors in small ruminant production and local trade but face barriers to finance and decision-making, while youth are disproportionately affected by unemployment yet present an opportunity for digital service adoption.

Financial inclusion in pastoral areas is low. Only 12–13% of Sudanese have access to formal banking, yet mobile phone penetration exceeds 70%, offering a platform for digital financial services, including premium payments and insurance payouts. Trust in formal finance is shaped by past experience, Sharia compliance, and product relevance. These factors highlight the importance of designing insurance products that are accessible, culturally appropriate, and integrated into broader resilience strategies.

Findings from the assessment indicate that while pastoralists recognise the potential value of livestock insurance as a risk management tool, willingness and ability to pay actuarially fair premiums remain constrained. Irregular income flows, competing livelihood priorities, and repeated exposure to shocks limit the capacity of households to finance premiums without external support. Willingness to pay was therefore closely linked to the availability of premium subsidies, flexible payment timing aligned with livestock sales cycles, and confidence that the product would respond during severe drought events.

Adoption behaviour was strongly influenced by trust dynamics and prior experiences with formal financial services. Baseline familiarity with insurance, and index-based products in particular, was low. Where insurance had previously been introduced, it was often perceived as short-term or externally driven. These experiences reinforced the importance of sustained engagement, transparent communication on payout rules and basis risk, and the involvement of trusted local institutions to support confidence and uptake.

With respect to distribution and access, the assessment identified multiple viable channels for insurance delivery, including pastoralist associations, community-based organisations, humanitarian partners, MFIs and banks, and, where feasible, digital platforms linked to mobile money. Each channel presents distinct advantages and limitations in terms of reach, cost, and trust, underscoring the need for hybrid delivery approaches that combine technical capacity with strong community-level presence.

[8] Sudan's Zakat Fund, managed by the Ministry of Welfare and Social Security via the semi-autonomous Zakat Chamber, provides a safety net against droughts, disasters, and epidemics; mitigates poverty with cash/in-kind aid; funds projects for the needy; and tackles unemployment through training and small projects. It features extensive infrastructure reaching villages, collecting revenues nationwide for centralized administration and local redistribution.

1.2 Technical Assessment

The technical assessment evaluated whether an NDVI-based Index-Based Livestock Insurance (IBLI) product could reliably capture drought-related forage stress in Sudan's pastoral systems and translate this into objective, timely, and credible insurance payouts. The analysis focused on data availability and accessibility, index construction and validation, product design parameters, and climate risk profiling, drawing on both historical analysis and lessons from comparable IBLI products in East Africa.

1.2.1 Data Availability and Access Context

The feasibility study assessed the availability, quality, and accessibility of biophysical and contextual data required for IBLI product design and implementation. Satellite-derived vegetation indices, particularly the Normalized Difference Vegetation Index (NDVI), were accessed from global, open-access Earth observation platforms, primarily:

- **NASA MODIS (Moderate Resolution Imaging Spectroradiometer)** products, which provide long-term, high-frequency NDVI time series suitable for historical analysis and back-testing; and
- **Copernicus Sentinel-2** imagery, used to complement MODIS data with higher spatial resolution for validation and spatial consistency checks.

Rainfall proxy data were sourced from established global datasets, including:

- **CHIRPS (Climate Hazards Group InfraRed Precipitation with Station data)**, which combines satellite imagery with station observations to generate gridded rainfall estimates; and
- **ERA5 reanalysis data** produced by the European Centre for Medium-Range Weather Forecasts (ECMWF), used to contextualise climatic variability and support drought profiling.

These datasets were broadly accessible to technical partners involved in product development and could be processed without restrictive licensing requirements, enabling consistent analysis across pilot areas.

In contrast, several ground-based and administrative datasets required institutional permissions for access. These included historical meteorological station records held by the Sudan Meteorological Authority, livestock population and production statistics managed by the Ministry of Animal Resources, and selected rangeland and pasture monitoring records maintained by government research institutions. Access to satellite-derived vegetation index (NDVI) data was obtained through publicly available platforms including eMODIS and Copernicus. These datasets are openly accessible, and no significant delays were experienced in obtaining the data for index calibration and monitoring.

1.2.2 Ground-Truthing and Index Validation

Ground-truthing was undertaken to validate the relationship between satellite-derived NDVI signals and observed forage and livestock conditions. Validation methods combined multiple approaches, including:

- **Livestock body condition scoring**, using standardized visual assessment techniques applied to cattle, sheep, goats, and camels.
- **Field observations and forage condition assessments**, documenting pasture availability and qualitative biomass conditions.
- **Structured herder recall surveys**, capturing pastoralist perceptions of forage stress, livestock health, and drought impacts during past seasons.

These data were collected across selected validation sites within the pilot regions. Observed field conditions were then compared with historical NDVI time series to assess alignment between vegetation signals and on-

the-ground realities. The analysis demonstrated a strong positive correlation between NDVI anomalies and reported forage and livestock stress, with correlation coefficients falling within ranges consistent with established IBLI applications in Kenya and Ethiopia. This provided confidence that NDVI was a suitable proxy for drought-related forage losses in the Sudanese context.

Validation sites were selected to represent variation in rangeland ecology, mobility patterns, and administrative boundaries within the pilot areas. Geo-referenced data from these sites ensured coverage across the designated Units Areas of Insurance (UAIs) and supported spatial consistency checks within the index.

1.2.3 Product Design Parameters

The IBLI product was designed around a Pasture Z-Score Cumulative NDVI (PZCumNDVI) index, which measures deviations in seasonal vegetation performance relative to historical baselines. Coverage thresholds were defined using percentile-based triggers rather than absolute NDVI values, allowing the index to adapt to local ecological conditions.

For example, a payout was designed to trigger when the seasonal NDVI index fell below the **20th percentile** of the historical distribution for a given UAI, with full payouts occurring at the **1st percentile** (exit point). This structure ensured that moderate drought conditions resulted in partial payouts, while severe droughts triggered higher compensation.

Payout schedules followed a linear progression between the trigger and exit points, translating index values into proportional payouts based on the sum insured. Insurance units were defined in Tropical Livestock Units (TLUs), enabling standardisation across species while reflecting relative economic value. The choice of UAIs was justified based on a combination of ecological homogeneity, administrative feasibility, and operational logistics, balancing basis risk reduction with manageable implementation costs.

1.2.4 Climate Risk Profiling and Historical Back-Testing

Historical back-testing was conducted to assess how the index would have performed during major drought events affecting Sudan. Simulated payout scenarios were generated for selected drought years, including **1984/85**, **2000**, **2011**, and **2022–23**, demonstrating that the index would have triggered payouts during periods widely recognised as severe forage stress events. These simulations illustrated the potential value of IBLI in smoothing consumption and protecting livestock assets during extreme climatic shocks.

In addition to historical analysis, the assessment considered the implications of climate change for future index reliability. Increasing variability in rainfall patterns and more frequent extreme events may alter vegetation responses, raising risks of index saturation (where NDVI fails to differentiate between very severe events) or false positives/negatives under atypical climatic conditions. These risks highlight the need for periodic index recalibration, continued ground-truthing, and complementary use of additional indicators where feasible.

The technical suitability analysis aimed at evaluating whether the key conditions for designing the IBLI index are met. The design of the IBLI index is optimal when the agroecological characteristics and quality of the satellite signal in depicting forage availability satisfy a certain criterion. In the current IBLI implementation across Africa, three major pre-requisites must be considered, including:

i) *Distinct seasonality with well-defined wet from dry seasons:* This is important for temporal aggregation of NDVI (see Figure 4) which relies on start and end dates for the vegetation growing period. This is also important in the definition of date parameters (i.e. insurance coverage period, sales windows, and payout period) within an insurance policy. In extensive pastoral systems within drylands, areas with limited intra-seasonal variability in NDVI normally correspond to pockets of evergreen forest/vegetation or bare/scarcely vegetated areas which are not suitable for IBLI.

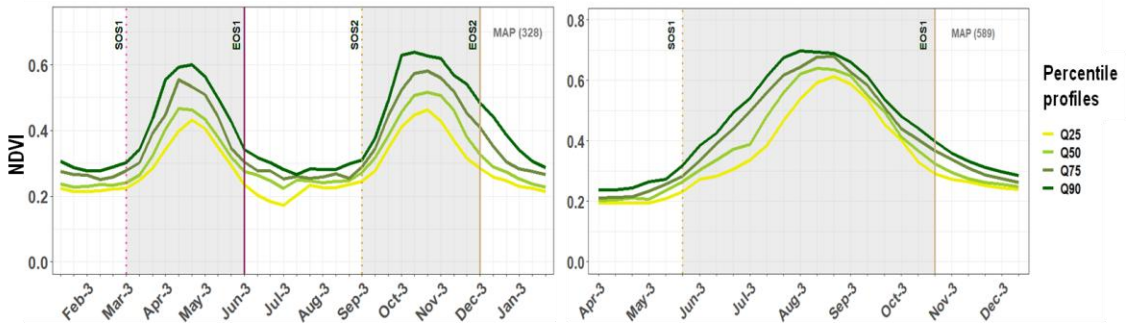
ii) *Sufficient forage production:* in IBLI, NDVI is used as a proxy for forage availability. NDVI detects greenness/vegetation vigour, thus the pastoral grazing areas should meet a minimum level of green

vegetation during the growth period to obtain a meaningful signal for index computation. These are considered as the 'NDVI valid areas' in this document, comprising of land areas within pastoral systems for which vegetation characteristics such as vegetation abundance, and inter annual variability suggest that an NDVI based index- insurance product could be meaningful.

iii) R*angeland dominance:* successful IBLI implementation requires areas with significant forage that can be detected through satellite derived NDVI signal, with minimal influence from other land cover types, e.g. croplands, forests and other land areas that are inaccessible for pastoral foraging. The three requirements were modelled following the procedure documented in Kahiu *et al.* (2021).

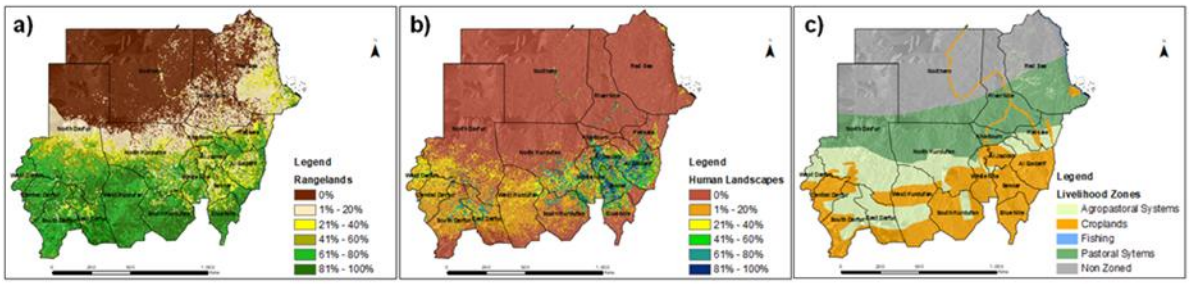
The technical feasibility of IBLI in Sudan was established through extensive rangeland mapping and satellite data analysis. Using Copernicus Land Cover and eMODIS NDVI datasets, it was determined that 38% of Sudan's land area is dominated by rangelands, particularly in the west and south, where NDVI readings reliably reflect forage conditions. These rangelands exhibit clear wet and dry season patterns, making them suitable for defining insurance contract parameters such as coverage periods, trigger points, and payout schedules.

Figure 4: NVDI Profile



The vegetation growing season in the pastoral regions of Sudan spans from March to October and show rather clear and geographically consistent patterns. Vegetation intensity increases with precipitation from a north to south direction across the country as shown by Normalized Difference Vegetation Index (NDVI) monthly averages, (**Error! Reference source not found.** below).

Land use/ cover characteristics



Rangeland **Human landscapes (crop/built-up)** **Livelihood zones**

Figure 5: Land Use Cover Characteristics

Percentage fractional covers for a) rangeland cover comprising grass and herbaceous cover; and b) Built Up and Cropland, together referred as Human Landscapes; and c) Livelihoods classifications adopted from FEWSNET livelihood Zones 2015 simplified from 22 to 4 classes (see Table A1). Source: Author's own

elaboration. Fractional covers are derived from the Copernicus Global Land Service Fractional Covers, i.e. percentage (%) of ground cover centred around year 2019.

Seasonal NDVI profiles showed a strong correlation between vegetation growth and precipitation, with a predictable north–south gradient. This allowed for the delineation of the Unit Areas of Insurance (UAIs) aligned with both ecological and administrative boundaries to ensure index accuracy and operational manageability. Validation exercises confirmed that NDVI could serve as a reliable proxy for forage availability, providing an objective, transparent, and scalable basis for triggering payouts.

The assessment also flagged important ecological and operational risks, including land use change from agricultural expansion, invasive species such as *Prosopis juliflora*, and the impact of recurrent bushfires on rangeland productivity. These factors underline the need for continuous monitoring and the integration of complementary adaptation measures, such as pasture management and resource mapping into the insurance model to sustain its reliability over time.

1.3 Operational Assessment

The operational assessment examined whether Index-Based Livestock Insurance (IBLI) could be delivered effectively and sustainably in Sudan's fragile and conflict-affected context. It builds on lessons from past insurance and risk-financing initiatives in Sudan and the wider region, and focuses on regulatory readiness, institutional capacity, delivery partnerships, and risk management considerations specific to pastoral areas.

1.3.1 Regulatory Readiness

Sudan's insurance sector is regulated by the Insurance Supervisory Authority (ISA), with all insurance products required to undergo an approval process prior to market introduction. While index insurance is not explicitly prohibited under existing regulations, it is also not yet comprehensively codified, meaning that index-based products are reviewed on a case-by-case basis. This creates both flexibility and uncertainty, particularly for innovative products such as IBLI that rely on parametric triggers rather than individual loss assessment.

A critical regulatory consideration was compliance with takaful (Sharia-compliant) insurance principles. Takaful refers to a cooperative risk-sharing arrangement in which participants contribute to a common fund to mutually cover losses, with the operator managing the fund on behalf of participants rather than transferring risk in a conventional commercial manner. In the context of IBLI, takaful compliance requires clear separation of participant risk funds, transparency in pricing and surplus management, and approval from Sharia supervisory boards. The feasibility study confirmed that these requirements can be integrated into IBLI design, but doing so necessitates close engagement with regulators, Sharia scholars, and licensed takaful operators throughout product development and approval.

Overall, the regulatory environment is permissive but capacity constrained. While approval pathways exist, additional guidance on index insurance, streamlined review processes, and continued regulator engagement will be essential to support scale-up beyond pilot phases.

1.3.2 Institutional Capacity Gaps

The feasibility study identified a mixed institutional readiness landscape. Shiekan Insurance, as Sudan's largest national insurer with takaful experience, has the mandate and market presence to underwrite IBLI but faces limitations in actuarial capacity for index products, experience with satellite-based indices, and digital enrolment and payout systems. Targeted technical assistance was therefore required in index calibration, pricing under high inflation, portfolio risk management, and claims automation.

Microfinance institutions (MFIs) and banks, such as Ebdaa Bank, had existing rural outreach but limited experience serving highly mobile pastoralists or delivering insurance-linked products. Their systems were better suited to sedentary clients and require adaptation for flexible identification, mobile payments, and seasonal cash-flow realities.

Pastoralist associations and community-based structures provided trusted entry points for outreach and mobilisation but typically lack formal data systems, insurance literacy tools, and the resources needed for sustained last-mile service delivery. Similarly, public extension and veterinary services were present but unevenly resourced, with constraints in staffing, mobility, and coverage in conflict-affected areas.

Across institutions, priority capacity gaps include: (i) technical training on index insurance and climate risk; (ii) actuarial and data management skills; (iii) digital platforms for enrolment, monitoring, and payouts; (iv) tailored insurance literacy and consumer protection tools; and (v) strengthened last-mile outreach capacity.

1.3.3 Partnership and Delivery Model Options

Given these capacity gaps, IBLI delivery in Sudan will depend on **multi-actor partnerships** rather than a single-channel approach. The feasibility study assessed several delivery models, including insurer-led retail distribution, integration with social protection programs, and hybrid public–private partnerships.

Potential partner clusters include:

- **Insurance and finance partners:** Shiekan Insurance, local banks, and MFIs for underwriting, premium management, and payouts.
- **Development and humanitarian partners:** WFP, IFAD, UNDP, and NGOs such as VSF to support outreach, targeting of vulnerable households, premium subsidies, and integration with resilience programming.
- **Public institutions:** Ministries responsible for animal resources, social protection, and disaster risk management to support alignment with national policies and programs.

Rollout pathways may include bank–insurance partnerships, digital-first enrolment supported by agent networks, and bundled models combining IBLI with animal health services, feed distribution, climate advisory services, or credit. Bundling is particularly relevant in Sudan, where standalone insurance may be less attractive to pastoralists with limited prior exposure to insurance.

The comparative analysis indicated that hybrid delivery models, linking insurers, government institutions, and development partners, are the most viable in Sudan's pastoral regions. These models allow subsidies and outreach support to address affordability and access constraints while maintaining a pathway toward market-based sustainability.

1.3.4 Risk Management in Fragile Contexts

Sudan's operational environment is characterised by political instability, active conflict in parts of the country, weak infrastructure, and constrained state presence in remote pastoral areas. In the pilot regions, these risks manifest through access limitations, population displacement, market disruptions, and heightened security concerns for field operations.

Operational strategies to address these challenges included flexible site selection based on security assessments, reliance on local partners with contextual knowledge, adaptive implementation planning, and coordination with humanitarian actors already operating in high-risk areas.

A key risk in conflict-affected settings is the potential exploitation of IBLI funds by armed actors, either through coercion of policyholders or diversion of payouts. Mitigation measures included transparent beneficiary targeting, community-based verification, clear communication on payout rules, routing payments through regulated financial channels rather than cash, and coordination with local authorities and humanitarian actors to monitor misuse. These safeguards are essential to ensure that IBLI functions as a protective mechanism rather than exacerbating local tensions.

1.4 Feasibility study methodology

The Sudan IBLI initiative was launched in 2021 as part of a broader feasibility study to assess the technical, socio-economic, and operational conditions for introducing index-based livestock insurance in pastoral areas. The project was structured in three stages:

- **Stage 1 – Technical Feasibility:** Mapping rangeland extent, evaluating NDVI reliability, analysing livestock mobility patterns, and reviewing climatic risk profiles to identify suitable unit areas of insurance (UAIs).
- **Stage 2 – Scenario Analysis and Pilot Design:** Assessing alternative implementation models, subsidy structures, and distribution strategies, and engaging stakeholders to validate design parameters.
- **Stage 3 – Pilot Implementation:** Deploying the product in selected sites to test operational systems, build market awareness, and collect performance data for future scale-up.

1.5 Stage 1– Technical Feasibility: Methods and Findings

Stage 1 of the feasibility study focused on assessing the technical, institutional, and contextual viability of introducing Index-Based Livestock Insurance in the proposed pilot areas. A mixed-methods approach was applied, combining desk review, stakeholder consultations, and community-level qualitative research to generate evidence for subsequent scenario analysis and pilot design.

Semi-structured interviews and focus group discussions were conducted with a broad spectrum of stakeholders, including relevant government agencies, insurance providers, development and humanitarian partners, pastoralist associations, and community representatives. These engagements explored perceptions of drought risk, existing coping mechanisms, familiarity with insurance concepts, and potential drivers and barriers to adoption of index-based insurance.

Findings from this stage highlighted a strong recognition of drought as a systemic and recurring risk to pastoral livelihoods, alongside limited access to formal risk transfer mechanisms. While stakeholders expressed interest in insurance as a complementary resilience tool, discussions revealed low baseline awareness of index insurance, concerns around affordability, and sensitivity to trust and credibility of delivery actors. Participants consistently emphasized the need for premium subsidies during early phases, extensive insurance literacy, and involvement of trusted local institutions to support uptake.

Institutionally, the assessment identified both opportunities and gaps. Government actors and development partners demonstrated strong interest in leveraging insurance for resilience-building, while insurers highlighted constraints related to data access, operational reach, and delivery costs in remote and insecure areas. These findings directly informed the identification of feasible delivery models, the emphasis on hybrid public–private partnerships, and the prioritisation of technical assistance needs addressed in later stages of the study.

2.0 Stage 2 – Scenario Analysis and Pilot Design

2.1 Overview and objectives of the scenario analysis

The scenario analysis aims to provide a broad overview of how an IBLI product might work in Sudan, with illustrations of indicative pricing for various options that could be considered for the product, based on willingness to pay and potential subsidy levels. The analysis considered three main product pricing options, customized for Sudan, based on 4, 5 and 7-year drought return periods, representing moderate, severe and very severe droughts respectively as seen in Table 2Table 2. These scenarios build upon the work done in Kenya and Ethiopia where the product is on offer and has been widely tested and validated through in-depth research and quality assessments on operations and design, and a detailed suitability analysis conducted in Somalia. The three costing options were simulated under varying subsidy levels, and two Total Sum Insured (TSI) options.

Table 2: Product costing options based on 4, 5 and 7-year drought return periods.

Description			Rates			Annual TSI Options	
Return Period	Trigger (Index P)	Exit Threshold	PLCR	CL	AP		
7 years (T7)	14th	Min	10.2%	30%	13%	$270	$160
5 years (T5)	20th	Min	12.4%	30%	16%	$270	$160
4 years (T4)	25th	Min	14.3%	30%	19%	$270	$160
Index P - Index Percentiles; PLCR - Pure loss cost rate; AP- Annual Premiums; CL - Commercial Loading; TSI - Total Sum Insured							

The proposed 4, 5 and 7-year drought return costing options are based on drought frequency and severity derived from NDVI used as a proxy for forage availability. The three options are used to define the forage index value below which a payout is activated, known as the trigger threshold. In this context the trigger thresholds are forage index value percentiles of 25th, 20th and 14th for the 4, 5 and 7-year drought return periods, respectively. Conversely, max payout value possible is also derived from the forage index, known as the *exit threshold*. Here the minimum forage index observed in the overall forage index for 2002 to 2021, is used to determine the exit trigger. Using the predefined triggers and the exit thresholds, payouts were determined, allowing the estimation of pure burn rates for an IBLI program in Sudan. These weresimulated for TSIs of USD 270 and 160, Table 2Table 2 (see section 2.3 on basis of valuation).

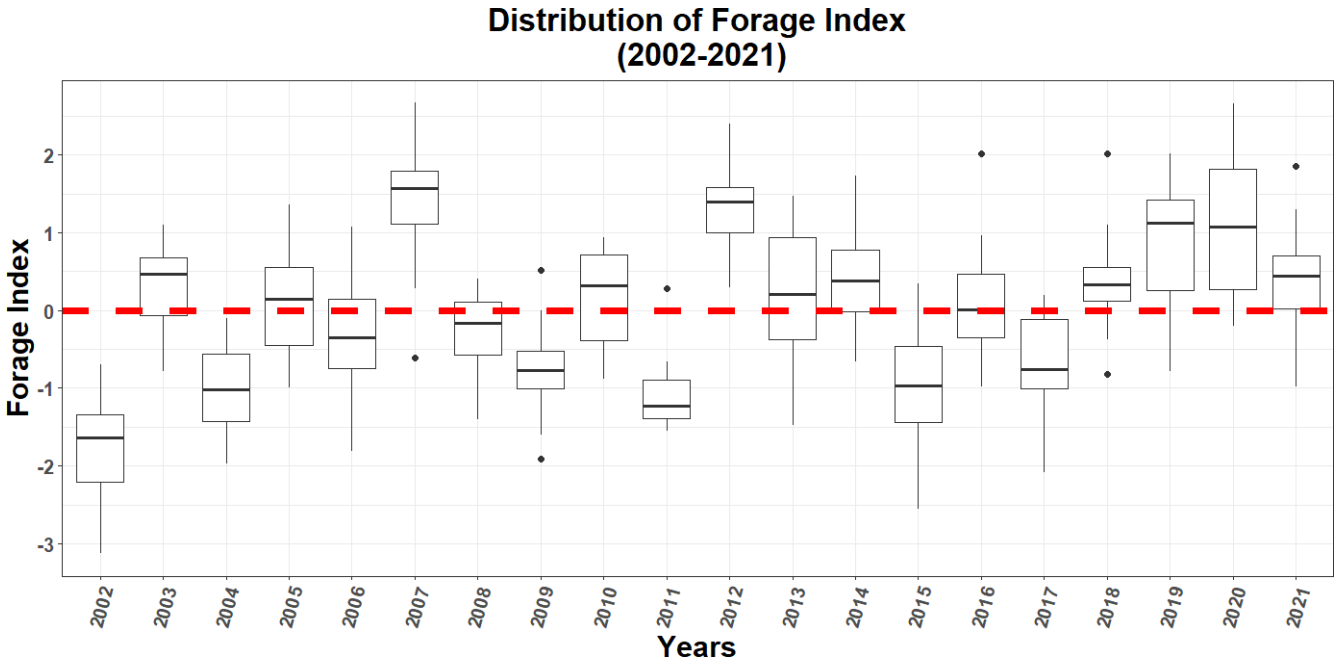
Implementing the variables defined in Table 2 and described above, the aim of the analysis here was to: i) conduct a simulation analysis on historical data to illustrate product performance during drought periods in Sudan pastoral areas and ii) financial analysis under a range of options to illustrate hypothetical costings for IBLI implementation in Sudan, under a subsidized product. The outcome derived from this historical analysis was applied to a hypothetical market under a 30% commercial loading. This value may change in Sudan based oninvestment requirements by underwriters and the private sector to operationalize the IBLI market. The impact of the ongoing political instability in Sudan should also be considered carefully and regular reviews done for matching market inflation and product needs in times of political insecurity. It is noteworthy, that the proposed cost scenarios are indicative and not meant to be recommendations for a specific option nor do they pretend to cover an exhaustive range of drought risk financial solutions, but are used to provide information on possible cost estimates for such products.

2.2 Simulation of historical payouts in Sudan

The pastoral regions of Darfur and Kordofan in Sudan have experienced several droughts according to forage indices computed using IBLI forage index models. The major widespread drought events occurred in the years 2002, 2004, 2009, 2011, 2015 and 2017, Figure 5. The region seems to have drought recurrence every 3-5

years, suggesting below normal cyclic rainfall patterns. This pattern is common in the horn of Africa (HoA), where cyclic below average precipitation seasons are tied to the El Niño Southern Oscillation (ENSO, the La Niña and El Niño phenomena). La Niña often causes hot and dry conditions, resulting in prolonged and recurrent droughts while El Niño induces wetter conditions in the HoA (MacLeod *et al.*, 2021; Nicholson and Kim, 1997; Wang *et al.*, 2017).

Figure 6: Distribution of forage index across the 16 defined unit areas of insurance in the northern part of

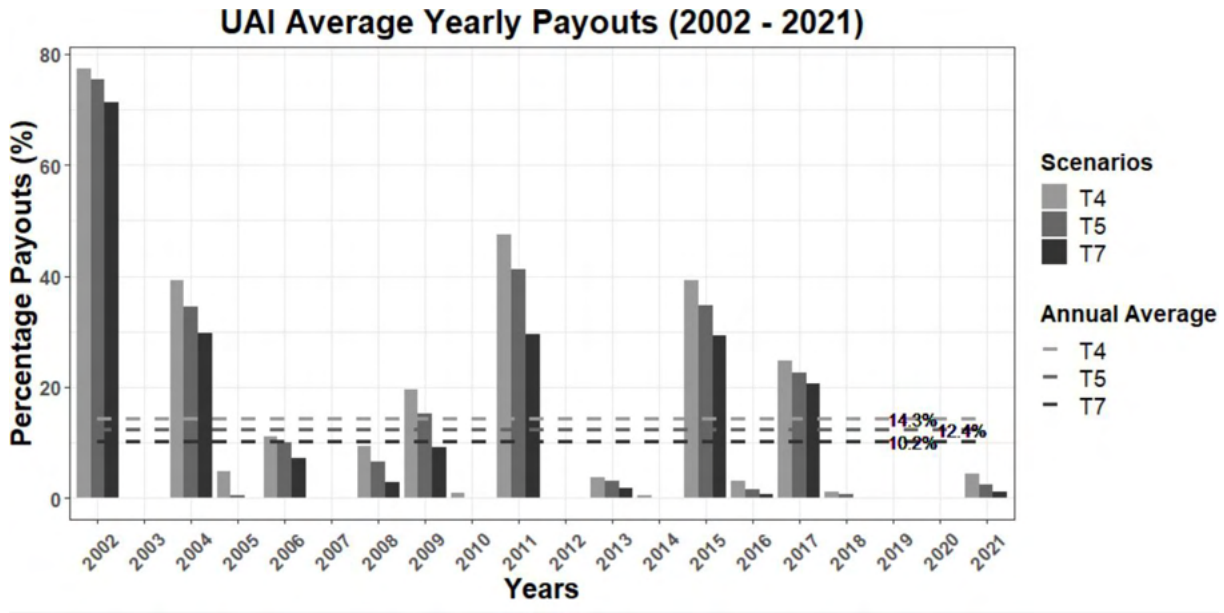


Sudan for years 2002-2021, covering the wet season period observed in the region from July – October.

Across the years, the peaks indicate above average years while troughs show drought years. The median is denoted by the inner horizontal line in the box, while the lower and upper bounds of the box showing 25th and 75th percentiles, respectively.The vertical whiskers show the full range of forage index excluding outliers shown as black points outside the whiskers.

Three historical payout scenarios are demonstrated using the IBLI product model in Sudan over the years 2002 to 2021. To illustrate the implications of increasing the frequency of payouts, scenarios are evaluated based on trigger thresholds set to pay out every 4, 5 and 7-years, hereby referred to as T4, T5 and T7, respectively, Figure 6. After computing T4, T5 and T7, majordrought events, i.e. triggering significant annual payouts (≥ 25%), were evident in the three options. The number of major drought events decreases with the increase in drought return periods, thus T7 had the lowest while T4 had the highest. T7 only captures extremely severe droughts while T4 captures both the moderate to extremely severe drought events. The observed temporal drought patterns based on NDVI computations in Sudan, align with regional/localized reports of drought occurrence in the region.

Figure 7: Historical annual payouts[9] as a percentage of total sum insured in northern parts of Sudan for the epoch July 2002 to October 2021.



Under T4, T5 and T7, the average payouts (i.e. pure burn rate[10]) are 14.3%, 12.4% and 10.2%, respectively. This illustrates that an increase in payout frequency increases the trigger thresholds resulting in significantly higher product costs, Figure 6. A comparison between the three costing options shows that the less frequent payout model (T7), is cheaper but mostly payssignificant amounts during very severe droughts. Conversely, the higher frequency payout model(T4) is more expensive and would still pay higher amounts than T7, but requires much higher premiums, Figure 6. The worst drought years that occurred in 2002, 2004, 2011 and 2015, attracted average annual payouts that ranged from 29% -77% across T4, T5 and T7, Figure 7 . Year 2002 recorded the worst drought, triggering 100% of annual payouts for most of the UAIs in the region. This aligns with the FGDs' feedback that most pastoralists lost a significant number of their livestock during this period. The drought impacts are worsened by the political instability that has affected Sudan for close to half a decade.

Table 3 . Average payouts for the northern pastoral regions of Sudan for the 4, 5 and 7-year drought return periods.

RETURN	UAI ID	STATE	UAI NAME	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
T7 (7-year Return at 14th Percantile Trigger)	1	North Darfur	North Darfur 001	19%	-	100%	-	28%	-	-	-	-	5%	-	-	-	-	-	-	-	-	-	-
	2	North Darfur	North Darfur 002	100%	-	-	-	-	-	-	-	-	15%	-	-	-	77%	-	77%	-	-	-	-
	3	East Darfur	East Darfur 002	100%	-	-	-	-	-	-	-	-	30%	-	-	-	-	-	-	0%	-	-	8%
	4	East Darfur	East Darfur 001	100%	-	-	-	5%	-	5%	-	-	5%	-	-	-	59%	-	-	-	-	-	-

[9] The annual payouts covering the wet season of July to October.
[10] Pure burn rate, also known as a pure premium, is a measure of the average loss per exposure, i.e. the average historical cost of a specified risk, excluding any administrative, fiscal, commercial costs or anticipated profits.

	5	South Darfur	South Darfur 001	48%	-	31%	-	-	-	-	9%	-	-	-	-	-	-	-	100%	-	-	-	-
	6	South Darfur	South Darfur 002	100%	-	21%	-	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	-	-
	7	West Darfur	West Darfur	52%	-	-	-	-	-	-	-	-	68%	-	-	-	-	-	100%	-	-	-	-
	8	South Darfur	South Darfur 003	100%	-	15%	-	-	-	-	-	-	-	-	-	-	47%	-	-	-	-	-	-
	9	Central Darfur	Central Darfur	66%	-	-	-	-	-	-	21%	-	66%	-	-	-	100%	-	-	-	-	-	-
	10	Abyei PCA	Abyei PCA	32%	-	100%	-	82%	-	-	-	-	9%	-	-	-	-	-	-	-	-	-	-
	11	West Kordofan	West Kordofan 001	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	11%	55%	-	-	-	11%
	12	West Kordofan	West Kordofan 002	100%	-	84%	-	-	-	-	-	-	-	-	-	-	37%	-	-	-	-	-	-
	13	South Kordofan	South Kordofan 001	100%	-	-	-	-	-	42%	79%	-	-	-	-	-	-	-	-	-	-	-	-
	14	South Kordofan	South Kordofan 002	100%	-	-	-	-	-	-	38%	-	-	-	27%	-	-	-	-	-	-	-	-
	15	South Kordofan	South Kordofan 003	100%	-	49%	-	-	-	-	-	-	74%	-	-	-	49%	-	-	-	-	-	-
	16	North Kordofan	North Kordofan	24%	-	74%	-	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-
T5 (5-year Return at 20th Percentile Trigger)	1	North Darfur	North Darfur 001	29%	-	100%	-	37%	-	-	-	-	21%	-	-	-	-	-	-	-	-	-	-
	2	North Darfur	North Darfur 002	100%	-	15%	-	-	-	-	-	-	62%	-	-	-	87%	-	87%	-	-	-	-
	3	East Darfur	East Darfur 002	100%	-	-	-	-	-	-	-	-	36%	-	-	-	4%	-	-	10%	-	-	15%
	4	East Darfur	East Darfur 001	100%	-	-	-	5%	-	5%	-	-	5%	-	-	-	61%	-	-	-	-	-	-
	5	South Darfur	South Darfur 001	63%	-	51%	-	-	-	-	40%	-	-	-	-	-	11%	-	100%	-	-	-	-
	6	South Darfur	South Darfur 002	100%	-	23%	-	-	-	-	6%	-	-	-	-	-	100%	-	-	-	-	-	-
	7	West Darfur	West Darfur	58%	-	-	-	20%	-	-	-	-	72%	-	-	-	2%	-	100%	-	-	-	-
	8	South Darfur	South Darfur 003	100%	-	28%	-	-	-	-	-	-	15%	-	-	-	55%	-	15%	-	-	-	-
	9	Central Darfur	Central Darfur	80%	-	-	8%	-	-	-	60%	-	80%	-	-	-	100%	-	-	-	-	-	-
	10	Abyei PCA	Abyei PCA	45%	-	100%	-	85%	-	-	-	-	32%	-	-	-	-	-	-	-	-	-	-
	11	West Kordofan	West Kordofan 001	0%	-	-	-	-	-	-	-	-	100%	-	-	-	-	19%	59%	-	-	-	19%
	12	West Kordofan	West Kordofan 002	100%	-	88%	-	-	-	30%	-	-	15%	-	-	-	52%	-	-	-	-	-	-
	13	South Kordofan	South Kordofan 001	100%	-	-	-	-	-	45%	80%	-	-	-	-	-	-	5%	-	-	-	-	5%
	14	South Kordofan	South Kordofan 002	100%	-	-	-	-	-	26%	58%	-	36%	-	50%	-	-	-	-	-	-	-	-
	15	South	South	100%	-	71%	-	-	-	-	-	-	85%	-	-	-	71%	-	-	-	-	-	-

		Kordofan	Kordofan 003																				
	16	North Kordofan	North Kordofan	34%	-	77%	-	12%	-	-	-	-	100%	-	-	-	12%	-	-	-	-	-	-
T4 (4-year Return at 25th Percentile Trigger)	1	North Darfur	North Darfur 001	31%	-	100%	-	39%	-	-	8%	-	23%	-	-	-	-	-	-	-	-	-	-
	2	North Darfur	North Darfur 002	100%	-	41%	-	-	-	-	-	-	70%	-	-	-	90%	-	90%	-	-	-	-
	3	East Darfur	East Darfur 002	100%	-	-	-	-	-	-	-	-	41%	-	-	-	13%	-	-	17%	-	-	22%
	4	East Darfur	East Darfur 001	100%	-	-	-	10%	-	10%	-	-	10%	-	-	-	63%	-	-	-	-	-	-
	5	South Darfur	South Darfur 001	68%	-	58%	-	-	-	-	49%	-	-	-	-	-	30%	-	100%	-	-	-	-
	6	South Darfur	South Darfur 002	100%	-	29%	-	-	-	-	13%	-	8%	-	-	8%	100%	-	-	-	-	-	-
	7	West Darfur	West Darfur	60%	-	-	-	24%	-	-	-	-	73%	-	-	-	12%	-	100%	-	-	-	-
	8	South Darfur	South Darfur 003	100%	-	36%	-	-	-	-	-	-	25%	-	-	-	60%	-	25%	-	-	-	-
	9	Central Darfur	Central Darfur	85%	-	-	41%	-	-	-	70%	-	85%	-	-	-	100%	-	-	-	-	-	-
	10	Abyei PCA	Abyei PCA	55%	-	100%	-	88%	-	-	24%	-	44%	-	-	-	-	-	10%	-	-	-	-
	11	West Kordofan	West Kordofan 001	0%	-	16%	-	-	-	-	-	16%	100%	-	-	-	-	32%	66%	-	-	-	32%
	12	West Kordofan	West Kordofan 002	100%	-	90%	-	-	-	45%	-	-	37%	-	-	-	63%	-	-	-	-	-	-
	13	South Kordofan	South Kordofan 001	100%	-	-	-	-	-	52%	83%	-	7%	-	-	-	-	16%	-	-	-	-	16%
	14	South Kordofan	South Kordofan 002	100%	-	-	-	-	-	43%	66%	-	49%	-	60%	-	-	-	-	-	-	-	-
	15	South Kordofan	South Kordofan 003	100%	-	77%	35%	-	-	-	-	-	88%	-	-	-	77%	-	5%	-	-	-	-
	16	North Kordofan	North Kordofan	39%	-	79%	-	19%	-	-	-	-	100%	-	-	-	19%	-	-	-	-	-	-

2.3 Costing scenario for drought index insurance for pastoralists in the pastoral areas of Sudan in Darfur and Kordofan regions

Indicative costings for an IBLI product were determined using T4, T5 and T7 drought return costing models (Figure 7: Historical annual payouts as a percentage of total sum insured in northern parts of Sudan for the epoch July 2002 to October 2021.Figure 7) as an indicator for premium and subsidy options available in Sudan. The analysis was done assuming an IBLI-like contract design discussed above to estimate the historical payouts for T4, T5 and T7, under USD 270 and USD 160 TSI, under 25%, 50% and 90% subsidy regimes for varying number of households covered under 5 AUS. Under T4, T5 and T7 assuming an implementation under a soft market operating at 30% commercial loading, the annual premium rates correspond to 19%, 16% and 13% respectively

Table 4. The cost is highest for T4, followed by T5 and least expensive is T7 at USD 51, USD43 andUSD 35 per AU respectively. The prices also increase with an increase in subsidy levels, Table 4. A similar example is demonstrated in Table 5, for a slightly cheaper option after reducing TSI fromUSD 270 to USD 160.

Table 4: Cost of 5 TLUs per household subsidy program under T4, T5 and T7 drought return cost options for a USD 270 TSI.

Description		Rates		APC (100%)		Annual Subsidies (5 TLUS/HH)		
				1 TLU	5 TLUS			
Return Period	Trigger (Index P)	PBR	AP (30% CL)	TSI $270	TSI $270	25%	50%	90%
7 years (T7)	14th	10%	13%	$35	$175	$44	$88	$158
5 years (T5)	20th	12%	16%	$43	$215	$54	$108	$194
4 years (T4)	25th	14%	19%	$51	$255	$64	$128	$230
Index P - Index Percentiles; PBR - Pure Burn Rate; AP- Annual Premiums; APC - Annual Premium Cost; CL - Commercial Loading; TSI - Total Sum Insured				Option	No. Households			
				T7	250	$10,938	$21,875	$39,375
					500	$21,875	$43,750	$78,750
					750	$32,813	$65,625	$118,125
					1,000	$43,750	$87,500	$157,500
				T5	250	$13,438	$26,875	$48,375
					500	$26,875	$53,750	$96,750
					750	$40,313	$80,625	$145,125
					1,000	$53,750	$107,500	$193,500
				T4	250	$15,938	$31,875	$57,375
					500	$31,875	$63,750	$114,750
					750	$47,813	$95,625	$172,125
					1,000	$63,750	$127,500	$229,500

A micro-level commercial insurance program for one year with a target pastoral population of 1,000 households, 5 TLUs/household and 90% subsidy regime for USD 270 TSI, would cost approximately USD 157,500; 193,500 and 229,500 for T7, T5 and T4 costing options, respectively. (Table 4 and Table 5). The cost of a subsidized product decreases with a corresponding decrease in the subsidy level, therefore, it is worth considering the pros and cons of reducing the size of subsidy and increasing the number of covered pastoral population and vice versa, particularly for a population that will be newly introduced to the product.

Table 5: Cost of 5 TLUs per household subsidy program under T4, T5 and T7 drought return cost options for a USD 160 TSI.

Description		Rates		APC (100%)		Annual Subsidies (5 TLUS/HH)		
				1 TLU	5 TLUS			
Return Period	Trigger (Index P)	PBR	AP (30% CL)	TSI $160	TSI $160	25%	50%	90%
7 years (T7)	14th	10%	13%	$21	$105	$26	$53	$95
5 years (T5)	20th	12%	16%	$26	$130	$33	$65	$117
4 years (T4)	25th	14%	19%	$30	$150	$38	$75	$135
Index P - Index Percentiles; PBR - Pure Burn Rate; AP- Annual Premiums; APC - Annual Premium Cost; CL - Commercial Loading; TSI - Total Sum Insured				Option	No. Households			
				T7	250	$6,563	$13,125	$23,625
					500	$13,125	$26,250	$47,250
					750	$19,688	$39,375	$70,875
					1,000	$26,250	$52,500	$94,500
				T5	250	$8,125	$16,250	$29,250
					500	$16,250	$32,500	$58,500
					750	$24,375	$48,750	$87,750
					1,000	$32,500	$65,000	$117,000
				T4	250	$9,375	$18,750	$33,750
					500	$18,750	$37,500	$67,500
					750	$28,125	$56,250	$101,250
					1,000	$37,500	$75,000	$135,000

Three primary models emerged:

I. **Retail Model with Premium Subsidies:** market-driven approach targeting individual pastoralists, with initial high premium subsidies (up to 90%) to encourage uptake and build trust. Over time, subsidies would be gradually reduced as awareness and willingness to pay increase. This model relies on strong private sector involvement and scalable digital payment systems but requires sustained early-stage public or donor investment.

II. **Social Protection Integration Model:** Embedding IBLI into government- or donor-funded safety net programmes, such as the Zakat Fund or WFP-supported cash transfers. In this model, the state or humanitarian actors purchase coverage on behalf of vulnerable households (meso- or macro-level contracts), using payouts to support asset protection or cash transfers during droughts. This approach ensures high coverage among vulnerable groups but may be dependent on political will and external funding stability.

III. **Hybrid Public–Private Partnership (PPP) Model:** Combining retail sales to better-off pastoralists with publicly funded coverage for the most vulnerable. Distribution could be bundled with veterinary services, feed provision, or extension support. This model balances financial sustainability with inclusivity and offers potential for cost-sharing between public, private, and development actors.

The feasibility study considered multiple implementation pathways for IBLI in Sudan, reflecting the country's fragile political economy, diverse pastoral systems, and varying institutional capacities.

Each scenario was evaluated for its operational feasibility in both stable and conflict-affected regions. While the retail model offers long-term market sustainability, the social protection and hybrid models present stronger near-term potential for achieving scale in Sudan's fragile context. The pilot adopted elements of the hybrid approach, leveraging donor-funded subsidies for 100% of premiums in 2024, while testing private sector delivery mechanisms for future scaling.

3.0 Interruption and Resumption

The project advanced through the feasibility stages and was poised for pilot rollout in 2023. A validation workshop was held in February 2023 in Khartoum, bringing together stakeholders to agree on contract terms, premium subsidy recommendations, and rollout strategies. However, the outbreak of armed conflict in April 2023 forced a complete suspension of activities.

- **Geographical Impact:** the original pilot sites in Greater Darfur and Kordofan, selected for their high livestock density and rangeland dominance, became inaccessible due to insecurity.
- **Operational Disruption:** field activities, sales campaigns, and monitoring operations were halted; institutional partners redirected efforts towards emergency humanitarian response.
- **Adaptation Measures:** recognising the need to maintain project momentum, the team identified alternative locations in eastern Sudan – Al Gadarif and Kassala, where security conditions allowed for controlled operations. Climate, rangeland, and market data for these areas were rapidly integrated into the insurance model, and new community mobilisation strategies were deployed.

The resumption of the pilot in 2024 reflected both the resilience of the project partnerships and the adaptability of the IBLI model. While the beneficiary targets had to be scaled down due to inflation, rising Total Livestock Unit (TLU) values, and operational constraints, the reconfigured rollout still enabled the testing of contract performance, beneficiary onboarding processes, and institutional coordination mechanisms under real market conditions.

4.0 Stage 3 – Pilot Implementation

The 2024 IBLI pilot in Sudan represented the first livestock insurance product tailored to the country's pastoral systems. Originally planned for Greater Darfur and Kordofan, the pilot was relocated to Al Gadarif and Kassala

States in eastern Sudan due to security concerns. These states were selected for their accessible pastoral communities, significant livestock populations, and workable institutional partnerships.

4.1 Pilot Sites

- **Al Gadarif State:** Total area 75,263 km², bordering Ethiopia, Gezira, and Sennar. The pilot focused on El Butana locality, which includes the main pastoral areas of Al Edaid Al Twal, Al Gafla, and Moswar Al Sabag.
- **Kassala State:** Total area 52,949 km², bordering Ethiopia and Eritrea. The pilot targeted Aroma and Khashm Al Gerba localities, both with active pastoral activity and strong livestock marketing links.

Selection of pilot sites was informed by a multi-criteria screening framework combining ecological, livelihood, and operational indicators. Ecological suitability was assessed using historical NDVI variability, rainfall proxy data, and rangeland homogeneity to delineate Unit Areas of Insurance (UAIs) that minimize intra-area basis risk. Livestock systems were analysed using Tropical Livestock Unit (TLU) conversions to compare grazing pressure and herd composition across candidate regions, supporting selection of sites with sufficient livestock concentration and exposure to drought risk. Socio-economic relevance was confirmed through baseline assessments indicating high dependence on livestock for income and food security, while operational feasibility was assessed based on partner presence, accessibility, and risk profiling. 'Safe' zones were therefore defined as areas where field operations could be conducted with risk mitigation measures in place, rather than as conflict-free locations.

4.2 Product Description

The Sudan IBLI pilot product was designed as a drought risk management instrument for pastoral households, insuring livestock against forage scarcity using an objective, satellite-based index. The product covered camels, cattle, sheep, and goats, with livestock values standardised using Tropical Livestock Units (TLUs) to ensure comparability across species.

Insurance coverage was defined at the Unit Area of Insurance (UAI) level, reflecting relatively homogeneous rangeland conditions while remaining operationally manageable. The insured peril was drought-induced forage stress, proxied through a Pasture Z-Score Cumulative NDVI (PZCumNDVI) index calibrated separately for each UAI.

4.3 Premium Setting, Enrolment, and Livestock Enumeration

Premiums were calculated as a proportion of the sum insured, reflecting historical drought frequency and severity derived from NDVI back-testing. For the pilot, premiums were set at approximately **12.6% of the insured value** and were fully subsidized through donor support to allow testing of product design and delivery mechanisms without imposing affordability constraints on pastoral households.

Households were enrolled through structured, in-person registration processes led jointly by Shiekan Insurance, Ebdaa Bank, and local government and community representatives. Livestock enumeration was conducted at enrolment using owner self-reporting validated through community verification mechanisms involving pastoralist leaders and extension staff. Species-specific conversion factors were applied to calculate TLUs and determine the sum insured per household.

Fraud and misreporting risks were mitigated through a combination of measures, including caps on insurable livestock numbers per household, cross-checks with community records, random spot verification by field teams, and reliance on area-based index payouts that reduce incentives for individual loss exaggeration.

4.4 Awareness, outreach, and enrolment

Awareness creation and enrolment activities were implemented to address low prior exposure to insurance, limited understanding of index-based products, and trust constraints identified during the socio-economic assessment. Outreach and campaigns were therefore designed as structured insurance education interventions, rather than one-off mobilisation events, to ensure informed participation and realistic expectations regarding payouts.

Awareness and campaign delivery was conducted through a mix of community sensitisation meetings, small-group discussions, and targeted sessions, facilitated by pastoralist leaders, local authorities, extension staff, and humanitarian partners already operating in the pilot areas. Campaigns were sequenced to coincide with seasonal calendars and livestock movement patterns to maximise attendance and relevance. Separate sessions were organised for women pastoralists to address gender-specific barriers, including limited access to information channels and decision-making spaces.

Campaign content was standardised across pilot sites and focused on:

- basic insurance concepts and risk pooling
- differences between indemnity insurance and index-based insurance
- explanation of NDVI, drought triggers, and exit thresholds
- historical drought experiences in the area and how these would have translated into payouts under IBLI
- clarification of non-payout scenarios to manage expectations
- enrolment requirements, policyholder rights, and grievance and feedback mechanisms.

In addition to building understanding of index-based insurance concepts, engagement sessions revealed strong pastoralist interest in complementary services that directly reduce livestock risk, particularly animal health support, feed availability during drought periods, and timely climate information. While these services were not bundled with insurance during the pilot, the feedback highlighted clear opportunities to integrate IBLI with existing resilience interventions in future phases to increase perceived value and uptake.

Delivery methods included facilitated discussions, visual flip charts, scenario-based storytelling using past drought years, and simplified policy summaries translated into local languages. These materials were designed to be accessible to low-literacy audiences and were pre-tested with community representatives.

Household enrolment followed the awareness campaigns and was conducted through in-person registration by trained field teams drawn from Shiekan Insurance, Ebdaa Bank, and government partners. Livestock ownership data were collected through structured self-reporting, supported by community verification involving pastoralist representatives and extension officers. Species-level livestock counts were converted into Tropical Livestock Units (TLUs) to standardise coverage and calculate sums insured.

To reinforce transparency and consumer protection, enrolment teams consistently communicated that payouts would depend on area-level index performance rather than individual livestock losses. Enrolment records were subsequently digitised to enable integration with monitoring systems and to ensure readiness for payout processing should index triggers be met.

4.5 Coverage Levels, Season Monitoring, and Index Tracking

A total of **762 households** (343 in Al Gadarif, 419 in Kassala) enrolled across the selected pilot UAIs. Based on population estimates from local authorities and pastoralist associations, this represents an estimated **10–15% coverage** of pastoral households within the pilot areas, reflecting a deliberate, manageable pilot scale rather

than an attempt at universal coverage and representing 1,237 TLUs. Gender inclusion was prioritised, with **25% of policyholders being women**. Covered livestock included:

- Camels: 43 TLUs
- Cattle: 185 TLUs
- Sheep: 508 TLUs
- Goats: 501 TLUs

Figure 8: Livestock Types Insured per State (2024)

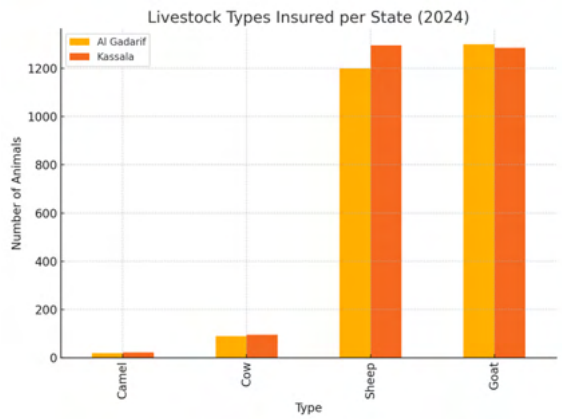
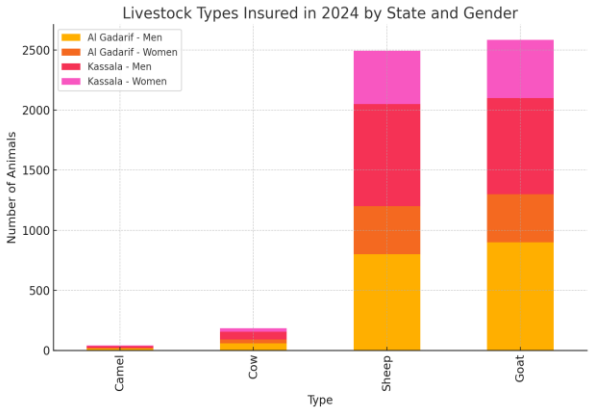


Figure 9: Livestock Types Insured by State & Gender (2024)



Once policies were issued, seasonal monitoring relied on continuous tracking of NDVI data throughout the insured season. NDVI values were processed and compared against historical baselines for each UAI to determine whether index thresholds were approached or breached. Monitoring outputs were shared among technical partners to support transparency and operational preparedness.

Ground observations from herders, extension officers, and local partners were systematically collected through structured field notes and post-season debriefs. While these observations informed validation discussions, payout determinations remained strictly index-based to preserve objectivity and product credibility.

4.6 Payout Parameters, Back-Testing, and Payment Processes

Payouts were contractually linked to index performance rather than individual livestock losses. A payout was triggered when the seasonal PZCumNDVI index fell below the predefined trigger threshold (20th percentile), with payout levels increasing linearly until the exit threshold (1st percentile).

Historical back-testing simulations were conducted using long-term NDVI data to assess how the product would have performed during major drought years, including 1984/85, 2000, 2011, and 2022–23. These simulations demonstrated that the index would have triggered moderate to high payouts during severe drought events, while avoiding payouts in non-drought years. The back-testing simulator applies historical NDVI values to the contract structure to estimate hypothetical payout amounts by season and UAI, providing insight into expected frequency, severity, and timing of payouts.

Based on these simulations, the expected loss ratio for the pilot product was estimated to fall within a technically viable range for index insurance, consistent with the subsidized premium structure used during the pilot phase.

Although no payouts were triggered during the 2024 pilot season due to favourable forage conditions, payout processes were tested through internal simulations. These tests verified beneficiary records, payout calculation logic, approval workflows, and reconciliation procedures. Payouts were designed to be made directly to individual policyholders through regulated financial channels, including bank transfers and mobile-enabled payment mechanisms where available.

4.7 Validation, Feedback, and Performance Metrics

To validate index performance and strengthen trust, the pilot incorporated mechanisms to collect feedback and observational data from pastoralists. Post-season discussions and community meetings were used to compare herders' perceptions of forage conditions with index signals, helping to identify potential basis risk concerns.

While no actual payouts were made, payment delivery mechanisms were reviewed and tested to confirm readiness. These tests focused on verifying account details, ensuring compliance with financial regulations, and confirming that payments could be delivered securely without reliance on cash-based systems.

The pilot defined a set of performance metrics to assess feasibility, including enrolment levels by gender and livestock type, coverage relative to target populations, operational readiness for payouts, and levels of understanding and trust among participating pastoralists. Together, these findings demonstrated that the technical and operational foundations for IBLI delivery in Sudan are viable, while highlighting areas for refinement prior to scale-up.

5.0 Pilot Results and Operational Performance

This section synthesises the empirical findings from the IBLI pilot with analytical reflections drawn from the feasibility study, implementation experience, and stakeholder feedback. It integrates evidence on technical performance, operational delivery, and pastoralist outcomes with interpretation of what these results mean for the viability, scalability, and sustainability of IBLI in Sudan's fragile and conflict-affected context.

The discussion builds on the pilot's objectives—to test the technical soundness of the index, assess institutional and delivery readiness, and understand pastoralist response to index-based insurance—and situates the results within broader lessons from comparable IBLI experiences in the region. Emphasis is placed on identifying what worked, what constrained performance, and what adjustments are required to responsibly scale IBLI, particularly with respect to partnerships, subsidies, inclusion, and risk management.

5.1 What Worked Well

The pilot demonstrated that an NDVI-based index can function as a technically credible instrument for managing drought risk in Sudan's pastoral areas, even within a fragile and conflict-affected operating environment. Continuous access to satellite-derived data allowed for stable monitoring throughout the insured season, and historical back-testing reinforced confidence that the index is well aligned with severe drought events experienced by pastoralists. The use of Unit Areas of Insurance proved effective in balancing ecological relevance with operational practicality, enabling transparent and objective payout determination while keeping delivery manageable.

Operationally, the hybrid delivery model emerged as a key success factor. Combining the technical and underwriting role of the insurer with the convening and facilitative roles of government institutions and humanitarian partners enabled outreach in areas where purely commercial models would have struggled. Engagement of pastoralist associations and local leaders strengthened community trust, supported enrolment, and facilitated verification processes. Importantly, the deliberate integration of insurance literacy into outreach activities helped manage expectations around basis risk and non-payout scenarios, reducing the likelihood of dissatisfaction during the pilot season.

For participating pastoralists, the pilot contributed to increased awareness and understanding of insurance concepts, particularly the logic of index-based products. Transparent communication and the involvement of familiar local actors helped build trust in formal insurance mechanisms, which has historically been low in pastoral settings. Gender-focused outreach sessions further improved the visibility and participation of women pastoralists, marking a positive shift compared to earlier insurance initiatives in similar contexts.

The pilot experience demonstrated that combining insurer-led technical functions with the outreach and facilitation roles of government and humanitarian partners was critical to achieving enrolment and maintaining

trust in a fragile context. This finding directly informed the recommendation to pursue phased scale-up through a structured public–private partnership model rather than standalone commercial expansion.

5.2 Challenges

Despite these achievements, the pilot also highlighted several constraints that must be addressed to support scale-up. From a technical perspective, basis risk remains an inherent challenge, particularly where localised forage conditions diverge from area-level NDVI signals. Limited availability of ground-based validation data further constrained opportunities for more granular calibration of the index. To manage basis risk, community sensitisation meetings and participatory validation sessions were conducted to explain index triggers and gather pastoralist feedback on observed vegetation conditions. Future ground-truthing efforts could include systematic field-based forage assessments, livestock body condition monitoring, and participatory drought monitoring involving pastoralist communities and local range management authorities. These approaches would strengthen alignment between satellite-derived indices and on-the-ground livestock conditions.

Operational challenges were largely shaped by Sudan's broader context of insecurity and mobility. Access constraints disrupted outreach schedules in some locations, while institutional capacity limitations affected digital enrolment and real-time data management. Potential solutions include flexible implementation planning that adapts to security dynamics, deeper reliance on local partners with contextual knowledge, phased digitalisation of enrolment and payout systems, and targeted technical assistance to insurers and financial intermediaries.

Challenges affecting pastoralist outcomes were most evident in managing expectations during non-payout years and addressing affordability concerns in the absence of subsidies. Even with strong literacy efforts, disappointment in non-payout seasons remains a risk for trust and retention. Continued investment in insurance education, transparent communication over multiple seasons, gradual tapering of subsidies, and bundling insurance with tangible services such as animal health support can help mitigate these risks.

Several challenges encountered during implementation—particularly related to data management, digital enrolment, and communication of index mechanics—were linked to institutional capacity constraints rather than product design alone. Addressing these gaps through targeted technical assistance and structured capacity development is therefore essential for sustainable scale-up, as reflected in the recommendations outlined in Section 7.

5.3 Opportunities for Scale and Improvement

The pilot also revealed several opportunities to enhance the relevance, reach, and sustainability of IBLI in Sudan. Bundling insurance with complementary services—such as animal health interventions, feed distribution, or climate advisory services—offers a clear pathway to increase perceived value and uptake among pastoralists. Such integration can also strengthen the resilience impacts of insurance by linking payouts to practical risk-reduction measures.

There are strong opportunities to deepen gender and youth inclusion by tailoring outreach approaches, linking IBLI to women's savings groups and youth livelihood programs, and addressing structural barriers to participation. From a regulatory and policy perspective, engagement with authorities to formalise index insurance guidelines and streamline approval processes could reduce uncertainty and support scale-up.

Advances in technology and data present further opportunities to reduce costs and improve performance. Expanded use of digital enrolment, mobile payment systems, and higher-resolution satellite data can enhance efficiency while reducing basis risk over time. Finally, strengthened partnerships with humanitarian and development actors can support outreach, premium subsidies, and integration of IBLI into broader resilience and social protection programming, positioning insurance as part of a coordinated drought risk management approach rather than a stand-alone intervention.

Opportunities identified through the pilot—including integration with complementary services and more tailored outreach for women and youth—reflect practical pathways to enhance the relevance and impact of IBLI. These opportunities underpin recommendations to move toward bundled and more inclusive delivery models as part of future scale-up.

6.0 Cross-Cutting Lessons and Policy Implications

6.1 Penetration and Reach

In the pilot areas, the estimated pastoral population comprises approximately 5,000–7,500 households, depending on seasonal mobility. Enrolment of 762 households therefore represents an estimated penetration rate of 10–15%, consistent with a deliberately small-scale pilot designed to test feasibility rather than achieve broad coverage.

6.2 Implementation Models

The hybrid delivery model proved most feasible in Sudan's fragile context, balancing affordability and institutional sustainability. Fully commercial insurance would have excluded most pastoralists due to limited ability to pay premiums, while fully subsidized insurance may not be financially sustainable long term. The hybrid model enabled pilot implementation through premium subsidies while building institutional capacity and pastoralist awareness. Future pilots could explore gradual transition models with partial subsidies to assess pastoralist willingness and ability to pay while maintaining inclusion of vulnerable households.

6.3 Lessons on Delivery Models

The pilot demonstrated that strong coordination among insurance providers, financial institutions, government agencies, and community-level actors is essential for successful IBLI implementation. Shiekan Insurance Company served as the insurance underwriter, while Ebdaa Microfinance Bank facilitated beneficiary registration and financial administration. The government Range and Pasture Directorate played a key coordination role by mobilizing pastoralist communities and supporting awareness campaigns.

Community sensitisation meetings were conducted in pastoral areas to explain insurance coverage, enrolment procedures, and payout triggers. These sessions helped address pastoralists' limited familiarity with formal insurance products and built trust in the scheme.

The Range and Pasture Directorate, which maintains regular engagement with pastoral communities, functioned as a trusted intermediary and facilitated communication between project partners and pastoralist households. This coordination mechanism ensured efficient enrolment and reduced implementation risks.

The pilot demonstrated that community-based institutions and government extension structures are critical delivery channels for IBLI, particularly in fragile contexts where formal financial infrastructure is limited.

6.4 Premium Subsidies and Resilience Incentives

Premium subsidies were essential in enabling participation of vulnerable pastoralist households, including women-headed households. During the pilot, premiums were fully subsidized, eliminating financial barriers that would otherwise have prevented participation due to limited liquidity and high economic vulnerability.

Targeted outreach was conducted through awareness campaigns organized by Shiekan Insurance Company, Ebdaa Microfinance Bank, and the government Range and Pasture Directorate. These campaigns included group sensitisation sessions and direct community engagement, ensuring that pastoralist households understood the insurance product and enrolment process. As a result, 762 pastoralists enrolled in the pilot, including approximately 25% women, demonstrating that subsidies enabled inclusion of traditionally underserved groups.

Subsidies were applied uniformly across eligible pastoralist households to ensure fairness and transparency. Beneficiary identification was conducted in coordination with local institutional actors and pastoralist community representatives, helping to ensure equitable participation and mitigate potential social tensions.

For long-term sustainability, continued premium support may be required through blended financing approaches involving government contributions, climate risk financing mechanisms, and development partner support. Over time, gradual introduction of partial premium contributions may be feasible as pastoralist incomes stabilize and confidence in the insurance product strengthens.

Community engagement and transparent enrolment processes were essential in preventing local tensions, ensuring that pastoralists clearly understood eligibility criteria and programme objectives.

6.5 Policy Implications

The pilot demonstrates the need to integrate index-based livestock insurance into Sudan's national climate adaptation and social protection frameworks. Government institutions such as the Ministry of Agriculture and the Range and Pasture Directorate can play a central role in facilitating scale-up through policy support, awareness creation, and integration with existing pastoral support programmes.

Public investment and donor support will remain critical to financing premium subsidies during early scale-up phases, with gradual transition toward blended financing models. Integration of IBLI into national disaster risk financing strategies could reduce reliance on humanitarian assistance by enabling earlier, predictable financial response to drought shocks.

6.6 Gender and Inclusion Dimensions

Gender-intentional product design and outreach contributed to increased participation of women pastoralists. The design process incorporated gender-disaggregated needs assessments conducted during community consultations, through which women pastoralists identified barriers to participation including mobility constraints, caregiving responsibilities, and limited access to information channels typically dominated by men. Based on these findings, outreach strategies were tailored to reach women through trusted, women-centred touchpoints — including women's savings and solidarity groups, female community health workers, and female extension staff from the Ministry of Animal Resources — rather than relying solely on mixed-gender public forums. These approaches should be more explicitly embedded across product design, enrolment, and monitoring processes in future phases, rather than treated as stand-alone activities.

This was a key concern in the pilot program, particularly in Eastern Sudan, where women's participation in public community events is substantially constrained by social and cultural norms. This dynamic was more pronounced in Kassala State than in Al Gadarif State, making responsive, women-specific outreach an operational necessity rather than an optional consideration. To navigate these norms, male community and religious leaders were engaged early in the program as advocates, with facilitated dialogue sessions designed to build their understanding of the benefits of women's participation in the index insurance scheme and to secure their active endorsement of women attending program activities. Personnel from the Ministry of Animal Resources worked alongside Shiekan Insurance staff to conduct gender-separated outreach sessions, allowing women to engage more freely with program information and enrolment processes. This approach proved more effective at facilitating women's participation in Sudan than conventional mixed-audience public events.

Additionally, existing institutional structures within the Pastoral Development Unit of the Ministry of Livestock — which had already established relationships with community leaders and were engaged in activities such as pasture fire management and seed scattering — were leveraged to extend the program's reach to women within pastoral communities. These structures provided a credible, trusted channel through which women could access program information without requiring their attendance at large public gatherings.

Looking ahead, future program design should move beyond gender-responsive outreach as a discrete activity and instead operationalize women's participation systematically across all program components. This means

embedding gender considerations into product design, enrolment workflows, claims processes, and monitoring frameworks from the outset. In pastoral areas where structural and social barriers significantly limit women's presence in public spaces, future design should include concrete mechanisms — such as mobile enrolment units, home visits by female staff, and partnerships with women-led community organizations — to ensure that women's participation is not merely encouraged in principle but made practically achievable.

6.7 Integration with Social Protection and Policy Frameworks

IBLI has potential to complement existing social protection and resilience programs by providing anticipatory support during droughts. Similar approaches have been implemented in countries such as Kenya and Ethiopia, where index insurance has been linked to safety net programs and disaster risk financing mechanisms.

In Sudan, potential entry points include national programs supporting agriculture and pastoralism, climate adaptation strategies, and disaster risk management frameworks. Alignment with these policies could reduce duplication and enhance sustainability.

6.8 Risks and Sustainability Considerations

Key risks identified through the feasibility study and pilot include prolonged conflict and insecurity, funding uncertainty for premium subsidies, operational disruptions due to population mobility, and the potential misuse or diversion of payouts in fragile settings. Addressing these risks requires coordinated action across stakeholders rather than reliance on a single actor.

Mitigation strategies include phased scale-up linked to security assessments, diversified and blended funding sources for premium subsidies, strengthened monitoring and transparency mechanisms, and continued engagement with communities, local authorities, and humanitarian actors to safeguard programme integrity.

6.9 Way Forward and Stakeholder Responsibilities

Building on the pilot findings and lessons, the following priority actions are recommended, with clear identification of lead stakeholders and supporting actors:

- **Government agencies** (lead), in partnership with insurers and development partners, should integrate IBLI into national social protection, disaster risk management, and climate adaptation policies using a public–private partnership approach. This includes alignment with programs supporting agriculture and pastoralism and the establishment of policy frameworks that enable anticipatory drought response.
- **Insurance providers** (lead), with technical support from development partners, should refine product design, recalibrate indices using additional seasons of data, and strengthen operational systems for digital enrolment, monitoring, and payout delivery.
- **Development partners and donors** (lead), in collaboration with government and insurers, should support time-bound premium subsidies, fund technical assistance for capacity building, and invest in data systems, consumer education, and conflict-sensitive monitoring mechanisms.
- **Humanitarian and resilience actors** (supporting role) should facilitate outreach, targeting of vulnerable households, and integration of IBLI with complementary services such as animal health, feed support, and climate advisory services.
- **Pastoralist associations and community institutions** (supporting role) should continue to play a central role in mobilisation, insurance literacy, community verification, and feedback collection to strengthen trust and accountability.

Clear coordination mechanisms and role definitions across these stakeholders will be essential to ensure sustainability, avoid duplication, and enable responsible scale-up of IBLI in Sudan’s fragile and conflict-affected pastoral regions.

7.0 Recommendations

The central recommendation emerging from the feasibility study and pilot is that scaling IBLI in Sudan is viable only through a phased, conflict-sensitive public–private partnership approach, anchored in premium subsidies, inclusive product and delivery design, and sustained capacity development. The pilot demonstrated that purely commercial delivery is not feasible under current conditions, while public or humanitarian-only approaches lack the technical and financial mechanisms required for insurance sustainability. A successful pathway for IBLI in Sudan therefore requires:

i. Structured collaboration between government agencies, insurers, and development partners

ii. A clear conflict-risk management and safeguarding framework embedded throughout implementation

iii. Deliberate inclusion of women and vulnerable households through targeted outreach and subsidy design, and

iv. Long-term investment in institutional and technical capacity to reduce dependency on external support over time.

The recommendations below translate these principles into concrete next steps for scale-up, grounded in the evidence and lessons generated by the pilot.

7.1 Scale-Up Strategy and Scenarios

Building on the pilot experience, scale-up of IBLI should follow a phased and geographically targeted approach, rather than immediate national expansion. A critical first step in this process will be organizing consultative public-private partnership (PPP) workshops involving government institutions, insurance providers, financial institutions, pastoralist representatives, and development partners. These consultations will help ensure alignment on roles and responsibilities, strengthen stakeholder ownership, and support development of a coordinated and comprehensive drought risk-mitigation strategy. Such engagement will also provide an opportunity to integrate IBLI within national climate adaptation, agricultural risk management, and social protection frameworks. In the short term, extension within the existing pilot areas offers the most feasible pathway, allowing the product to benefit from accumulated trust, familiarity, and operational learning.

Expansion to additional pastoral regions—particularly in eastern Sudan—should be pursued incrementally, informed by security assessments, rangeland characteristics, and institutional readiness. Scenario-based planning provides a practical framework for scale-up. A low-scale extension scenario would focus on increasing household coverage within existing Unit Areas of Insurance (UAIs), leveraging established delivery partnerships and refining enrolment, monitoring, and payout processes. This approach minimises operational risk and allows for progressive reduction of basis risk through additional data and seasons of experience.

A broader expansion scenario would involve launching IBLI in new pastoral clusters, requiring higher upfront investment in outreach, insurance literacy, subsidy financing, and institutional coordination, as well as stronger policy alignment and stakeholder engagement. Consultative PPP platforms will be particularly important in facilitating this expansion by strengthening coordination between public and private actors and ensuring sustainable institutional arrangements.

Findings from the pilot underscore that scale-up decisions must account for differences in livestock systems, mobility patterns, and security dynamics across regions. The shift in focus from conflict-affected western regions to eastern Sudan presents both opportunities—such as improved access and institutional presence—and risks related to rangeland pressure and climate variability. These factors should guide prioritisation of next launch areas and the pace of expansion.

7.2 Bundling and Value Enhancement

The pilot demonstrated that insurance uptake and retention are closely linked to perceived value beyond payouts alone. Outreach discussions and implementation experience highlighted strong pastoralist interest in complementary services, particularly animal health support, feed access, and climate advisory information. While bundling was not fully implemented during the pilot, these insights emerged consistently through insurance literacy sessions and community feedback.

Future phases should therefore move toward structured bundling of IBLI with selected resilience-enhancing services. Such integration can increase demand, strengthen impact, and help justify premium subsidies by linking insurance to tangible risk reduction. Importantly, bundling also provides an entry point for humanitarian and development actors to align existing interventions with insurance delivery.

Lead stakeholders: Insurance providers (technical lead); humanitarian and development partners (delivery support); government agencies (policy alignment)

7.3 Institutional Partnerships and Capacity Development

The pilot highlighted both the value and limitations of existing institutional capacity. While government actors, pastoralist associations, and humanitarian partners played a critical role in outreach and trust-building, insurers faced constraints related to data access, index calibration, and last-mile delivery. Capacity development was therefore explored during the pilot through hands-on collaboration, joint monitoring activities, and iterative refinement of operational processes.

Scaling IBLI will require formalising and deepening these partnerships, alongside targeted technical assistance in actuarial analysis, data management, digital systems, and client education. Strengthening institutional capacity is essential not only for operational efficiency but also for long-term sustainability and gradual reduction of subsidy dependence.

Lead stakeholders: Government agencies (coordination lead); insurers (technical implementation); development partners (capacity support)

7.4 Gender Equality and Social Inclusion (GESI) as a core design principle

IBLI design and delivery must be grounded in **gender and youth-sensitive approaches** that recognise differentiated needs across socio-economic groups and agro-ecological zones. For example, women pastoralists may prioritise coverage for small ruminants and seek smaller premium instalments, while youth may be more responsive to mobile-based enrolment and digital advisory services. Integrating GESI into product design enhances uptake, ensures equitable benefit distribution, and addresses systemic exclusion from financial services.

7.5 Agro-ecological and socio-economic customization

Given Sudan's diverse ecological zones and pastoral systems, a **one-size-fits-all insurance contract is insufficient**. Product parameters such as contract periods, UAIs, and forage monitoring baselines should be calibrated to local climate patterns, livestock mobility routes, and market cycles. Socio-economic profiling should inform distribution strategies, ensuring that outreach, pricing, and service bundling reflect the realities of both semi-nomadic and highly mobile pastoralists.

7.6 Embedding IBLI into social protection systems

For sustained impact in conflict-prone areas, IBLI should be integrated into **national and donor-funded social safety nets**, bridging short-term humanitarian relief with long-term resilience frameworks. In this model:

- Humanitarian actors fund **emergency coverage** during active crises, while government social protection programmes maintain **baseline coverage** in normal years.

- Households gradually transition toward **co-financed or self-financed premiums** as livelihoods stabilise; the layered approach allowing for strengthened household resilience, protection of productive assets such as their livestock while supporting national stability objectives.

7.7 Operational Adaptation During Armed Conflict

Experience from the pilot underscores the need for adaptive implementation strategies in active conflict settings. Key lessons include the importance of flexible planning that allows for shifts in outreach locations, reliance on local partners with contextual knowledge, phased implementation linked to security assessments, and contingency arrangements for enrolment and monitoring when access is constrained. Embedding conflict-sensitivity throughout delivery—including beneficiary targeting, payment mechanisms, and community engagement—is essential to safeguarding both participants and programme integrity during scale-up.

8.0 Conclusion

Despite prolonged political instability throughout the project period — culminating in armed conflict that forced a geographic shift from the originally intended areas in South Kordofan, Darfur, and parts of southern and central Sudan toward the relatively accessible eastern states of Al Gadarif and Kassala — the pilot generated important evidence on the adaptability of IBLI under fragile conditions. The earlier field interventions conducted across western, southern, central, and eastern Sudan were not without value; they built the comparative understanding that made geographic reconfiguration possible and informed index calibration across ecologically diverse landscapes.

This experience points to the broader value of investing in community-based assessments across Sudan, particularly to validate and strengthen the historical NDVI database at locality level, refine the clustering of ecologically coherent Unit Areas of Insurance, and identify areas where index insurance would not perform reliably due to weak forage signal, excessive heterogeneity, or structural un-insurability. Such an investment would increase implementation flexibility during periods of insecurity while widening the potential insurance frontier for pastoralists across different parts of the country.

The severe economic disruption caused by the conflict has altered market actors, service channels, and household purchasing conditions, meaning that the pilot alone cannot provide a definitive conclusion on the long-term commercial functionality of the IBLI product or the most efficient distribution modality for Sudan. What can be concluded, however, is that the feasibility and pilot findings offer encouraging early evidence that IBLI is well-suited to the Sudanese pastoral context, and that both demand-side and supply-side actors have demonstrated genuine interest in the product.

For that interest to translate into sustainable scale, significant work remains on institutional technical capacity, product literacy, delivery systems, and digital administration. In this regard, developing the livestock platform demonstrated by Agtuall[11] into a fuller commercial architecture[12] is a reasonable and worthwhile proposition — provided the system is designed not merely as a demonstration interface, but as an operational digital platform linked to a properly structured national livestock insurance map with clustered UAIs, and equipped with functions that allow insurance providers to onboard pastoralists, issue policies, maintain records, and process payouts through regulated channels. Equally important is the development of stronger risk-pooling arrangements for index-based livestock and crop coverage, whether through layered domestic structures or partnerships with willing reinsurers, given the importance of portfolio diversification and reinsurance support in absorbing correlated drought risk.

[11] Transforming Livelihoods: Case Study on Innovative Insurance Solutions for Pastoralists in Sudan agtuall.com/SudanCasestudy. This case study was developed as part of the project by Agtuall in collaboration with Sustainable Agriculture Foundation – Africa (formerly Syngenta Foundation), International Livestock Research Institute (ILRI), Swiss Capability Building Facility (SCBF) and the Arab Gulf Programme for Development (AGFUND).

[12] Climate Analytics for Risk Mitigation Assessment tool developed https://agtuall.com/carma

As a protective financial instrument, IBLI is designed to safeguard pastoralists' productive assets and support livelihood continuity by providing financial relief when forage stress becomes critical — before large-scale livestock mortality occurs. In drought-prone regions such as the Horn of Africa, where fragile livelihoods coexist with recurring climate shocks, inflationary pressure, and institutional weakness, this kind of product can help shift the response paradigm from repeated emergency relief toward more anticipatory risk management. Yet commercialization in such an environment is unlikely to succeed if insurance is offered in isolation. IBLI would be considerably more viable if embedded in or bundled with services that pastoral households already perceive as directly valuable — including bank-linked finance, animal feed, vaccination, veterinary support, and practical advisory services.

The proposed scale-up path should therefore focus not only on expanding insurance coverage, but on strengthening the service architecture through which the product reaches pastoral communities. Given the deterioration of infrastructure and service access across many pastoral areas — even where urban centres such as Al Gadarif and Kassala retain some service concentration — a more decentralized distribution model is essential. This is achievable in Sudan because veterinary service providers and related livestock actors are already distributed across several states and are well-positioned to serve as local host points for bundled IBLI options, as agents for different market providers, as channels for extension and knowledge dissemination, and as operational anchors for the digitized administration of bundled insurance products. If structured within a viable business model, such outlets could also strengthen the connection between supply and demand under disrupted market conditions, generate entrepreneurship opportunities for youth, and contribute to localized economic stabilization — particularly where government agencies, NGOs, insurers, financial institutions, and private sector actors are sufficiently aligned to support a more resilient pastoral economy.

The IBLI pilot in Sudan demonstrates that index-based livestock insurance is both technically feasible and operationally viable, even within fragile and conflict-affected environments. The successful enrolment of 762 pastoralist households confirms strong demand for drought risk protection and validates the hybrid delivery model anchored in institutional partnerships and targeted premium subsidies. Crucially, the pilot has also surfaced the conditions, constraints, and design adaptations necessary for sustainable scale-up — findings that must now be translated into decisive action.

Sudan's pastoralist communities face compounding pressures from climate variability, conflict, and structural poverty. IBLI alone cannot resolve these vulnerabilities, but it represents a proven, scalable mechanism for protecting productive assets, stabilizing livelihoods, and building long-term resilience. The window to act is narrow: without sustained investment and coordinated policy commitment, the institutional momentum and community trust built during the pilot will erode.

Scaling IBLI requires more than replication — it demands a deliberate transition from humanitarian-led delivery to a structured public-private partnership model, embedded within national climate adaptation and social protection frameworks. Achieving this transition depends on the willingness of governments, insurers, development partners, and donors to move from intent to coordinated investment.

8.1 Call to Action

The Sudan IBLI pilot has demonstrated that index-based livestock insurance can work in fragile and conflict-affected settings but only if we are willing to rethink how it is designed, delivered, and sustained. The lessons learned are not a conclusion; they are a foundation. The question now is: what do we build on top of it?

Our call to action to governments, insurers, other development partners, humanitarian actors, and donors including SCBF is to take the following concrete steps:

8.1.1 Invest in the next generation of IBLI — bundled, blended, and context-sensitive.

A standalone insurance product is not enough. Future programming must embed IBLI within broader packages of financial and non-financial services — combining livestock insurance with animal health support, climate advisory services, savings, and credit — designed around the real livelihoods of pastoralists. We invite partners

to co-design and co-finance bundled IBLI models adapted to new markets, including in West Africa and East Africa's fragile corridors.

8.1.2 Extend and deepen the Sudan experience — do not abandon it.

The Sudan pilot was cut short by crisis, not by failure. The investment in trust, institutional relationships, delivery infrastructure, and index calibration represents an asset that should not be written off. We call for renewed commitment to continuing this work in Sudan and to exploring natural extensions into South Sudan, where cross-border pastoral mobility, shared ecological systems, and growing donor interest in livestock-based resilience create a compelling entry point.

8.1.3 Establish public-private partnerships as the structural backbone of scale-up.

No single actor — government, insurer, or development partner — can carry this alone. We call for the formation of structured PPP platforms at national and regional levels that bring together insurance providers, government agencies, pastoralist associations, and development partners around a shared drought risk-mitigation strategy. These platforms must be conflict-sensitive, inclusive of women and youth, and anchored in long-term institutional capacity development rather than short-term project cycles.

8.1.4 Use digital tools and innovation to reach the last mile.

In conflict-affected and remote pastoral settings, traditional outreach and ground-truthing are increasingly constrained. We call for accelerated investment in digital delivery channels, AI-assisted index calibration, and multi-index product design that draws on soil moisture, biomass, and other indicators to improve accuracy and reduce basis risk. These tools are not a luxury — in many FCAS contexts, they will be the only viable pathway to scale.

8.1.5 Anchor IBLI within social protection systems.

For impact to be sustained, insurance cannot exist outside of broader safety net architecture. We call on governments and donors to integrate IBLI into national social protection frameworks, with humanitarian actors financing emergency coverage during active crises and governments maintaining baseline coverage in stable periods — creating a layered resilience model that protects pastoral livelihoods across the full spectrum of vulnerability.

8.1.6 Mobilise funding now, while the window is open.

The convergence of growing donor focus on climate resilience, youth employment, and fragile state programming creates a strategic moment. We call on SCBF, ILRI, SAF-A, and their networks to actively engage with emerging funding opportunities — including the Islamic Development Bank's regional livestock portfolio and other donor pipelines targeting West Africa to bring a new generation of IBLI programming to scale before this window narrows.

The evidence is clear, the model is proven, and the need is urgent. Each season without action is a season in which pastoralist households remain exposed to drought-related losses that insurance could have mitigated. The time to scale is now.

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