



Centre for Agricultural Research and Development

The 2023-24 El Nino: The Uncertainties and Opportunities for the 2023-24 Agricultural Season in Malawi.

POLICY BRIEF 2010010123

OCTOBER 24, 2023

Summary

El Nino is a climate phenomenon, characterized by unusual warming of waters in the Eastern Central Equatorial Pacific Ocean and typically leads to drier conditions over Southern Africa countries, including Malawi. It is one of the most important drivers of climatic variability in the country. Historically, analogue years of El Nino in Malawi include 1982/83, 1991/2, 1997/98, 2009/10, and 2015/16. According to the Department of Climate Change and Meteorological Services (DCCMS), the country expects moderate to strong El Nino conditions for a significant portion of the agricultural season; October 2023 to April 2024. The climate projections suggest high chance of normal to below normal rainfall amount over most parts of the country.

Understanding El Nino events is pivotal for planning, preparedness, adapting, immediate response, and medium-long term investments in collaborative research for the agricultural sector to withstand the adverse effects of any El Nino events. Directly, El Nino will negatively impact agricultural crop output, thereby downward affecting the country's economic growth. El Nino-induced food shortages will likely increase food prices both in rural and urban areas, inflating general market prices, trapping households into a vicious cycle of food insecurity and poverty. Low food consumption and limited diversified healthy diets will likely negate strides gained around national nutrition programming. Besides, vulnerable populations like persons living with disability, women, the sick, and the elderly will be hit most by the effects of El Nino as they heavily depend on agriculture for their livelihoods.

Other sectors like forests, fisheries, and water will be equally affected by the effect of El Nino. For instance, the forest restoration programs will be at stake as urban households will resort to fuelwoods as the main source of energy due to power load shedding. Strides in the fish farming will also slowdown as fishponds become drier with water stress. Water boards will also have to undertake water rationing as El Nino will result into low water supply in the reservoirs in the absence of functioning high yielding boreholes.

It is therefore imperative for the Ministries of Finance, Agriculture, Gender, Department of Disaster Management Affairs (DoDMA), National Planning Commission (NPC), and other development partners to mobilize resources to finance emergency resources and provide price stabilization mechanisms. Stakeholders should also invest in collaborative research that generates knowledge products, technologies, and innovations for cushioning households during the El Nino. Thus, existing research and experiences by prominent experts at the Lilongwe University of Agriculture and Natural Resources (LUANAR), the Centers of Agricultural Research and Development (CARD), and Agricultural Policy Analysis (APA) provide a summary of ten (10) complementary points at the end of this Policy brief in Box 2.



El Nino Reducing the Rainy Days of 2023-2024 Agricultural Season.

The Malawi 2023-2024 agricultural season is under threat as evidenced by the downscaled in-country weather forecasts. The Department of Climate Change and Meteorological Services (DCCMS) projects the presence of moderate to strong El Nino conditions, which will cause an early or delayed onset of rainfall in some parts, whereby the first rainfall will come some two weeks earlier or after the end of October 2023. The El Nino will reduce or increase the rain duration, where in some areas, it will result in a prolonged dry spell, lasting at least 10 days in January and strong chances of dry spell of at most 10-15 days in February. During the prolonged dry spell, excessive heat and water stress may result in 2023- 2024 seasonal crop failures and food shortages. At the start of the rainy season for 2023/2024, some areas have already witnessed excessive heat like most districts in the southern and northern Malawi (see Figure 1). Some districts like Lilongwe already received rains, midway of October 2024, more than the expected chizimyalupsa, which is a likely effect of El Nino. According to Department of Disaster Management Affairs (DoDMA), with the residual effects of Tropical Cyclone Freddy, Idai, Ana, and the previous drought of 2015, the number of households becoming food insecure will increase while several households will be trapped in poverty cycle.

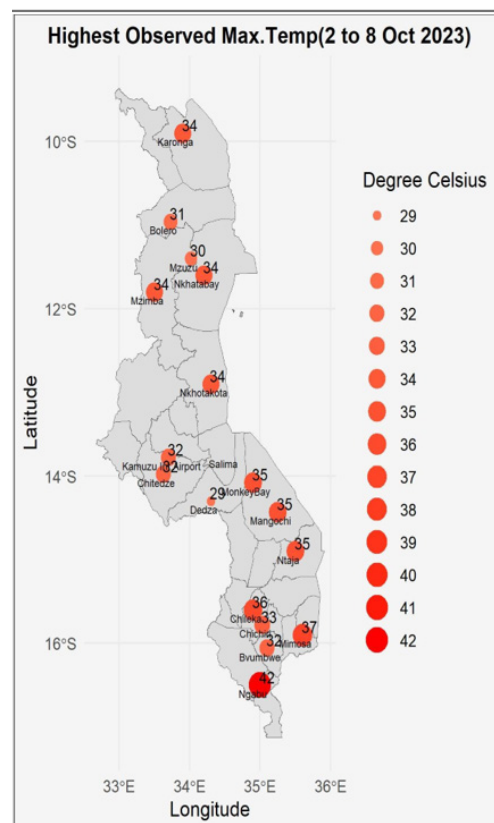


Figure 1. Heatwaves across the country (Source: DCCMS 2023)

Experiences from past El Nino events.

El Nino events are not a new phenomenon in Malawi. These conditions have occurred since 1988 with varying degrees of impacts on the agri-food-nutrition sector (Figure 2). Historically, analogue years for El Nino in Malawi include 1982/83, 1991/2, 1997/8, 2009/10, 2015/16. The impact has been widely documented. For instance, the 1991/1992 the resultant drought reduced agricultural production by half and the country

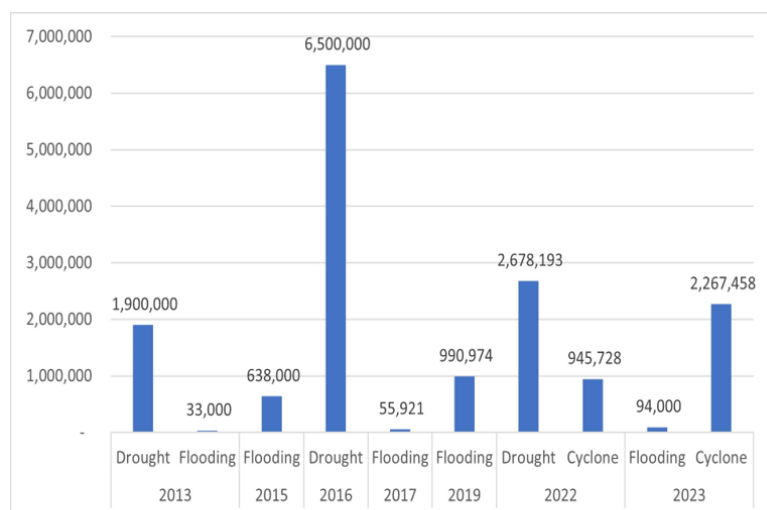


Figure 2a: Disasters in Malawi 2013–2023.

Source: International Database

resorted to food imports. According to the Department of Disaster Management Affairs, in 2015-2016, 6.5 million people (39%) of the populace was at risk of food insecurity. Apart from affecting short term food security, disasters have caused a shift in the country's priorities from agricultural productivity and commercialization to survival from climate-related shocks or disasters. Resources are re-allocated towards humanitarian assistance and reactive disaster response, thereby affecting the achievement of medium to long term development goals in all sectors of the economy.

Although we have drawn lessons from the past events and policies and strategies are in place to reduce impacts of such weather

shock, the context this year is unique. El Nino is hitting at a time the country has been ravaged by Covid-19 and several tropical cyclones. The economy is faced with high level of foreign currency shortage making importation of food and inputs challenges, frequent fuel shortages are reducing the efficiency of food distribution networks and affecting small scale irrigation farming. The high inflation rates have raised the cost of food basket making it unaffordable to low wage-earning households.

Models developed to understand the effect of El Nino on agricultural production

It is common knowledge that El Nino will likely reduce agricultural production, in this case, maize. However, what policy makers lack is the extent of reduction in agricultural maize production and what could be done to avert the adverse effects of El Nino. Hence, following Liu et al (2022), we develop an autoregressive integrated moving average (ARIMA) model to assess the effect of El Nino on maize yield in Malawi. Mathematically, we estimate the following model:

$$\Delta \log(y_t) = \gamma_1 elnino_{t-1} + \delta_1 CWV_{t-1} + \delta_2 CWV^2_{t-1} + \beta_j \ln x_{t-1} + \omega \varepsilon_{t-1} + \varepsilon_{it}$$

Where y_{it} denotes agricultural maize production, CWV_{it} is a vector of climate and weather related variables like rainfall and temperature, x_{it} stands for production factors such as log of land, NPK, and labor, ε_{it} is the white-noise disturbance to the agricultural production system. For robust check, we estimate other models like seasonal ARIMA-M, and Vector Autoregressive Model, and their results display almost the same range of decline in maize yield. We compile data from the FAOstats, World Bank Development Indicators, and the Ministry of Agriculture for the years between 1961 to 2022. We also gather data from 216 randomly sampled households to solitate information on what are the expectation from the El Nino and what strategies will household put in place to minimise the effect of El Nino. We also conduct 14 focus group discussions (FGD) with rural households to triangulate likely farming household adaptive measures around potential effects of El Nino and possible actions to reduce its effect at household level (see Figure 2b).



Figure 2b: Some of the FGDs highlighting effects of El Nino and possible adaptive measures, October 2023.

Expected effect of El Nino in 2023/24 agricultural season

1) Effect on Agricultural Production – Food Availability and -Nutritional Status of Malawians

Existing agricultural crop varieties in Malawi take around 120 days to fully mature and in countries like Malawi, where the adaptive capacity of farmers is still low, agricultural production is heavily affected. All models in our econometric analysis suggest that maize yield or flexibly called maize production will likely drop by 16.85 ± 4.41 percent (see Table 1). However, this is conditioned on different levels of adaptive capacity and intensity of El Nino. Previous studies further suggest that cascading effects of El Nino may commence via several transmission channels. Liu et al (2022) noted that agriculture-dependent countries, of which the GDP share of agriculture is $>20\%$, show a greater response to El Nino. For example, extreme weather will lower crop yields, agricultural productivity, leading to food shortages, trade contractions, and commodity price increases.

Moreover, less days of rainfall will translate into low agricultural output, consequently escalating food prices, hunger, and inadequate intake of energy, proteins, fat carbohydrates, vitamins, and minerals. Together, these effects will result in compromised immunity particularly among vulnerable population groups such as pregnant women, children, elderly, and the sick. The low immunity may result in increased hospitalization and eventual death. Economically, the population may have reduced productivity, thereby stalling national development. Following the United Nations Food and Agricultural Organization (FAO) and Malawi Vulnerability Assessment reports, late onset of rainfall and prolonged dry spells will increase the number of food insecure households, especially in the rural areas, where already over 3.8 million people are expected to be severely food insecure before harvest.

The estimated model suggests that the 2023-24 El Nino event will lead to 16.85% decline in maize yield if no climate resilient adaptive measures are not actioned.

Table 1: Effect of El Nino on maize yield

Depvar	ElNino	llabor	lnpk	lland	rain	rainsq	temp	temsq
Yield	-16.85%	1.30%	0.14%	-0.38%	5.40%	-0.03%	27.9%	-16.9%
StdEr	4.41%	0.22%	0.10%	0.32%	1.93%	0.01%	13.08%	7.91%
Pvalue	0.000	0.000	0.171	0.238	0.005	0.011	0.033	0.032

The 2023-24 El Nino will drop maize production by 561,574 metric tons, leading to under supply of food demanded by 466, 526 metric tons.

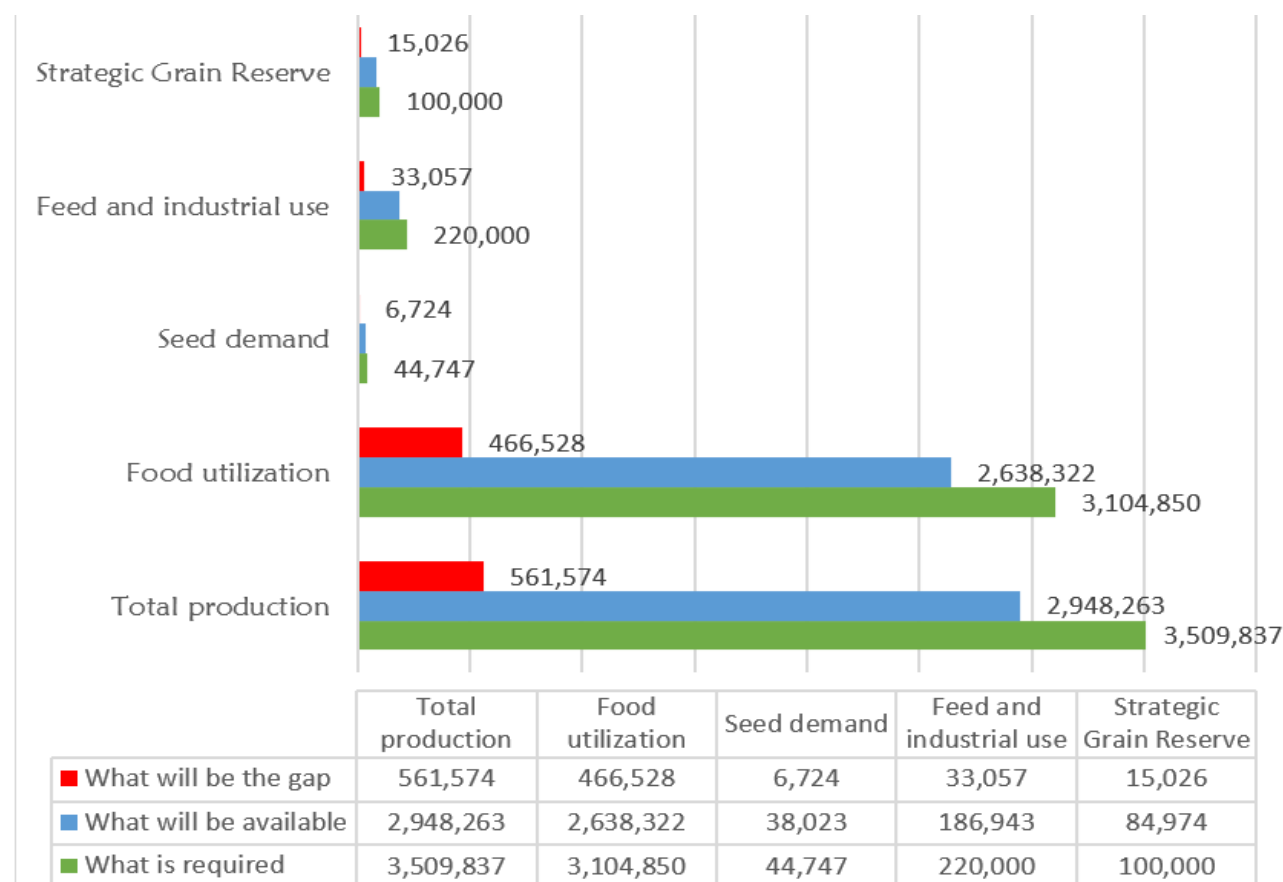


Figure 3. Gap in total MAIZE production, food utilization, seed demand, strategic grain reserves.
Source: Author

Figure 3 shows that El Nino will reduce total production of maize by 561,574 metric tons, which will translate into 466,528 metric tons under supplied for food demanded by households and 15,026 metric tons decline in maize which is supplied to the Strategic Grain Reserves in Malawi. Maize for industrial use will drop by 33,057 metric tons. Thus, we should expect at least 14% of the population becoming food insecure in 2024.

2) Effect on Fisheries and Aquaculture

Fish are poikilothermic in nature, as such, their physiology is directly affected by the water temperature. Reduced rainfall associated with higher temperatures will render drying up of ponds, rise in conditions, where fish will lack oxygen, rise in ammonia production, and increased multiplication of diseases and parasites. These situations will heavily influence survival and growth of fish, both juvenile's and adult sizes, culminating into fish deaths and therefore substantially lowering fish biodiversity and yields. Fish is one of the proteins consumed by many Malawians. Therefore, low production of fish will translate into low amount of proteins consumed by most communities in the rural as well as urban areas. Besides, low fish catch will likely affect the livelihood of fish farmers as well as fishers who depend on fish as main source of income.

Box 1. El Nino has Social Repercussions

Already skyrocketing food prices due to Tropical Cyclone Freddy and expected low crop yield will render food affordability at household level a challenge, negating the achievements and performance of the social sectors such as education, health, and social inclusiveness. Food shortages will further increase dropouts and underperformance of school-going children since they cannot attend and concentrate in class on an empty stomach (see Table 2). It will intensify acute malnutrition deficiencies of vitamins and minerals, further increasing healthcare cost and reduce labour productivity. Programs related to school-feeding programs should be intensified to ensure that food grain is available for school-going children.

Gender-wise, women will take up more responsibilities, and their male counterparts may migrate to more urban areas to look for resources to fend for their families. Likewise, women will have to walk longer distance to look for water as some of the protected wells may dry-up, thereby reducing the available effective labour time for economic activities as well as other social responsibilities that women play in the community. In urban areas, El Nino will also affect provision of water services by the Water Boards through a drop in water volume in water reservoir. Accordingly, water boards need to invest in high yielding boreholes to supplement the water in the reservoirs. However, extrication of water from the underground has to be treaded carefully with application of the hydro-engineering and environment lens. Households will further resort to extraction of forest resources for fuelwood for cooking, hence alternative, affordable, and efficient energy sources should be promoted.

Table 2: Proportion of households reporting likely effects of El Nino, October 2023.

Variables	Households
Food shortages	209 (97%)
Crop failures	207 (96%)
Increased pests/diseases	138 (64%)
Selling of assets	115 (53%)
Reduced labour productivity	71 (33%)
Food inflation	48 (22%)
Displaced homes	43 (20%)
Malnutrition	34 (16%)
School absenteeisms	21 (10%)

3) Effect on Energy Production putting efforts in Forest Restoration at stake

Malawi electricity generation largely depends on hydro, where it accounts for above 95% of the total installed electric capacity. With the looming El Nino, the Shire River Basin may likely receive less rains throughout the period. In past, El Nino have reduced the river flow rate leading to lower amount of water flow into the dams used for hydro-power generation. For instance, in 2015-2016, El Nino reduced expected power generation capacity by 36%, that is at Nkula Power Plant, rendering the nation survive on power rationing. Power rationing promotes deforestation that services provision of biomass fuels like fuelwood and charcoal. This will likely frustrate the Department of Forest's efforts of forests and other natural resources' restoration. Hence, stakeholders should strengthen activities around alternative energy sources like access to gas and use of efficient technologies like cookstoves which demand less fuel to meet the daily needs of the households.

4) Effect on Agricultural Growth.

Low crop output due to unpredictable onset or cessation of rainfall will impact the agricultural and overall country gross domestic product (GDP), hindering the long-term attainment of the aspirations stipulated in the Malawi Vision 2063 and the Malawi Implementation Plan 2021 – 2030. The projected agricultural growth is expected to decline in the ranges of 3 to 9 percent in the 2023/24 due to the effect of El Nino (see Figure 4). This is basically consisted with other previous studies. According to the World Bank report, the 2015-2016 El Nino reduced agricultural production by 30%, contracted GDP by 2.8%, and increased food inflation due to high demand of cereals on the market, and overall downward adjustments of the country's economic growth targets. Unless the Ministry of Finance identifies resources to smoothen consumption and stabilize food prices on the market, El Nino will therefore further push more households into vicious cycle of food insecurity and chronic poverty. In line with the Malawi Vision 2063 and the Malawi Implementation Plan 2021-2030, the achievement of the two of the three pillars; industrialization and urbanization, are at stake as they are heavily supported by the performance of the agricultural sector

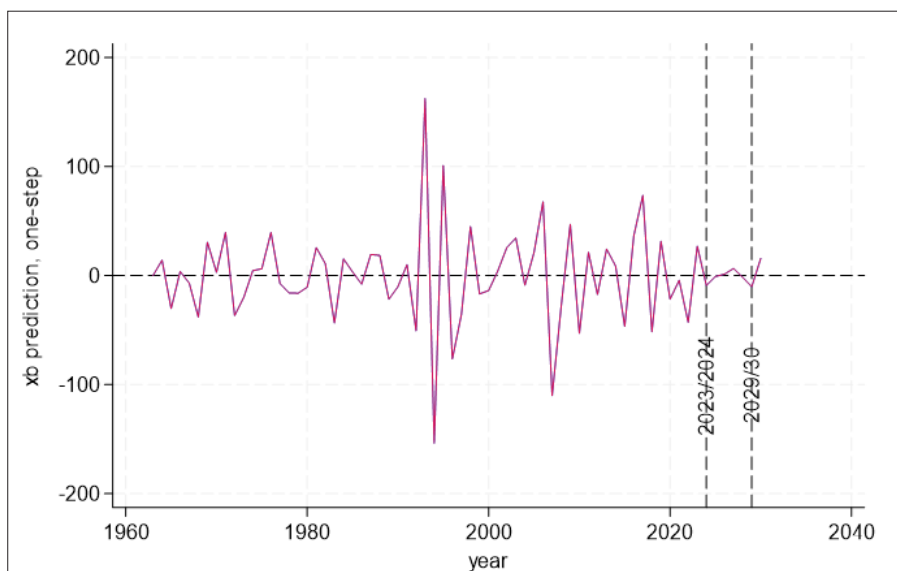


Figure 4.
Annual maize production
gap 1960 – 2024.
Source: Own compilation
from FAOSTat Data

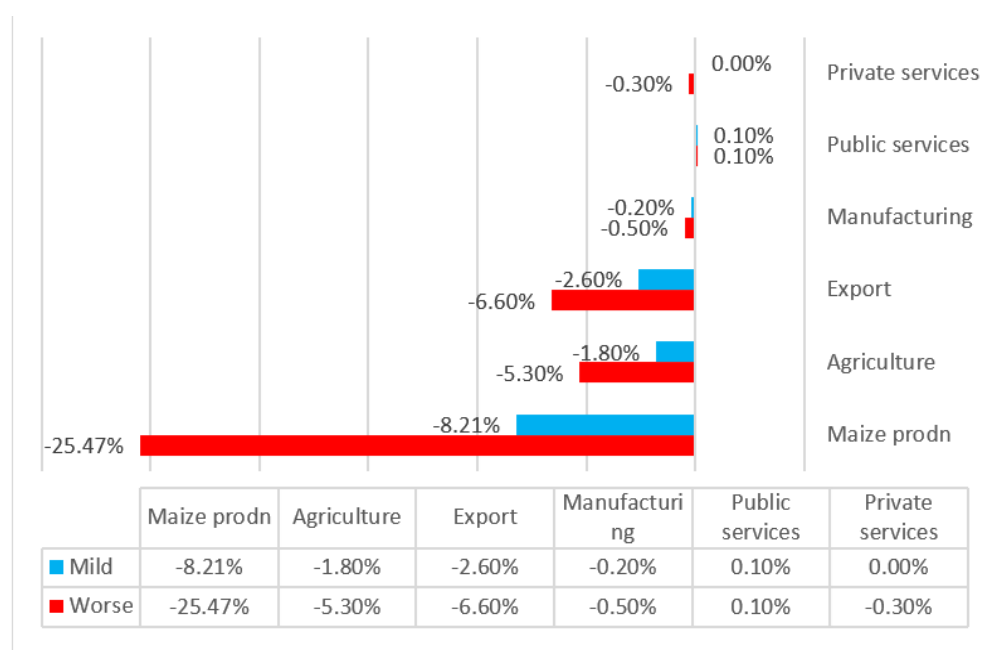


Figure 5: El Nino causing
decline in sectoral GDP,
with agriculture being the
most affected. Source:
Author compilation

Figure 5 shows the effect of El Nino on maize production and sectoral gross domestic product. El Nino will cause a general decline in agricultural sectoral gross domestic product by 5.3% under the worst scenario and 1.8% under mild effect of El Nino. It will also cause a drop in other sectors like manufacturing and export to drop by 0.5% and 6.6% under worst scenario. On average, we expect a 1% decline in GDP but agriculture's contribution may drop by 5% due to loss of yields from El Nino.

What should be done amidst El Nino?

Malawi is not without policies and strategies but rather the country suffers lack of effective implementation of well-crafted policies and strategies. Economists at the Ministry of Finance and Economic Affairs, Central Bank of Malawi and other Economic Think Tanks will ascertain the obvious the economic joke: "no free money is available for any development intervention or response". Malawi economy is agro-based; hence, it is pivotal to identify strategies to address the effects of the looming El Nino, especially, in the agricultural sector. Thus, using existing research and experiences of prominent experts at the Center for Agricultural Research and Development (CARD), the Agricultural Policy Analysis (APA), and the wide LUANAR have laid down ten complementary policy points to minimise the effects of El Nino (see Box 2 and Table 3).

Box 2: Recommendations: Ten Complementary Points

- 1. Tailormade extension messages:** Forecast are clear that different parts of the country will be affected differently by the El Nino. District level actors should, thus, devise tailor made messages to farmers on how to reduce negative effect of El Nino. One size fits all approach is less ideal.
- 2. Investing in the mega and anchor farm initiatives by the Ministries of Finance and Agriculture, with support from LUANAR and other actors, should be enhanced with functioning irrigation infrastructure.** Mass production from mega-farms should aid in food price stabilization. In addition, mega-farms should diversify to other crops that survive under dry conditions like roots and tubers, which should also be processed into value additions. Partnership with private sectors such as Initiative between LUANAR and ILOVO should be strengthened and supported.
- 3. Prioritizing water harvesting technologies by the Departments of Irrigation (DoI) and Water Resources (DWR) to service mega-farm initiatives through irrigation.** The DWR should enhance development of water harvesting technologies such as dams as those recently launched by the State President in Nkhata-Bay.
- 4. Refilling the country Strategic Grain Reserves in all regions** to work as stabilizers of the prices of food grains on the market and likely emergence response for disaster hotspot areas. Regional refill will particularly reduce logistical challenges of maize distribution.
- 5. Strengthening border controlling mechanisms** to monitor food grain exports during and after the El Nino since neighbouring countries will equally be hit by the same effects.
- 6. Implementing reforms of the Affordable Input Programme (AIP)** to support productive farmers and supply climate-resilient crop varieties that are early maturing and drought-tolerant. The AIP should be conditioned on conservation agriculture practices and, in other parts, enhance livestock that are drought tolerant. Fundamentally, continue supporting intensive research on informing timely AIP programming, targeting, and implementation.
- 7. Investing in collaborative research, development, and partnership** that identify knowledge, technologies, and innovations for integrating digital agriculture and modern extension services within the mega and anchor farm initiatives. Furthermore, intensify demonstration plots for adoption of early maturing crop varieties, drought-tolerant crops, crop diversification, and conservation agriculture.
- 8. Identifying resources during the budget mid-year review for subscribing to an agricultural tailor-made premier insurance product** that can insure smallholder farmers from a prolonged dry spell of about 10 to 20 days.
- 9. Implementing CASH Plus interventions within the existing scalable social protection instruments** (such as climate smart agriculture initiatives) would have the long-term impact of promoting resilience by enabling beneficiary households to withstand and recover from livelihood shocks, such as drought, pests and diseases that will be brought by the El Nino.
- 10. Investing in climate smart productive public works program** for households with labour to augment households' purchasing power to buy food grains on the market

Table 3: Proportion of households suggestions adaptive measures amidst El Nino, October-2023.

Variables	Household
2023-24 El Nino Knowledge	110 (51%)
Source: DCCMS	106 (94%)
Climate Resilient Prodn	51 (47%)
ClimateSmartAgric	25 (24%)
Conservation Agric	23 (22%)
Irrigation Farming	20 (19%)
Early Maturing Crops	31 (30%)
Drought Tolerant Crops	25 (24%)
Crop Diversification	38 (36%)
Sample Size	216

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