



Kenya Agricultural Risk Assessment

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Despite highly variable growth rates, agriculture remains a crucial backbone of Kenya's economy. The sector directly accounts for more than one quarter of the gross domestic product (GDP), 70 percent of rural jobs, 65 percent of exports, and 60 percent of foreign exchange earnings. Consequently, agriculture is vital to Kenya's economic growth, national food security, and poverty reduction. Yet Kenya's reliance on smallholder, rain-fed agriculture and its high poverty rates render the country particularly vulnerable to climate risks. This Note highlights major risks facing Kenyan agriculture and identifies pathways toward stronger sector resilience.

BACKGROUND

Since the vast majority of Kenya's poor depend on smallholder agriculture for their livelihood, increasing their productivity can contribute to improving food availability and increasing rural incomes. Putting more and better seeds, fertilizers, and other inputs into the hands of farmers and pastoralists and finding ways to link them more directly to markets are among the key thrusts of current sector development policies. More broadly, Kenya's Vision 2030 aims in part to transform the country's agriculture from subsistence to a more competitive and commercially oriented sector, one that can meet the country's food needs, expand exports, and become a key engine for forward growth.

Notwithstanding Kenya's strong commitment to agriculture, sectoral growth remains well below the 6 percent target and meaningful gains in productivity and in rolling back rural poverty have been slow in coming. The Economic Survey 2014 shows that the agricultural sector grew by a mere 2.9 percent in 2013, down from 4.2 percent a year earlier. Moreover, Kenya continues to rely heavily on imports to feed its growing population amid a widening structural imbalance in key food staples. Reversing these

trends is not only about raising farmers' productivity. It is also about finding ways to strengthen the resilience of agricultural systems.

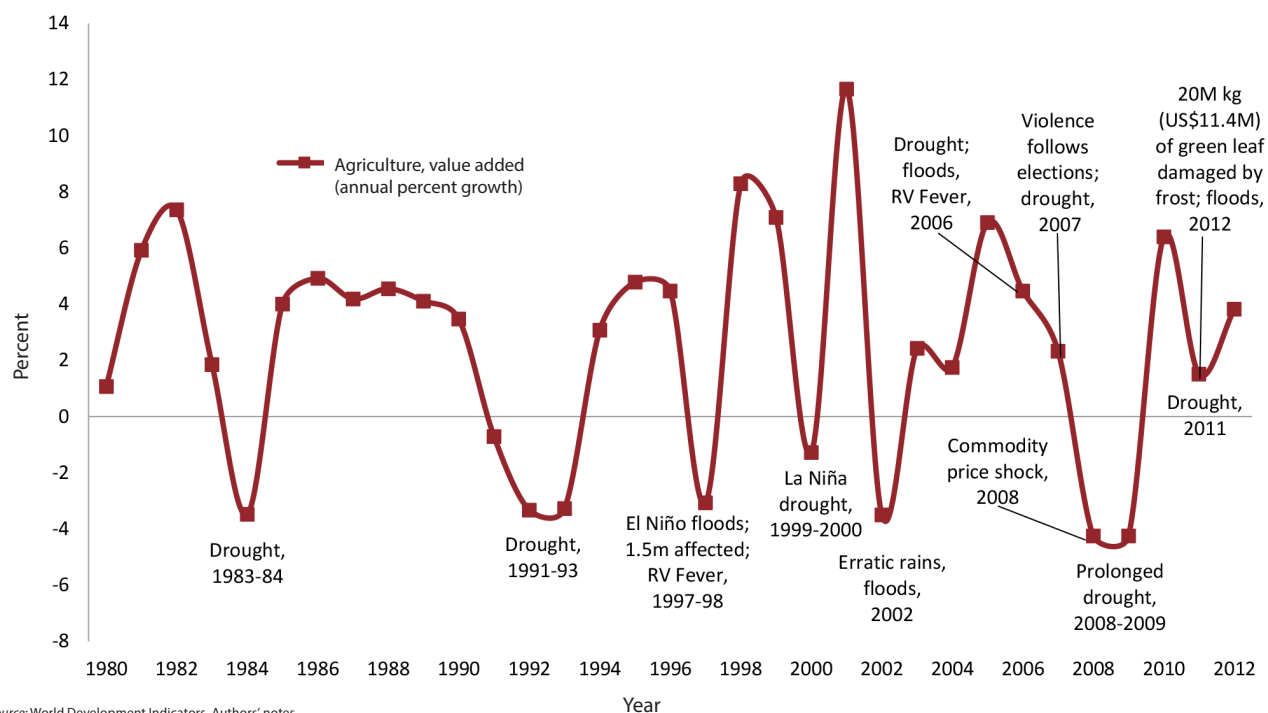
MAJOR RISKS

Kenya's agricultural sector is increasingly vulnerable to risks, especially to extreme and growing weather variability. Figure 1 depicts a historical timeline of the most notable risk events to adversely impact sector performance from 1980 to 2012. In addition to extreme weather events, the global financial and economic crisis, volatile food and fuel prices, and a tense and at times uncertain political environment have repeatedly disrupted agricultural supply chains and markets, jeopardizing growth and the sector's ability to ensure food security and reduce poverty.

Production Risks

Erratic rainfall, punctuated by severe droughts, is the biggest risk facing Kenya's agricultural sector, with profound impacts on both crop and livestock production. Severe, widespread droughts occurred with increasing frequency over the past decade, accompanied by rising levels of

FIGURE 1: Historical timeline of major agricultural production shocks in Kenya, 1980–2012



year-on-year rainfall variability. The country experienced an extreme rainfall event during two out of every three years, on average, between 1980 and 2012. The combination of high dependence on rain-fed agriculture and the high poverty rates among smallholder farmers and pastoralists who have limited coping capacity makes Kenya particularly vulnerable to the effects of droughts.

Relative to most other crops, maize is highly susceptible to moisture stress. Kenya's reliance on rainfed maize production in meeting its food needs and growing consolidation of production toward maize (and dry beans) has rendered the country increasingly vulnerable to supply disruptions and food shortages. Amid declining yields, production gains have come largely through land expansion into marginal areas that receive lower and more variable rainfall. This trend coupled with Kenya's increasingly erratic rainfall has amplified year-on-year yield variability, with substantial food security implications.

Beyond weather risks, pests and diseases pose a significant threat to Kenya's farmers. The most common crop threats are armyworms, thrips, aphids, mealybugs, nematodes, and parasitic weeds, which are all a permanent fixture of Kenya's agricultural landscape. Maize is particularly susceptible to a range of fungal and viral diseases, the

most noteworthy of which is Maize Lethal Necrosis Disease (MLND). MLND was first detected in 2011, and seed varieties resistant to the disease have yet to emerge from research institutions. Incidence in the field ranges from 40–100 percent of the crop, and crop losses of over 80 percent have been reported. Among Kenya's industrial crops, coffee is particularly susceptible to Coffee Berry Disease and Coffee Leaf Rust, which can cause losses of

FIGURE 2: Domestic maize output versus utilization demand, 2003–2015

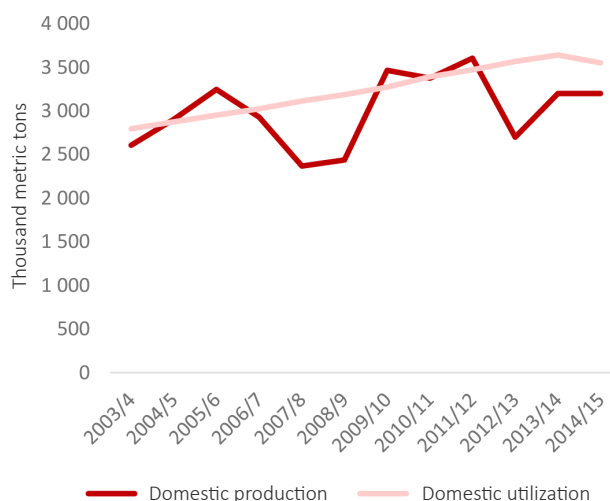




Photo credit: Curt Carmack / World Bank

50–80 percent if left untreated. Chronically low farm-gate prices offer poor incentives to farmers to invest in control measures for these diseases, aggravating their impact.

For Kenyan livestock, diseases pose a significant threat, though due to a paucity of data, related impacts are difficult to measure. East Coast Fever (ECF) is perhaps the most noteworthy threat. Tick-borne, ECF can kill large numbers of calves in pastoralist herds. The presence of ECF in neighboring countries severely handicaps effective control. Rift Valley Fever in Kenya is similarly hard to control but is more predictable due to its positive correlation with heavy rainfall and flooding. During outbreaks, animal losses are often high, as treatment by vaccination frequently leads to abortion in pregnant animals. Foot and Mouth Disease (FMD) is endemic in Kenya and can cause high mortality rates, especially among improved breeds. Vaccination is effective but existing coverage is limited (roughly 10 percent). Widespread outbreaks were recorded every third year on average during the review period. One severe FMD flare up in the early 1980s resulted in losses valued at an estimated KShs 230 million. Other notable diseases include small ruminant pest, contagious bovine pleuropneumonia, and catarrhal fever. The risk associated with animal disease is especially acute during drought

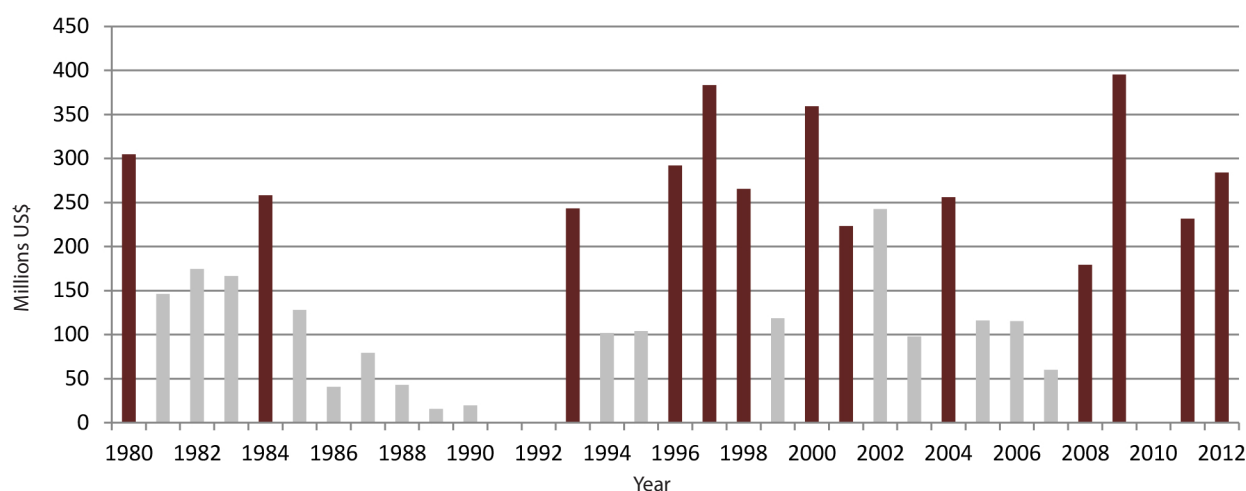
when even common day-to-day levels of infection or internal or external parasites can be fatal.

Market Risks

At the market level, the analysis highlights price volatility as the most significant risk. Producer prices for key crops are subject to moderate-to-high levels of interannual price variability. Rice, coffee, sorghum, and to a lesser extent, cowpea exhibit the highest levels of year-on-year producer price volatility. In the case of rice and coffee, domestic price fluctuations are influenced by imports and/or changes in international market prices, exposing Kenyan producers to significant swings in farm-gate prices from one year to the next.

While public support programs manage to keep producer prices for maize relatively stable, wholesale prices are among the most volatile, a critical issue for the government given maize's importance to household consumption and food security. Sharp increases during 2008–2009 and then again in 2011 and 2012 coincided with domestic and external shocks. For example, maize prices jumped by 145 percent during the first six months of 2011 following a sharp increase (39 percent) in the commodity food price index and a near doubling of U.S. maize prices in 2010. In

FIGURE 3: Estimated losses to aggregate crop production from risk events, 1980–2012 (US\$ millions)



Source: FAOSTAT 2013.

general, domestic maize prices tend to be more volatile than international maize prices, as domestic prices are highly sensitive to uncertainty and constant speculation in projected and real annual output. The Government of Kenya's active role in cereal markets, while designed to increase productivity, stabilize prices, and ensure food availability, can also discourage private sector investment in input supply, storage, and other services due to the added uncertainty over the timing and scale of public interventions.

Enabling Environment Risks

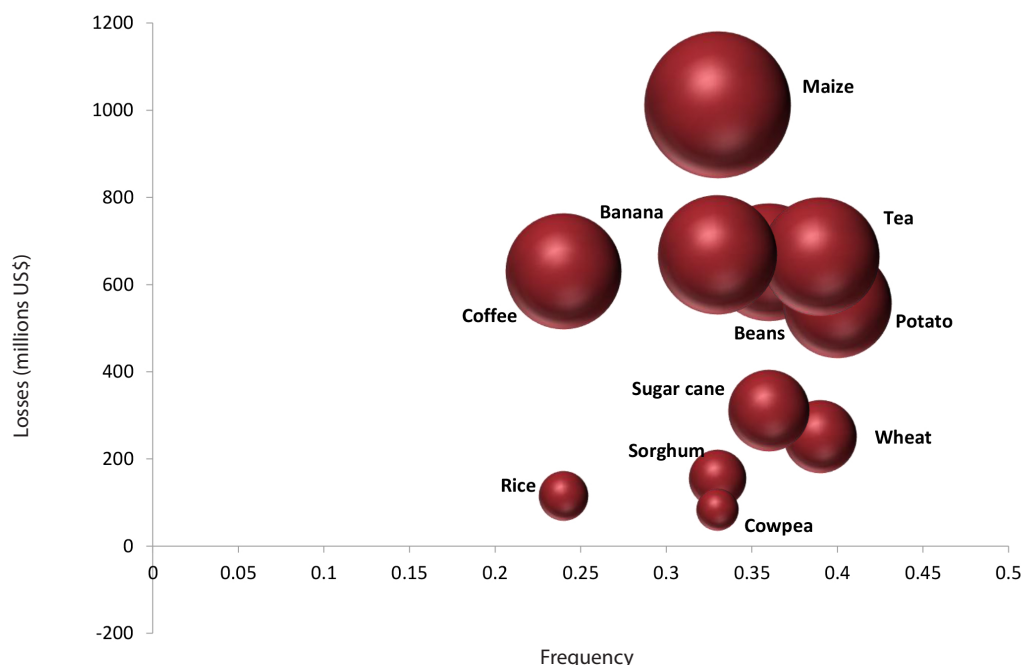
The political uncertainty and associated insecurity that disrupted agricultural production and markets in recent years have declined markedly since the new Constitution was enacted in 2010. Moving forward, the restructuring, consolidation, and reorganization of the agricultural sector's legal and regulatory frameworks and ministerial functions and the devolution of policy planning, decision making, and administration to the county level will continue to have major consequences for the sector. Such seismic change imparts uncertainty and significant and myriad institutional risks in the short-to medium-term. These include potential for increased inefficiencies, disruptions, and breakdown of critical public services such as extension, data collection, and MIS systems and higher volatility of producer, wholesale, and retail prices.

Kenya's sugar industry, in particular, faces significant regulatory risks. Policy unpredictability related to import regulations and ongoing exceptions to the COMESA

(Common Market for Eastern and Southern Africa) rules pose considerable risk to mills, cane producers, and other stakeholders. Unpredictability also impedes investments and needed industry reforms, including the planned privatization of remaining government-owned mills. Sizeable unrecorded imports of refined sugar from outside the region pose additional risks to the industry. Prices can fall precipitously when the market becomes saturated and mills are unable to compete, as happened in 2002 when the industry assumed massive debts. A more recent surge in sanctioned and unsanctioned imports in 2013 resulted in sizeable government payouts to a number of mills to stave off bankruptcy.

Kenya's growing dependence on cereal imports is also noteworthy. Imports today make up a much higher proportion (37 percent) than they did a decade ago. This exposes the country to external pressures that can adversely impact domestic food prices, availability, and access. Moreover, amid recurrent maize shortages, uncertainty exists about whether rising Kenyan maize imports will be able to fill the gap in light of Kenya's 50 percent ad valorem tariff for non-COMESA sourced maize, its import ban on genetically modified (GM) maize, and inadequate supplies of non-GM exportable maize in the COMESA region. This is especially true in light of episodic export bans for maize in Tanzania, Malawi, and Zambia during production shortfalls. Supply markets have also thinned out due to the growing attractiveness of the South Sudan market and of markets in the Democratic Republic of Congo for Ugandan and Tanzanian maize exports.

FIGURE 4: Value and frequency of losses per crop in Kenya, 1980–2012 (US\$ millions)



Source: FAOSTAT 2013, Authors' calculations.

ADVERSE IMPACTS

Estimated crop losses in Kenya amounted to more than US\$5 billion from 1980–2012, or roughly US\$155 million on an average annual basis. Average loss figures conceal the severity of impact in individual years; losses amounted to more than \$250 million in 2012 and exceeded \$300 million in 2009 (figure 3). Key crops experienced significant production losses in one out of every three years as a result of adverse risk events between 1980–2012 (figure 4). Combined, these crop-loss events resulted in drops in agricultural GDP of 2 to 4.2 percent. Maize losses were highest by production value, accounting for nearly 20 percent of total indicative losses. Coffee, tea, banana, dry beans, and sugarcane also experienced notable losses over the period.

Extensive livestock systems and pastoralists in Kenya's northern rangelands are particularly vulnerable to the effects of drought. Estimated losses to livestock populations from droughts that have occurred within the most recent decade alone amount to more than US\$1.08 billion. Ancillary losses related to production assets and future income and the costs of ex-post response measures are likely several times that figure. The increased incidence of droughts across Kenya's arid and semi-arid lands in recent years means that affected communities have less time

to recover and rebuild their assets. This has weakened traditional coping mechanisms, handicapping household resilience against future shocks.

The increasing frequency of shocks has negative impacts on food security, especially for vulnerable groups, precipitating spikes in emergency aid. In addition to an estimated one-half million Somali and Sudanese refugees in Kenya's Dadaab and Kakuma camps, an estimated 1.5 million Kenyans are chronically food insecure and in need of assistance, according to the World Food Programme. In drought years, that number can grow exponentially, as it did in 2011 when 4 million Kenyans in the northern rangelands needed food aid. In 2012, total humanitarian assistance to Kenya had climbed to US\$287 million (based on the 3-year average, 2010–12), more than triple what it was receiving earlier in the decade (US\$90 million, 2003–05). As evidenced elsewhere, frequent crises coupled with an overreliance on food aid can lead to a breakdown of household resilience. While emergency food aid can help address immediate food needs, it does little to help rebuild household resilience and may induce higher rates of dependency and chronic malnutrition. As such, it can increase the cost of managing future crises.

MANAGING AGRICULTURAL RISKS

While handicapping growth, unmanaged risks are also a significant factor contributing to chronic poverty in Kenya. Shocks to agricultural production and markets adversely impact household wellbeing in a variety of ways: by limiting food availability, weakening food access, and negatively affecting future livelihoods through income disruption and depletion of productive assets. Chronically vulnerable groups with high exposure to risks experience a disproportionately large impact from adverse events and typically lack coping mechanisms available to other groups. Understanding these and other risk dynamics is key to developing appropriate risk management responses that can help reduce production volatility, safeguard livelihoods, and put the sector and the broader economy on a firmer footing for growth. Effective strategies can also make a meaningful contribution to poverty reduction efforts.

Management of agricultural risk is not new to Kenya. The Government of Kenya has a long track record of investing in risk mitigation, transfer, and coping mechanisms. Moving forward, Kenya's Vision 2030 recognizes the need to strengthen existing risk management systems and the Government has launched a range of new initiatives to confront the most severe threats facing the country. In 2011, it established the Drought Risk Management Authority to better coordinate preparedness and speed up response measures. It also launched the Disaster Risk Reduction Program, the National Climate Change Action Plan, and the National Hunger Safety Net Program. These and other initiatives by the GoK and its development partners are already helping to safeguard livelihoods, promote adaptation, and strengthen resilience against impacts from natural disasters and a changing climate. Yet Kenya's agricultural supply chains remain highly vulnerable to myriad risks that disrupt the country's economic growth, cripple poverty reduction efforts, and undermine food security. A more targeted and systematic approach to agricultural risk management is needed in Kenya.

Strengthening Resilience

Strengthening ex ante resilience requires moving beyond individual practices to integrate through a whole-farm and whole-landscape systems approach. Many gains will come through better and more equitable management of natural resources such as soil, water, and landscapes,



Photo credit: Curt Camermark / World Bank

which will require knowledge generation and sharing, and integration of investments at multiple levels. These will need to be supported by policy and institutional reforms. Equally critical will be ensuring that producers have good access to needed productive inputs, including market and weather information, credit, and well-functioning markets.

Based on an assessment of existing risk management practices and programs in Kenya, the following recommendations are tailored to address Kenya's unique risk landscape, fill existing gaps, and scale up effective strategies. The interventions encompass a broad range of interrelated, mutually supportive investments that align with the Livelihoods Enhancement goals within Vision 2030 and aim to strengthen the resilience of vulnerable farming and pastoralist communities to shocks.

1. Improved Water and Soil Management

Addressing climate-change-induced water stress and promoting better water-use efficiency, particularly in marginal rainfall zones, will be required to strengthen resilience in Kenya's agricultural sector. Similarly, curbing soil erosion, increasing soil fertility, and improving access to high-quality, drought- and disease-tolerant seed varieties are crucial to enhancing the productivity of smallholder systems. In most parts of the country, access to irrigation remains limited, and farmers are at the mercy of rainfall. Perception of high production risks drives their ex-ante decisions and discourages them from investing in fertilizers, improved seeds, and better crop husbandry practices.

Irrigation infrastructure build-out is costly and not suitable for many areas where long-term access to groundwater is uncertain. However, water harvesting and improved soil management offer a sustainable and cost-effective way to favor investments in yield-enhancing practices.

In order to strengthen risk management at the farm level, increase the effectiveness of productivity-enhancing programs, and improve the effectiveness of public support systems, the following is recommended:

- Incentivize farmer/community-driven investments in improved rainwater harvesting and storage measures such as terracing, water harvesting pans, roof and rock catchment systems, multi-pond systems, furrows, small basins, sub-surface dams, and micro-irrigation systems.
- Promote broader awareness and adoption (via Farmer Field Schools and other participatory extension approaches) of improved soil and water conservation practices such as zero tillage, mulching, integrating livestock, composting and use of organic fertilizers, crop diversification and rotation, terracing and grass strips, and agroforestry.
- Create stronger linkages with continental-level initiatives such as the Comprehensive Africa Agriculture Development Programme's African Alliance for Climate Smart Agriculture to better leverage expertise and scale up best practices technologies.
- Strengthen management of subsidized seed and fertilizer distribution schemes to better incentivize farmers to adopt "best practice" soil and water conservation technologies that build climate resilience and improve productivity.
- Strengthen seed research, developing credible and commercially-driven certified seed production and distribution systems, and upgrade monitoring and enforcement of seed-quality standards to curb counterfeiting and adulteration.
- Create linkages between research centers and county governments to ensure that nationally funded research is aligned with farmers' needs and county development priorities.
- Support research to address gaps in the empirical evidence related to the costs/benefits of climate smart adaptation and mitigation technologies.

2. Strengthening Rangeland Management and Livestock Services

Given the importance of the livestock sub-sector, safeguarding the long-term viability of arid and semiarid rangeland ecosystems is a key component of building resilience in Kenya's agricultural sector. This will require reversing the degradation of water, soil, and vegetative cover, and ensuring access to sufficient grazing land. Successful strategies to mitigate rangeland degradation must also address resource conflict between and within communities, improve pastoralists' access to markets, and reduce the vulnerability of marginal livestock owners to shocks. In order to achieve sustainable, community-driven pastureland management, the following is recommended:

- Promote sustainable land management practices such as contour erosion and fire barriers, cisterns for storing rainfall and runoff, controlled/rotational grazing, grazing banks, homestead enclosures, and residue/forage conservation. Counties and communities should be encouraged to implement joint rangeland management strategies.
- Strengthen traditional customary institutions to implement grazing and water management plans that leverage customary forms of collective action and economic instruments to reward sound pasture management strategies recognized by county and national authorities to ensure protection of pastoralists' rights and enforcement by the judicial system.
- Implement supportive policies and livelihood development programs (targeted credit schemes, technical/business skills training, small business grants, and public sector investments in infrastructure projects) for income and livelihood diversification (feed/fodder production/storage, animal health services, milk/meat processing).
- Strengthen the availability of financial resources (e.g., County Adaptation Fund) that can support needed improvements to rangeland and market infrastructure.
- Train pastoralists to access formal banking services and introduce/expand financial instruments offered by lending institutions that are sharia-compliant and that allow movable assets, like livestock, to be used for collateral.

- Create a Livestock Enterprise Fund to provide access to finance for value chain entrepreneurs such as livestock traders, animal vets, and feed/fodder suppliers.
- Conduct training of community leaders and county government staff to deal proactively with livestock emergency situations using the Livestock Emergency Guidelines and Standards toolkit.

3. Climate Services for Better Decision Making

Improving the productivity and climate resilience of smallholder farmers and pastoralists requires timely, cost-effective, and relevant information on improved agricultural practices, markets, prices, inputs, weather, and news of impending disasters. Yet, access to and quality of these climate and market information services are critically low or non-existent in many parts of Kenya. The assessment highlighted the need for developing integrated, modern agro-weather forecasting and marketing information systems to equip farmers with the right information to make better decisions and manage climate variability. These tools will also enhance extension services delivery by providing advice on agronomic best practices, agro-input use, storage technologies, and marketing of production.

Building partly on the experiences from Agro-weather Tools for Climate Smart Agriculture pilots funded by the World Bank Netherlands Partnership Program in Embu and elsewhere, proposed interventions include:

- Upgrade existing weather infrastructure and install new automated weather stations to improve agro-weather observation monitoring.
- Strengthen institutional capacity for downscaling climate models, numerical weather prediction modeling, processing and satellite weather data analysis, visualization of the data, and improved weather

communications in conjunction with national and international universities.

- Develop big data crop-weather analytics to help reduce risks and uncertainties, and assist farmers in making decisions on what, when, and where to plant.
- Leverage multiple delivery channels (traditional extension, radio, SMS) to disseminate weather and market advisories to rural farmers and pastoralists. These delivery channels should be integrated with the agro-weather and market information support systems and allow for bi-directional information exchange to maximize collection of data from farmers.

CONCLUSIONS

The risk assessment process highlighted opportunities for strengthening the climate resilience of Kenya's agricultural sector. The country is currently undergoing a revolutionary transformation within its political, fiscal, legal, and administrative makeup. Launched in 2012, the devolution process has decentralized power and resources across key sectors of the economy to local levels of government. For agriculture, this means that 47 county governments are now in the driver's seat. While this presents near-term challenges, it also presents a unique opportunity for more localized and more targeted planning and decision making on agricultural sector growth and development priorities. It also empowers more localized, more effective responses to the growing threat of climate variability and extreme weather. It is hoped that this study's findings will help to inform optimal policy and investment choices toward stronger climate resilience of agricultural systems and livelihoods in Kenya.

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