InsuResilience Solutions Fund

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This feasibility study seeks to explore the challenges and opportunities in providing multi-peril crop insurance to smallholder farmers in the United Republic of Tanzania (URT). It aims to offer clearer insights into the insurance product, the crops and regions for a pilot, its technical feasibility and other components that will be prioritized in the initial phase of the agriculture insurance scheme developed by the Insurance Development Forum (IDF) Consortium. Based on the findings, the Consortium plans to develop a revised Concept Note for submission to InsuResilience Solutions Fund for funding.

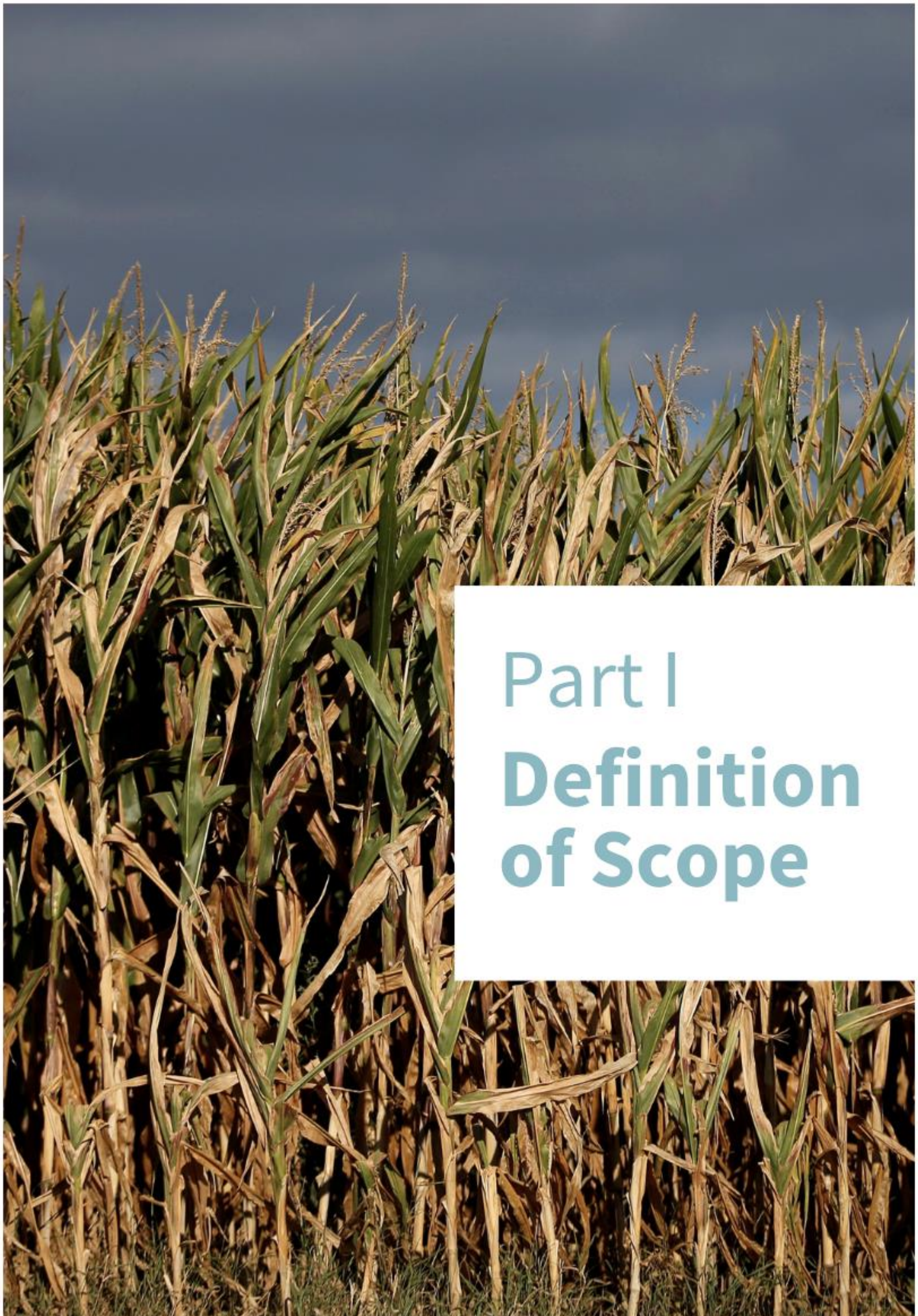
Presented by:

Table of Contents

Acronyms

ACRP: Agriculture Climate Resilient Plan
AGRA: Alliance for a Green Revolution in Africa
AMCOS: Agricultural Marketing Cooperative Society
ARC: Africa Risk Capacity
ASDP-II: Agricultural Sector Development Programme
ASDS: Agricultural Sector Development Strategy
AYII: Area-Yield Index Insurance
BMZ: German Ministry of Cooperation
CCE: Crop-Cutting Experiments
CGIAR: Consultative Group on International Agricultural Research
CHIRPS: Climate Hazards Group InfraRed Precipitation with Station
CSA: Climate-Smart Agriculture
DCSAA: District Climate Smart Agriculture Alliance
DIRISHA: Drought Index Insurance for Resilience in the Sahel and Horn of Africa
EM-DAT: Emergency Events Database
ERA5: Reanalysis V5
EUMWF: European Center for Medium-Range Weather Forecasts
FAO: Food and Agriculture Organization
GAINS: Gender and Inclusion Agriculture Insurance Solutions
GBON: World Meteorological Organization's Global Basic Observing Network
GWP: Gross Written Premium
IBI: Index-Based Insurance
IDF: Insurance Development Forum
IPM: Integrated Pest Management
ISF: InsuResilience Solutions Fund
Kg: Kilogram
MAAIF: Uganda Ministry of Agriculture, Animal Industry, and Fisheries
MCODE: Movement for Community Development
M&E: Monitoring and Evaluation
MoA: Ministry of Agriculture
MPCI: Multi-Peril Crop Insurance
NBS: National Bureau of Statistics
NDF: Natural Disaster Fund
NIC: National Insurance Corporation
NPCI: Named Peril Crop Insurance
OAF: One Acre Fund
OCGS: Office of the Chief Government Statistician Zanzibar
PPP: Public-Private Partnership
SACCOS: Savings And Credit Cooperative Societies
SHF: Smallholder Farmers
TAM: Total Addressable Market
TAIC: Tanzania Agriculture Insurance Consortium
TAIS: Tanzania Agricultural Insurance Scheme
TARI: Tanzania Agricultural Research Institute

TCDC: Tanzania Cooperative Development Commission
TCSAA: Tanzania Climate Smart Agriculture Alliance
TIRA: Tanzania Insurance Regulatory Authority
TMA: Tanzania Meteorological Agency
TZS: Tanzanian Shillings
URT: United Republic of Tanzania
UAIS: Uganda Agriculture Insurance Scheme
UGX: Uganda Shillings
USD: United States Dollar
USDA: United States Department of Agriculture
USGS: United States Geological Survey
USSD: Unstructured Supplementary Service Data
WBI: Water Balance Index
WBII: Weather-Based Index Insurance
WFP: World Food Programme



Part I
Definition of Scope

I. Definition of the scope of an insurance product

This first part of the study aims to define the concept of a feasible insurance product to support one key subsistence agricultural asset, whether a crop or livestock breed in the United Republic of Tanzania (URT). It involves identifying **an agricultural asset, primary hazards and selecting three specific regions for a potential pilot.**

Agricultural asset prioritization

Context of agricultural production in URT for smallholder farmers

To build a viable agriculture insurance product and to be able to test it in a pilot, this feasibility study seeks to **select one crop** for analysis, which is essential to the subsistence of smallholder farmers (SHF) in URT and is vulnerable to climate hazards that lead to low or loss of production.

The agricultural landscape of the URT is characterized by diverse crop and livestock practices across its territory. According to the 2019/20 National Census of Agriculture, and multiyear statistics from the Food and Agriculture Organization (FAO) and the United States Department of Agriculture (USDA), **maize** stands out as the most produced crop on the mainland while rice is the most important crop in Zanzibar. However, rice's limited agroecological adaptability restricts its overall importance to the national agricultural output.

Indicator	2018	2019	2020	2021	2022	% Change
Maize	6,273	5,652	6,711	7,039	6,417	-8.8
Rice	2,220	2,063	3,038	2,688	1,708	-36.5
Wheat	57	63	77	70	62	-11.4
Pearl millet, finger millet, and sorghum	988	1,117	1,043	1,077	1,046	-2.9
Dried cassava	2,791	2,728	2,427	2,486	2,411	-3.0
Beans and legumes	1,823	1,888	1,895	2,236	2,499	11.8
Dried bananas	1,132	1,135	1,358	1,443	1,290	-10.6
Dried sweet potatoes and round potatoes	1,608	1,644	1,647	1,626	1,715	5.5
Total	16,892	16,290	18,196	18,665	17,147	-8.1

Figure 1 - Production of Major Foods (in thousand tons).
Source: M. Rweyemamu, T. Mruma, et al., Tanzania Agricultural Policy Profile, January 2024, CGIAR from Tanzania Ministry of Finance 2023 data.

Beyond crops, livestock farming is an integral component of smallholder agricultural systems in URT. However, exclusive livestock herding is practiced by only a minority of households. The predominant agricultural model involves mixed farming, where livestock rearing is combined with crop cultivation. Therefore, we will focus on crop cultivation, and more specifically maize, which is the most cultivated crop on mainland URT across households. Additionally, there is already an initiative through the World Bank's DRIVE project to increase livestock insurance in the country.

Agricultural Activity	Tanzania		Mainland Tanzania		Tanzania Zanzibar	
	Number	Percent	Number	Percent	Number	Percent
Total Households (Projection from 2012 PHC)	12,007,839		11,659,589		348,250	
Total Households involved in Agriculture	7,837,405	100.0	7,657,185	100.0	180,220	100.0
Crops Only	5,088,135	64.9	4,972,373	64.9	115,762	64.2
Crops and Livestock	2,589,156	33.0	2,526,846	33.0	62,310	34.6
Livestock Only	157,290	2.0	155,141	2.0	2,149	1.2
Fish Farming	1,358	0.01	1,358	0.01	0	0
Pastoralist	1,465	0.02	1,465	0.02	N/A	N/A

"N/A" Not Applicable
"0" insufficient number/percent

Figure 2 – Number and percentage of agricultural households by type of agricultural activity during 2019/20 agricultural year, *Source: Ministry of Agriculture, 2020.*

Maize

The prominence of maize in terms of planted area can be partly attributed to maize's adaptability to various agroecological zones and its status as a staple food for a significant portion of the population. Smallholder Farmers (SHF) heavily depend on maize cultivation for both food and income generation, making it a cornerstone of subsistence agriculture in URT[1]. Maize is the dominant cereal crop in the country, with 7.4 million households cultivating it in 2022/23 across 6.29 million hectares. Of this, 61.3% (3.85 million hectares) was harvested, yielding 6.97 million tons, primarily from agricultural households. Mainland Tanzania accounted for nearly all production (6.94 million tons), with a small contribution from large-scale farms and Zanzibar (NBS & OCGS, 2023).

Maize serves as a staple food, animal feed, and raw material for industrial processes. The crop's importance is further highlighted by its prevalence in the daily diet, with maize and legumes collectively constituting a significant portion of caloric intake in URT (Benimana et al., 2021). The disproportionate prevalence of maize in the Tanzanian diet has been criticized, as it can lead to public health issues.

SHF operate on a mean land capacity of 1.2 hectares, typically using their land for both subsistence and limited commercial production.[2] A 2017 Alliance for a Green Revolution in Africa (AGRA) study found that average SHF maize yields are approximately 1,650 kg per hectare per year[3], which is particularly low in comparison to potential yields in the country. Indeed, literature suggests that rain-fed maize yields in Sub-Saharan Africa (SSA) could attain levels of up to 4.481 kg per hectare[4]. This low yield can partly be explained by the fact that many Tanzanian farmers adopt low-risk, low-yield crop and production patterns

[1] Utouh, Harold. (2024). Factors Affecting Maize Production in Kiteto District, Manyara Region, Tanzania: Cross Sectional Design. SCIENCE MUNDI. 4. 52-62. 10.51867/scimundi.4.1.5.
[2] Food and Agriculture Organization of the United Nations. *Country Factsheet on Small Family Farms: Tanzania*. 2018. FAO, http://www.fao.org/3/i8356en/I8356EN.pdf.
[3] The AGRA report gathered data from 380 smallholder households growing maize in Kilimanjaro, Arusha, Iringa, Ruvuma, Manyara, Dodoma
[4] Hillocks, R.J, 2015, Addressing the yield gap in Sub-Saharan Africa, Outlook on Agriculture Vol 43, No 2, 2014, pp 85-90 doi: 10.5367/oa.2014.0163

to ensure they secure a minimum volume for food security to mitigate risks from weather, pests, and diseases.[5]

Crop		Planted Area (Hectares)			Harvested Area (Hectares)			Production (Tons)		
		Tanzania	Mainland Tanzania	Tanzania Zanzibar	Tanzania	Mainland Tanzania	Tanzania Zanzibar	Tanzania	Mainland Tanzania	Tanzania Zanzibar
Maize	**Total**	**4,946,799**	**4,943,417**	**3,381**	**4,358,753**	**4,356,633**	**2,120**	**6,536,324**	**6,532,362**	**3,961**
	SHF	4,931,111	4,927,748	3,363	4,345,266	4,343,160	2,106	6,504,727	6,500,776	3,951
	LSF	15,688	15,669	18	13,487	13,473	14	31,597	31,586	10
Paddy	**Total**	**1,700,701**	**1,667,393**	**33,307**	**1,497,277**	**1,472,598**	**24,678**	**3,443,605**	**3,393,029**	**50,576**
	SHF	1,688,241	1,655,087	33,154	1,485,125	1,460,571	24,554	3,380,715	3,330,293	50,422
	LSF	12,460	12,306	153	12,152	12,027	124	62,890	62,736	154
Sorghum	**Total**	**514,435**	**514,313**	**122**	**448,738**	**448,641**	**93**	**650,498**	**601,496**	**80**
	SHF	512,888	512,767	121	447,566	447,474	92	601,470	601,390	80
	LSF	1,547	1,546	1	1,172	1,170	1	49,028	106	0

SHF = *Smallholder Farmers*; LSF = *Large Scale Farms*

"0" Insufficient information

Figure *3* - Planted Area, Harvested Area and production of cereal crops during 2019/2020 agricultural year, URT.
Source: Ministry of Agriculture, 2020.

Conclusion: *Given maize's widespread cultivation, adaptability, and significance as a staple crop, we believe it would be the most appropriate focus for an initial insurance product. The widespread production and consumption of maize across diverse regions of URT make it a relevant focus for understanding and improving smallholder farmers' food security.*

Maize (Zea mays L.) is proposed as the crop of focus for the Insurance Development Forum (IDF) project.

Hazard prioritization

Hazards impacting maize production

Maize production in URT faces several natural hazards that can significantly impact yields and quality, both climatic and non-climatic shocks. Among others, climate related shocks lead to drought and water scarcity, flooding and excess rain, extreme temperatures, disrupted growing seasons, and reduced nutritional value of crops. On the other hand, non-climatic shocks include crop theft, plant pests and diseases, fires, animal, and bird damage. Climate hazards have been reported as the main agricultural constraint during the 2019/20 cultivation year.[6] The primary challenge affecting maize production in URT is likely **agricultural drought**. For example, in 2019, the central regions of Tabora, Singida, and Dodoma indicated that maize production in these areas was between 20-55% lower than the previous year's output, as the erratic and below-average rains significantly affected crop growth and overall agricultural productivity (FAO GIEWS 2019). Rainfall scarcity, exacerbated by climate change, is a critical issue as more

[5] Ibid.
[6] 2019/20 National Sample Census of Agriculture, United Republic of Tanzania.

than 95% of maize cultivation in mainland URT is rain-fed.[7] Insufficient rainfall leads to lower yields, impacting food security in the process.

Drought can severely affect maize at every stage of its growth[8]:

Early Vegetative Phase	Jointing Stage	Tasseling Stage
More than five consecutive dry days during this phase can significantly reduce maize yield. Lack of soil moisture limits nutrient uptake and hinders photosynthesis. This can lead to stunted growth and weaker plants, leading to lower yields. (Laudien et al., 2020) [9].	Drought conditions during the jointing stage can negatively affect maize emergence. Insufficient soil moisture leads to poor germination and weak seedling establishment, which can lead to a reduced yield.	Water stress during the tasseling stage can decrease plant height and limit leaf area expansion, reducing the plant's photosynthetic capacity, in turn decreasing yields.

A 2015 World Bank report used linear regression models for each region to analyze the relationship between maize yield (tons per hectare) and cumulative rainfall during different crop seasons (sowing, mid-season, harvest). A strong relationship was found between yield and rainfall. It was calculated that drought during the sowing season significantly impacts maize yield in the Arusha region, while mid-season rainfall accounts for yield variability in Dodoma and Ruvuma.

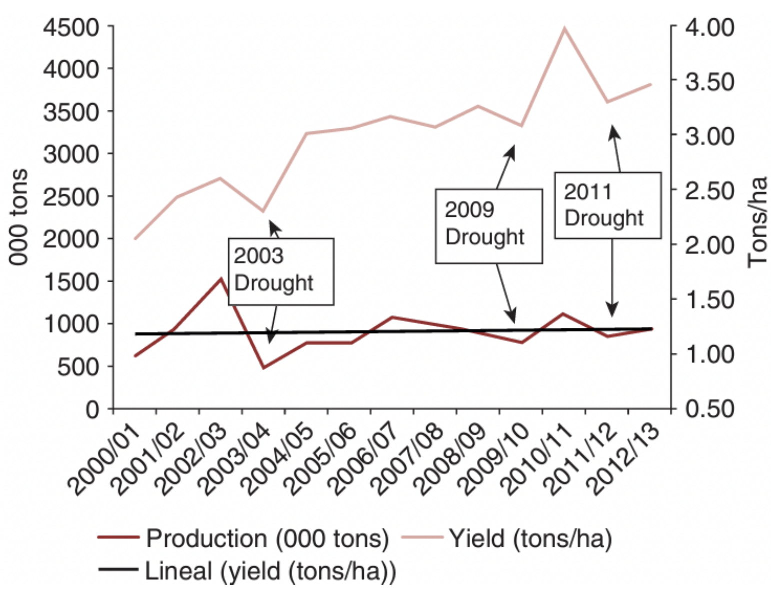


Figure 3 – Relationship between maize production, yield and major droughts in Tanzania.
Source: United States Department of Agriculture (USDA)

[7] 2019/20 National Sample Census of Agriculture, United Republic of Tanzania.
[8] Khalili, Marouf, et al. "Effects of drought stress on yield and yield components in maize cultivars (Zea mays L.)." (2013): 809-812.
[9] Laudien, R., Schauberger, B., Makowski, D. et al. Robustly forecasting maize yields in URT based on climatic predictors. Sci Rep 10, 19650 (2020). https://doi.org/10.1038/s41598-020-76315-8

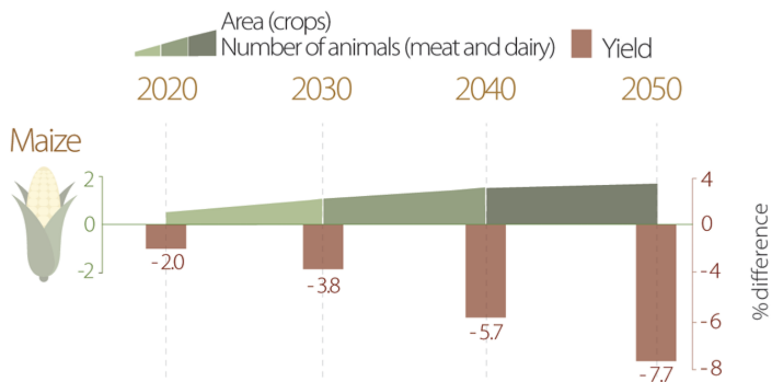


Figure 5 – Climate change impacts on yield, crop area, and livestock numbers in URT.
<u>Source</u>: CIAT from Robinson, S., Mason-D'Croz, D., Islam, S., Sulser, T., Gueneau, A., Pitois, G., & Rosegrant, M. W. (2015). The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT): Model description for version 3 (IFPRI Discussion Paper). Washington, D.C: International Food Policy Research Institute. Available at: http://ebrary.ifpri.org

Excess rainfall also impacts maize cultivation in URT, leading to significant yield losses. While above average rainfall generally benefits maize yields[10], extreme rainfall can damage maize crops. For instance, during the 2015-2016 El Niño event, URT experienced unusually heavy rains which resulted in widespread flooding, particularly in regions prone to flooding such as the southern highlands, the Lake Victoria basin, and coastal areas. This excess moisture caused waterlogging of soils and was associated with a 57% yield decrease for maize in URT.[11] The heavy rains not only damaged crops but also led to the destruction of seeds and fertilizers, along with more severe soil erosion and nutrient leaching as well as incidences of fungal diseases. Damaged soil health is already an important issue in URT, and floods further threaten soil fertility and affect maize production in subsequent seasons[12].

Extreme rainfall can severely affect maize at every stage of its growth[13]:

Early Vegetative Phase	Jointing Stage	Tasseling Stage
Too much rain can waterlog the soil, reducing the oxygen available for seeds to sprout and roots to grow. This leads to poor plant establishment and stunted early growth. Plants may have weak roots and show slow	Continued soil saturation during this stage can cause root hypoxia (lack of oxygen), leading to poor nutrient uptake[14]. Plants may also become more susceptible to diseases affecting the roots and stems. Reduced plant growth and increased risk of diseases like root rot and stalk	Excess water during tasseling can disrupt pollination processes. Poor kernel development, leading to lower yields. There's also a higher chance of fungal diseases like ear rot, which affect both yield and grain quality due to toxins[16]. High soil moisture can delay the plants from reaching maturity, resulting in

[10] Rowhani, P., Lobell, D. B., Linderman, M., & Ramankutty, N. (2011). Climate variability and crop production in URT. Agricultural and Forest Meteorology, 151(4), 449-460.
[11] Food and Agriculture Organization of the United Nations. " Rapid Agriculture Needs Assessment in response to the "El - Niño" effects in the United Republic of Tanzania, www.fao.org/fileadmin/user_upload/emergencies/docs/TZ%20final%20needs%20assessment_report-reformatted-new.pdf.
[12] Food and Agriculture Organization (FAO). (2017). Tanzania Climate-Smart Agriculture Framework. FAO Report.
[13] Ren, B., Zhang, J., Li, X., Fan, X., Dong, S., Liu, P., & Zhao, B. (2014). Effects of waterlogging on the yield and growth of summer maize under field conditions. Canadian Journal of Plant Science, 94(1), 23-31.
[14] Zaidi, P. H., Rafique, S., Rai, N., Singh, N. N., & Srinivasan, G. (2004). Tolerance to excess moisture in maize (Zea mays L.): susceptible crop stages and identification of tolerant genotypes. Field Crops Research, 90(2-3), 189-202.
[16] Munkvold, G. P. (2003). Epidemiology of Fusarium diseases and their mycotoxins in maize ears. European Journal of Plant Pathology, 109(7), 705-713.

development, making them less vigorous overall.	rot, which weaken the plant structure.[15].	wetter grains at harvest and increasing drying costs.[17].

In URT, maize is cultivated across two main rainy seasons: Masika and Vuli. Masika maize, grown during the long rains from March to May and harvested between June and August, benefits from steadier moisture, supporting higher yields and stronger crop growth, though it is vulnerable to flood risks from excessive rainfall. In contrast, Vuli maize, grown during the short rains from October to December and harvested in January-February, benefits from the season's quick, intense rains but faces higher drought risk due to inconsistent rainfall. Most farmers grow maize during Masika season.

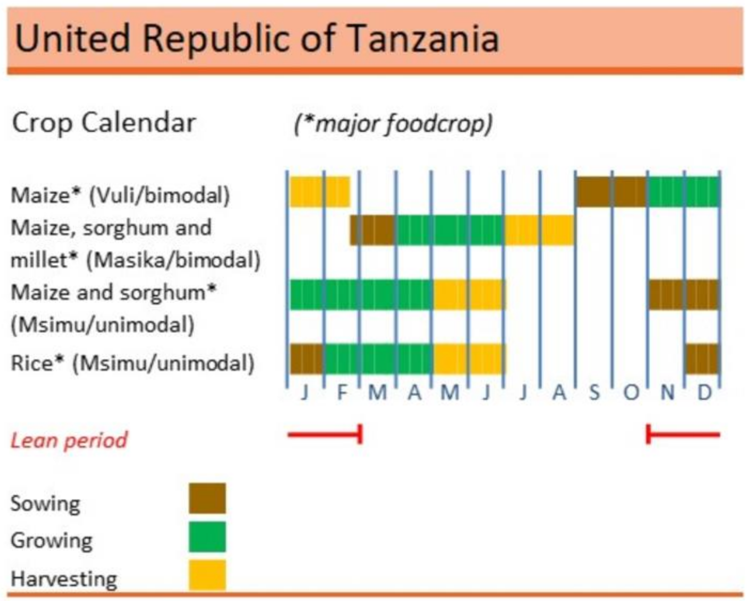


Figure 6 - Crop calendar of United Republic of Tanzania, including the two main rainy seasons.
Source: Food and Agriculture Organization (FAO).

The Masika season is vital to Tanzania's maize production and national food security, more often leading to abundant supply and lower prices, which supports rural employment and benefits consumers. The mean maize yield during Masika season ranges from 0,9 ton/ha for local varieties and 1,5 ton/ha for hybrid varieties.[18]

Vuli season provides a supplementary harvest for additional income and food but carries greater risk due to its variable rainfall, increasing the likelihood of drought and thus raising maize prices, affecting food accessibility. In Tanga, typical maize yields for SHF during Vuli season range from 0,8 ton/ha to 1 ton/ha.[19] Climate change and oscillations like El Niño and La Niña have intensified rainfall unpredictability. El Niño typically brings excessive rains, heightening flood risks, especially during Vuli, while La Niña often leads to extended droughts, impacting the central and northern regions during both seasons.

Pests and diseases are also significant threats to maize cultivation in URT, and their prevalence is closely linked to climatic conditions like drought and excess rainfall. Drought-stressed maize plants become more

[15] Robertson, A. E., & Munkvold, G. P. (2017). Corn disease management in wet conditions. Iowa State University Extension and Outreach.
[17] Cox, W. J., Cherney, J. H., & Shields, E. (2010). Managing flood-damaged corn. Cornell University Cooperative Extension.
[18] KIT, 2020. Tanzania Outcome Monitoring Report 2019, AGRA-PIATA Programme. Alliance for a Green Revolution in Africa, Nairobi; KIT Royal Tropical Institute, Amsterdam.
[19] 2016 estimates by the URT Ministry of Agriculture. Numbers are not available for the entirety of URT.

susceptible to pests such as the maize stem borer (*Busseola fusca*), which can cause substantial yield losses (Midega et al., 2015). Excess rainfall and excess rainfall, on the other hand, creates humid conditions that favor the spread of fungal diseases like gray leaf spot and northern corn leaf blight, which can severely reduce maize productivity[20]. The fall armyworm (*Spodoptera frugiperda*), a pest that has recently invaded URT, thrives under both drought and excessive moisture[21] and threatens cultivation but also maize stored after harvest.

One specific disease, **aflatoxin contamination**, poses a significant threat to maize production in URT[22]. Aflatoxin is a toxic byproduct produced by certain fungi, such as *Aspergillus* species, which can contaminate the crop and pose significant health risks to humans and animals. Aflatoxin occurrence is favored by high temperatures and humidity. Studies have shown that around 18% of maize produce in URT is contaminated with aflatoxins[23], which can have detrimental effects on both human health and agricultural productivity.

The most dangerous hazard for smallholder maize cultivation in URT is considered to be drought, due to its frequency, severity and dependency on rain.[24] The 2016-2017 drought caused a 1.5% drop in URT's Gross Domestic Product (GDP) due to lower agricultural output, higher food prices, and increased import costs for staple grains. The Ministry of Agriculture (MoA) reported a 20% decrease in cereal production, leading the government to spend around Tanzanian Schillings (TZS) 768 billion (USD 300 Million)[25] on maize, rice, and wheat imports to meet demand. According to conservative climate projections, maize yields are projected to decline by up to 40% due to drought under climate change[26], making it the most significant threat to maize productivity. Excess rainfall and excess rainfall are important risks for maize as well, although with less sustained frequency and more localized effects, see table below.

	in % of respondents			
Type of hazard	Rarely	Regularly	Seasonally	Yearly
Floods	73	14.5	26.5	0
Drought	13.5	14.5	29.5	70
Storm	13.5	71	3	0
Pest and disease	0	0	35	20
Frost	0	0	3	0
Hail	0	0	3	0
Others	0	0	0	10

Figure 7 - Frequency of natural hazards.

[20] Mahoo, H., Radeny, M., Kinyangi, J., & Cramer, L. (2015). Climate change impacts on agriculture in URT. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
[21] Kansiime, M. K., Mugambi, I., Rwomushana, I., & Nunda, W. (2019). Farmer perception of fall armyworm (Spodoptera frugiperda J.E. Smith) and farm-level management practices in Zambia. Pest Management Science, 75(10), 2840-2850.
[22] Seetha, A., Munthali, W., Msere, H.W. et al. Occurrence of aflatoxins and its management in diverse cropping systems of central Tanzania. Mycotoxin Res 33, 323–331 (2017). https://doi.org/10.1007/s12550-017-0286-x
[23] Kimanya, Martin, et al. "Co-occurrence of fumonisins with aflatoxins in home-stored maize for human consumption in rural villages of tanzania". Food Additives &Amp; Contaminants: Part A, vol. 25, no. 11, 2008, p. 1353-1364. https://doi.org/10.1080/02652030802112601
[24] Mdemu, M., et al. "Community's vulnerability to drought-driven water scarcity and food insecurity in central and northern semi-arid areas of tanzania". Frontiers in Climate, vol. 3, 2021. https://doi.org/10.3389/fclim.2021.737655
[25] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*
[26] Kim K-H, Lee B-M. Effects of Climate Change and Drought Tolerance on Maize Growth. Plants. 2023; 12(20):3548. https://doi.org/10.3390/plants12203548

Source: Food and Agriculture Organization of the United Nations. " Rapid Agriculture Needs Assessment in response to the "El - Niño" effects in the United Republic of Tanzania, 2016. Surveys were conducted in Arusha, Dodoma, Morogoro, Mwanza and Shinyanga after the 2015 El Nino floods. It is unclear how many respondents were interviewed. These surveys took place at the end of the short agricultural season "vuli" and at the start of the long agricultural season "masika" in the bi-modal areas, where most crops were close to the harvesting period for "vuli" and in the land preparation stage for "masika".

Conclusion: *Agricultural drought and excess rainfall are proposed as the hazards of focus for the IDF project, with two risk periods.*

Geographical prioritization

Selection of the most relevant regions for a pilot insurance product

Across URT, very heterogeneous climate conditions and agricultural risk profiles are represented. To build a solution that can be relevant across all maize-producing regions, this study seeks to shortlist three potential regions for a pilot. A diverse sample would provide a good foundation for understanding how well the product can be scaled and adapted across the complete territory. By testing in regions that represent semi-arid, temperate and high-rainfall zones, the project would gather insights into the adjustments or support needed for an application of the product across the full country.

Several characteristics were prioritized in selecting these three focus regions:

- Their exposure to agricultural drought and excess rainfall/flooding given these are the predominant hazards
- The dependency of local smallholder farmers (SHF) on maize cultivation
- Their history of significant maize losses due to agricultural drought or excess rainfall
- Their difference in terms of climatic conditions

The choice of the following three regions has been made with available literature and ACRE's expertise. **Dodoma**, **Arusha**, and **Ruvuma** capture a range of climatic conditions, agricultural systems, and socioeconomic factors that provide a robust dataset to evaluate the suitability and impact of the product across URT's diverse smallholder farming communities. Each region presents unique challenges due to climate hazards, dependency on maize cultivation, and a history of climate-induced crop losses. By addressing these specific vulnerabilities in each region, targeted strategies can improve crop resilience, stabilize yields, and support sustainable livelihoods.

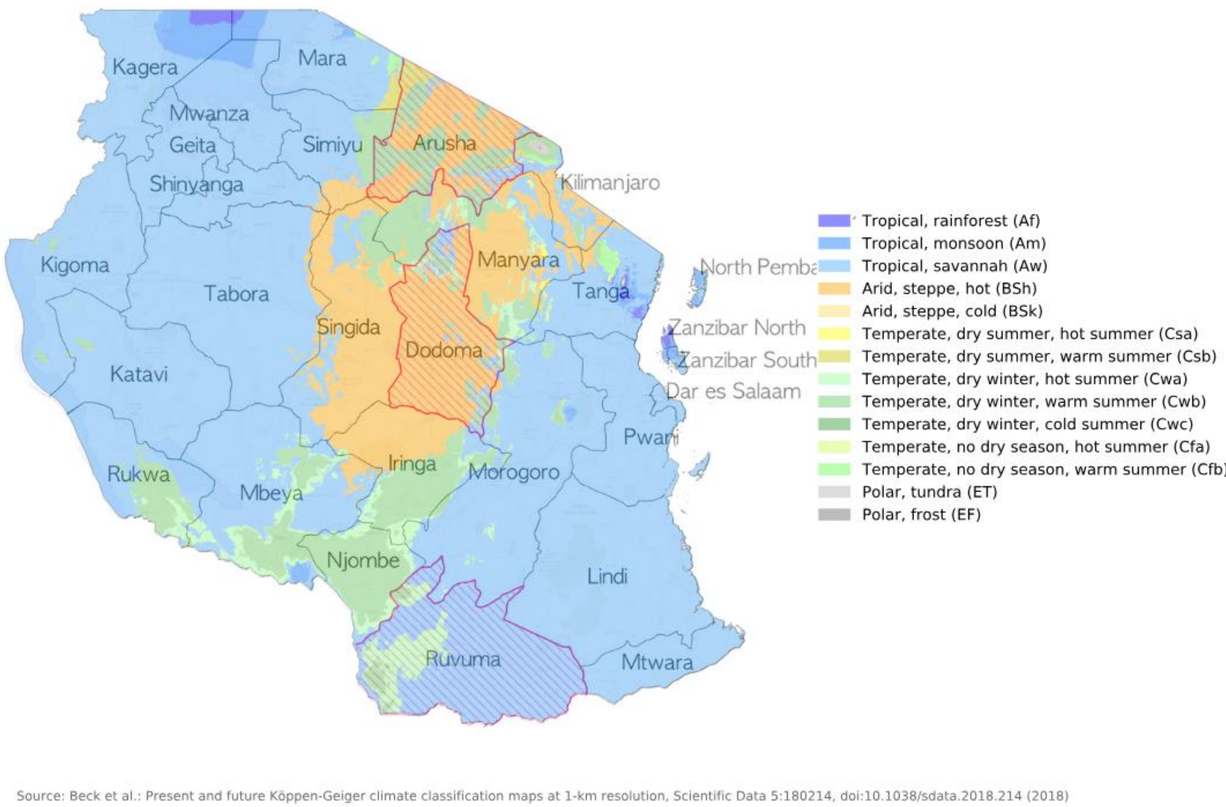


Figure 4 – Regions suggested for analysis (Adm1) overlaid with Köppen-Geigen (1980-2016) climate classification maps.
Source: Insurance Development Forum, 2024 from Beck et al (2018).

Dodoma Region

Dodoma's semi-arid climate exposes it to frequent droughts, significantly impacting rain-fed agriculture and increasing vulnerability to maize crop losses during dry spells. A 2023 study has cited Dodoma as a zone at high drought risk, that would greatly benefit from the adoption of drought-tolerant maize varieties.[27] Consequently, Dodoma has experienced multiple instances of drought-driven losses, resulting in strained local food supplies and an increased need for external assistance. This region is also susceptible to occasional heavy rains, which cause flooding in low-lying areas. Dodoma was greatly impacted during the 2015 floods. In this region SHF rely heavily on maize as a staple crop, which is central to both food security and household income. Although exact numbers are difficult to pinpoint, it is estimated that there are more than 300,000 maize farmers in Dodoma.

[27] Gebre, G. G. *et al.* (2023) 'Potential impact of scaling adaptation strategies for drought stress: a case of drought-tolerant maize varieties in Tanzania', *International Journal of Agricultural Sustainability*, 21(1). doi: 10.1080/14735903.2023.2189396.

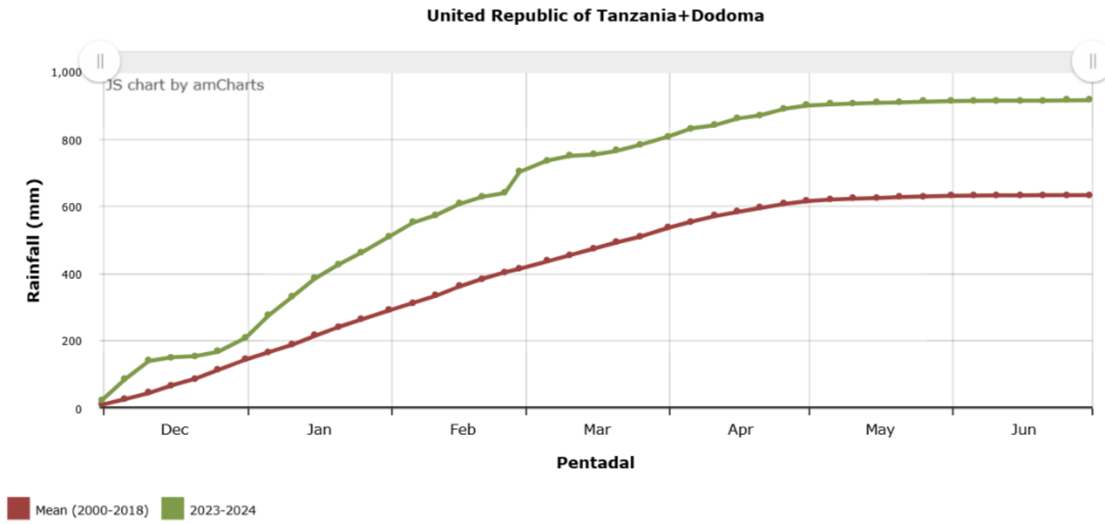


Figure 9 - Rainfall conditions in Dodoma (Africa CHIRPS Pentadal).
<u>Source</u>: United States Geological Survey (USGS) from Group InfraRed Precipitation with Station (CHIRPS) data.

Arusha Region

Arusha, located in Tanzania's northern highlands, faces a unique set of challenges due to its bimodal rainfall pattern. This climate results in both seasonal droughts and sporadic periods of intense rainfall, exposing the region's agricultural systems to both drought and flood risks. Arusha is cited in three out of five major droughts in EM-DAT's records and was greatly impacted during the 2015 floods. Such weather variability has been increasing, amplifying the threats to crop reliability and resilience. Arusha's altitude and cooler climate are favorable for maize production, and SHF in this region rely on maize as a major source of food and income. However, the region's heavy dependence on this crop places local farmers at significant risk when rainfall patterns become erratic. It is estimated the region has more than 200,000 maize farmers.

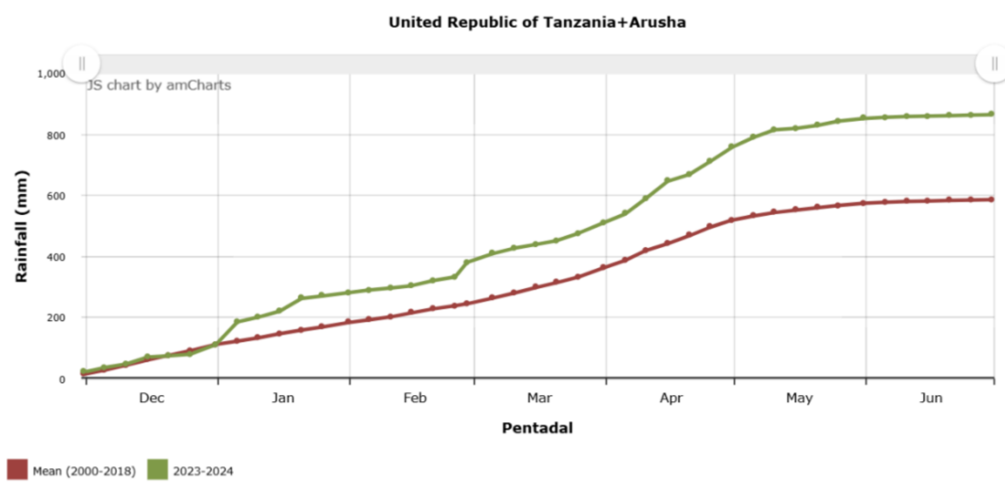


Figure 10 - Rainfall conditions in Arusha (Africa CHIRPS Pentadal).
<u>Source</u>: United States Geological Survey (USGS) from Group InfraRed Precipitation with Station (CHIRPS) data.

Ruvuma Region

Ruvuma, located in southern Tanzania, is known as one of the country's agricultural hotspots due to its fertile soils and favorable conditions for maize cultivation. Although it generally receives higher rainfall, Ruvuma is not immune to climatic extremes. The region also experiences periodic dry spells that compromise crop growth cycles and yield consistency. These climatic fluctuations present complex challenges for local SHF, who depend heavily on maize for both subsistence and market sales. This dependency on maize cultivation makes farmers in Ruvuma particularly vulnerable to crop failures when weather patterns deviate from the norm. The recurring risks of dry spells in Ruvuma, which have historically led to reduced yields, coupled with its importance in contributing to the national maize output, have led to studies pushing for more drought-adaptation strategies for the region.[28] Approximately 300,000 to 400,000 farmers in Ruvuma are involved in maize farming. This estimate is based on national agricultural surveys and local reports on crop production.

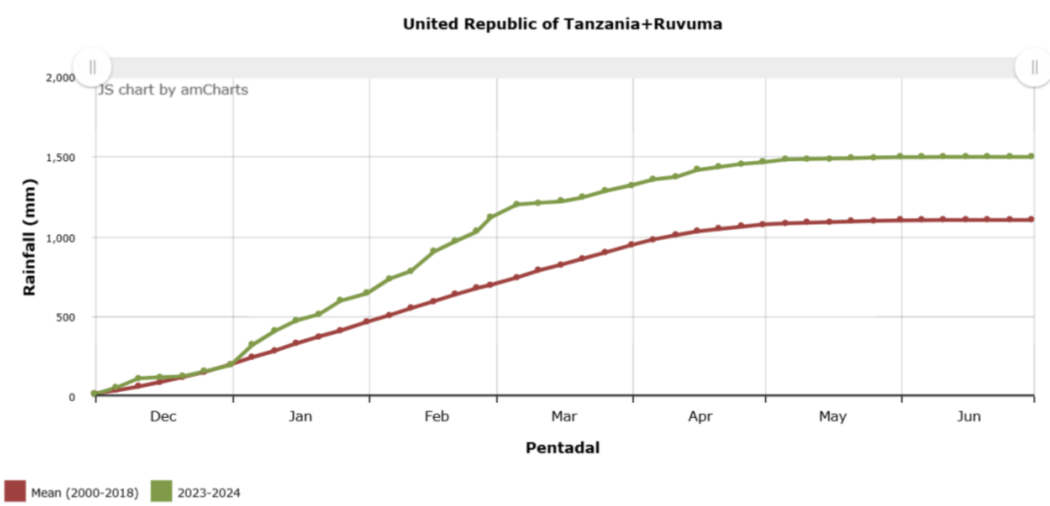
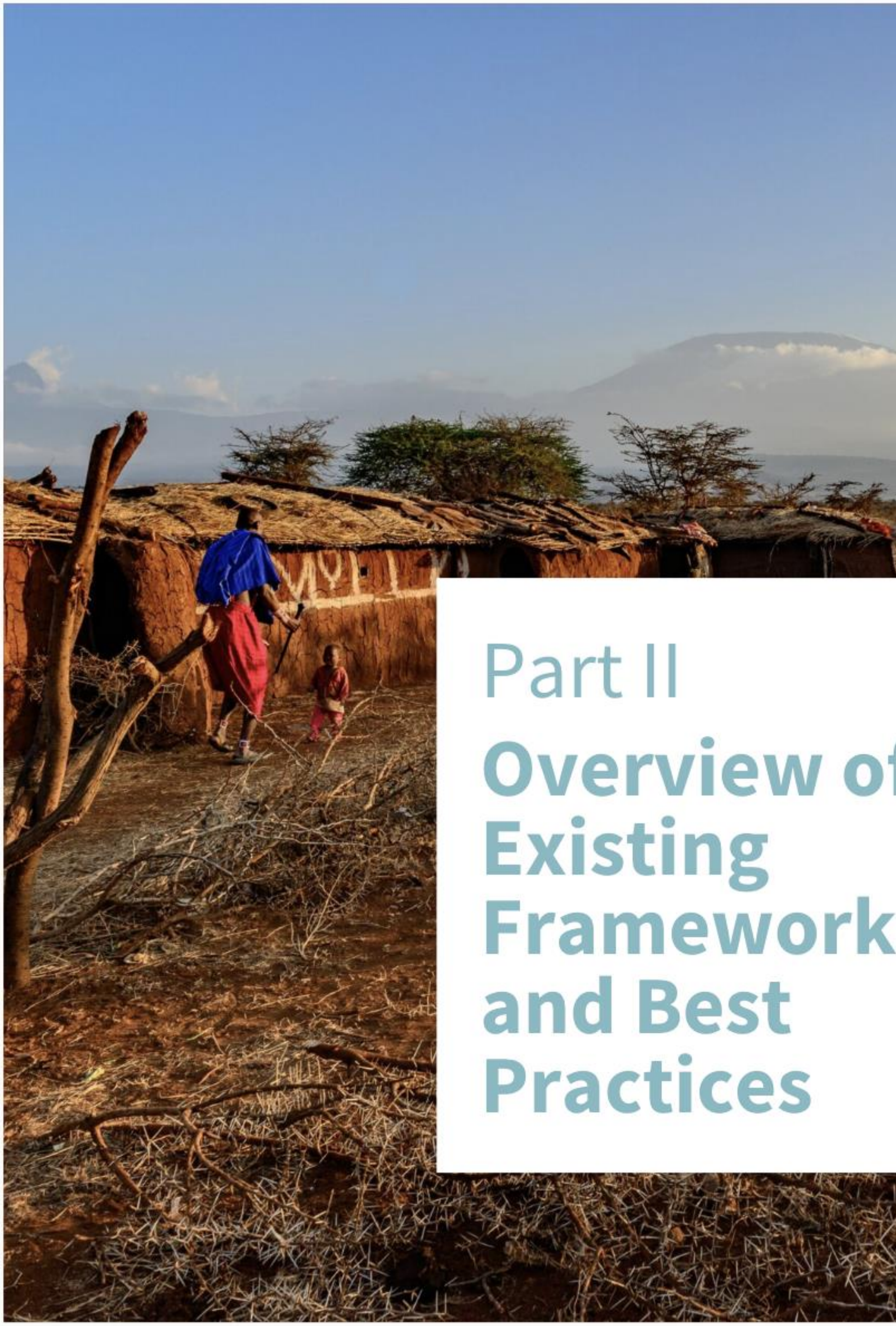


Figure 11 - Rainfall conditions in Ruvuma (Africa CHIRPS Pentadal).
Source: United States Geological Survey (USGS) from Group InfraRed Precipitation with Station (CHIRPS) data.

Ruvuma, Arusha and Dodoma regions provide a diverse and representative sample for analyzing the impact of drought and excess rainfall on maize cultivation by SHF.

[28] Gebre, G. G. *et al.* (2023) 'Potential impact of scaling adaptation strategies for drought stress: a case of drought-tolerant maize varieties in Tanzania', *International Journal of Agricultural Sustainability*, 21(1). doi: 10.1080/14735903.2023.2189396.



Part II

Overview of Existing Frameworks and Best Practices

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II. Overview of existing frameworks and best practices

Best practices and lessons learnt from past insurance programs

Agricultural insurance programs are important tools for mitigating risks faced by SHF's, especially in countries like Tanzania, where agriculture is heavily influenced by climate variability. This literature review examines various past crop insurance initiatives, distilling best practices and lessons learned from multiple case studies across Africa and beyond. The aim is to identify effective strategies for increasing insurance adoption, enhancing product design, and ensuring the sustainability of agricultural insurance programs.

Programmes in URT

ACRE – Area Yield Index Insurance Product

ACRE Africa's Area Yield insurance provides essential protection for farmers cultivating key food and cash crops such as maize, rice, tobacco, and coffee. Designed to shield against climate-induced risks like drought, floods, pests, and diseases, the product uses at least five years of historical production data specific to each crop and region. This data-driven approach helps set yield thresholds that trigger payouts when harvests fall below expected levels.

The insurance model blends farm monitoring with agricultural support to enhance productivity and reduce losses. Farmers receive training on best agricultural practices, ensuring they follow methods that improve yields. Inspections are conducted at critical stages of the growing season, while crop-cut experiments at harvest verify actual yields for claims processing. Collaboration with agricultural experts and local officers strengthens the program's reach and reliability.

The program currently has around 45,000 mainly tobacco farmers subscribed per season and employs/contracts more than 80 field officers to do the development reports and crop cutting experiments. The covered regions include Tabora, Kigoma, Mbeya, Ruvuma, Iringa, Geita, Morogoro, Katavi and Mara.

Key lessons from this approach emphasize the need for accurate data collection and customized risk assessment. Challenges like incomplete data and delays in manual inspections highlight the value of integrating digital tools such as satellite monitoring. Moreover, educating farmers on insurance processes and enhancing digital literacy can drive adoption and long-term success.

Pula – Area Yield Index Insurance Product

Pula's Yield Index Insurance (YII) offers comprehensive protection against risks that threaten crop yields by covering the value of purchased inputs like seeds and fertilizers. If yields in a specific agro-ecological zone (AEZ) fall below a set trigger, the insurance compensates farmers by replacing inputs. The AEZs are defined using historical weather and yield data, ensuring that coverage reflects local farming conditions for precise risk assessment.

The model's strength lies in its integration of insurance with agronomic services, providing farmers with both financial protection and productivity-enhancing tools. Bundling inputs, vouchers, and agronomic advice encourages the adoption of better farming practices, while a well-designed technological infrastructure supports policy management, farmer registration, and customer service through a dedicated call center.

However, bundling insurance with specific inputs can limit farmers' flexibility in choosing how to recover from losses. Offering more adaptable payout options could better meet diverse farming needs. Similarly, while field data collection ensures accurate yield assessments, incorporating remote sensing technologies could streamline the process and enable faster payouts. Expanding farmer education on insurance and financial literacy would further strengthen the program's long-term success.

Global Parametrics and One Acre Fund

One significant initiative is the partnership between Global Parametrics and One Acre Fund (OAF) in URT, which developed a scalable crop insurance model using the Water Balance Index (WBI) bundled with loan protection. This project remains active, protecting 70,000 smallholder maize farmers from drought and excess rainfall through satellite data on daily rainfall and evapotranspiration.

The core innovation of the initiative was a parametric weather index that triggers payouts based on climate conditions, specifically rainfall and evapotranspiration data from ERA5, a weather model developed by the European Centre for Medium-Range Weather Forecasts (ECMWF), at a 31 km resolution. The index aligns with the maize growth cycle, enabling payouts during critical stages like germination, flowering, and harvesting. Although the index was tailored to specific conditions, its reliance on broad data inputs sometimes caused overestimated payouts due to limited local accuracy. A simpler, more balanced model could enhance reliability.

The project also highlights the integration of public-private partnerships. The Natural Disaster Fund (NDF), managed by Global Parametrics, pools public and private capital from sources such as the German Government (BMZ), the UK Government, and Hannover Re, a global reinsurance firm. This collaboration reduces risks for all parties and demonstrates how public-private partnerships can serve as a foundation for scaling agricultural insurance across URT.

Additionally, One Acre Fund integrated insurance with its lending model. The index-based product acts as a safety net by relieving farmers from loan repayments during extreme weather, helping them avoid debt traps. This approach aligns with other URT agricultural sector practices where bundling insurance with agricultural input loans and mobile payment platforms has improved access and reduced administrative hurdles.

Despite these successes, the initiative faced several challenges. One major obstacle was data availability and accuracy. Parametric insurance requires reliable weather and crop yield data for model calibration, but historical data in low-income countries like URT is often incomplete or lacks sufficient granularity. One Acre Fund mitigated this issue by grouping farmers into regions with similar environmental conditions and focusing on large-scale extreme weather events. However, more granular, real-time data collection remains essential. Efforts by the Tanzania Meteorological Agency (TMA) to expand weather stations and modernize meteorological infrastructure will be crucial for future products.

Another challenge was managing basis risk, as the detailed index design combined with coarse input data made accurate loss measurement difficult. One Acre Fund and Global Parametrics addressed this by keeping cash reserves to cover smaller weather events that did not trigger parametric payouts. This blended approach reduced basis risk while keeping insurance affordable. However, frequent payouts during adverse weather led to instances of overpayment, partly due to farmers adjusting their practices in response to expected weather patterns, raising concerns about moral hazard.

Cost considerations also posed barriers. While initial WBI trial results were promising, reducing administrative and operational costs remains critical for scaling the program. Bundling insurance with loans faced scalability challenges due to high fronting costs, limited capital access, and premiums that were often unaffordable for farmers.

Lastly, awareness and education emerged as essential components of the project. On-the-ground sales efforts proved challenging, complicating program implementation. Many smallholders lacked familiarity with insurance products and were less likely to trust or invest in them without proper understanding. OAF's integration of financial literacy and climate resilience training alongside insurance offerings is a best practice worth replicating across URT.[29]

Agriculture Insurance Viability Diagnostic Study

The Agriculture Insurance Viability Diagnostic Study, conducted by AGRA in collaboration with the Tanzanian government in August 2024, provides an in-depth analysis of the challenges and opportunities for agricultural insurance in Tanzania. This study was initiated to address critical gaps in insurance coverage for smallholder farmers (SHFs), who form the backbone of Tanzania's agricultural sector. Despite agriculture's susceptibility to climate risks such as unpredictable rainfall, droughts, and pest outbreaks, less than 3% of SHFs are covered by insurance. This low uptake is attributed to high premiums, limited awareness, and mistrust in insurance providers.

The study emphasizes the viability of Index-Based Insurance (IBI), highlighting its potential to mitigate risks like climate shocks, though it underscores the necessity for tailored designs adapted to local agro-climatic conditions. IBI's efficiency in risk management relies heavily on accurate and accessible data infrastructure, such as weather stations and satellite technology, to reduce basis risk and ensure timely payouts. The report also notes that the integration of Area Yield Index Insurance (AYII) with crop-cutting experiments remains underutilized due to challenges in operational capacity and farmer understanding.

Key lessons from this study include the need for robust public-private partnerships (PPPs) to enhance affordability and outreach, leveraging technology to streamline claims and payments, and expanding insurance education to build farmer trust and awareness. The study recommends government subsidies as a crucial component for scaling insurance adoption and emphasizes aligning product offerings with regional climatic and economic realities to improve relevance and uptake. The recommendations align with national priorities underlined by the Ministry of Agriculture and TIRA, aimed at enhancing resilience in the agricultural sector while securing food systems and livelihoods.

This study is pivotal for informing policy and guiding the development of inclusive insurance models, ensuring SHFs have access to effective financial safety nets against growing climatic uncertainties.[30]

Other projects

Tanzania's agricultural insurance sector, contributing only 0.7% to the national Gross Written Premium (GWP) as reported by TIRA in 2023, offers several established models that provide a foundation for future development. Providers such as ACRE Africa, One Acre Fund, Pula, Global Parametrics, Reliance Insurance,

[29] Scott, Z., Bierenbaum, D., & Borchert, J. (2021). *Better Weather Protection for Tanzanian Farmers: Global Parametrics and One Acre Fund Trial a New Approach*. InsuResilience Global Partnership.
[30] AGRA. (2024). *Agriculture Insurance Viability Diagnostic Study: Enhancing resilience for smallholder farmers in Tanzania*. Alliance for a Green Revolution in Africa (AGRA).

Jubilee Allianz, UAP offer products including weather-index, area-yield, and multi-peril crop insurance. However, scaling these models has remained challenging due to structural and operational barriers.

These models demonstrate some best practices worth building upon. The Global Parametrics and One Acre Fund's project and Green Climate Fund and CRDB Bank Plc's project seek to integrate weather-index insurance with credit products to reduce loan defaults while expanding coverage. ACRE Africa's use of cooperative networks highlights the potential of leveraging agricultural value chains for distribution. Pula and One Acre Fund have shown that bundling insurance with inputs like seeds can increase uptake but can also be the cause for scaling limitations. Jubilee Allianz's partnership with Yara Tanzania also demonstrates the potential of private-sector collaboration.

Key challenges include high operational costs, particularly for Area-Yield Index Insurance (AYII), which requires costly crop-cutting experiments. Limited farmer awareness and the complexity of bundled or multi-peril products further constrain adoption. Additionally, unreliable data in rural areas and the lack of premium subsidies make insurance unaffordable for many smallholder farmers.

Regional Programmes: East Africa and West Africa

Drought Index-insurance for Resilience in the Sahel and Horn of Africa (DIRISHA)

The DIRISHA project focused on protecting approximately 350 million people in the **Sahel** and **Horn of Africa** exposed to drought risk, particularly those dependent on livestock.[31] This parametric insurance product used Index-Based Livestock Insurance to cover drought losses and went through four iterations, moving from macro to micro-level implementation in Kenya and Ethiopia. The project demonstrated varying levels of success, with adoption challenges at the micro-level and greater acceptance at the macro level. This difference in adoption levels highlighted the need for better integration between micro and macro-level insurance, as well as the importance of affordable pricing and scalability.

One Million Farmers Platform

Kenya's One Million Farmers Platform[32], supported by the World Bank, aimed to bring innovative agricultural technologies to one million Kenyan farmers, including insurance coverage for drought and excess rainfall. The platform allowed farmers to purchase insurance via mobile phones, using scratch cards that came with seeds or fertilizer purchases. This method significantly enhanced accessibility and ease of use for farmers, particularly in rural areas. Notably, 89% of the farmers had never accessed insurance before, making this an essential financial inclusion project. The success of this platform underscores the effectiveness of leveraging mobile technology as a distribution channel for insurance products.

Gender and Inclusive Agricultural Insurance Solutions (GAIINS)

[31] Building Evidence for Scaling Drought Risk Financing in East Africa. PreventionWeb, https://www.preventionweb.net/news/building-evidence-case-scaling-drought-risk-financing-east-africa.
Climate Impacts on the Front Line: Lessons from the DIRISHA Project for Pre-Prepared Finance. Disaster Protection, https://www.disasterprotection.org/blogs/climate-impacts-on-the-front-line-lessons-from-the-dirisha-project-for-pre-prepared-finance.
"DIRISHA Project Evaluation." CGIAR, https://cgspace.cgiar.org/server/api/core/bitstreams/12998542-46d5-4d84-a230-74116046c616/content.
[32] Evaluation of the Kenya Hunger Safety Net Programme (HSNP). Oxford Policy Management, https://www.opml.co.uk/projects/evaluation-kenya-hunger-safety-net-programme-hsnp.
World Bank. Disruptive Innovations Boost Uptake of Agriculture Insurance Solutions in Kenya. World Bank, 22 Oct. 2020, https://www.worldbank.org/en/news/feature/2020/10/22/disruptive-innovations-boost-uptake-of-agriculture-insurance-solutions-in-kenya.

The GAIINS project in Kenya[33] addressed the gender gap in agricultural insurance by designing products that cater to the unique needs of women. Recognizing that women represent half of Kenya's agricultural labor force yet invest in insurance far less than men, GAIINS aimed to make insurance more accessible by considering barriers such as lack of financial literacy and training. This initiative demonstrated that designing gender-sensitive insurance products can significantly improve adoption rates among women farmers.

The Impact of the Uganda Agriculture Insurance Subsidy (UAIS) Scheme on the Agriculture Sector[34]

The **Uganda** Agricultural Insurance Scheme (UAIS), launched in 2016 as a Public-Private Partnership (PPP), has proven a pivotal mechanism for addressing agricultural risks in Uganda. The scheme was designed to mitigate challenges such as unpredictable weather, pests, and other climate-related risks that threaten the livelihoods of farmers. Implemented through the Agricultural Insurance Consortium —a coalition of 13 insurers. The UAIS offers a range of products, including Multi-Peril Crop Insurance (MPCI), Weather-Based Index Insurance (WBII), Area Yield Index Insurance (AYII), and coverage for livestock, aquaculture, and forestry. The scheme covered risks like droughts and pest outbreaks. Its goal is to protect farmers, increase resilience, and enable access to credit from financial institutions.

The scheme has insured over 303,000 farmers. Regional trends in insurance product preference showed that the northern region favoured Area Yield Index Insurance (AYII), while the western region leaned toward Multi-Peril Insurance. Eastern regions exhibited a higher preference for Weather-Based Index Insurance (WBII), and central Uganda showed significant uptake in Poultry and Aquaculture Insurance. Despite the diversity in product offerings, the scheme faces a satisfaction gap, as only 34.4% of farmers reported being satisfied, compared to 38.8% expressing dissatisfaction, mainly due to insufficient compensation, delayed compensation, issues with the evaluation process, communication and transparency issues, issues with premiums and coverage, and dissatisfaction with the frequency of compensation.

By December 2021, the scheme had collected premiums amounting to UGX 57.5 billion (USD 15.5 Million)[35], while payouts totaled UGX 16.7 billion (USD 4.5 Million), reflecting a claims-to-premium ratio of approximately 29%. Notably, 89% of insured farmers faced production risks, yet 67% reported not receiving compensation with delayed or irregular rains being the most common cause of compensation.

A major hurdle for the UAIS is low awareness among farmers. Prior to the scheme's introduction, 87% of beneficiaries had never accessed insurance services, and even during the program, knowledge gaps persisted. The study emphasized the need for widespread educational campaigns to build understanding and trust in agricultural insurance products.

Preferred distribution channels varied by farmer type and region. Smallholders preferred rural agents, SACCOs, and self-help groups, while large-scale farmers favoured direct engagements with insurers and financial institutions.

[33]GAIINS: Making Agricultural, Climate Risk Insurance Gender-Inclusive. Climatelinks, https://www.climatelinks.org/resources/gaiins-making-agricultural-climate-risk-insurance-gender-inclusive.
Kenya: Protecting Women Farmers from Climate Risk in Rural Areas. PreventionWeb, https://www.preventionweb.net/news/kenya-protecting-women-farmers-climate-risk-rural-areas.

[34] *Insurance Training College, (2024), the impact of the Uganda Agriculture Insurance Subsidy Scheme on the Agriculture Sector. Kampala Uganda,* https://ira.go.ug/wp-content/uploads/2024/04/UAIS-Abridged-Version-February-2024.pdf

[35] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

The UAIS has had significant positive effects on beneficiaries. Approximately 59.5% of farmers reported income increases after enrolling, with the eastern region showing the highest gains. Confidence in pursuing higher-value agricultural activities also improved, with 74% of beneficiaries expressing confidence in venturing into profitable ventures due to risk coverage. However, small-scale farmers exhibited less appetite for higher-value investments compared to large-scale farmers.

The UAIS study identified key barriers to optimal implementation, including inadequate risk coverage, delays in claims settlement, and limited transparency in operations. Dissatisfaction with premiums and the frequency of payouts remains a concern for 46% of farmers who find the current product offerings inadequate.

To address these issues, the study proposed several recommendations: Enhanced Awareness Campaigns: Simplified and regionally tailored educational initiatives to increase understanding and uptake of insurance products. Bundling Services: Integrating agricultural insurance with input services, credit facilities, and other micro-insurance products to enhance accessibility and utility. Improved Risk Assessment and Claims Processes: Leveraging Uganda Ministry of Agriculture's extension networks for better coordination in claims verification, loss assessment, and awareness campaigns. Revised Subsidy Strategies: Increasing the annual subsidy fund to UGX 27.5 billion (USD 7.4 Million)[36] to meet rising demand and conducting actuarial analyses to ensure fair pricing. Exit Strategies: Gradual reduction of subsidies and introduction of single-risk insurance products to maintain affordability and transition to free-market conditions.

The UAIS underscores the effectiveness of PPP models in addressing complex agricultural risks. Drawing from its performance, it highlights the importance of innovative insurance products, regional customization, and leveraging government support for subsidies and infrastructure development. However, the scheme must address persistent issues such as claims delays, transparency, and inclusivity to maximize its impact on Uganda's agricultural sector. This evolution will not only enhance farmer resilience but also contribute to the broader goal of agricultural transformation in Uganda.

Other projects[37]

In **Ethiopia**, Nyala Insurance launched an index-based insurance scheme in 2009 to protect smallholder farmers against drought. However, scaling the product proved difficult due to a lack of adequate weather data in regions outside the pilot area. This case underscores the importance of investing in data infrastructure during the design phase to ensure scalability of index-based insurance products.

Also in **Ethiopia**, Pula's Area Yield Index Crop Insurance initiative in Ethiopia demonstrates a successful public-private partnership (PPP) model that effectively addresses climate risks for smallholder farmers. The program, implemented during the 2023 Meher season, insures over 122,000 farmers and recently made a 39.4 million birr payout to 51,000 policyholders. A key best practice in this initiative is the integration of crop insurance with Ethiopia's Input Voucher System (IVS). Farmers pay a premium per fertilizer bag. This PPP approach demonstrates how government-backed input distribution systems can serve as viable channels for scaling agricultural insurance.

[36] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

[37] Agricultural Insurance in Sub-Saharan Africa: Can It Work? Index Insurance Forum, https://www.indexinsuranceforum.org/project/agricultural-insurance-sub-saharan-africa-can-it-work.

The MicroEnsure initiative in **Malawi** linked weather-index insurance to credit access for smallholder farmers, aiming to encourage the adoption of climate-smart practices. Despite the potential benefits, uptake was low, with only 17.6% of farmer loan clients opting for the bundled product compared to 33% who opted for credit alone. This suggests that bundling insurance with credit did not significantly increase adoption rates, highlighting the need for more tailored bundling options that align with farmer priorities.

In **Mali**, an insurance scheme utilized the Normalized Difference Vegetation Index (NDVI), a satellite-based measure of vegetation density, to offer drought protection. While NDVI was effective for grain yields, its performance was inferior for other crops like cotton. This case illustrates the importance of tailoring indices to specific crops and regions to ensure effectiveness.

The case studies reveal several important lessons for improving insurance adoption among smallholder farmers. First, factors such as low trust in insurance providers, limited financial literacy, and the complexity of insurance products can significantly hinder uptake. To address these barriers, simplifying the insurance process, building trust through transparent communication, and ensuring reliable payouts are crucial strategies. Additionally, effective distribution methods, such as leveraging mobile technology and utilizing meso-level channels like farmer cooperatives, play a key role in increasing access to insurance. Educating farmers, particularly vulnerable groups like women, and building financial literacy are also essential for helping them understand the value of insurance. Furthermore, designing insurance products that are tailored to local farming conditions and specific crop needs improves their relevance and effectiveness. Lastly, societal factors, including gender dynamics and cultural or religious considerations, must be considered for insurance programs to succeed. For example, Takaful-compliant insurance products are needed in Islamic regions to align with local practices. Together, these lessons highlight the importance of a comprehensive approach to overcoming barriers and improving insurance adoption.

International Programmes

Austria's subsidized drought insurance program is a public-private partnership that combines indemnity-based insurance with weather index-based insurance. The government covers 55% of the insurance premiums. This model addresses the impacts of drought on agriculture by providing farmers with faster compensation. Key lessons from Austria include the advantages of combining traditional indemnity-based insurance with innovative index-based products, which simplify compensation calculations and speed up payouts. Challenges include rising costs of insurance due to increasing climate risks and the need to balance insurance with production-based risk management strategies like irrigation infrastructure.

In the **Kyrgyz Republic**, the World Food Programme launched a meso-level climate risk insurance pilot covering vulnerable farmers and herders against drought and harsh winters. The insurance product uses a weather index-based model where payouts are triggered by pre-set thresholds, ensuring quick mobilization of resources. The program provided coverage to 22,500 farmers, with a significant portion being women, highlighting its inclusive nature. Challenges faced included regulatory constraints due to the lack of a comprehensive framework for parametric insurance and low insurance culture, with many considering insurance as a burden like taxes. This case emphasizes the importance of establishing appropriate regulatory frameworks and building public perception of insurance as a valuable risk management tool.

In **Colombia**, the Microinsurance Catastrophe Risk Organization (MiCRO), in collaboration with SBS Seguros Colombia and Bancamía, designed a microinsurance product for small and medium enterprises. This product combines an innovative index-based insurance component with traditional insurance, providing automatic payouts based on predetermined triggers. Effective collaboration with local partners and addressing regulatory and training considerations were key to the program's success. Lessons learned include the importance of client education and trust, regulatory adaptation to accommodate the unique needs of urban and rural poor populations, and balancing insurance components to provide comprehensive coverage.

Mexico's CADENA program was a pioneering effort integrating macro-level catastrophe agricultural index products as a social safety net for small subsistence farmers. The program combined indemnity-based and index-based insurance products, subsidized by the federal government. Key best practices included the effective use of public-private partnerships and the provision of subsidized insurance to ensure affordability and access for smallholder farmers. Lessons learned highlighted the need for sustainable financial planning due to the exponential growth of the program's budget and the challenges in market competition due to the dominance of a public insurer. The main weakness of the programme was that insurance payments were made to the Mexican States (acting as aggregators), of which just a small portion reached the end farmers. This led the incoming Government to cancel the programme.

The program's discontinuation in 2020 led to the development of new initiatives, such as the Tripartite Agreement (TPA) project co-funded by the InsuResilience Solutions Fund (ISF) to maintain protection for climate-vulnerable farmers in Mexico. This aimed at providing sovereign parametric insurance to cover smallholder farmers against drought and excess rainfall, emphasizing direct payments to farmers and integrating technology for efficient enrollment and payout processes. Gender considerations were also integrated to address the differential impacts of natural disasters on women.

The agricultural insurance programs reviewed provide valuable insights into increasing insurance uptake, improving distribution, and designing inclusive, effective products. Key strategies include leveraging technology to improve efficiency and scalability, providing farmer information to build trust, and reducing basis risk to align coverage with actual losses if the data is available. Subsidies play an essential role in making products affordable, while public-private partnerships ensure financial sustainability and broaden outreach. Additionally, investing in robust data infrastructure is crucial for the accuracy and growth of index-based insurance products. Finally, addressing societal factors, such as land-use, gender disparities, and cultural considerations, is important for the successful adoption and long-term viability of these products.

Part III
Stakeholder Engagement Surveys and Interviews

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III. Stakeholder Engagement surveys and interviews

To complete our feasibility study on the development of agricultural insurance in the country, we successfully conducted a survey involving various stakeholders from the agriculture, finance, insurance sectors, Ministry of Agriculture (MoA) staff, farmers, and leaders of cooperative societies in the regions of Dodoma, Arusha, Ruvuma, and Dar es Salaam. The study employed a qualitative data collection method, where farmers were asked a variety of questions through focus group discussions and by filling out questionnaires. A total of 296 farmers from the regions of Ruvuma, Dodoma, and Arusha were interviewed, including 86 farmers in Ruvuma, 84 farmers in Arusha and 96 farmers in Dodoma, in addition to 9 cooperative leaders in Arusha, 10 in Ruvuma and 11 in Dodoma. Additional data were collected from 15 government officers and input suppliers to understand systemic gaps and complementary needs in the insurance market. The results of the study can be found in a separate Annex 2.

Photo 1 - Picture from a November Stakeholder workshop in Ruvuma. Source: ACRE Africa

Demand-Side Data Analysis

This section integrates survey findings from smallholder farmers in Ruvuma, Arusha and Dodoma regions, as well as responses from government officials and input companies. These insights provide a foundation for validating and tailoring a product which aligns with farmer needs and addresses specific regional challenges.

Farmer Profile and Market Segmentation

Survey data from Ruvuma, Arusha and Dodoma indicates that most respondents are SHF, with landholdings of an average 13.5 acres (5,4 ha), out of 266 respondents 241 farmers own within 1 to 24 Acres of land. All regions show a high dependency on staple crops with maize emerging as the predominant crop. It is cultivated by over 60% of respondents, where Ruvuma represented 98.8% of the farmers, Arusha 96.43% and Dodoma 74%.

Crop Type	Ruvuma surveyed Farmers (Count)	Arusha surveyed Farmers (Count)	Dodoma surveyed Farmer (Count)	Total surveyed Farmer Count (from Survey)
Maize	85	81	71	237
Coffee	74	2	-	76
Beans	56	66	-	122
Sunflower	27	40	56	123
Sesame	10	-	31	41
Paddy	1	18	66	85

Table 1: Crop Distribution by Region and Count of Farmers Cultivating Each Crop

Key Observations:

- Maize is the main crop across both regions, suggesting it as a priority for insurance coverage during the first stage in implementation.
- Regional variances exist, such as the high concentration of coffee cultivation in Ruvuma, which indicates an additional layer of climate risk sensitivity due to coffee's susceptibility to pests and diseases. The same applies with paddy in Dodoma with perils such as drought and pests.

Farm Output and Income Levels

The survey reveals variability in yields and income, reflecting regional differences in productivity and crop type. In Ruvuma, average yield per acre was around 14 bags (bags of 100kgs) while income varies significantly but with most farmers earning over TZS 10 million (USD 3,900)[38] per season. Dodoma farmers, however, reported relatively lower income levels with most being below TZS 10 million (USD 3,900)[39], with average yield of 4 bags per acre. Arusha had a relative difference with Dodoma and Ruvuma as some farmers had over 10 bags average yield per acre annually with over TZS 10 million (USD 3,900)[40] total income from the crops grown in previous season.

Region	Average Yield per acre *(Number of 100kgs bags/acre)*	Total Income per Season *(TZS/ (USD)[41])/acre*

[38] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*
[39] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*
[40] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*
[41] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

Ruvuma	14	2,000,000 - 20,000,000 / (780 – 7,800)
Arusha	9	500,000 - 11,200,000 / (195 – 4,368)
Dodoma	4	156,000 – 105,000,000 (60.84 – 4,095)

Table 2: Average Yield and Income per Acre by Region

The income disparity suggests potential affordability issues for insurance premiums, especially for low-yield farmers in areas Dodoma and Arusha.

Key Risks and Demand for Agricultural Insurance

The survey data indicates that weather-related risks such as droughts and excess rainfall, pests and diseases, soil degradation and market price fluctuations are the most pressing concerns across both regions. In Arusha wild animals and theft are also among the concerns of farmers. Around 89.5% of the sample size of Ruvuma farmers and 100% of Arusha farmers identified weather related risks, drought and flooding being among them as one of their primary threats, pests and diseases stood out as the major risk to both farmers in areas of Ruvuma (98.8%) and Arusha (95.2%) while market fluctuation and soil degradation were also frequently cited.

Risk Type	**Ruvuma (% of Respondents)**	**Arusha (% of Respondents)**	**Dodoma (% of respondents)**
Weather related risks	89.5%	100%	95.8%
Soil degradation	81.4%	91.4%	89.6%
Pests and Diseases	98.8%	95.2%	96.9%
Market Fluctuations	97.7%	85.7%	96%

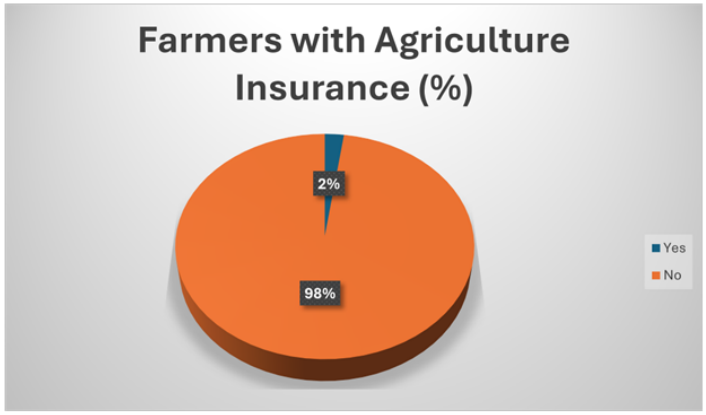
Table 3: Percentage of Farmers Citing Each Risk Type as a Major Concern

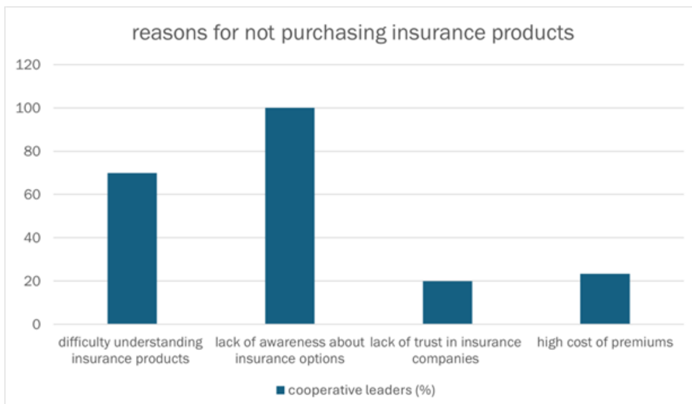
Insurance Situation, Willingness to Pay and Affordability Barriers

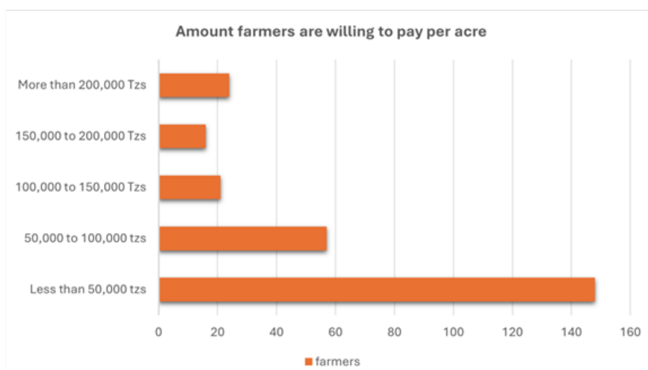
Survey data reveals that 93% of government officers believe that providing agricultural insurance subsidies to farmers would help more farmers to enroll in agricultural insurance services, whilst 64.3% of the officers believe that farmers have the ability to pay for their insurance directly without relying on subsidies or government assistance. On the other hand, 36% of Ruvuma farmers, 88% of Arusha farmers and 77% of Dodoma farmers consider premium affordability as one of the major factors to consider when evaluating the attractiveness of a crop insurance product. 30.2% of Ruvuma farmers, 79% from Arusha and 62.5% from Dodoma require financial support for premium. About 19.5% of respondents in all regions had no expression in affordability issues and premium financing, therefore, this group shows willingness to pay for insurance at full premium rates. However, 54.1% of farmers in all regions indicated that they would show interest in insurance if there were ease of enrollment and claims payment. 55.6% of surveyed farmers were willing to pay premium if less than TZS 50,000 (USD 19.5)[42], for premiums around TZS 50,000 (USD 19.5) to 100,000 (USD 39) only 21.4% of farmers showed willingness to pay, 7.8% showed willingness to pay premium ranging from TZS 100,000 (USD 39) to 150,000 (USD 58.5). For premiums ranging from

[42] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

TZS 150,000 (USD 58.5) to 200,000 (USD 78) only 6% were willing, only 9% showed willingness to pay more than TZS 200,000 (USD 78)[43].







Charts 1 – Percentage of farmers with agriculture insurance, their reasons not to, and the amount farmers are willing to pay per acre.

Barriers Identified:

[43] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

- Affordability: Most farmers cannot afford standalone premiums, indicating a high sensitivity to insurance pricing.
- Payment Models: Farmers prefer flexible payment models, such as insurance integrated into loan packages for inputs, seeds, or fertilizers.

Implications for Pricing Strategies:

- Government subsidies may be essential to make agricultural insurance financially accessible for smallholder farmers.

Demand-Driven Product Design and Preferred Features

Survey responses highlight that 94.7% of farmers across all regions favor indemnity, as it would greatly limit basis risk. Additionally, 4.8% of farmers expressed interest in single-peril insurance, with a strong preference for digital enrollment and claim processing options due to high mobile penetration. 83.3% of the market players think the use of technology and mobile phones can facilitate the delivery of insurance services to farmers in the country, however, only 33.3% of the government officers believe that farmers can purchase agriculture insurance via their mobile phones, and 46.6% of the government officers also believe that farmers can purchase insurance linked with credit services from financial institutions. 74.4% % of surveyed farmers desire cash payouts and 25.6% desire inputs as the payout mechanism during claims.

Technological Integration:

Out of surveyed government officers, 33.3% believe that their office, organization, or institution can help in providing agricultural insurance services to all farmers in the country by helping to provide technology that can assist farmers in paying for insurance and provide information about agriculture insurance. Such organizations with this vision are for example, Cashewnut Board and Movement for Community Development (MCODE)

Summary Table and implications

Category	Sub-Category	Ruvuma	Arusha	Dodoma
Farmer Demographics	**Primary Crop** (farmers count)	Maize (85), Coffee (74), Beans (56)	Maize (81), Sunflower (40), Beans (66)	Maize (71), Paddy (66), Sunflower (56)
	Average Yield per acre per year (Kg)	30-450	10-384	2-1500
	Average Income per Season (TZS / (USD)[44])	2M - 20M (780 – 7,800)	500K - 11.2M (195 – 4,368)	156K – 105M (60.84 - 40,950)
Key Agricultural Risks	**Weather Related Risks** (% of farmers respondents)	89.5%	100%	95.8%

[44] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

	Pests and Diseases	98.8%	95.2%	96.9%
	Market Fluctuations	97.7%	85.7%	96%
	Soil Degradation	81.4%	91.4%	89.6%
Demand & Preferences	**Willingness to Pay Full Premium (**% of farmers respondents**)**	19.5%		
	Need for financial support for premium	30.2%	79%	62.5%
	Preferred Insurance Product (type and % of farmers respondents**)**	Indemnity Insurance		
		94.7%		
	Use of technology and mobile phones (% of market players respondents)	83.3%		
	Desired Payout Mechanism (% of farmers respondents**)**	Inputs (25.6%), Cash (74.4%)		

Part IV
Market Analysis

funded by KFW
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IV. Market analysis

Market Landscape: Market Trends and Existing Products

Trends and growth of Agricultural Insurance in URT

Tanzania's agricultural insurance market is still in the nascent stages of development. However, significant strides have been made in recent years, with a growing number of initiatives aimed at addressing the risks posed by climate change. The Tanzania Agricultural Insurance Scheme (TAIS) initiated by the government in partnership with various stakeholders, is in the designing process to expand insurance coverage, focusing on mitigating risks such as drought and floods.

By 2025, it is estimated that 500,000 smallholder farmers will be covered by IBI products, according to the AGRA Tanzania Strategy 2023-2027. The TAIS initiative, along with other projects, seeks to cover up to 80% of SHF in URT by 2030.

The Tanzanian government has demonstrated increased commitment to addressing agricultural risks, as evidenced by the budget allocation request in the 2024/2025 fiscal year. According to the MoA, a total of TZS 1.2 trillion (USD 468 Million) was requested for agricultural development projects, with TZS 332 billion (USD 129,480)[45] specifically directed toward expanding irrigation infrastructure. By improving irrigation, the government aims to make farming less dependent on rainfall, thus reducing the exposure of farmers to drought and providing an ideal environment for scaling up insurance initiatives. The MoA, recognizing the challenges faced by SHFs, including the impacts of changing weather patterns, has also initiated a program to drill 68,000 boreholes to support SHFs produce crops throughout the whole year. This initiative was officially launched in August 2023.

The government's Kilimo Kwanza initiative and Agricultural Sector Development Programme (ASDP II) aims to integrate insurance products into agricultural finance, helping to incentivize the adoption of risk mitigation mechanisms.

Existing Insurance Products

The Tanzanian agricultural insurance landscape features a mix of indemnity-based and index-based products, primarily targeting smallholder farmers and agribusinesses. Indemnity-based policies dominate, often bundled with loans provided by financial institutions. These policies are typically group-based and include coverage for various crops such as maize, rice, coffee, sunflower, and cotton. Index-based products, including Area Yield Index Insurance (AYII) and Weather Index Insurance (WII), have also gained traction. Under AYII, payouts are determined through Crop Cutting Experiments (CCE), where harvest samples are analyzed to establish thresholds, including the minimum "trigger value" and the "Total Sum Insured" for losses. Loss reports are verified through detailed assessments by certified auditors and field inspections, followed by the preparation of final payout reports.

WII relies on satellite data and metrics from the TMA to activate payouts based on predefined climatic triggers such as rainfall deficits or excessive rainfall. Insurers like Reliance Insurance, and Jubilee Allianz

[45] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

offer Index-Based Insurance and hybrid products that combine indemnity and index approaches. These products cover risks ranging from drought, floods, and excessive rainfall to pests and diseases. Livestock insurance products are also available, covering losses due to diseases, theft, or accidents.

Since 2022, the Green Climate Fund and CRDB Bank Plc have collaborated to improve agribusiness access to climate adaptation technologies in Tanzania, offering a credit line, a credit guarantee facility, and a weather-indexed crop insurance product designed to de-risk loans for smallholder farmers. Despite over six registered insurance companies offering agricultural insurance in Tanzania, agricultural insurance contributes only 0.7% to the national Gross Written Premium (GWP), according to the 2023 TIRA report. Public insurance facilities could help subsidize costs, enabling broader adoption. Key players like ACRE Africa, One Acre Fund, Global Parametric, Pula, Reliance Insurance, UAP, and Yara Tanzania already offer various crop insurance products, including weather-index, area-yield, and multi-peril insurance. Investigations into why these products have not scaled up broadly will be conducted, leveraging ACRE Africa's invaluable insights as a consortium member.

Premium rates for products like AYII and MPCI typically range from 3% to 5% of the sum insured, with indemnity limits varying by product type. The current market structure underscores the potential for technologically integrated, scalable, and modular insurance products tailored to the specific needs of Tanzanian farmers. The proposed parametric products aim to address these gaps by simplifying enrollment and claims processes, leveraging digital technology, and offering customizable, unbundled solutions to empower smallholder farmers with climate-smart practices and resilient risk management tools.

Market Size

According to Annual Agriculture Sample Survey 2022/23, total addressable market for agricultural insurance in Tanzania is substantial, comprising 8,970,096 agricultural households, of which 72.9% are male-headed and 27.1% are female-headed. Of these households, 98.3% (8.82 million) are engaged in crop production, cultivating a total of 17.2 million hectares of land. Maize accounts for the largest share, covering 6.3 million hectares, with a production volume of 7.0 million tons out of the 9.7 million tons of cereal crops produced. However, only 4.9% of agricultural households have accessed loans for agricultural purposes, highlighting a significant gap in financial inclusion

SHF cultivating less than 5 hectares are the core target of this project, as they constitute more than 80% of the total farming population in URT. Over 85% of smallholder farmland is dedicated to food crops, with maize being the primary staple, followed by beans, cassava, sweet potatoes, and rice (Tanzania Invest). The National Bureau of Statistics (NBS) estimates that women make up 54% of the agricultural workforce, with many women-headed households increasingly adopting agricultural insurance. Programs focusing on female farmers have recorded higher adoption rates due to targeted marketing campaigns.

Most SHF have limited or no access to traditional banking services, as only 10% have a bank account. Digital financial services offer a potential avenue to reach this segment in URT, with mobile money penetration at 75%, representing a vital channel for insurance distribution. Despite the growing availability of agricultural insurance products, farmers remain skeptical towards insurance. According to the 2024 **AGRA Tanzania Strategy**, 45% of surveyed farmers were unaware of insurance products, and 20% expressed concerns over delayed payouts and high premium costs. Willingness to pay remains a key obstacle, with most farmers only willing to pay premiums if they are subsidized by the government. According to the **2022** Tanzania **TIRA report**, farmers are generally willing to pay around 2-4% of their income for insurance coverage, but many insurance products exceed this price threshold.

Supply Chain Dynamics

The agricultural insurance supply chain in URT encompasses a network of public institutions, private financial entities, input suppliers, cooperatives, processors and transportation companies, all working collaboratively to deliver insurance products to smallholder farmers. This interconnected supply chain structure is crucial to expanding insurance accessibility, especially in rural areas where most farmers reside, and traditional banking infrastructure is limited.

The following market actors of the maize value chain can be involved in our project:

- **Insurance Providers:** The main insurance providers, including NIC, UAP, Jubilee General Insurance Company, Mgen Tanzania, GA Insurance Company & Britam, have adopted innovative distribution strategies to reach underserved rural farmers. These companies partner with mobile money platforms such as M-Pesa and Tigo Pesa to enable digital premium payments and claim disbursements, thereby overcoming barriers posed by limited physical banking infrastructure in rural areas. They also work with cooperatives, SACCOS, and community-based organizations to broaden the reach and understanding of agricultural insurance among smallholder farmers.
- **Cooperatives and AMCOS**: Cooperatives, specifically AMCOS, are integral to Tanzania's agricultural supply chain. These organizations act as intermediaries, providing CSA advice and purchasing insurance on behalf of their members. There are 7,349 cooperatives in total in Tanzania, including 4,279 AMCOS. There are 50 AMCOS in Dodoma, 223 in Ruvuma and 24 in Arusha. All types of cooperatives including SACCOS could also be leveraged, which amounts to a higher number of potential aggregators, as visible below.

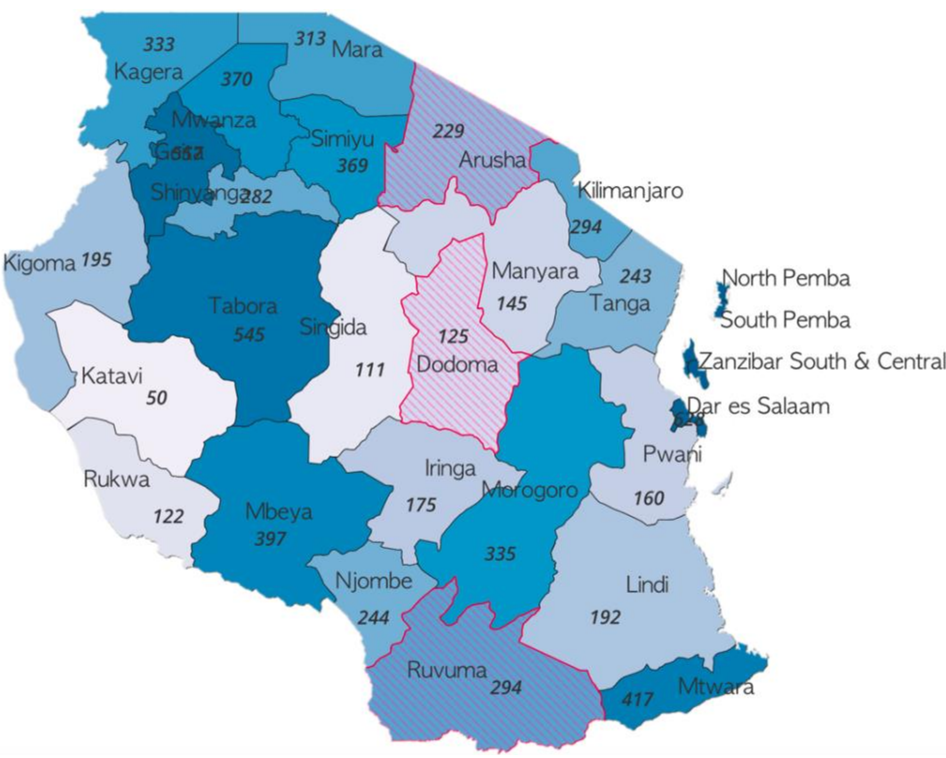


Figure 5 - Number of cooperatives by region.
Source: IDF from The COOPERATIVE STATISTICAL REPORT For 2022/23 by The United Republic of Tanzania Ministry of Agriculture The Tanzania Cooperative Development Commission (TCDC).

Regulatory Framework

To address various challenges in the agricultural sector, the government, through the Ministry of Finance, has implemented several initiatives. One key step is the **exemption of crop insurance from VAT**, making these products more affordable for farmers. Additionally, the government has established the Tanzania Agriculture Insurance Consortium (TAIC)[46] to enhance efforts in enrolling farmers, providing education, and organizing the delivery of crop insurance services nationwide. Furthermore, the number of agricultural insurance providers has grown, with over 10 insurance companies now offering services in the country, driven by rising awareness and demand for such products, particularly in response to the challenges posed by global climate change. This growth of the sector was underscored in 2024 by the development of a new national regulatory framework, the "Agricultural Insurance Regulations".

Draft Agricultural Insurance Regulations, 2024

This structured framework presents rules for regulating agricultural insurance business in URT. These regulations aim to protect farmers, promote risk management, and create a sustainable insurance landscape for the agricultural sector.

The key aspects covered by this regulation and relevant for a potential project are the following:

Registration and Approval to Conduct Agricultural Insurance Business: All insurers or intermediaries (e.g., agents, brokers) interested in agricultural insurance must be registered and approved by the Commissioner of Insurance. This includes both public and private entities engaging in agricultural insurance. Each applicant must meet specific capital requirements, follow prescribed forms (Form A for insurers, Form B for intermediaries), and pay corresponding fees for registration and maintenance.	**Underwriting Agricultural Insurance**: Insurers cannot transact agricultural insurance products without prior written approval from the Commissioner. The regulations specify the underwriting requirements, which include the types of cover (indemnity-based and index-based) and methods for determining the sum insured, policy wording, and indemnity thresholds. Agricultural insurance products in URT are underwritten through the **TAIC,** creating a collective approach to risk management and pricing.	**Claims and Settlements**: **Tanzania Agriculture Insurance Scheme (TAIS):** The scheme is designed to cover various agricultural risks, including climate and natural hazards. The geographical scope is nationwide, and priority crops, livestock, and forestry are determined by the relevant authorities in collaboration with sectoral ministries. The scheme focuses on enhancing farmer resilience against natural hazards through subsidized premiums, and collaboration between the public and private sectors.
Types of Insurance Coverage: These include:	**Agricultural Insurance Policy Issuance and Distribution**:	**Public Awareness and Training:**

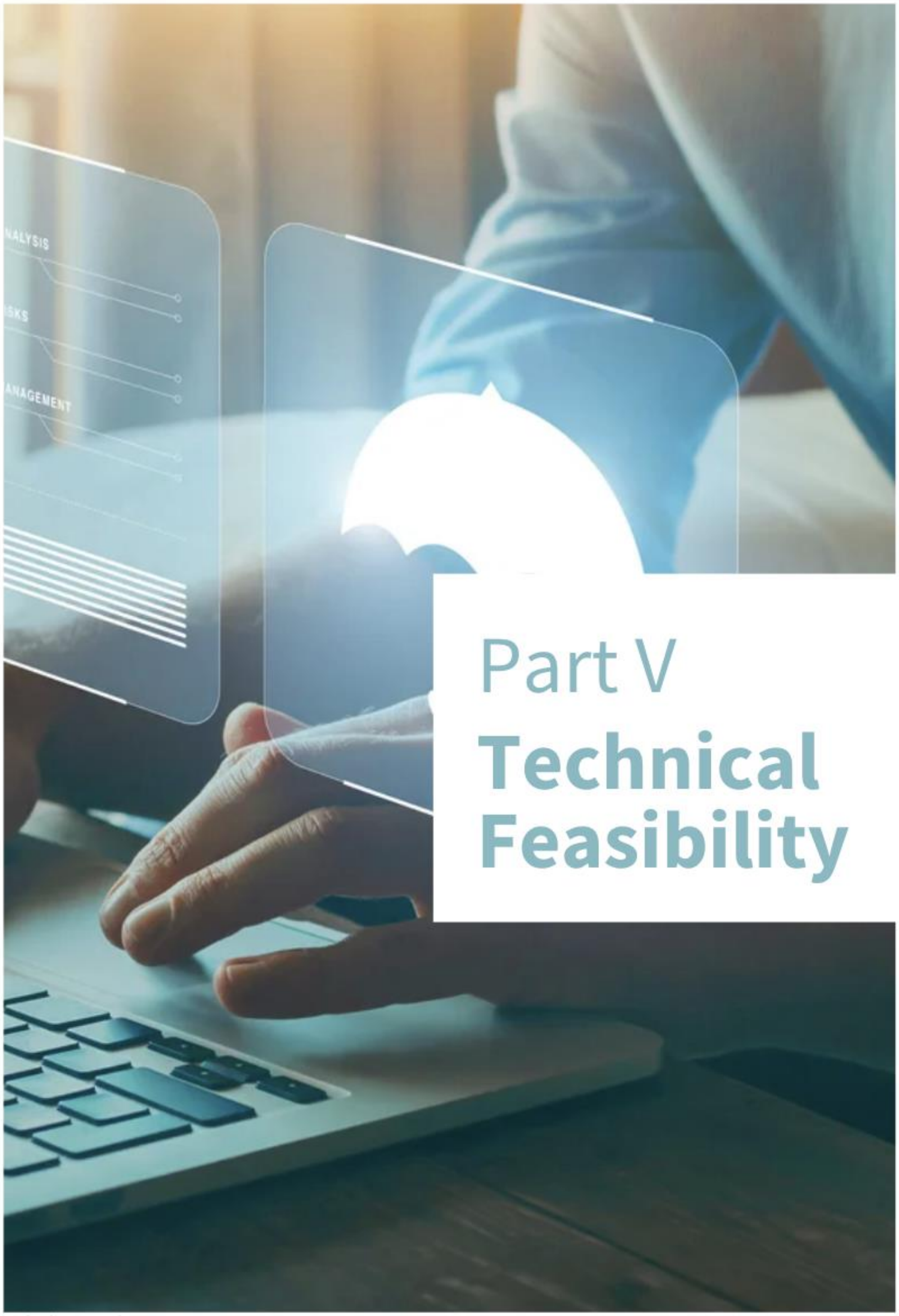
[46] The TAIC was launched in July 2023. It is a consortium of private insurance companies which offer agriculture insurance in URT. Its goal is to provide comprehensive crop and livestock insurance services to cushion farmers against losses from drought, floods, pests, diseases, and other agricultural risks. By fostering technical capacity building, promoting financial access through insurance-backed loans, and ensuring risk-sharing among local insurers, TAIC seeks to stabilize farmers' incomes, encourage modern farming practices, and enhance food security.

Indemnity-based: This may cover named perils, multiple perils, crop revenue, and live-stock losses due to accidents, mortality, or epidemics. **Index-based:** IBI covers risks like rainfall deficit or excess, temperature variations, or soil moisture levels.	Policies issued must be simple, easy to understand, and written in Kiswahili. The distribution of these products can be done through registered intermediaries, including insurance brokers and agents, SACCOS, microfinance institutions, digital platforms, and agro-dealers.	Insurers and intermediaries are obligated to participate in public awareness campaigns, helping educate farmers on the importance of agricultural insurance. A semi-annual report on awareness initiatives must be submitted to the regulatory authority. Insurance companies must train their officers to ensure competent management of agricultural insurance business operations.
Capital Requirements: Insurers must maintain capital as specified under the Insurance Act and Insurance Regulations, ensuring financial sustainability and capacity to handle claims related to agricultural risks.	**Claims and Settlements**: Regulations define a process for handling claims, including submission, assessment, and adjustment, with set timelines for each phase. This ensures transparency and timely payouts to policyholders. Notably, the claim process is based on the principle of utmost good faith.	**Consumer Protection***:* Consumer protection principles are enshrined in the regulation to ensure fairness, transparency, and full disclosure of policy terms. The guidelines also emphasize effective complaint handling mechanisms, dispute resolution, and transparency in policy exclusions, deductibles, and fees.

When analyzing the framework, several key aspects emerge that support the study's objectives.

- **Index-Based Insurance Products**: The regulations promote both indemnity-based and index-based insurance products.
- **Coverage of Vulnerable Groups**: The regulations state that SHF are farmers cultivating between 0.2 to 2.0 hectares of land.
- **Intermediaries:** The regulations clearly define the roles of intermediaries such as insurance brokers, agents, SACCOS, and agro-dealers. The requirement for insurers and intermediaries to register with the Commissioner ensures that only financially capable and reputable entities operate in this space. This promotes the goal of ensuring that any agricultural insurance product introduced has the backing of strong financial institutions and robust risk management mechanisms.

The draft regulations recommend enhancing public-private partnerships to ensure agricultural insurance remains accessible and sustainable, expanding digital platforms to improve reach and efficiency, subsidizing premiums for vulnerable smallholder farmers to maintain affordability, and building the capacity of local stakeholders through consistent training to foster trust and understanding. Addressing challenges *such as premium affordability, regional customization, and enhanced farmer education is crucial for the project's success.*



Part V
Technical Feasibility

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V. Technical feasibility Assessment

Potential Products - Cost-Benefit analysis.

This section will assess the cost-benefit ratios of several insurance types, namely indemnity, area yield index insurance or parametric insurance.

Indemnity insurance

Indemnity crop insurance, including multi-peril and named-peril options, can encounter issues like moral hazard and adverse selection. These problems arise when farmers take on greater risks or exaggerate losses to receive higher payouts. Effective indemnity insurance requires detailed farm-level data on historical yields and farming practices, which is generally unavailable in URT. Additionally, the high fixed costs and technical challenges of conducting on-site loss assessments make indemnity insurance largely impractical, especially for SHF for which the fixed cost is a high proportion of the premium. While targeting high-value crops in concentrated regions with Named Peril Crop Insurance (NPCI) is a possible alternative, it remains complex and expensive to implement, especially for smallholder farmers for which affordability of the product will be essential.

Area-Yield Index Insurance (AYII)

Area-Yield Index Insurance (AYII) combines elements of indemnity and parametric insurance by using aggregated yield data from specific agroecological zones to determine payouts. AYII provides comprehensive coverage, including non-climatic risks such as pests and diseases, making it attractive to producers. Implementing AYII requires reliable historical yield data, typically gathered through crop cutting experiments (CCE). Although Tanzania has extensive yield data for key crops like maize, much of it is survey-based and not sufficiently robust for AYII purposes. Some organizations in Africa such as Pula have launched area yield insurance programmes without any historic CCE-based yield data. Instead, they have used national-level yield data per crop (typically provided by FAO) and disaggregated the data to region-level or even department-level using in-house formulae that look at production per zone and rainfall risk profiles. However, insurers typically prefer to use actual historic CCE-based yield data for a solid understanding of the risk. Establishing the necessary infrastructure and training for accurate yield data collection is required, which may delay its implementation to the medium term.

We recommend that the government sets up the infrastructure and puts the resources in place for carrying out crop cutting experiments for maize, especially given their investment in irrigation infrastructure to shift farmers away reliance on the weather. If this is done at the very start of the national agriculture insurance programme's launch, the CCE-based yield data can be collected over at least two years, allowing the subsequent launch of an area yield insurance cover in the medium-term. However, this would have to be accompanied in parallel by the training of government extension officers by specialists, such as Acre Africa, on how to carry out the CCEs. There would also be a need for insurers to train their own specialists to then conduct shadow CCEs – this type of auditing is done in India for the country's national agriculture insurance scheme which is based on AYII and has significant issues of misreporting of yield data. Shadow CCEs would be an additional cost to consider in the premium.

Index-Based Insurance

Index-Based insurance stands out as the most feasible and ideal crop insurance solution for Tanzania to complement the existing initiatives already ongoing on AYII. Our approach would rely on predefined indicators for drought and excess rainfall, utilizing satellite data and, if relevant, from existing weather stations to trigger payouts. The TMA operates a network of 41 automatic weather stations, 27 manned synoptic weather stations and is expanding its infrastructure, although it has not yet fully met the World Meteorological Organization's Global Basic Observing Network (GBON) standards. However, there are only 15 stations currently available on Speedwell, a climate data service provider used by the insurance industry to filter high quality weather station data.

Index-Based Insurance offers several advantages:

- *Speed and Objectivity:* Payouts are triggered automatically based on weather data, providing timely and less biased settlements.
- *Cost Efficiency:* Reduces administrative and operational costs by eliminating the need for individual loss assessments or crop cutting experiments.
- *Scalability:* Can be rapidly deployed across wide areas using existing satellite coverage and meteorological infrastructure.

While Index-Based insurance offers numerous advantages, it does present the challenge of basis risk—the potential mismatch between actual losses experienced by farmers and the payouts triggered by the insurance index. This can occur when the selected weather parameters do not sufficiently correlate with on-the-ground conditions, leading to situations where farmers may suffer losses without receiving compensation, or receive payouts without significant losses. To mitigate basis risk, the insurance product will be carefully designed and calibrated using high-quality satellite data and available ground observations. Incorporating local agricultural expertise and continuous validation of the index will further enhance its accuracy, ensuring that payouts closely reflect the actual experiences of farmers.

Index-Based Insurance emerges as the more advantageous option due to its speed, lower administrative and lack of loss adjustment costs, reduced moral hazard, and scalability. Specifically, loss adjustment costs for Area Yield Crop Insurance can range from 2-3% up to 10% of either cost of production or expected crop value (ACRE Africa 2024), and potentially higher for smaller portfolios, making Index-Based Insurance much more cost-effective, especially for larger or rapidly scaling programs.

Moreover, Index-Based Insurance significantly mitigates moral hazard risks, which in some AYII schemes have led to loss increases of up to 50% before corrections were implemented (ACRE Africa 2024). IBI's reliance on objective weather data, particularly using satellite, provides broad applicability, especially in regions with variable weather risks and limited historical data.

Transitioning to more precise area yield index insurance is possible and encouraged to reduce basis risk and enhance coverage to pests and disease but will require significant investment in infrastructure and collaboration with governmental bodies for a sovereign insurance solution of this nature to be implemented.

***Index-Based insurance** emerges as the most feasible and effective crop insurance solution for a rapidly scaled programme. It offers more cost-effectiveness, streamlined* *operations, reduces the risk of moral hazard, adverse selection, and can be rapidly deployed using available satellite and weather station data.*

Institutional Setup

The project setup will **involve insurers from TAIC co-insuring** to share risks and enhance coverage capacity. The project will adopt a coinsurance setup, where multiple insurers from TAIC will jointly underwrite policies, sharing premiums and claims in agreed proportions. A lead insurer will manage policy issuance and claims administration, while co-insurers will back a portion of the risk. This structure will diversify risk, increase coverage capacity, and enable broader market participation. A formal agreement will outline roles, obligations, and financial shares to ensure smooth coordination and regulatory compliance.

Looking ahead, a centralized risk pool, as visible in the figure below, will serve as a long-term structural evolution for TAIC, creating a more sustainable and scalable insurance framework. We will provide advisory support by developing a detailed roadmap outlining key steps, operational structures, and regulatory considerations, as establishing such a risk pool would be a complex process likely requiring a few years to fully implement.

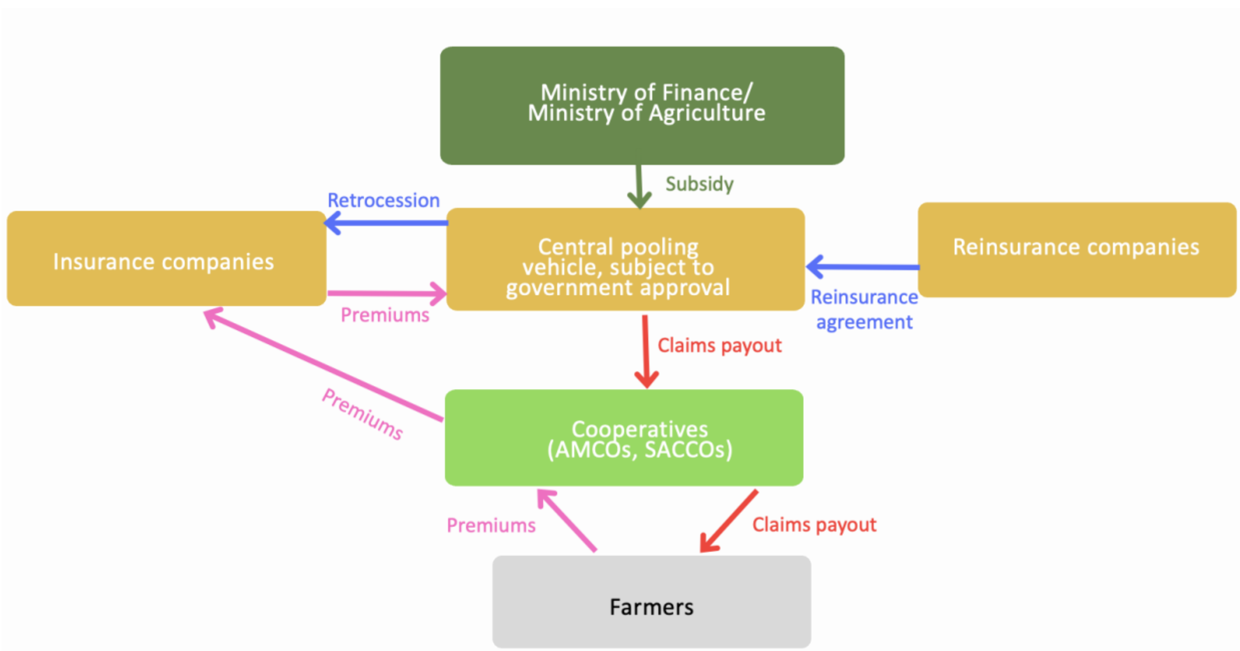


Figure 6 - Future potential institutional set-up. *It would be an insurance risk pool retroceding to private insurance companies. It distributes payouts to cooperatives, which redistribute the payouts and collects premiums from the farmers to insurance companies, which transmit premiums back to the risk pool.*

This future institutional setup would have several benefits, including scalability, efficiency, and risk-sharing. By establishing a central pooling vehicle[47] – the nature of which will be discussed with the government - the model provides more financial stability by pooling risks and retroceding them to private insurers, reducing the burden on individual companies and encouraging their participation in agricultural insurance markets. The involvement of cooperatives as intermediaries streamlines the collection of premiums and distribution of

[47] Potentially TAIC.

payouts, leveraging their existing networks and trust within farming communities. This enhances accessibility for SHF while lowering administrative costs. Furthermore, as a consortium, the risk pool can negotiate better terms with reinsurers and attract investment, fostering long-term sustainability.

Successful implementation of the agricultural insurance program requires close coordination between the Tanzanian government, insurance providers, cooperatives, and financial institutions. These entities will play distinct yet interrelated roles in ensuring the delivery of insurance products that address the specific risks faced by smallholder farmers across various regions.

Public actors which will be leveraged in the context of the IDF project:

The **Ministry of Agriculture** serves as the central policymaker, driving the development and implementation of agricultural insurance schemes. It ensures that insurance products align with national objectives such as food security and rural development. By providing strategic leadership, the Ministry collaborates with regulatory bodies and financial institutions to promote financial inclusivity for smallholder farmers.

The **Tanzania Insurance Regulatory Authority (TIRA)** ensures that all insurance products comply with national standards and facilitates the introduction of innovative products like index-based insurance. TIRA is leading the approval processes and advocating for regulatory reforms.

REGULATION & STRATEGY

The **Tanzania Agricultural Research Institute (TARI)** and the **Tanzania-Climate Smart Agriculture Alliance** (TCSAA) can play a pivotal role in supporting the insurance framework through its research on climate-smart agricultural practices and innovations. They provide data and insights on pest-resistant crops and climate-adaptive farming methods.

Tanzania Meteorological Authority (TMA) is responsible for supplying granular weather data necessary for the creation of parametric insurance products. By operating numerous synoptic, automatic, and agro-meteorological weather stations, TMA has useful data for calibrating insurance models and validating satellite

The **National Bureau of Statistics (NBS)** contributes by collecting and analyzing demographic and crop yield data, which are important for understanding the insurance needs of over 7.8 million smallholder farmers. NBS provides survey data that can enable the customization of insurance products to address specific regional risks.

DATA PROVIDERS

Support from the government, and specifically from the MoF will also be essential in addressing the affordability of insurance premiums through subsidies. Given that an average of 57.23% of farmers consider insurance premiums unaffordable without subsidies according to the surveys, the Tanzanian government will need to play a central role in providing financial subsidies to offset the cost of insurance premiums. The IDF team is in talks with TIRA, which confirmed the government's intention to deploy insurance subsidies for crop insurance. This could be achieved through the Agriculture Insurance Subsidy Scheme. It is still unclear how much the government will subsidize the TAIC.

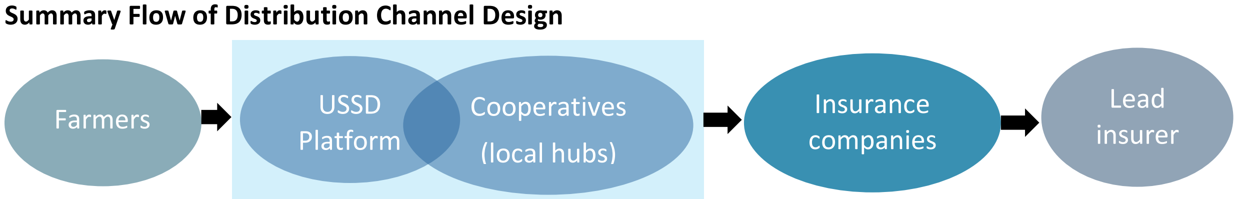
Distribution Channel Design

Given the structural challenges of reaching Tanzania's SHF—many of whom reside in rural, hard-to-access areas—innovative distribution models that leverage technology, partnerships, and local networks will be essential for success.

Our proposed distribution channel is the following:

- **Farmers Access the Product**: To incentivize cooperatives to act as representatives of the program and promote CSA and organic agriculture, a combination of financial and non-financial rewards could be implemented. For example, agents from cooperatives could be incentivized through a commission-based model where they receive a fixed amount of each premium collected or claim processed. SHF access the insurance product either through AMCOS, SACCOS or through USSD for convenient premium payments, claims processing, and information. In URT, over 47.6 million subscribers use mobile phones, and mobile money services like M-Pesa and Tigo Pesa have deep market penetration. These platforms have become critical enablers of financial inclusion, especially in remote areas and are widely trusted by rural populations.
- **Premium Collection**: Farmers can pay premiums either directly via the USSD platform or through **cooperatives** if they prefer cash transactions. AMCOS and SACCOS can consolidate these payments on a central digital platform and transfer them to insurance companies, ensuring a centralized fund collection for all farmers and a clear basis for commissions.
- **Claims Disbursement**: In the event of a payout trigger, the **lead insurer disburses funds** to cooperatives, which redistribute the payouts to farmers. For example, farmers in Dodoma could receive payouts directly into their mobile wallets if rainfall levels fall below a certain threshold, ensuring prompt relief without the bureaucratic delays associated with traditional insurance claims.
- **Farmer Engagement Through cooperatives**: AMCOS' and SACCOS' involvement would ensure a deep community penetration and effective farmer outreach.
- **Support from Public Institutions**: **Public institutions provide financial subsidies** for premiums, ensuring affordability for smallholder farmers and enabling broader adoption. This support reinforces the program's alignment with national resilience and food security strategies.

Summary Flow of Distribution Channel Design



Technology and Infrastructure Development

Existing infrastructure

The project would leverage existing technology and infrastructure to ensure cost-efficiency and scalability. Widely used mobile platforms like USSD and mobile money services (e.g., M-Pesa and Tigo Pesa) would facilitate premium payments, claims processing, and farmer engagement, minimizing the need for new investments. Apps such as FarmSMS, already in use in Tanzania, could be expanded to include insurance updates and real-time weather alerts, helping farmers anticipate adverse conditions.

Cooperatives (AMCOS, SACCOS) would act as local hubs for product distribution, awareness-raising, and training in CSA, complemented by collaboration with Climate-Smart Agriculture Alliances.

To enhance modeling reliability, the project could incorporate existing weather stations alongside satellite data, if deemed adequate from a modeling standpoint. TMA operates a network of weather and agro-meteorological stations, though some regions still face significant data gaps, including the three focus regions.

Infrastructure to be developed

A centralized Informatics (IT) system to handle large-scale data collection and analytics will be essential for the smooth operation of agricultural insurance programs. This system will need to process real-time weather updates, farmer profiles, and insurance transactions, ensuring that all stakeholders (farmers, insurers, and the government) have access to the information they need to make timely decisions.

Available data providers

Available satellite data

Several satellite data providers are available to support the development and assessment of an IBI product. These providers offer a wide range of satellite-based data to build a drought and excess rainfall model, at varying resolution and temporal availability, including precipitation, vegetation health, soil moisture, and other environmental factors.

Climate data						
Index	***Associated risk***	***Method***	***Spatial resolution***	***Temporal resolution***	***Availability***	***Historical availability***
Precipitation	*Drought/ Excess rainfall*	*Satellite measure (CHIRPS) derived from temperature of*	*8km x 8 km*	*Daily*	*1 month after processing (around 20 days after the end of the month)*	*1981*

		the upper clouds.				
		Gridded data, recalculated from satellite measurements and station data (ERA5).	*27km x 27km*	*Hourly*	*2–3 months (final)* *2-5 days (ERA5T – temporary data)*	*1979*
		TAMSAT (Reading University)	*17km x 17km*	*Daily*	*5 days*	*1977*
Vegetation (NDVI)	*Drought*	*Satellite measurement from the infrared band (MODIS and Copernicus mask)*	*250m x 250m*	*Daily*	*3 hours*	*2000*
		EVI (MODIS)	*500m x 500m*	*Daily*	*3 hours*	*2000*
Soil moisture (Soil Water Index…)	*Drought/Excess rainfall*	*Copernicus*	*12.5km x 12.5km*	*Daily*	*1 week (temporary)*	*2016 – real* *2002 - extended*
Evapotranspiration (ET0)	*Drought/Excess rainfall*	*Gridded data, recalculated from other sources (ERA5)*	*27km x 27km*	*Daily*	*2–3 months (final)*	*1979*
Precipitation-Evapotranspiration (SPEI)	*Drought/Excess rainfall*	*Index calculated from precipitation and evapotranspiration (ERA5)*	*27km x 27km*	*Daily*	*2-3 months (final)*	*1979*
Temperature Humidity Index (THI)	*Drought*	*Index calculated from temperature and humidity data (ERA5)*	*27km x 27km*	*Daily*	*2-3 months (final)*	*1979*

Agriculture data

Object	Source	Format	Temporal Availability	Update frequency	Spatial resolution
Maize production data	Ministry of Agriculture	Excel	2002/2007/2019	N/A	Admin1 et Admin 2
Maize Crop production survey	FEWS Net	CSV	1993-2005	Yearly	Admin2
Trade of maize	FEWS Net	CSV	2005-2024	Yearly	Admin 0
Yield and Production	IFPRI	Excel	2000, 2005, 2010 et 2017	N/A	Admin1 and Admin 2
Production and Yield (Maize)	United States Department	Excel	Production: 1971-2022	Yearly	Admin 0

	of Agriculture				
Autres Indices d'Insécurité Alimentaire (Production et Rendements, nutrition des enfants etc.)	FAO	Excel	1962-2022	Yearly	Admin 0

Local data providers in URT

In URT, several organizations and government bodies provide critical agricultural data relevant for developing and assessing the adequacy of weather-index insurance products. These institutions typically offer data related to weather, crop yields, pest infestations, and socio-economic factors, which can complement satellite data for index-based agricultural insurance schemes.

Data Provider	Type of Data	Relevance	Spatial Resolution	Temporal Resolution	Availability	Source
Tanzania Meteorological Authority (TMA)	Weather and climate data (rainfall, temperature, humidity)	Supports drought and excessive rainfall insurance	District and regional levels	Daily, monthly, yearly	Upon request or subscription	TMA, 2024
National Bureau of Statistics (NBS)	Demographic, economic, employment, agricultural production data	Sector-wide analysis of employment and agricultural output	Nationwide	Periodic censuses and household surveys	Official publications and request	NBS, 2024
Tanzania Agricultural Research Institute (TARI)	Agricultural research (crop varieties, soil health, climate-resilient tech)	Supports product development and climate risk assessment	9 research centers, 8 sub-centers nationwide	Ongoing research outputs	Reports, research publications, partnerships	TARI, 2024
Ministry of Agriculture	Agricultural production, budget allocations, policy direction	Supports insurance schemes and government-aligned initiatives	Nationwide	Annual budget speeches, sector reviews	Public data	Ministry of Agriculture, 2024/25 Budget

Technical Limitations Assessment and Feasibility Gaps

While the project leverages existing infrastructure and technology, several technical limitations could pose challenges to its implementation.

Lack of awareness

A significant concern is the lack of farmer awareness and understanding of insurance products and their mechanisms. Survey data revealed that only 22% of farmers were aware of the existence of agricultural insurance, with the lowest awareness rates recorded in regions like Kigoma (15%) and Tabora (12%). Many farmers may view insurance as complex or unnecessary, particularly if they are unfamiliar with the concept of risk pooling or have had negative experiences with similar products in the past. Addressing this gap will require targeted education and outreach efforts to build trust and ensure farmers fully understand the benefits and limitations of the insurance product.

Targeted education campaigns, delivered through cooperative agents and digital platforms like FarmSMS, would be implemented to explain the product, its benefits, and its limitations in simple, relatable terms.

Lack of historical and current data

Technological gaps in data collection and availability also present challenges. The reliability of index-based insurance depends on accurate, timely data, yet gaps in weather monitoring infrastructure and a lack of historical yield and loss statistics in certain regions could affect the accuracy of risk modeling and premium calculation. For instance, while satellite data can provide broad coverage, it may lack the granularity needed to capture microclimatic variations that impact farmers. Similarly, the limited reach and uneven distribution of weather stations in some regions, such as Dodoma and Morogoro, could introduce inaccuracies in determining insurance triggers.

Basis risk

Another potential risk is basis risk, which occurs when the index used to trigger payouts does not align with the actual losses experienced by farmers. For example, localized drought conditions might not be captured by broader satellite or station data, leaving affected farmers without compensation. Conversely, a payout may be triggered when losses are not significant, straining the insurers unnecessarily. Basis risk can erode farmer trust and confidence in the product, particularly if it occurs repeatedly.

Technological bias

Additionally, technological bias in the design and application of the product may lead to inequities. For instance, farmers using drought-resilient maize varieties with different growth cycles might experience losses that are not reflected in standard drought indices. This scenario has occurred in other programs, such as ARC, where payout mechanisms failed to account for variability in crop types and planting practices (ie. 90-day maize versus 120-day maize reacted very differently in a season that saw erratic rain and very hot periods followed by normal rain only at the end of the season – beyond the 90-day cycle). Addressing these limitations will require designing an adaptive index and collaborating with local agronomists to ensure the insurance product reflects the diverse realities of smallholder farming systems.

Affordability and Government Subsidies

Affordability remains a key challenge, with an average of 57.2% of farmers finding premiums too expensive without subsidies and only 19.5% willing to pay full price, according to our survey. Public subsidies will be essential to address this gap, but their current capacities and limitations, such as budget constraints and delays, are still unclear and must be managed carefully. The project will explore co-financing with development partners, implement efficient subsidy management, and reduce subsidy reliance by improving farmer incomes through resilience and productivity.

Training and Capacity Building

Successful implementation of the insurance program will require targeted training for key stakeholders.

Stakeholder training

- ➔ ***Public institutions**,* such as the MoA and government extension officers, will need training on the insurance product, monitoring mechanisms, and supporting crop-cutting experiments or data collection. Extension officers, as trusted advisors to farmers, will also help align the program with national agricultural policies and ensure effective communication at the grassroots level. For example, TIRA, which oversees the insurance industry, will play a key role in regulating and facilitating the rollout of agricultural insurance. Training programs for TIRA and other relevant government agencies (e.g., MoA, TMA, TARI) should focus on: Understanding the technical requirements for parametric insurance and index-based insurance
- ➔ ***Local insurers*** will be trained in the technical aspects of the product, including index-based triggers, claims processes, and engagement with cooperatives and farmers. This will ensure they can manage operations efficiently and maintain trust within the system.
- ➔ ***Cooperatives (SACCOS and AMCOS)*****,** as local distribution hubs, will need capacity building on the insurance product and their role in promoting it. Considering the substantial number of cooperatives, UNDP will be leveraged to train trainers by selecting the best candidates from all involved SACCOs and AMCOs to serve as knowledge multipliers. Training will also equip them to educate farmers on CSA practices, such as crop rotation and sustainable pest management, enhancing resilience and adoption. Trainers could be incentivized through performance-based rewards, with incentives linked to metrics such as the number of farmers enrolled, the volume of insurance premiums collected, and farmer satisfaction rates - this will ensure that trainers remain motivated to reach as many farmers as possible and to deliver high-quality training. Given the significant number of SACCOs and AMCOs, a training-of-trainers system could be put in place, training one representative per cooperative who would then be the lead to train others within the cooperative.
- ➔ ***Farmers*** will receive training through cooperatives and extension officers to understand the insurance product and adopt CSA practices, integrating risk management with improved productivity. This multi-level capacity building creates a strong foundation for program success and scalability.

Summary Table: Training and Capacity Building Design

Stakeholder	Training Focus	Methodology	Data Source/Supporting Reports
Public Institutions (MoA Extension Officers)	Understanding the insurance product monitoring mechanisms crop-cutting experiments and policy alignment.	Workshops hands-on field training and policy briefings.	Agricultural policy briefs historical insurance performance reports and extension service guidelines.
Local Insurers	Technical knowledge of index-based triggers claims processes and farmer engagement strategies.	Workshops digital training modules and role-specific guides.	Insurance product manuals industry best practices and technical documentation.
Cooperatives (AMCOS and SACCOS)	Promotion of the insurance product educating farmers on CSA practices and managing local operations.	Workshops on-site demonstrations and peer-learning sessions.	CSA training manuals cooperative management reports and community feedback surveys.

Farmers	Understanding the insurance product adoption of CSA practices and integrating risk management into farming.	Community meetings field demonstrations and multimedia campaigns.	Farmer surveys CSA implementation reports and extension service guidelines.

Piloting and scaling up

Pilot Testing and Region-Specific Adjustments

Pilot testing in key regions such as Dodoma, Ruvuma, and Arusha will provide insights into the initial performance of the insurance product. These regions were selected for their diverse agricultural risks and economic conditions, ensuring the pilot captures a broad spectrum of potential challenges. Data collected during this phase, including real-time weather and crop yield metrics, will inform adjustments to parametric insurance triggers, such as rainfall thresholds. For example, if drought conditions in Dodoma occur more frequently than anticipated, payout triggers for drought-indexed insurance will be recalibrated to reflect actual risk patterns, reducing basis risk and improving farmer confidence. This iterative, data-driven approach will ensure the insurance products are responsive to localized needs and effective in mitigating risks.

Future scaling and sustainability

Following the IDF project phase, the program could scale based on lessons learned. Initial expansion could focus on neighboring regions with similar risk profiles, such as Singida (drought-prone) and Mwanza (flood-prone), before moving to a nationwide rollout. Real-time weather data from TMA's upgraded network and satellite sources will support region-specific insurance model adjustments.

To ensure the long-term sustainability of the program, government subsidies could gradually be phased out as farmer adoption and trust in the product grow. Partnerships with international donors such as ISF and AGRA could provide transitional funding to maintain affordability during scaling. By year 5, the program could potentially aim to cover 50% of Tanzania's smallholder farmers, with a 30% self-sufficiency rate achieved by year 7 and 70% of premium costs covered by farmers by year 10.

The project will integrate pilot testing insights and stakeholder feedback to refine the program and guide its expansion.

Leveraging lessons learned

As presented in Part 2, there have been numerous efforts to develop and offer crop insurance services to smallholder farmers in URT, particularly those growing food crops such as maize and rice, and who farm on half an acre or more. These efforts have focused on creating insurance products that can be integrated with agricultural services such as inputs (fertilizers, seeds) and even loans from financial institutions like banks. However, these efforts have faced several challenges:

Scattered smallholder farmers:

Many SHF who grow food crops such as maize and rice are spread out across vast areas. This scattered nature makes it difficult and expensive to reach them and provide them with crop insurance services. As a result, many insurance companies have reduced their interest in offering products for SHF and have focused mainly on larger-scale farmers. Consequently, many SHF have been left without access to crop insurance.

- ➔ *The USSD-based access of our parametric product would ensure that farmers across vast and remote areas can easily access insurance services directly via their mobile phones, reducing the logistical costs of physical outreach. The SACCO and AMCO networks, will be localized hubs for farmer engagement.*

High cost of crop insurance:

The cost of crop insurance has been high partly due to the lack of historical data on crop yields, which is required for developing accurate insurance policies. The absence of this data has led insurance companies to charge higher premiums for crop insurance, making it unaffordable for many farmers. As a result, crop insurance is often seen as a service for wealthy large-scale farmers only.

- ➔ *We propose an index-based model relying on trigger-based indices rather than yield data, significantly reducing administrative and underwriting costs. Additionally, planned investments in weather monitoring infrastructure will enhance the accuracy of indices over time, ensuring fairer pricing.*

Limited understanding of insurance among farmers:

A lack of understanding of insurance concepts has also contributed to the low uptake of crop insurance. Many farmers treat farming as a subsistence activity rather than a business and therefore do not invest time in learning how they can use insurance to improve their agricultural practices and mitigate risks.

- ➔ *Capacity-building efforts will include farmer-focused education campaigns conducted through SACCOS, AMCOS, and local extension services. These will focus on explaining the benefits and mechanisms of insurance in simple, relatable terms, positioning it as a tool for risk mitigation and farm productivity enhancement.*

Poor past experiences with agricultural insurance:

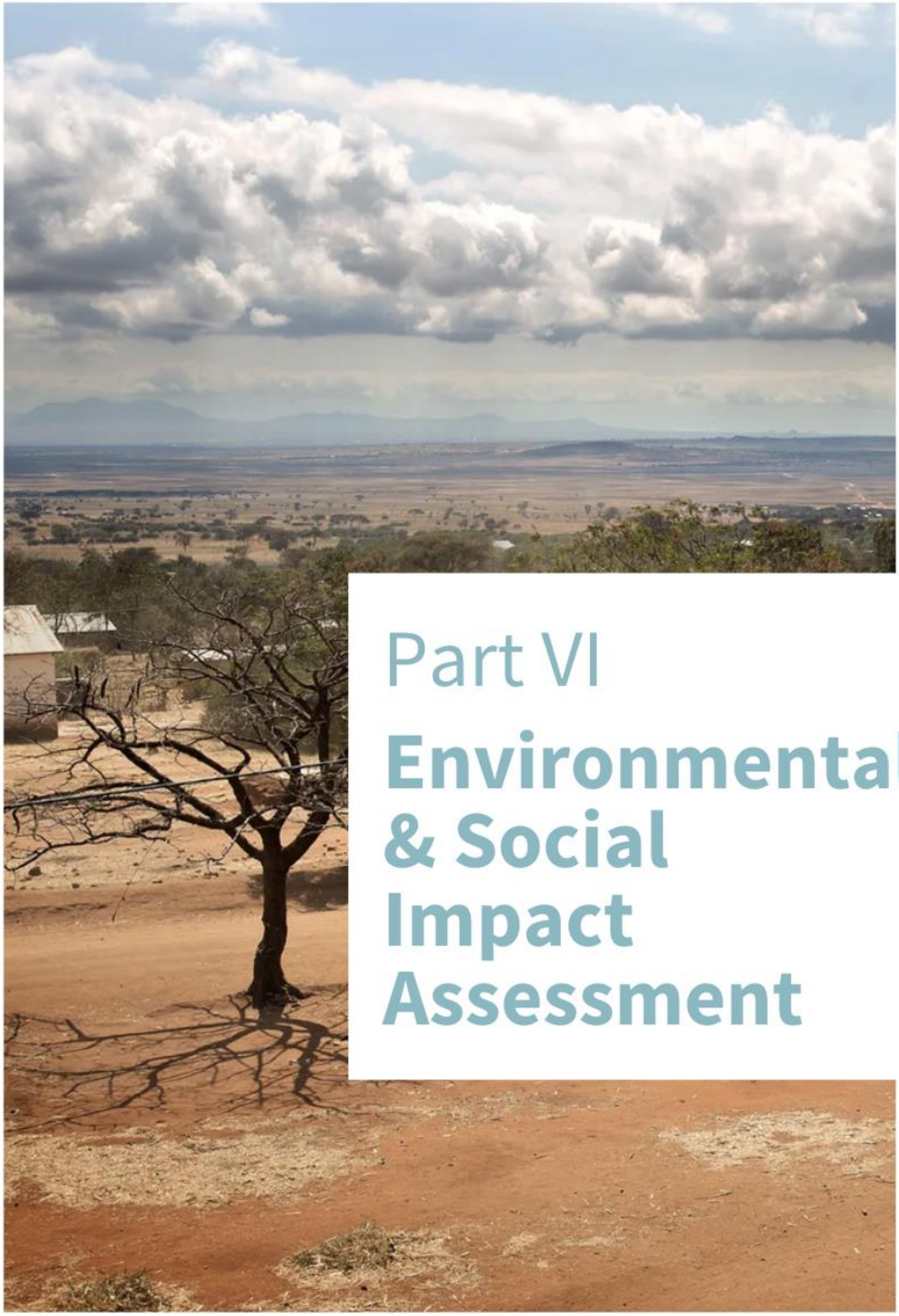
Some farmers have had negative experiences with previous agricultural insurance services offered by other companies. In the past, some insurance providers failed to deliver on their promises, either by not paying out claims or not meeting farmers' expectations. As a result, many farmers have a negative perception of crop insurance.

- ➔ *Our approach prioritizes trust-building by ensuring transparency, quick payouts, and farmer involvement in the process. A USSD-based system allows for direct farmer interaction with the product, giving them greater control and visibility over their coverage. Regular community-level check-ins via SACCOS and AMCOS will provide a platform for addressing concerns and demonstrating the reliability of this service. Collaboration with proven partners like Pula and the adoption of best practices will further reinforce the credibility of the product.*

The proposed parametric product is designed to complement existing AYII solutions in URT, including those financed by the ISF, by offering additional flexibility in deciding risk management strategies for farmers. As mentioned in the survey data, more than 74% of farmers wish to receive cash payouts instead of inputs. While current ISF projects in Tanzania provide valuable support to SHF through loan and input bundling, this product takes a different approach by remaining unbundled. This design empowers farmers to independently adopt coping strategies suited to their unique needs and circumstances. The product will be available at micro-level, directly accessible via USSD technology. The unbundled nature of the product also supports training in and promotion of climate-smart agriculture (CSA) practices such as crop rotation, intercropping, and integrated pest management, which are crucial for addressing challenges like soil degradation, pests, and genetic diversity.

The product's distribution channel will be modular, making it easier for the government to adopt and integrate into its broader strategy, as it does not rely on financial or material bundles. In URT, cooperatives working closely with farmers and households in the rural areas play a key role as distribution channels. In this sense, existing SACCO and AMCO networks will be leveraged and strengthened to enhance distribution and scalability. The parametric model will be cost-effective, offering an affordable alternative to area yield insurance while ensuring reliable coverage. While survey results show a preference for indemnity insurance, the cost and labor intensity required for such coverage will result in a more expensive product. Moreover, as high premium costs are cited as one of the most significant barrier to insurance adoption, both in the survey and in past projects in the country and the region, a parametric product is preferable.

Additionally, the project will leverage the existing models, such as OAF's to assess its performance, adapt it or develop a new index, suitable to be refined through the planned weather infrastructure improvements. The IDF team will collaborate with Pula to set the stage for an eventual integration of area yield approaches as weather infrastructure improves and government extension officers are trained in crop-cutting experiments.



Part VI
Environmental & Social Impact Assessment

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V. Environmental & Social Impact Assessment

Potential Positive Environmental Impacts

Enhancing climate resilience is a core objective of the insurance scheme. By mitigating financial and production risks, farmers are better positioned to adopt adaptive strategies such as diversifying their crops and implementing climate-smart, organic or agroecological practices (see table below). These strategies build resilience by spreading risk, improving soil health, and enhancing ecosystem services, thereby reducing vulnerability to future climatic events.

Criteria	Climate-Smart Agriculture (CSA)	Organic Farming	Agroecological Methods
Definition & Primary Goal	Aims to boost productivity, resilience to climate change, improve water management and reduce emissions.	Focuses on avoiding synthetic inputs, promoting biodiversity, and maintaining ecological balance.	Seek to enhance biodiversity and sustainability by applying ecological principles.
Use of Synthetic Inputs	Allows synthetic inputs if they enhance resilience or reduce emissions.	Prohibits synthetic chemicals, fertilizers, and Genetically Modified Organisms.	Avoid synthetic inputs, emphasizing natural processes and biodiversity.
Soil Health	Promotes sustainable soil management to boost resilience and productivity.	Maintains soil health through organic amendments and crop rotations.	Focus on regenerating soil through natural cycles and biodiversity.

Table *1* - Comparison table between CSA, organic farming and agroecological practices.

For Tanzania, where soil health is a significant issue, agroecological methods could be beneficial for maize cultivation. Focusing on enhancing soil health through practices such as crop rotation, intercropping, cover cropping can improve soil fertility and resilience over time. Adopting CSA can also be positive, as it incorporates practices that increase productivity while adapting to climate change. CSA can include improved seed varieties and efficient water management. Organic Farming can contribute to long-term soil health but may require time to build fertility levels.

Promoting climate-smart agriculture

CSA is a comprehensive approach that enhances productivity, strengthens resilience to climate change, improves food security, and reduces or removes greenhouse gas emissions where possible[48]. CSA technologies also offer co-benefits such as reducing pollution, decreasing water usage, and preventing land degradation. In URT, these practices include agroforestry, drought-resistant and early maturing seed varieties, cover cropping, rainwater harvesting, composting, intercropping with legumes, organic fertilizers, conservation agriculture, crop diversification, among others.

In 2013, the government introduced the National Climate Change Strategy, which included guidelines for agriculture. Following this, the Agriculture Climate Resilient Plan (ACRP) was developed for 2014-2019 to address climate change challenges in agriculture. The Agricultural Sector Development Program (ASDP-II)

[48] Adegoke, Jimmy, et al., Improving climate risk transfer and management for Climate-Smart Agriculture. (Global Alliance for Climate-Smart Agriculture: 2017) http://www.fao.org/3/a-bu216e.pdf.

and the Agricultural Sector Development Strategy (ASDS) further emphasize the use of CSA practices. These policies align with Tanzania's long-term Vision 2025, aiming to build resilience in the agriculture sector, improve productivity and farmer incomes, and contribute to climate change mitigation where possible. The introduction of an agricultural insurance scheme, accompanied by adequate CSA training and advisory services, can serve as a catalyst for promoting CSA practices among smallholder farmers and increase resilience, making agriculture more sustainable.

Despite their benefits, adoption of CSA technologies remains quite low in URT, with practices like maize-legume rotation adopted by less than 10% of farmers[49]. In contrast, improved maize varieties are used by nearly 95% in Lushoto, Tanzania[50]. Adoption rates vary due to unique constraints, influenced by household assets, institutional factors, farm characteristics, access to information, access to finance, and location-specific factors.

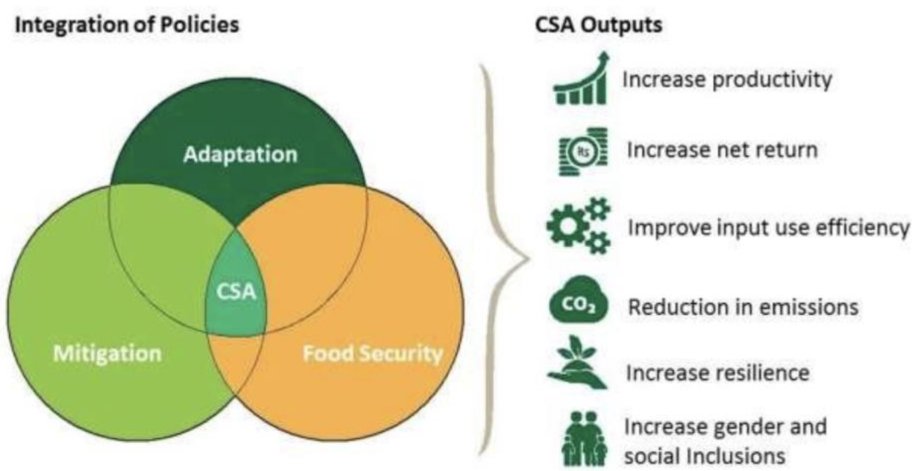

Figure 7 - Food security, climate adaptation and climate risk mitigation are integral components of climate-smart agriculture. Conceptual Framework for Climate-Smart Agriculture and Expected Outputs.
Source*: Khatri-Chhetri, Arun & Poudel, Bikash & Shirsath, Paresh. (2017). Assessment of Climate-Smart Agriculture (CSA) Options in Nepal.*

[49] Tesfaye, K., Kassie, M., Cairns, J., Michael, M., Stirling, C., Tsedeke Abate, M., et al. (2017). "Potential for scaling up climate smart agricultural practices: examples from sub-saharan africa," in Climate Change Adaptation in Africa: Fostering Resilience and Capacity to Adapt, eds W. Filho, B. Simane, J. Kalungu, M. Wuta, P. Munishi, and K. Musiyiwa (Cham, AG: Springer International Publishing, 185–203

[50] Nyasimi, M., Kimeli, P., Sayula, G., Radeny, M., Kinyangi, J., and Mungai, C. (2017). Adoption and dissemination pathways for climate-smart agriculture technologies and practices for climate-resilient livelihoods in lushoto, northeast tanzania. Climate 5, 2–22. doi: 10.3390/cli5030063

Figure 8 - Selected CSA practices and technologies for production systems key for food security in URT. The practices shown in the graphics have been chosen for each production system identified as key to the country's food security.
Source*: CIAT; World Bank. 2017.*[51]

According to a 2020 paper from the World Bank and Columbia SIPA, productivity gains from CSA practice can act as incentives for farmers to continue adopting and investing in these technologies. To achieve the dissemination of information regarding CSA practices, local networks such as the Tanzania Climate Smart Agriculture Alliance (TCSAA), established in 2016, and its local District-level Climate-Smart Agriculture (DCSAA) alliances existing in Lushoto, Kilosa, and Kilolo districts, should be leveraged.

Two members from TCSAA have been interviewed in the context of this study. They have cited stakeholder mapping and engagement as the main objectives of the TCSAA, targeting both SHF for food security and commercial farmers for income generation. These alliances are active through occasional meetings, and seasonal gatherings. According to the interviewees, these alliances require a strategic revamp to drive effective engagement and resilience-building in the sector. To achieve this, the alliances could focus on developing structured programs and activities in partnership with governments and private sectors, such as the IDF project, as well as gaining legislative support to strengthen their influence. Drivers for CSA adoption vary based on farming goals, focusing on best-fit technologies and practices to manage climate stressors like erratic rainfall, drought, and soil infertility.

Maize suffers from these challenges, which are intensified by outdated practices. Some drivers for CSA adoption are the management of environmental risks, enhancing economic productivity, improving access to CSA knowledge, supporting institutional policies, and enabling access to finance. Additionally, the government initiates a transition from individual to block farming. This presents an opportunity for a new climate insurance product accompanied by CSA advisory, covering harvest, post-harvest, and market systems.

The digital platforms which will be leveraged for the insurance distribution in the context of the IDF project can also be instrumental for delivering CSA advisory services. Partnerships with aggregators such as SACCOS can also facilitate the dissemination of cost-effective and feasible practices. Providing advisory services, potentially designed with the TCSAA, on affordable and practical CSA practices is essential, as the cost and perceived risk associated with technology loss are major hindrances to adoption. By focusing on these aspects, the insurance scheme can effectively promote sustainable agricultural practices and enhance the resilience of smallholder farmers to climate change.

Promoting organic agriculture

Currently, less than 1% of Tanzania's arable land is dedicated to certified organic farming, although a significant amount is cultivated using non-certified or agroecological methods. It is important to note that some regions, like Dodoma, are more likely to adopt organic farming as it is the predominant production system there, while other regions, such as those on the coast, do not commonly practice organic farming. Introducing insurance schemes, potentially bundled with premium discounts or material benefits for farmers who adopt sustainable practices, can safeguard the use of these already existing organic farming

[51] CIAT; World Bank. 2017. Climate-Smart Agriculture in URT. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); World Bank, Washington, D.C. 25 p.

methods. The IDF project presents an opportunity to inform farmers on the advantages of organic agriculture through organizations like Kilimohai and aggregators and highlighting the long-term risks to soil fertility and productivity associated with some CSA practices, such as the use of synthetic inputs.

Promoting the conservation of natural resources

Agricultural insurance in URT can provide financial stability, enabling farmers to invest in resource-efficient technologies. For example, a maize farmer in Ruvuma might be more likely to invest in agroforestry, knowing they're protected against catastrophic losses. To guarantee the adoption of sustainable natural resource practices, the project could condition the insurance product on specific resource use practices. However, individual inspections are very difficult to implement for smallholders. Theoretically, verification could be implemented through group-based policies, mobile technology (e.g., farmers submitting geo-tagged photos), remote sensing, or partnerships with agricultural extension services. However, it is unclear to which extent this verification process would be feasible and cost-efficient.

Potential Negative Environmental Impacts

Despite its potential benefits, the insurance scheme could inadvertently encourage some environmentally detrimental practices.

Monoculture

There is a risk that monoculture farming may be inadvertently promoted if farmers prioritize crops, such as maize, that are insured against climatic risks[52]. Monoculture reduces genetic diversity, increases susceptibility to pests and diseases, and often leads to higher usage of water and chemical inputs, exacerbating environmental degradation.

In URT, maize is already the dominant crop and a key subsistence crop. Monoculture has been the primary agricultural practice for generations, but this system has contributed to severe soil exhaustion, resulting in declining yields and nutrient depletion in soils.[53] Bundling the product only with drought-resistant maize seeds can have negative effects. It is important to use a variety of seed types and rotate crops to maintain genetic diversity and soil health. Moreover, public health issues may arise when one crop is overly consumed in the daily diet. This prevalence is due to cultural traditions and public subsidies to maize cultivation, and developing an insurance product for maize exclusively would further this dynamic. This project will aim to address these issues by encouraging crop rotation, and information on the benefits of crop diversification. Bundling the product with alternative seeds which may be more drought-resilient, like sorghum, could also be an alternative to encourage the culture of other crops. As well, digital advisory services focused on sustainable soil health management will be developed. Key measures will include promoting crop rotation, particularly rotating maize with cover crops during fallow periods to restore soil nutrients and to help interrupt the growth cycle of pests.

Overuse of inputs

[52] Müller, Birgit, Leigh Johnson, and David Kreuer. *Risks of Maladaptation: Climate Insurance in Agriculture*. Helmholtz Centre for Environmental Research – UFZ, 2017, https://www.idos-research.de/uploads/media/BP_22.2017.pdf.

[53] Msafiri Yusuph Mkonda, The underway to pragmatic implementations of sustainable and intensive agricultural systems in URT, Environmental and Sustainability Indicators, Volume 11, 2021, 100117, ISSN 2665-9727, https://doi.org/10.1016/j.indic.2021.100117.

For now, chemical fertilizer is lowly applied, with 9 kg/ha over all crops in the country[54]. However, if the insurance is bundled with fertilizers, this could pose a risk of increased use of agricultural inputs like fertilizers and pesticides. This can result in long-term soil acidification, the development of pesticide-resistant pest species, nutrient leaching, contamination of water bodies, and harm to non-target organisms, including beneficial insects and soil microbes.

To mitigate the risk of input overuse, several strategies can be implemented. Promoting organic and biodegradable alternatives, such as supporting the use of organic fertilizers and biopesticides can reduce harmful environmental impacts. Integrated Pest Management (IPM) training should be provided to equip farmers with techniques that combine biological, cultural, mechanical, and chemical methods for pest control. Strengthening agricultural extension services through workshops can educate farmers on sustainable practices and responsible agrochemical use and agrochemical waste management. Financial incentives and eco-friendly certification programs can further encourage adoption of these practices.

Land-use issues

Increased financial security might incentivize the expansion of agricultural activities into marginal lands or ecologically sensitive areas. As mentioned in Part II of this report, agriculture insurance has been reported to increase demand for land in past insurance programmes[55]. Farmers may clear forests or drain wetlands to cultivate more land, leading to deforestation, loss of biodiversity, and disruption of natural habitats. [56] Such land-use changes can exacerbate greenhouse gas emissions and undermine the ecosystem services that support agriculture, such as pollination and natural pest control. This can not only affect biodiversity but also disrupt traditional land management systems and can lead to conflicts over land rights.

Eligibility for insurance can be linked to compliance with land use regulations, with clauses that discourage expansion into prohibited areas. Community engagement is key, raising awareness about the impacts of land conversion and promoting sustainable practices by leveraging the support of aggregators and local support organizations.

Overuse of natural resources

With an insurance safety net, farmers may be incentivized to invest in irrigation facilities. The introduction of irrigation without sustainable practices can lead to over-extraction of water resources. Moreover, droughts have an adverse effect on dams in URT, which may impact irrigation as well. This can result in lowered groundwater levels, reduced river flows, and negative impacts on aquatic ecosystems and downstream water users.

Mitigation strategies will be promoted through the local network of aggregators alongside the CSA capacity building sessions. These include promoting water-efficient irrigation systems, such as drip irrigation, and encouraging drought-resilient farming. Additionally, monitoring irrigation, water extraction and promoting rainwater harvesting systems can help preserve groundwater levels and reduce the stress on natural water sources. Eligibility for insurance can be linked to compliance with sustainable natural resource use. An example of such an approach is the R4 Rural Resilience Initiative, developed by the World Food Programme (WFP) and Oxfam, which operates globally, including in Ethiopia, Malawi, and Senegal.

[54] Msafiri Yusuph Mkonda, The underway to pragmatic implementations of sustainable and intensive agricultural systems in URT, Environmental and Sustainability Indicators, Volume 11, 2021, 100117, ISSN 2665-9727, https://doi.org/10.1016/j.indic.2021.100117.

[55] Si, Chengyu et al. "Effect of Insurance Subsidies on Agricultural Land-Use." International journal of environmental research and public health vol. 20,2 1493. 13 Jan. 2023, doi:10.3390/ijerph20021493

[56] "Deforestation and Agriculture." World Resources Institute, World Resources Institute, https://research.wri.org/gfr/forest-extent-indicators/deforestation-agriculture. 4 April 2024

Farmers receive insurance coverage in exchange for adopting sustainable land management practices such as soil conservation and water management.

Potential Social Benefits

Implementing such a smallholder agricultural insurance program can deliver significant social benefits, enhancing the livelihoods of farmers, promoting equitable growth, and fostering more resilient communities.

Enhanced financial stability

SHF often face significant financial risks due to unpredictable weather patterns and crop failures. According to a 2009 World Bank study, climate volatility is likely to increase the vulnerability of Tanzanians to poverty due to its effects on staple grain production in agriculture.[57] Without adequate protection, these risks can plunge families into poverty and economic hardship. By providing agricultural insurance, the program can help protect a part of farmers' incomes against climate-related losses. This enhanced financial stability can allow households to better manage unexpected downturns, ensuring that families are able maintain their livelihoods and invest in future agricultural activities. Additionally, stable incomes reduce the need for distress sales of assets or reliance on high-interest loans, which have been listed as current risk management capabilities for SHF in URT in a 2015 World Bank Study[58]. The reduction in economic stress can also have positive ripple effects on education and health outcomes, as families are less likely to withdraw children from school or forgo medical care during financial hardships. Enhanced livelihoods contribute to improved social cohesion and can reduce rural-to-urban migration by providing viable economic opportunities within rural communities.

Improved food security

URT relies heavily on agriculture for food production, with SHF playing a crucial role in ensuring a consistent food supply in rural zones. Climate variability and extreme weather events can severely disrupt agricultural productivity, leading to food shortages and increased vulnerability to hunger. According to EM-DAT, major droughts in 2004, 2006, 2011 and 2021 provoked important food shortages in Arusha, Kilimanjaro, Manyara, Tanga, Pwani and Dar es Salaam. Moreover, a 2015 World Bank study concluded that, compared to a baseline without climate change and focusing on domestic agricultural production, "food security in URT is expected to worsen as a result of climate change."[59] This agricultural insurance program could help maintain consistency in production by delivering climate risk and CSA advisory, helping ensure that communities are more informed in ways to safeguard their food production, have a more reliable and sustainable access to food, reducing the risk of malnutrition and enhancing overall food security.

Increased access to credit and financial services

[57] Ahmed, Syud Amer; Diffenbaugh, Noah S.; Hertel, Thomas W.; Lobell, David B.; Ramankutty, Navin; Rios, Ana R.; Rowhani, Pedram. 2009. Climate Volatility and Poverty Vulnerability in URT. Policy Research working paper ; no. WPS 5117. © http://hdl.handle.net/10986/4309

[58] Arce, Carlos E.; Caballero, Jorge. 2015. Tanzania: Agricultural Sector Risk Assessment. © World Bank, Washington, DC. http://hdl.handle.net/10986/22277

[59] Arce, Carlos E.; Caballero, Jorge. 2015. Tanzania: Agricultural Sector Risk Assessment. © World Bank, Washington, DC. http://hdl.handle.net/10986/22277

Access to credit is essential for smallholder farmers to invest in modern agricultural technologies and practices that can enhance productivity and sustainability. However, lenders often perceive uninsured farmers as high-risk clients, limiting their access to necessary financial resources. By introducing agricultural insurance, the program can reduce the risk for financial institutions, making them more willing to extend loans and other financial services to insured farmers. This increased access to credit would enable farmers to purchase more high-quality inputs, invest in irrigation systems, and adopt more advanced farming techniques such as CSA practices. Consequently, farmers can improve their yields and incomes, fostering economic growth and development within rural communities.

Empowerment of women and vulnerable groups

In many Tanzanian communities, women play an integral role in agriculture but often lack access to financial protection and resources. The IDF project will seek to identify levers to include women and other marginalized groups, drawing from ACRE's experience in recruiting local "champions", many of which are women, for their Index-based insurance product implemented in 2020. Insured women and vulnerable farmers can make more informed decisions, invest in their farms, and contribute to household and community well-being. This empowerment also enhances their bargaining power and could improve their overall socio-economic status.

Potential Social Challenges

Despite these benefits, the insurance scheme may present several social challenges.

Lack of affordability, accessibility and equity

The poorest farmers might struggle to afford insurance premiums or lack awareness of the scheme's existence. This could exacerbate existing inequalities, with wealthier farmers gaining more benefits while the vulnerable remain marginalized. Inclusive policy design that focuses on reaching vulnerable groups through local cooperatives or farmer organizations ensures that the benefits of insurance are equitably distributed. Public awareness campaigns can also improve accessibility by informing marginalized farmers about the insurance scheme and its benefits. One key approach is government subsidization of premiums, ensuring that the poorest farmers can participate without financial strain. This could be done through targeted subsidies for smallholder farmers or by offering sliding scale premiums based on income levels. An example is the Indian Pradhan Mantri Fasal Bima Yojana (PMFBY), where the government heavily subsidizes premiums for small-scale farmers. Across all crop types, farmers only pay a premium below 5% of the sum insured. However, subsidization alone is not sufficient to guarantee adoption, as a 2023 study on PMFBY revealed that many barriers remain: some farmers remain unaware of the scheme, encounter difficulties accessing banking services and opening accounts and are dissatisfied with the indemnity amounts.

Changes in social dynamics

The reliance on formal insurance mechanisms might weaken traditional community-based support systems and coping strategies. This shift could reduce communal solidarity and mutual aid practices that are vital during times of crisis. To mitigate this risk, one approach is to involve community-based organizations in the distribution channel, such as SACCOS, allowing for shared decision-making and maintaining existing mutual aid practices. Incorporating local cultural practices into the insurance model, such as Takaful practices if relevant, or group-based or cooperative insurance schemes, could also further enhance trust and the relevance of the product. The relevance and feasibility of these practices will be investigated during the project.

Lack of cultural acceptance

In areas where formal insurance is unfamiliar, there may be skepticism or mistrust towards the scheme. Moreover, some products more fitted to local cultures, such as Takaful for Muslim communities, could be preferred over another insurance products. Further, misunderstandings about premium payments, coverage, and claim processes can lead to dissatisfaction and low uptake rates. Community outreach and education campaigns can be instrumental in the development of such an initiative. Engaging with local networks, such as the TCSAA, local leaders and trusted community figures in promoting the scheme could help address skepticism and foster acceptance. To boost awareness, another lesson from the PMFBY could be drawn: at least 0.5% of the gross premium collected by insurance companies in this program is allocated to Information, Education, and Communication (IEC) activities.

*The insurance program will integrate **capacity building** for farmers on insurance with practical advice on soil conservation, crop rotation, intercropping, and reducing pesticide and fertilizer use, encouraging more sustainable practices. Partnerships with **digital agricultural advisory services** will be sought to provide ongoing guidance on these methods. **Climate Smart Agriculture (CSA)** Alliances will be leveraged as distribution channels, with part of the premium allocated to support these alliances and incentivize others to form. Bundling of insurance with inputs will be done carefully, focusing on sustainable inputs like drought-resistant seeds rather than highly chemical fertilizers or pesticides. The program will also prioritize advisory on CSA, organic farming, and agroecological practices, fostering both financial resilience and environmentally sustainable farming.*

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APPENDIX 1

Maize production costs

Estimation of maize production costs based on best practices for maize farming.

The cost of maize production in Tanzania varies from one region to another and from one farmer to another. A good investment in land preparation, the use of quality inputs such as improved seeds, fertilizers, pesticides, and irrigation during the farming season can lead to higher yields compared to a farmer who does not follow good maize farming practices.

Requirements	**Breakdown/ details**	**Cost TZS (USD)**[60]
Land Purchase or Rental	The cost depends on the location and size of the land. For farmers who already own land, this cost may be zero, but for those renting, it can range from TZS 50,000 (USD 19.5) to TZS 200,000 (USD 78) per acre per year, depending on the area.	50,000 (19.5)
Land Preparation	Land preparation includes clearing the land, ploughing, and creating ridges or drainage channels for water flow. For tractor use, ploughing one acre can cost between TZS 80,000 (USD 31.2) and TZS 150,000 (USD 58.5), depending on the service and location.	80,000 (31.2)
Buying Quality Seeds	High-quality maize seeds that are disease-resistant and yield high harvests are available on the market. One kilogram of high-quality maize seed costs between TZS 3,500 (USD 1.4) and TZS 6,000 (USD 2.34). For one acre, you need approximately 10 kilograms of seed, so the cost can range from TZS 35,000 (USD 13.65) to TZS 60,000 (USD 23.4) per acre.	60,000 (23.4)
Initial Fertilizer	Farmers need to use fertilizer during planting to enhance plant growth. DAP (Diammonium Phosphate) or NPK fertilizer is required in quantities of 50 to 100 kilograms per acre. The cost of a 50-kilogram bag of DAP fertilizer ranges from TZS 80,000 (USD 31.2) to TZS 120,000 (USD 46.8). Therefore, one acre may require between TZS 80,000 (USD 31.2) and TZS 240,000 (USD 93.6)for fertilizer.	240,000 (93.6)
Additional Fertilizer	During the growth stage of maize, CAN (Calcium Ammonium Nitrate) or SA (Sulphate of Ammonia) fertilizer is used to boost nutrients. This fertilizer costs between TZS 70,000 (USD 27.3) and TZS 100,000 (USD	100,000 (39)

[60] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

	39) per 50-kilogram bag, and one acre may require between 50 to 100 kilograms.	
Water and Irrigation (In Case of Drought)	In areas with limited rainfall, irrigation costs may increase. Using pumps and other equipment for irrigation can cost between TZS 150,000 (USD 58.5) and TZS 300,000 (USD 117) per acre for the entire season, depending on the size of the farm and the water source.	0
Weeding and Weed Control	Farmers need to weed in order to remove weeds from the farm. Manual weeding can cost between TZS 20,000 (USD 7.8) and TZS 40,000 (USD 15.6) per acre for each weeding session, with weeding needing to be done two to three times during the entire season. Therefore, weeding can cost between TZS 40,000 (USD 15.6) and TZS 120,000 (USD 46.8) per acre.	50,000 (19.5)
Pesticides and Disease Control	Maize can be attacked by pests like stem borers and fungal diseases. The cost of pesticides and disease control can range from TZS 50,000 (USD 19.5) to TZS 100,000 (USD 39) per acre for the entire season.	50,000 (19.5)
Estimated production cost per acre TZS (USD)		**630,000/- (245.7)**
Expected Yields	Maize can yield between 1.5 to 3 tons per acre, depending on the farming methods used, weather conditions, and the type of seeds.	15-30 bags (100kgs/bag) per one acre. Price per kg estimated to be 700 TZS/ kg (USD 0.273/kg)

Comparison of AYII and Index-Based Insurance

	Yield Index Crop Insurance
Average cost per acre, per season for a crop cutting exercise (CCE)	Staffing • One specialised staff and two assistants Payments – TZS (USD)[61] • Specialized staff payment per day, per farm @20,000 TZS (USD 7.8)(The cost covers travel allowance, meals) [62]

[61] NOTE: All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.
[62] We are implementing an area yield cover in Tanzania (as ACRE Africa) and the amount we are paying our Officers ranges from 400k-600k TZS basing on the value chain, location and number of crops cuts/ visits the field officer is supposed to perform. Usually, they perform 30-40 crop

<table>
<tr><td></td><td colspan="2">
Assistants' payment @10,000 (USD 3.9) per farm, per day x2 =20,000TZS (USD 7.8)
Tools (These are re-used)

Ropes @ 5,000 (USD 1.95)
Bags @10,000 (USD 3.9)
Matts @10,000 (USD 3.9)
Pegs @1000 (USD 0.39)
Moisture meters @40,000 (USD 15.6)
Weight scales @20,000 (USD 7.8)

Estimated crop cut cost per farm, per day is approximately

Staff -40,000 TZS (USD 15.6)
Tools - 86,000 TZS (USD 33.54)

Total = 126,000 TZS (USD 49.14)
</td></tr>
<tr><td>How many people will be required to do a crop cutting exercise and how much will that cost?</td><td colspan="2">
People – 3 (One experienced staff and two assistants)
Estimated cost to conduct crop cut for one farm is around 126,000 TZS (USD 49.14)[63]. The cost can go down to 40-50% less if the tools are re-used and the Officers are given more crop cuts to do. Field officers are usually required to conduct at least 30-40 crop cuts per season/ contract. For MPCI, usually it is recommended that there are 2-3 visits during the crop development stage (1^{st} visit during crop development stage, 2^{nd} visit during crop vegetative and flowering stage, 3^{rd} visit during the crop pre-harvesting stage where the crop cut experiment is performed to determine the farmers yield). For pure area yield, insurance loss computations are performed based on the yields realized at the insured area. Here area, could be yields collected from sampled farmers at village, farmers' AMCOS, ward level etc. Adding more visits to the area yield product, it depends on the availability of data and its quality. It is not a must to do the three visits like MPCI.
</td></tr>
<tr><td>- What is the gap in resources for the government?
- How many resources are there on the ground via an agriculture extension</td><td>
There is a resource gap as majority of the government extension officers at ward and village level are experienced in conducting yield surveys and not actual crop cut experiments. If they're going to conduct actual crop cut experiments, they will need training which is costly
In every ward or village there is a government extension officer who
</td><td>
There is a resource gap as majority of the government extension officers at ward and village level are experienced in conducting yield surveys and not actual crop cut experiments. If they're going to conduct actual crop cut experiments, they will need training which is costly
In every ward or village there is a government extension officer who
</td></tr>
</table>

cuts per season. The cost covers their wage, transport, communications. If you work on average of 30-40 crop cuts per season, the cost of conducting one crop cut to 1 acre of land (One farm) is more or less 15k TZS.

[63] NOTE: *All USD equivalents referenced in this document are based on exchange rates retrieved from Oanda as of December 11, 2024. These figures have been rounded for simplicity and ease of reading.*

service, who can support farmers with the crop cutting exercises? How are they split out across the country, and will more people be required? - Cost of a loss adjuster going out and evaluating claims	can support farmers with the crop cutting experiments. These officers will need to train several farmers who will support them to do the work as conducting crop cut for one farm requires 3-5 people. These people will input the pegs, harvest and weigh the crops etc.	can support farmers with the crop cutting experiments. These officers will need to train several farmers who will support them to do the work as conducting crop cut for one farm requires 3-5 people. These people will input the pegs, harvest and weigh the crops etc.
Institutional viability of the solution	It is a viable solution but requires a lot of coordination, it is costly and very time consuming. Arranging it from the MoA at a national level as well as a regional, district and ward, village level might help to secure the Government officers who can support the exercise but it is also crucial that the quality of yield data collected from the exercise is not compromised.	
Cost of cheating	Field officers need to receive proper training in how to conduct the crop cut experiments on the ground and efficient and accurate project coordination and monitoring is crucial to avoid any temptation by field officers to invent information or to collect incorrect information. This is especially key given that the project involves thousands of smallholder farmers who are scattered, disorganised and difficult to reach.	

	Index-based insurance	**Area Yield Insurance**
Faster Payouts and Claims Processing	Since payouts are triggered by measurable weather parameters (e.g., rainfall, temperature, or drought indices) rather than field-level yields, the claims process is generally faster. The data used to assess weather events is often readily available from weather stations or satellites, and the claims are paid out more quickly because there is no need to wait for field inspections or yield assessments.	Payouts under AYCI require the assessment of actual yields in a given area (such as a village, district, or region). This requires more time to collect data, conduct field visits, and determine losses, which can lead to delays in payouts.

Reduced Moral Hazard Index-based insurance:	There is typically less room for moral hazard or fraudulent claims in index-based insurance because payouts are not based on the reported yields or losses by individual farmers. The trigger for the insurance is a clearly defined weather parameter (such as cumulative rainfall or temperature deviation), so there is little opportunity for manipulation.	In AYCI, there is a greater risk of moral hazard, as farmers may misreport their actual yields or exaggerate the losses to claim insurance benefits. Additionally, since the payout is based on the average yield of an area, there can be instances where the payment does not reflect the individual farmer's actual loss, or some farmers may claim based on unreported poor yields.
Lower Administrative Costs Index-based insurance:	Index-based insurance usually has lower administrative costs because it is based on objective, verifiable weather data. There is no need for complex yield surveys or field inspections to verify losses. Data on weather conditions is often provided by satellite systems, weather stations, or other remote sensing technology.	AYCI typically involves higher administrative costs due to the need to collect and process detailed yield data for a large number of farmers over a specific area. This involves significant resources for monitoring, data collection, field inspections, and verification.
More Targeted Risk Coverage Index-based insurance:	This type of insurance allows for more precise targeting of the risks faced by farmers, especially when the weather directly influences crop yield and farming outcomes. For instance, farmers who are primarily at risk from a specific weather event (e.g., drought or excessive rainfall) can be insured against those specific risks, and payouts will be tied directly to weather data.	AYCI relies on area-level yields, which might not accurately represent the specific risk or loss faced by an individual farmer. For example, if one farmer's plot experiences a localized drought while the area as a whole has normal or average rainfall, the farmer may not receive the full payout they need despite suffering significantly.
Easier to Implement and Scale Index-based insurance	Index-based insurance can be implemented more quickly and scaled more easily across larger regions. Since it is based on objective weather data, it can cover vast areas without the need for intensive ground-level monitoring or complex yield assessments. It can be implemented in remote areas where field-level monitoring would be difficult or expensive.	Can be more difficult and costly to scale, particularly in large or remote regions. The need to monitor yields across various locations requires significant infrastructure, which can be a barrier to implementation in some areas.

Better for High-Variation Weather Risks	This type of insurance is particularly well-suited for regions where crop yields are strongly influenced by highly variable weather conditions. For example, in areas prone to drought, excessive rainfall, or temperature extremes, index-based insurance can be designed to trigger payouts based on specific thresholds of rainfall or temperature that would directly impact the crop.	While AYCI is effective for more widespread agricultural risks that affect large areas (such as regional droughts), it may not be as responsive to localized weather events or risks that disproportionately affect individual farmers within an area.
More Transparent and Objective Index-based insurance:	Index-based insurance is typically more transparent and objective because the triggers are based on publicly available weather data. There is less ambiguity in the assessment of the insured risk, as the weather parameters (rainfall, temperature, etc.) are objectively measured and verifiable.	In AYCI, the process of determining payouts can sometimes be less transparent, as it depends on yield data that might not always accurately reflect the individual farmer's losses. Additionally, the yield data for a given area can be subject to errors, inaccuracies, or manipulation.
Potential for Customization	**Potential for Customization** Index-based insurance can be highly customizable to match the specific needs of different crops, geographic areas, or risk factors. For instance, different types of crops may have different weather thresholds for triggering payouts, and farmers in different regions may face different weather risks.	While AYCI can be customized to some extent, it is less flexible when it comes to tailoring coverage to individual farmers or specific types of weather risks. Since it is based on the average yield of an area, it may not account for variations in weather or risks faced by individual farms.
Encourages Investment in Risk Management	Because the payouts are linked to weather parameters that can be directly influenced by the farmer's own risk management practices (such as irrigation, pest management, or planting at optimal times), index-based insurance can encourage farmers to adopt better risk management practices. Knowing that their actions may influence their payout can motivate farmers to take proactive steps to mitigate risk.	Area yield insurance does not directly link payouts to individual risk management actions and may not provide the same incentive for farmers to improve their on-farm practices or risk preparedness.

A. Crop insurance Business projection: Product (IBI)[64]

Region	Estimated number of Maize farmers	Estimated number of farmers who will buy insurance (@30%)	Estimated production cost per farmer/ acre of land	Total sum Insured	Insurance Premium (@7% premium rate)[65]	Product Management cost (*Processes are automated hence 0 cost)*
Ruvuma	300,000	90,000	250,000	22,500,000,000.00 (USD 8.8 Million)	1,575,000,000.00 (USD 614,250)	0.00
Dodoma	200,000	60,000	250,000	15,000,000,000.00 (USD 5.9 Million)	1,050,000,000.00 (USD 409,500)	0.00
Arusha	300,000	90,000	250,000	22,500,000,000.00 (USD 8.8 Million)	1,575,000,000.00 (USD 614,250)	0.00
Total TZS (USD)				**60,000,000,000.00 (USD 23.4 Million)**	**4,200,000,000.00 (USD 1.7 Million)**	**0.00**

B. Crop insurance Business projection: Product Area Yield or MPCI

Region	Estimated number of Maize farmers	Estimated number of farmers who will buy insurance (@30 %)	Estimated production cost per farmer/ acre of land	Total sum Insured	Insurance Premium (@7% premium rate)	Number of farmer samples for crop cut experiments @15% of the total insured farmers in the region. *One crop*	Number of field Officers who will be required to do the crop cut experiments @ 40 farms	Cost of conducting the crop cut experiments (The amount covers salaries of the field officers, training, travel allowances, tools such as weight scale,

[64] NOTE: more costs will have to be incurred (commission-based system for SACCOs, etc)

[65] *7% is an average rate. In the market Acre Tanzania has parametric covers with premium rates from 4-15% based on the risk profile of the regions where farmers are, type of value chain, risk distribution, business volume. Proper pricing will be conducted at a later stage.*

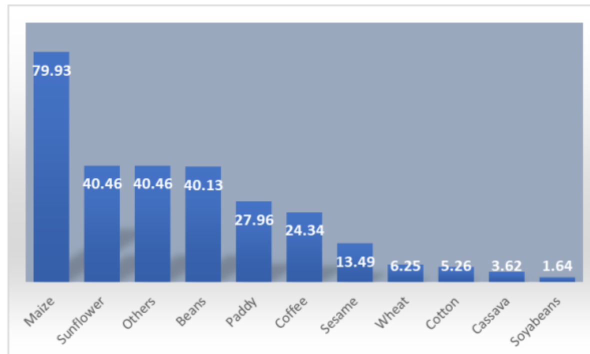
						cut will be performed per season at the pre-harvesting stage)	**per officer.**	**ropes, tapes etc) (*Estimated an Officer will be paid 232,988.17 TZS (USD 90.9) which will cover transport, communication, and wage. The Officer will be required to conduct crop cut experiments to at least 30-40 farmers)***
Ruvuma	300,000	90,000	250,000 (USD 97.5)	22,500,000,000.00 (USD 8.8 Million)	1,575,000,000.00 (USD 614,250)	13,500	337.50	78,750,000.00 (USD 30,712.5)
Dodoma	200,000	60,000	250,000 (USD 97.5)	15,000,000,000 (USD 5.9)	1,050,000,000 (USD 409,500)	9,000	225.00	52,500,000.00 (USD 20,475)
Arusha	300,000	90,000	250,000 (USD 97.5)	22,500,000,000 (USD 8.8 Million)	1,575,000,000 (USD 614,250)	13,500	337.50	78,750,000.00 (USD 30,712.5)
Total TZS					**4,200,000,000 (USD 1.638 Million)**	**36,000**	**900**	**210,000,000.00 (USD 81,900)**

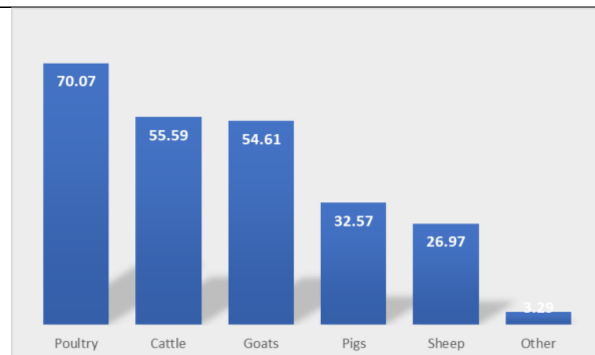
Note.

The cost associated with area yield or MPCI (Multiple Peril Crop Insurance) will either be included in the premium or the insurer will need to allocate a separate budget to cover the expenses of the crop-cutting experiment. For products like MPCI, which require insurers to conduct risk assessments and visit insured farms at least 1-2 times per season to evaluate crop development and ensure adherence to good agricultural practices, the cost of these activities can be up to twice the expense of conducting a single crop-cut in a season. This makes yield index insurance significantly more expensive and complex to implement compared to parametric insurance products.

APPENDIX 2

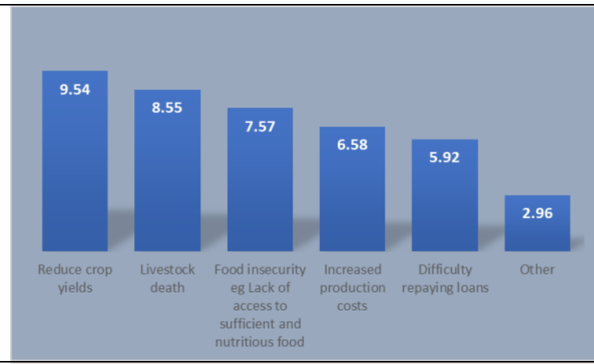
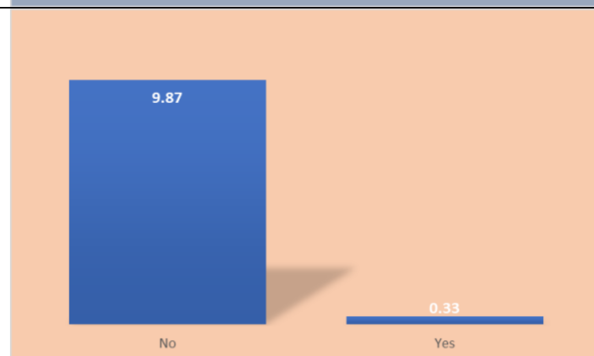
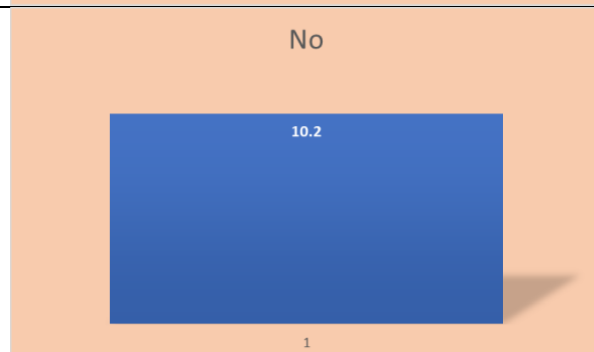
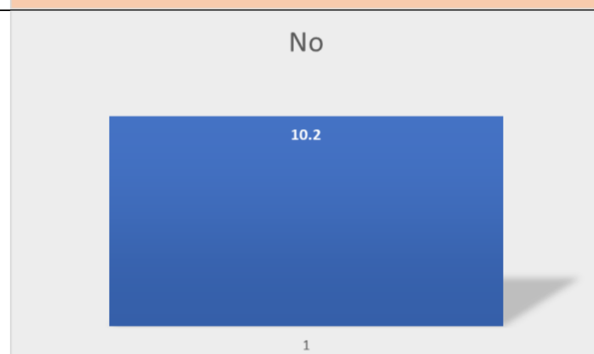
Survey Results

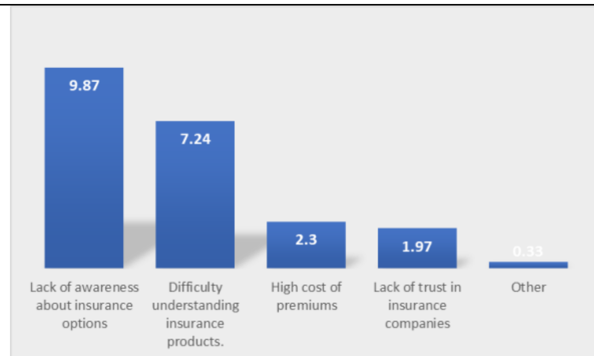
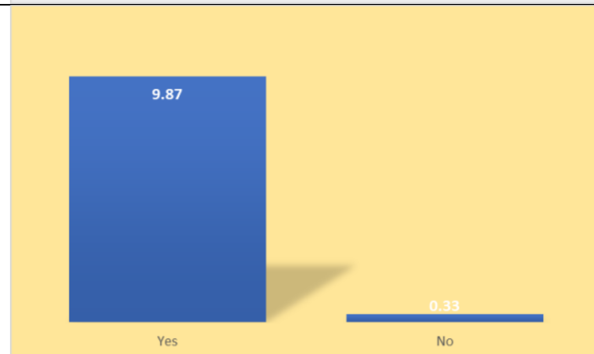
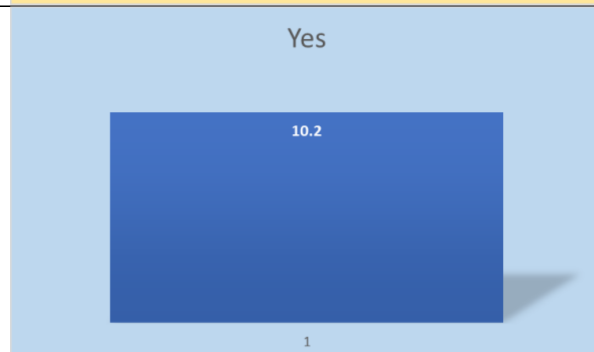
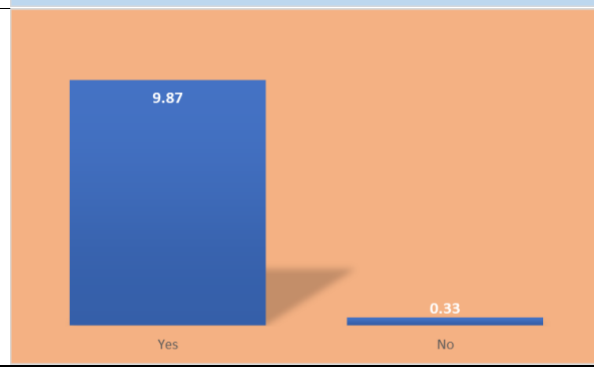
<table>
<tr><th>Survey Questions</th><th>Answers in Graphs</th></tr>
<tr><td>What is the main crop cultivated by your members?</td><td>


</td></tr>
<tr><td>What is the main livestock reared by your members?</td><td>


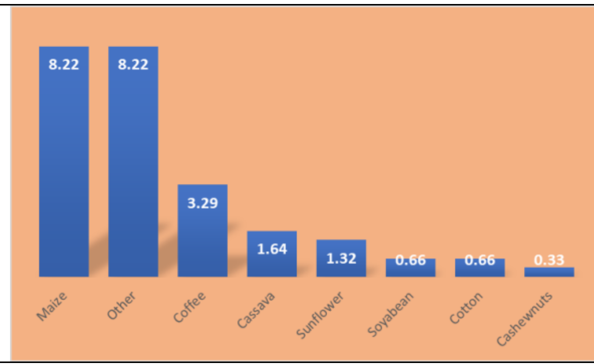
</td></tr>
<tr><td>In the past 5 years, have your members experienced any of the following risks that affected their crops or livestock</td><td>


</td></tr>
</table>

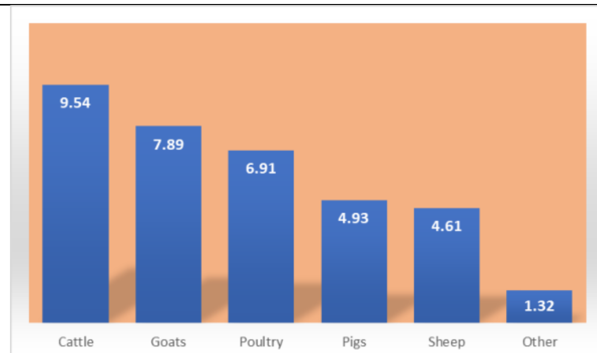
How did these risks affect your members	
Do your members have any knowledge on agricultural insurance and how it works?	
Have your members had any experience with any agricultural insurance products in Tanzania?	
Do your members currently have any form of agricultural insurance?	

What are the main reasons why your members do not have agricultural insurance	
Would your members be interested in agricultural insurance if it was more affordable?	
Would your members be interested in agricultural insurance if it was easier to understand?	
Would your members be interested in agricultural insurance if it was tailored to their specific needs?	

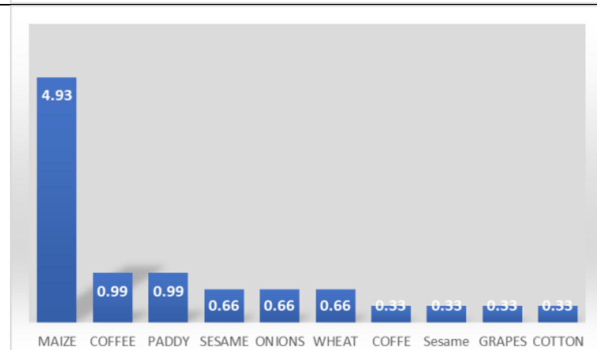
Which type of crops would your members be most interested in insuring (select up to 3



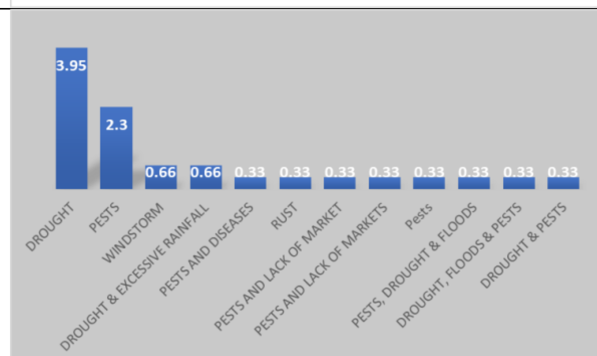
Which type of livestock would your members be most interested in insuring (select up to 3):

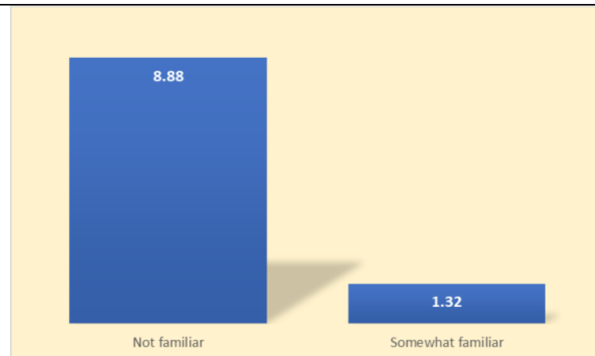
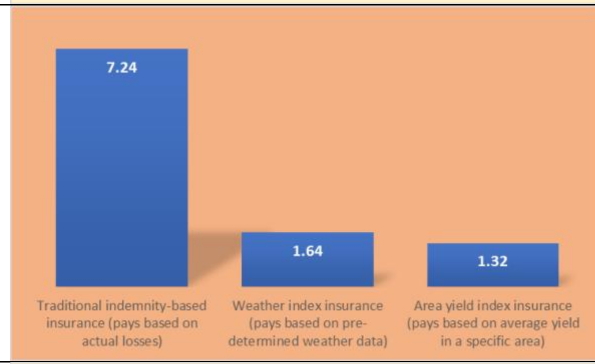
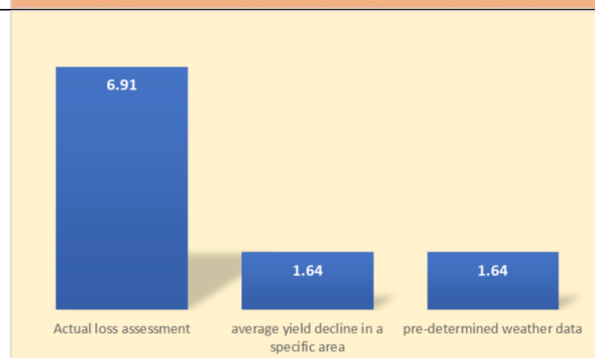


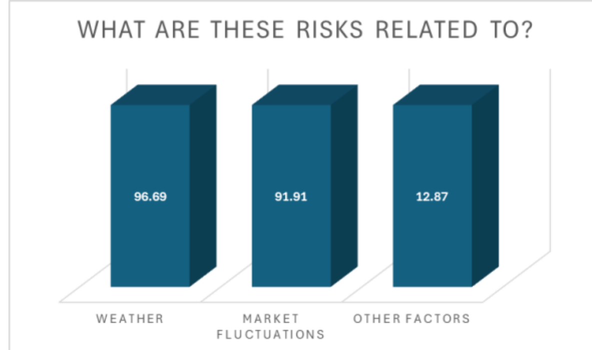
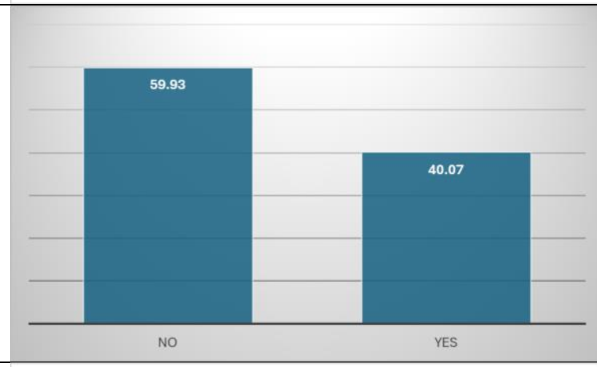
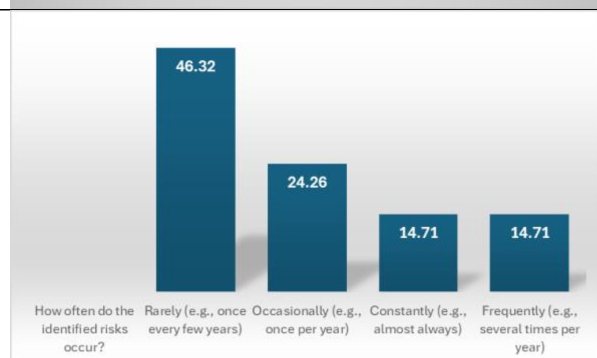
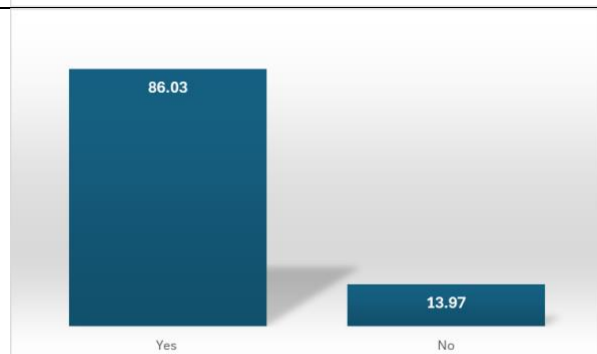
Based on your members' experience, which crop is most vulnerable to specific perils?

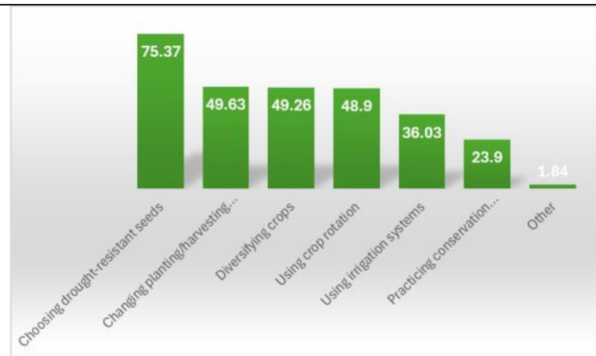
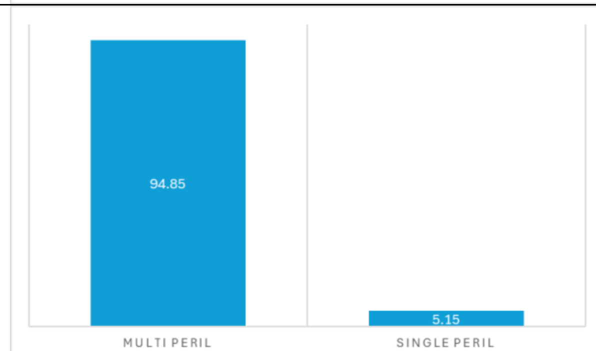


What is the specific peril this crop is most vulnerable to?



How familiar are your members with different insurance product types?	
Which type of insurance product would your members prefer?	
Preferred Payout Triggers: What factors would your members prefer to trigger insurance payouts	
Feedback from farmers	
a. *What are the typical risks you face in your farming activities? (Select all that apply):*	

a. Are these risks more related to: ?	
a. Do the key risks differ depending on the crop?	
a. How often do the identified risks occur?	
Are you adapting to any climatic event? (Choosing drought-resistant seeds, etc.)	

<table>
<tr><td>If yes, what type of adaptation measures are you using? (Select all that apply):</td><td>
</td></tr>
<tr><td>Is a multiperil crop insurance product necessary or would a cheaper insurance product devoted to one peril (i.e. Drought) be more adapted?</td><td>
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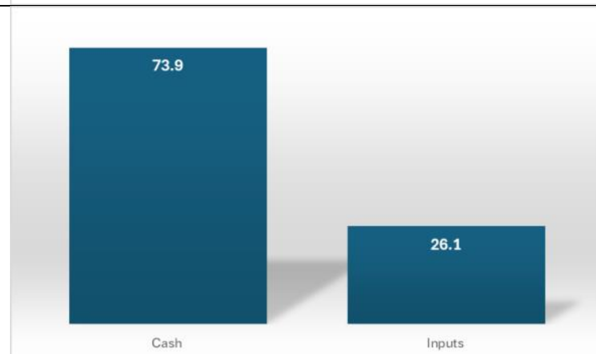
<tr><td>What type of payout would be most useful? Cash, or inputs?</td><td>
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