Recipes for success: policy innovations to transform Africa's food systems and build resilience

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FOREWORD

In 2017 we took over as co-Chairs of the Malabo Montpellier Panel to work alongside African governments and the African Union Commission (AUC) to provide sound policy analysis and strategic guidance on meeting the targets under the Malabo Declaration and the African Union Agenda 2063. The focus of the Panel is on identifying countries making the biggest strides towards agricultural growth, food security and improved nutrition in Africa, examining what they are doing right, how they are doing it and why they are successful.

Five years on, eight reports and 53 country analyses later, the Malabo Montpellier Panel has established itself as an active partner for African governments, the AUC and donors in guiding policy choices to transform their food systems.

There is no doubt that the continent has made great strides in advancing towards the goals set under the Malabo Declaration and the Sustainable Development Goals. But the progress is fragile. Demographic changes, rapid urbanization, weather extremes and economic shocks put great stress on our food systems to deliver sustainable and healthy diets for all. Indeed, in some places we have seen the progress made over the past decades stall or even reverse.

As the world regroups and reconsiders its post-COVID priorities, it is an opportune moment to pause and reflect. This report coincides with the end of a “super-year” – having been host to the UN Food Systems Summit, COP26, and the end of the first ten-year implementation plan under the African Union (AU) Agenda 2063, to mention a few.

What must Africa’s leaders prioritize to maintain or even accelerate the pace of economic recovery and agriculture growth achieved so far? How can they broaden the impact on poverty and food and nutrition security to include the marginalized

and most vulnerable? How can a food systems transformation tackle the triple challenge of providing affordable and healthy diets, creating decent and profitable employment, and strengthening the resilience of farmers and other stakeholders to future socio-economic and climatic shocks? What are the policy and institutional opportunities to align decision making processes to tackle this triple challenge more effectively? What Malabo commitment areas have countries overall performed well on, and where are the gaps?

The large body of evidence gathered over the last five years through dozens of country case studies document what we need to do to achieve a food systems transformation that is sustainable, resilient, equitable, and in line with overall climate goals and ambitions. We know what we need to do to unlock the transformative power of our food systems.

Since 2017, the Malabo Montpellier Panel has analyzed the policy and institutional innovations across seven thematic areas, including nutrition, mechanization, irrigation, digital agriculture, the energy-agriculture nexus, livestock, and trade. Our analyses have shown what the most successful countries have done to achieve sustained progress and based on those findings, our recommendations show how this success can be replicated and scaled-up across the continent.

This report summarizes the main findings from the seven reports the Panel has published between 2017-2020 into one piece, thereby providing a very practical guide to support efforts by African countries seeking to accelerate progress towards ending hunger and transforming their food systems.

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THE MALABO MONTPELLIER PANEL

The core mission of the Malabo Montpellier Panel, a group of leading African and international experts from the fields of agriculture, ecology, food security, nutrition, public policy and global development, is to support evidence-based dialogue among policy makers at the highest level. The Panel's reports seek to inform and guide policy choices to accelerate progress toward the ambitious goals of the African Union Commission's Agenda 2063, the Malabo Declaration and the global development agenda. The Panel works with African governments and civil society organizations to provide support and evidence-based research that facilitate the identification and implementation of policies that enhance agriculture, food security and nutrition.

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1. INTRODUCTION

Remarkable progress has been made over the past few decades in reducing global hunger and malnutrition in Africa. However, over the past few years, much of the progress that had been made in reducing all forms of malnutrition has slowed down or been undone, jeopardizing the lives of millions of Africans and undermining progress towards key future development targets such as the Sustainable Development Goals, the CAADP goals and the AU Agenda 2063. About one in five people faced hunger in Africa in 2020 – more than double the proportion of any other region, and an increase of three percentage points in one year.¹ In fact, as it stands, Africa is not on track to achieve the major goal of Zero Hunger by 2030 (SDG 2).

Growing food insecurity is being driven by various short-lived but increasingly frequent and overlapping shocks which severely disrupt food production, processing and distribution. These shocks include extreme weather events triggered by climate change, conflicts, and health crises such as the COVID-19 global pandemic, which have dramatically exposed the fragility of the food and agriculture sectors through supply chain disruption, job losses, rising food prices and reduced dietary diversity. These events are occurring against a backdrop of broader structural changes and challenges such as population growth, rapid urbanization, deepening globalization, a growing energy deficit, youth unemployment, and migration – all of which exacerbate the challenges of achieving food and nutrition security in Africa. Although these trends and events have evoked responses from a variety of stakeholders within Africa's food systems, the interventions are disparate and limited. Policy responses have not kept up with the rapidly changing challenges taking place across food systems.

The stakes are high and decisive action is needed. There is now a strong case for broadening our understanding of, and approach to, a systems-wide perspective. Food systems around the world play three key roles: they provide food security and nutrition; they provide livelihoods for millions, not only in agriculture and food production, but also across the broader supply chain and complementary sectors; and they contribute to the protection and enhancement of ecosystems. Tackling this 'triple challenge' requires complex solutions involving multiple sectors, industries, and stakeholders, all of whom arrive with varying interests. Policy analysts need to offer more comprehensive system-based assessments and nationally relevant models. And

policymakers must rise up to the challenge of this complexity and develop a more holistic and nuanced approach – one that operates within the interlinkages of policy domains that have been historically dealt with distinctly, such as agriculture, health, education, and the environment. The post-Covid recovery process provides opportunities for stakeholders to coalesce around new approaches and to restore progress.

It will no longer be enough to tinker at the margins or make isolated adjustments in particular sectors. The transformation of Africa's food systems will require sound quantitative analyses, evidence-based and guided experimentation, policy innovations, and innovative technical solutions, as well as commitment from the highest levels of government, facilitating cooperation across all government departments relevant to food systems.

The reports published by the Malabo Montpellier Panel between 2017 and 2020 have provided evidence-based expert knowledge and guidance for policymakers to accelerate progress towards food security and improved nutrition in Africa. The reports are based on the latest research and analyses, scientific evidence and countries' practical experience to learn from. They cover a broad range of topics including mechanization, digitization, energy, and trade. The Panel works with African governments and civil society initiatives to identify areas of progress and positive change across the continent and assess what successful countries have done differently. It identifies the most important institutional and policy innovations and programmatic interventions that can be replicated and scaled by other countries.

The transformation of Africa's food systems will require sound quantitative analyses, evidence-based and guided experimentation, policy innovations, and innovative technical solutions, as well as commitment from the highest levels of government, facilitating cooperation across all government departments relevant to food systems.

As such, this monograph can serve as a resource for policymakers in Africa as they seek to deploy a food systems approach for creating optimal and coherent policies, which can deliver positive spillover effects and manage trade-offs. It can also support African policymakers to leverage existing structures and frameworks and ensure that policies keep up with

the rapid structural changes taking place across food systems.

It is important to note that the original reports date back to 2017 and while every effort has been made to update them, this is a fast-changing environment.

Critical for transforming Africa's food systems are its mutual accountability country processes, including the CAADP biennial reviews and the agriculture joint sector reviews. While CAADP has focused national efforts in transforming agricultural sectors, it is now time to adopt a more systemic view of food systems transformation and to go beyond the CAADP's current ambition of agricultural growth and transformation. Additional indicators are needed which better measure and reflect food

systems' interconnectedness with the environment, social inclusion, nutrition and public health, youth employment, and income generation. Within this context, the development of the Second Ten Year Implementation Plan of the AU Agenda 2063 is an opportune moment to consider Africa's food system transformation goals.

The work has just begun on implementing a sustainable food systems transformation across the continent. It will be important to sustain the momentum generated by the UN Food Systems Summit to ensure that those commitments are met, and to get back on track towards achieving the continental and global commitments and targets.

2. ACTION AGENDA

African countries have made real progress since the turn of the century in boosting economic and agricultural sector growth, improving food security and diets, and in reducing poverty. Continent-wide efforts to improve the quality and effectiveness of policies and raise public sector investments have born real fruits. But the progress is now slowing – or even reversing – and the continent is no longer on track to achieve key development targets. Now is the time to take stock, learn from what has worked and redouble efforts to accelerate the pace of progress.

Through this report, the Malabo Montpellier Panel proposes evidence-based recommendations to inform and guide policy choices to accelerate progress toward the ambitious goals of the AU Agenda 2063, the Malabo Declaration and the global development agenda. Among those African countries that have made progress towards tackling the triple challenge of food systems, some common features of success emerge, outlined below. Their experiences in designing and implementing policy and institutional innovations as well as programmatic interventions offer a wealth of lessons for replication and scaling out across the continent.

At the same time, it is important to note that there is neither one single policy nor a unique mix of strategies that can deliver change across all objectives of a food system. Rather, policymakers will be required to forge new pathways to build sustainable, resilient, and prosperous food systems that deliver healthy and nutritious diets, improve livelihoods, and protect the environment. Individual countries must identify their specific needs and objectives, using a framework that allows space to innovate.

1 INTEGRATE food systems transformation into long-term national vision, growth and development agendas. A food systems transformation is unlikely to be rapid. Policymakers must therefore seek to elevate the transformation process beyond the impulses of political administrations. Integrating food systems transformation (including specific targets) into long-term national strategies can help transcend politics and make the transformation a national priority. This in turn builds certainty for investors and for other stakeholders engaged in the process. It also enables the continuity of the work required to transform food systems. Each country represented within the case studies in this report has demonstrated long-term commitments to support their agricultural sectors and broader food systems.

2 ELEVATE African research capacity for home-grown solutions. Transforming food systems is science intensive. The UN Food Systems Summit emphasized the key role of science and evidence. A robust science, research and technology system that encourages interdisciplinary approaches is at the heart of addressing the multifaceted challenges facing Africa's food systems such as improving crop and animal productivity and nutrition, tackling pests and diseases, improving storage technologies and methods, raising food safety standards, adapting to and mitigating climate impacts, or developing innovative solutions to deliver humanitarian aid to communities in conflict. African countries need to develop their own science, research and technology sectors and capacities, tailored to the unique, multifaceted challenges of their food systems. It is therefore critical for African countries to assess their food, agriculture and nutrition-related science landscapes. In order to nurture the necessary analytical and advisory capacities, they must identify and build on existing strengths and consider the formation of clusters that can facilitate synergies among universities, academies of sciences, colleges, and innovation hubs. The private sector is an important arena for the development of new solutions and public-private partnerships will be essential to unlocking research and innovation capacity.

3 INNOVATE to create the policies and technical solutions to drive the transformation of food systems. Countries are required to forge new and adapt existing pathways to build sustainable, resilient, and prosperous food systems that deliver healthy and nutritious diets, improve livelihoods, and protect the environment. A country's institutions and frameworks must be nimble enough to absorb those changes. That flexibility to innovate is important because the "ingredients" of food systems transformation may change as new ideas, knowledge and technologies emerge. Disruptive innovations can reorient the trajectories of national and regional food security and nutrition outcomes.

4 CO-ORDINATE across government departments for policy cohesion, and more broadly across sectors for impact. Food systems transformation requires us to tease out connections and to form new alliances and partnerships. Well-coordinated national-level policies can facilitate success. This ‘policy coordination’ is important for creating policy cohesion and “synergies, between” ministries of health, agriculture, infrastructure and finance, for example. Equally important is broader coordination between governments and other stakeholders, so that there is a common vision across research institutions, civil society, the private sector, and development partners. With this common vision, you can ensure that policies have broad ‘buy in’, thereby making them more impactful. A coordinated, multi-stakeholder approach must also build in iterative processes. Learning must be captured, even – or especially – if it sometimes is the result of a failure. Reliable monitoring, evaluation, and data systems will maximize accountability, reflection and impact.

5 OPTIMIZE conditions for sustainable growth. Onerous regulations can act as a drag on growth, while conversely, smart regulation can accelerate it. In livestock markets, for example, strong regulation builds confidence in the safety and quality of both inputs and outputs. Effective regulation governing the use of water in agriculture can improve efficiency and environmental performance. Regulating quality standards for machinery gives farmers the confidence to invest in productive assets. In the digital sector, strong regulation can ensure that the value of innovation is captured within African economies. As African policymakers work towards food systems transformation, it will be important to consider all of these regulatory domains and their interactions. Conflicts must be resolved, but overlaps may also be opportunities to amplify complementarities and create synergies.

6 STIMULATE investment in infrastructure. Ending poverty and hunger will depend on rural populations being able to improve their productivity and earn income from markets. Without greater investment in infrastructure, that is unlikely to happen. A food systems transformation needs reliable, affordable access to energy, irrigation, communications, storage and transport infrastructure. But it is also vital that investment in infrastructure be conceived in a holistic way. If irrigation raises productivity, there must also be storage, roads and market information to turn that productivity into real gains. New and diverse sources of funding, new business models, and a more dynamic approach to connecting urban and rural areas will be needed. This must include addressing the constraints that might deter private sector investments, ranging from access to finance, government institutional capacity, land tenure issues, trade barriers, skills development and more.

3. AFRICAN AND GLOBAL POLICY FRAMEWORKS

AFRICAN UNION AGENDA 2063

The African Union's Agenda 2063 is a roadmap for Africa's socio-economic development over a period of 50 years from 2013. It seeks to accelerate the implementation of past and existing continental initiatives for growth and sustainable development, using a series of 10-year plans. The Agenda aligns thinking from across the continent and proposes a set of aspirations, one of which is the aspiration to eradicate poverty in one generation and build shared prosperity through social and economic transformation.

COMPREHENSIVE AFRICAN AGRICULTURAL DEVELOPMENT PROGRAMME (CAADP)

The CAADP was established by the AU Assembly of Heads of State and Government through the Maputo Declaration in 2003. It is the flagship strategy guiding agricultural development in Africa. The CAADP recognizes that enhancing Africa's agricultural performance is key to growth and poverty reduction through its direct impact on jobs and livelihoods (especially for women and youth) and on food security and improved nutrition. Through the CAADP, African governments have agreed to allocate at least 10 percent of national budgets to agriculture and rural development, and to achieve agricultural growth rates of at least 6 percent per annum.

MALABO DECLARATION ON ACCELERATED AGRICULTURAL GROWTH

The 10th anniversary of CAADP provided an opportunity for the AU Heads of State and Government to assess progress and look ahead to what CAADP would need to achieve over the next decade to 2025. This led to the 2014 Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods. The Malabo Declaration made specific commitments including ending hunger in Africa by 2025, halving poverty by 2025 through inclusive agricultural growth and transformation and enhancing the resilience of livelihoods and production systems to climate variability and other related risks.

LIVESTOCK DEVELOPMENT STRATEGY FOR AFRICA (LIDESIA)

The Livestock Development Strategy for Africa (2015-2035) aims to transform the African livestock sector to significantly contribute to socioeconomic development and equitable growth. In line with the AU Agenda 2063, the strategy positions the livestock sector as the main driver for providing the desired 6 percent annual growth in agriculture. The strategy acts as a framework and advocacy tool to increase reforms and development in the livestock sector. It also aims to increase public and private investments in livestock sector value chains, improve animal health, and strengthen the resilience and productivity of livestock production systems.

AFRICAN CONTINENTAL FREE TRADE AREA (AfCFTA)

The AfCFTA is a flagship program of the first 10-year plan of the African Union Agenda 2063, and is designed to form the world's largest free trade area by connecting almost 1.3 billion people across 54 African countries. The agreement aims to create a single market for goods and services, boosting regional and continental economic integration and accelerating Africa's development. Regional economic communities (RECs) play a decisive role in driving Africa's regional and continental integration process and are the pillars of the free trade area. The Agreement entered into force on May 30, 2019, and trading under the agreement began on January 1, 2021, after a sixth month delay as a result of the impact of COVID-19.

SUSTAINABLE DEVELOPMENT GOALS

The Sustainable Development Goals (SDGs) were agreed by world leaders and adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. Each goal typically has 8–12 targets, and each target has between 1 and 4 indicators used to measure progress toward reaching the targets. Agriculture is a common thread for sustainable development and the achievement of the SDGs as a whole, and is particularly key to Africa's progress on SDG1 (no poverty) and SDG2 (zero hunger).

NOURISHED

How Africa Can Build a Future Free from Hunger and Malnutrition

CHAPTER 4 - NUTRITION

4.1 Introduction

Remarkable progress has been made during the last two decades in reducing extreme hunger in Africa. However, more needs to be done to achieve the Malabo Declaration targets of reducing the prevalence of stunting, wasting, and underweight, while ensuring a minimum dietary diversity for women and meeting minimum standards for infant diets by 2025.²

Good nutrition contributes to cognitive development and the realization of lifelong economic potential.³ Poor nutrition, on the other hand, impairs productivity, acting as an impediment to national growth. The cost of undernutrition to African economies averages 11 percent of gross domestic product (GDP) annually.⁴ At the same time, the economic returns from investing in nutrition are high: for every US\$1 invested, US\$16 is generated.⁵

Increasing food production is not enough on its own. Africa's agriculture sector must be unlocked in a way that captures the synergies among nutrition, health and food production. This depends on the political will to prioritize nutrition across all areas of government, including agriculture, health, and rural development.

Box 4.1: Malnutrition terminology

Malnutrition: Deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients, including undernutrition, micronutrient deficiencies or insufficiencies, and overweight/obesity.

Undernourishment: Insufficient food intake to provide enough calories (energy) to meet minimum physiological needs for an active and healthy life.

Micronutrient deficiency ("hidden hunger"): Intake or absorption of vitamins and minerals – iron, folic acid, vitamin A, zinc, and iodine – that is below healthy thresholds and too low to sustain good health and development in children and normal physical and mental function in adults.

Overweight/obesity: Abnormal or excessive fat accumulation that may impair health.

4.2 An overview of nutrition in Africa

Malnutrition is a term for a condition caused by improper diet or nutrition. It results from inadequate intake of protein, calories, or micronutrients and is characterized by frequent infections and disease and reduced cognitive development.⁶ It can lead to children being stunted (too short for their age), wasted (weighing too little for their height) or overweight, or obese.

While the proportion of children below the age of five who grew up stunted in Africa decreased from 41.5 to 30.7 percent between 2000 and 2020, in some regions the proportion is still as high as 36.8 percent. The overall number of children with stunting is declining in all parts of the world except Africa, where it rose from 54.4 million in 2000 to 61.4 million in 2020.⁷ In addition, there are several million children and adults across Africa who suffer vitamin or mineral deficiencies, which can lead to anemia, blindness, cognitive impairment, and greater susceptibility to many diseases, and can result in higher mortality rates.⁸ Fortunately, micronutrient deficiencies can be effectively targeted through food-based interventions, such as biofortification.

Meanwhile, middle class consumers are rapidly growing in number across Africa, and these consumers also need to be able to make healthy and affordable food choices. It is not uncommon to find undernutrition and obesity (also a form of malnutrition) coexisting within the same country (Figure 1), the same community, or even the same household.⁹ This double-burden of malnutrition is partly due to the rapid food system transition taking place in some middle-income African countries. Children in Africa are increasingly exposed to energy-dense processed foods which tend to be lower in cost but also lower in nutrient quality. The prevalence of overweight in children under 5 dropped from 6.2 to 5.3 percent between 2000 and 2020 for Africa as a whole, but increased in northern and southern African countries, and the total number of overweight under-5s in Africa rose from 8.2 to 10.6 million.¹⁰

Figure 1: Overview of nutrition in Africa

Box 2: COVID-19 and malnutrition

The COVID-19 pandemic is likely to exacerbate all forms of malnutrition through its effects on household incomes; disrupted supply chains impeding access to nutritious food; disruptions in essential nutrition services; and reduced opportunities for physical activity. The impact of the pandemic on stunting, for example, is likely to appear gradually, and may persist for years after COVID-19 is under control and economies recover. As stunting is the result of chronic or recurrent malnutrition, it will be influenced by the persistence of these pandemic-related shocks to the economy, food systems and health systems.¹¹

4.3 Successful interventions and innovative approaches

There is no one-size-fits-all solution to successfully reducing malnutrition levels across Africa. Interventions and solutions, including the ones discussed here and in the case studies, have to be adapted to local contexts.

Breastfeeding

Optimal breastfeeding practices are crucial to a child's development. In Africa, a majority of babies

are breastfed, but suboptimal breastfeeding practices continue to put them at risk. Of total deaths of children under the age of five, 12 percent are attributable to suboptimal breastfeeding practices. To overcome the barriers faced by women in adopting breastfeeding practices, governments and the private sector must provide mothers with information on the benefits of breastfeeding, best practices, and advice on how to prepare nutritious complementary foods.

Biofortification

Biofortification uses conventional plant-breeding methods to enrich the micronutrient content of the staple crops that comprise a majority of rural populations' diets. Over 130 varieties of several biofortified crops – such as vitamin A enriched sweet potato – have been released in over 30 countries. Given the positive evidence supporting biofortification, biofortified crops could provide a steady and safe source of certain micronutrients for people unable to access nutritious crops.¹²

Social protection programs

For many poor households, social protection – either financial or in-kind – presents a lifeline that helps avoid chronic poverty, malnutrition and

disease. In 2006, the government of Malawi piloted a cash transfer program called Mtukula Pakhomo (Lifting up Families) targeting ultra-poor, labor-constrained households with school-age children. Evaluations of the program found that stunting fell from 55 percent to 46 percent in beneficiary households and the proportion of children who were wasted fell by an additional 2 percent within one year.¹³

Homestead gardens

Home gardens are an integral part of local food systems and the agricultural landscape of developing countries.¹⁴ Most of the value of the home garden to the rural household lies not in the net income but in the range of production and its contribution to the overall livelihood and well-being of the household. Moreover, when combined with other interventions, such as the promotion of better nutrition and social transfers, homestead gardens are proven to be even more effective in reducing malnutrition.

Better data for more effective interventions

There is no single system for collecting, tracking, and processing the different indicators of malnutrition in Africa. This deprives decision makers of critical insights and means that responses to food crises remain reactive rather than proactive. There is an urgent need for more and better dietary data. Efforts such as the Global Dietary Database (GDD)¹⁵ and Global Individual Food Consumption Data Tool,¹⁶ developed by the FAO and the World Health Organization (WHO), should be developed further.

Innovative tools for expanded coverage and improved coordination

By 2025, Africa is expected to have more than 600 million unique mobile phone subscribers.¹⁷ The mobile industry therefore plays an increasingly important role in social and economic development in Africa, with opportunities for community-based, inexpensive early-warning and response systems to tackle malnutrition and disease in the community. This is explored further in the chapter on digitalization.

4.4 Critical threats to making progress on nutrition

Climate change, civil conflict, and protracted crises continue to pose critical threats to sustainably addressing malnutrition across Africa.

The impact of climate change on nutrition

Without effective adaptation and mitigation, food insecurity is likely to worsen due to climate change in regions across Africa that already have a high prevalence of hunger and undernutrition. Following current trends, rice, wheat, and maize yields in Africa are set to decline by up to 14, 22, and 5 percent, respectively, by 2050, while prices in 2050 are projected to rise by 7, 15, and 4 percent, respectively.¹⁸ The African research system needs to be more strongly connected to global climate science and build capacity to engage in evidence-based climate adaptation policy. The West African Service Center on Climate Change and Adaptive Land Use (WASCAL), in which 10 countries participate, is a promising example. Another policy option is to support the production of crops that are both nutritious and more tolerant of difficult conditions. In Kenya, for example, the NGO Farm Africa is working with 7,000 farming households to help them grow and earn an income from drought-tolerant sorghum and mung beans. Access to varieties with higher yields and shorter maturation periods increases the economic viability of these crops, while also improving household dietary diversity.¹⁹

Addressing the impact of conflicts on nutrition

Conflict continues to be a driver of food insecurity, famine, and hunger in Africa, having triggered famine conditions in Ethiopia, South Sudan, northern Nigeria, and Somalia in recent years. Governments need to invest in strengthening local early-warning capacities for crisis prevention and emergency interventions during times of peace and stability as measures of national preparedness. In addition, policymakers must join the call to eliminate the use of food as a weapon of war by making these tactics illegal.²⁰ Matching policy responses to the underlying drivers of conflict ensures that they go beyond the immediate crises, relief and development interventions and policies, to promote and protect livelihoods, including the restoration of agricultural potential.²¹ Food security policies, including targeted social safety nets and health- and nutrition-specific programs, would help increase the resilience of communities and households in times of crises.²² A critical role rests with the African Union and regional economic communities when national initiatives are not able to overcome internal conflicts in a country.

4.5 Country analyses

Six countries—Cameroon, Ethiopia, Ghana, Rwanda, Senegal, and Togo—are presented here as case studies, based on the decreases they achieved in the Global Hunger Index (GHI)²³ between 2000 and 2020. The GHI combines undernourishment, child wasting, child stunting, and child mortality indicators into one index, and is a tool designed

to comprehensively measure and track hunger at the global, regional, and country levels. The institutional structures and programs adopted by these countries provide lessons for others. (Note: The information used in these analyses was accurate at the time of publication.)

Cameroon

Cameroon made substantial progress in reducing malnutrition levels between 2000 and 2016, decreasing its GHI score from 40 to 23 with the help of several institutional and programmatic interventions.

Institutional innovations

In the 1990s, nutrition levels deteriorated in Cameroon due to economic crises and the HIV/AIDS pandemic. There was no clear government policy to address rising malnutrition levels. However, in 2001 the government took concrete measures, notably including food security and nutrition in its health sector strategy. In 2009, the Interdepartmental Committee for Food Security was created.²⁴ Its mission was to develop a coherent policy strategy for food security actions and to implement a National Food Security Program (PNSA).

Policy innovations and programmatic interventions

Nutrition was well integrated in the PNSA 2010-2015, which included a support component for nutrition education, and in the National Agriculture Investment Plan (PNIA) 2014-2020. Direct interventions in Cameroon have had a significant impact on malnutrition reduction. In 2011, the country instituted a mandatory food fortification program. The program includes the addition of vitamin A to refined vegetable oil and the addition of iron, zinc, folic acid, and vitamin B12 to wheat flour. In 2012, an evaluation of the impact of the fortification program was conducted in Yaoundé and Douala. Greater iron, zinc, folate, and vitamin B12 status and a lower prevalence of deficiencies of these micronutrients were observed among women of reproductive age and children aged 12-59 months. Folate levels had increased by 300 percent, and B12 by 50 percent.²⁵

There is also evidence that traditional dishes in Cameroon are contributing significantly to addressing malnutrition. A study was conducted to determine the nutrient content of some traditional dishes and their potential contribution to dietary reference intakes.²⁶ These dishes were *ekomba*, prepared from maize flour with roasted peanut paste; *ekwang*, prepared from crushed cocoyam tubers and cocoyam leaves; *tenue militaire*, prepared from dried maize flour and cocoyam leaves; and *koki*, prepared from dried crushed cowpea seeds. It was found that 100 grams of each dish eaten by children aged one or two years can provide more than 100 percent of their daily recommended vitamin A intake.

Ethiopia

Between 2000 and 2016, Ethiopia made significant progress in reducing malnutrition levels, lowering its GHI score from 59 to 33. This was largely due to increased stability and governmental commitment to reducing malnutrition, reflected both at the institutional and programmatic level.

Institutional innovations

Institutional reform to address malnutrition in Ethiopia started in 1987 with the creation of a nutrition unit situated within the Ministry of Finance and Economic Development. However, with a change of government, the unit was disbanded in 1991. In 2008, the government adopted a multisectoral approach to alleviate malnutrition. One of the major institutional changes was the creation of the National Nutrition Coordination Body²⁷ (NNCB) led by the Federal Ministry of Health.

Policy innovations and programmatic interventions

The NNCB became the main mechanism for the National Nutrition Programme (2008-15),²⁸ which targeted children under the age of five, pregnant and lactating women, and adolescents. It gave priority to the rural population while recognizing that significant malnutrition exists in low-income urban areas.

Community-based Nutrition (CBN) was one of the key nutrition activities of the NNP.²⁹ CBN is focused on children under the age of two and uses monthly growth-monitoring and health promotion to involve families in assessing health and nutrition issues. Initial analysis of 1.5 million children under the age of two showed a decline in underweight from 30 percent in January 2009 to 20 percent in March 2010.

Programs have included the Ethiopia Productive Safety Net Programme, which ran from 2008 to 2012. A large-scale social protection intervention, it aimed to improve food security and stabilize asset levels through a mix of public-works employment and unconditional cash and food transfers, and it successfully improved household food security.³⁰ The program may provide a basis for further strengthening nutrition impact, if combined with action for closer contact with mothers through health extension workers and information on good feeding practices and sanitation.

The Empowering the New Generation to Improve Nutrition and Economic Opportunities project (ENGINE)³¹ – which ran from 2011 to 2016 – trained health and agriculture workers to introduce vulnerable households to homestead gardening of nutrient-dense vegetables and fruits, and animal husbandry. This resulted in a decline in stunting of 12-20 percent in different regions.

Ghana

In 2008, Ghana was ranked among the 36 countries in the world with the highest burden of chronic childhood undernutrition.³² However, the reduction of undernutrition levels since then has been substantial compared to other countries in West Africa. This is backed up by its GHI score, which decreased from 30 to 14 between 2000 and 2016.

Institutional innovations

Nutrition is led by Ghana's Ministry of Health. However, the National Development Planning Commission (NDPC) – a body with oversight of all facets of development in Ghana, created in 1994 – has led on the implementation, monitoring and evaluation of nutrition policy. Nutrition targets have been included in human development objectives under government policy frameworks such as the Ghana Shared Growth and Development Agenda (GSGDA) for 2010-2013.

Policy innovations and programmatic interventions

A multisectoral approach bringing together the Ministries of Health, Education, and Agriculture has been shown to be successful in malnutrition reduction. In 2008, a five-year Integrated Malnutrition, HIV/AIDS and Tuberculosis (TB) Prevention and Control project to reduce childhood illness and death was implemented in central and northern Ghana. Between 2009 and 2012, stunting rates decreased from 43 to 25 percent, and among pregnant women there was an increase in iron supplement consumption from 77 to 99 percent.³³

Another project, Nutrition Links,³⁴ aims to improve the health and economic well-being of vulnerable rural populations in the Upper Manya Krobo district (Eastern Region) of Ghana, focusing on women farmers. The project develops small poultry businesses for egg production, home gardens, and supports weekly group meetings promoting nutrition and health education. Before the program started, 16 percent of all children had consumed eggs in the previous 24 hours; after the intervention, this rose to 27 percent.

Rwanda

Following conflict in the 1990s, Rwanda's nutrition situation worsened dramatically. However, Rwanda has made significant progress thanks to a combination of recovered economic stability and the government's institutional and programmatic commitments. Rwanda's GHI score decreased from 59 in 2000 to 28 in 2016.

Institutional innovations

Rwanda developed a National Nutrition Policy in 2007.³⁵ At the national level, the coordination bodies and implementation structures are composed of an intersectoral nutrition committee, which includes line ministries, NGOs, the Rwanda Bureau of Standards, the Rwandan Consumers Association, the Private Sector Federation, and the national nutrition technical working group. In 2013, Rwanda revised the National Nutrition Policy of 2007 and adopted a National Food and Nutrition Policy (NFNP), coordinated by an Inter-Ministerial Coordination Committee (IMCC).

Policy innovations and programmatic interventions

Many of the strategic areas and activities originally defined by the 2007 National Nutrition Policy were retained in the 2013-18 National Food and Nutrition Policy. The government also developed and implemented a three-year (2010-2013) National Multisectoral Strategy to Eliminate Malnutrition (NSEM). The objectives were to reduce all forms of malnutrition in Rwanda by 2013 and to protect the nutrition of young children and pregnant and lactating women. Although the reduction in stunting among under-5s did not fall to 30 percent or lower, it did reduce from 44 percent to 37 percent between 2010 and 2014.³⁶

There is a strong recognition that making agriculture and the food system more nutrition sensitive is an effective strategy to reduce malnutrition. The Girinka program (One Cow, One Family), which launched in 2006, had distributed 248,566 cows to poor households within six months and led to a significant improvement of the nutritional status of children under the age of five. In addition, as beans are the predominant staple crop in Rwanda, the Rwanda Agriculture Board, with the support of HarvestPlus, has scaled up the availability of biofortified beans.³⁷ Farming households are trained in nutrition improvements, crop management, postharvest handling, and marketing. An evaluation revealed that consuming iron biofortified beans improves the iron status in Rwandan women after just 128 days, with greater increases in hemoglobin (3.8 g/L), log serum ferritin (0.1 log mg/L), and BI (0.5 mg/kg).³⁸

Senegal

Between 2000 and 2016, Senegal made remarkable progress on undernutrition reduction, with its GHI score falling from 38 to 17. The country's improvements in nutrition have been driven in large part by significant institutional and programmatic commitment by the Senegalese government.

Institutional innovations

Senegal created its Cellule de Lutte contre la Malnutrition (CLM) in 2001 within the prime minister's office.³⁹ The CLM provides technical assistance in the definition and implementation of the national nutrition policy. It coordinates its activities with seven ministries – Health, Education, Economy and Finance, Decentralization, Trade, Industry, and Agriculture – and the National Association of Rural Advisors and civil society organizations.

Policy innovations and programmatic interventions

In 2002, the Programme de Renforcement de la Nutrition (PRN) was launched by the CLM, framed by the Lettre de Politique de Développement de la Nutrition (Nutrition Policy Letter) which defined – for the first time – national nutrition policy and set out appropriate strategies for programming and monitoring.⁴⁰ PRN interventions were organized around six main activities:

- A monthly weighing of children from birth to age three;
- Treatment of moderate cases of malnutrition through the distribution of fortified food and awareness activities for mothers;
- Community-based distribution of products and medicines;
- Information, Education and Communication (IEC) and Communication for Behavior Change for the promotion of key family practices;
- Support for community initiatives (such as mills and market gardening);
- Provision of potable water.

While the health sector remains the lead sector tackling malnutrition in Senegal, there is evidence that a value chain approach to making agriculture more nutrition-sensitive can improve nutrition outcomes. A study among pastoralists in northern Senegal showed that the introduction of a micronutrient-fortified yogurt reduced anemia prevalence from 80 percent to close to 60 percent.⁴¹ Another program, Yaajeende (Abundance),⁴² has been developing biofortified varieties of millet, beans, and sweet potato since 2011, addressing micronutrient deficiencies including iron, zinc, and vitamin A. The Yaajeende mid-term evaluation found that stunting prevalence among children aged 6-59 months in project areas decreased from 23 percent before project implementation to 16 percent at the mid-term evaluation.

Togo

After a long period marked by socio-political instability prior to 2000, Togo has made significant progress in reducing malnutrition levels and its GHI score decreased from 39 in 2000 to 22 in 2016.

Institutional innovations

The Togolese government created its Service National de Nutrition (SNN) within the Ministry of Health in October 1990. However, prior to 2006 the SNN operated without a strategic plan. Following the 2007 nutrition crisis, the government made SNN a priority and created a Nutritional Emergency Response unit within the SNN. National legislation on nutrition is extensive and includes laws on food fortification. A multisectoral approach has been adopted to tackle malnutrition, involving the agricultural sector.

Policy innovations and programmatic interventions

The Plan Stratégique National d’Alimentation et de Nutrition,⁴³ which ran from 2012 to 2015 and was led by the Ministry of Health, formed one of the government’s key programs for tackling malnutrition. The main elements of the program included the promotion of nutrition and nutritional education, school feeding, strengthening the implementation of infant and young child feeding, and preventing and managing acute malnutrition.

The government has also implemented innovative interventions across the country to improve the health and nutritional status of children.⁴⁴ Community-based interventions were implemented in 2011 to reduce morbidity and mortality rates among children under age five in the Savannah and Kara regions. The Integrated Management of Newborn Diseases and the Child program trained more than 1,000 community health workers, from villages over five kilometers away from the nearest health center, to recognize early signs of childhood illnesses and to either refer patients to community health facilities or to treat some of the most common illnesses on site.

Furthermore, the implementation of national legislation on food fortification in Togo has ensured that more fortified foods, such as oils, are made available to consumers. A Togolese company, Nioto, manufactures edible oils that meet international standards from local and imported raw materials.⁴⁵ Since 2009 the oils have been enriched with vitamin A. Their consumption makes it possible to largely cover 40 IU/g, or 30 percent, of the daily vitamin A requirements recommended by UNICEF and WHO.

4.6 Conclusion

African governments can successfully reduce malnutrition, as illustrated by the case studies presented in this report. Doing so requires policies and interventions that go beyond increasing agricultural production to making actual improvements in the provision and quality of diets, leveraging the potential of the agriculture sector and of other rural services such as health, water, sanitation, and hygiene.

Much progress has been made across the continent, but climate change and protracted crises, coupled with urbanization and a growing double burden of obesity and undernutrition, are threatening to undermine these achievements. In some cases, policies have not kept up with the rapid structural change taking place across food systems; nor have they kept pace with the challenges that have subsequently been introduced, including rising obesity, low productivity and incomes, and increasingly degraded ecosystems. The COVID-19 pandemic has further exacerbated stresses on Africa's food systems.

There is now a window of opportunity to redouble efforts to achieve national, continental, and international obligations and targets. Nutrition needs to be prioritized and be at the heart of all efforts to deliver on the African Union's Agenda 2063 and the Malabo Declaration targets. This is required for African countries to deliver on the 2030 Sustainable Development Agenda and the UN Decade of Action on Nutrition.

4.7 Recommendations

- ✓ Elevate nutrition to a top policy priority and work across ministries and departments to ensure a holistic and inclusive approach to tackling all forms of malnutrition (including obesity) and hunger as part of broader country development efforts.
- ✓ Coordinate with other stakeholders – particularly national research centers, the private sector, and development partners – to establish a common vision and support for policies, and to capture synergies between agriculture, water, health and sanitation.
- ✓ Address the threat of conflict to reducing malnutrition through interventions including diplomacy, security actions, and emergency aid.
- ✓ Invest in programs to protect the nutritional status of vulnerable populations during extreme weather events.
- ✓ Invest in national agricultural and nutrition research to mainstream the breeding and release at scale of micronutrient-rich crops, including through partnerships with the private sector.
- ✓ Empower women's groups to enable more women to take control over nutrition-relevant resources and decision making, particularly in regard to food, nutrition, and healthcare.
- ✓ Regulate to optimize conditions for the adoption of healthier diets and consumption patterns and embed nutrition education in school curricula.
- ✓ Invest in the availability and use of better data for more effective interventions.

WATER-WISE

Smart Irrigation Strategies for Africa

CHAPTER 5 - IRRIGATION

5.1 Introduction

Across Africa, agriculture continues to be almost exclusively rain-fed. But in many countries, rainfall is highly variable or insufficient. Currently, only 6 percent of arable land in Africa is irrigated⁴⁶ compared to 14 and 37 percent in Latin America and Asia respectively, and on average the area equipped for irrigation grew by just 1.5 percent between 1990 and 2015.⁴⁷

Expanding countries' irrigation potential can improve agricultural productivity on existing land and extend growing seasons throughout the year, which would reduce poverty, food insecurity, and import dependency across the continent. However, expanding and upgrading irrigation systems will require individual and collective action by governments, the private sector, and communities in rural and urban areas. This section identifies what certain countries have done right, and why and how to 'move the needle' in the area of irrigation. In particular, it identifies the most important institutional innovations as well as policy and program interventions that can be replicated and scaled up by other countries.

5.2 An overview of irrigation in Africa

Unlocking Africa's irrigation potential must be a crucial component of strategies to improve farmers' resilience and livelihoods, and to meet food security and nutrition targets. African countries produce 38 percent of their crops (by value) under irrigation, while 62 percent are rain-fed.⁴⁸ Access to irrigation can allow farmers to extend the growing season(s) and thus diversify activities and increase productivity levels and incomes. Yields from irrigated crops in Africa are at least double those of rain-fed agriculture.⁴⁹ This is particularly significant in the context of climate change: in the absence of solid adaptation strategies and coping mechanisms, such as irrigation, many studies predict that temperature and weather changes will directly affect the livelihoods of millions of Africa's smallholder farmers. According to models developed by the International Food Policy Research Institute (IFPRI), by 2050, yields of rain-fed maize will decline by as much as 25 percent

or more in some parts of Africa, relative to 2000 levels.⁵⁰

At present, two-thirds of irrigation in Africa is concentrated in just five countries – Egypt, Madagascar, Morocco, South Africa and Sudan – each of which have more than a million hectares of irrigated land.^{51,52} The potential to increase irrigation in Africa is therefore high, and much of the increase would take place in sub-Saharan Africa, where irrigated land could be expanded to 38 million hectares, up from the current 7.7 million.⁵³ An estimated 113 to 369 million people in rural areas could benefit.⁵⁴

Furthermore, most existing irrigation schemes in Africa rely on surface water, despite a remarkable potential for using renewable groundwater resources for irrigation. It is estimated that tapping into groundwater in 13 African countries – Nigeria, Tanzania, Ghana, Zambia, Burkina Faso, Ethiopia, Niger, Kenya, Mali, Mozambique, Rwanda, Uganda, and Malawi – could offer a potential 120-fold increase, equivalent to 13.5 million hectares, in the total area under irrigation.⁵⁵ But large quantities of water are also lost each year as a result of poor application of irrigation technologies and techniques, limited capacity for water harvesting, and limited use of reusable water resources. Therefore, as irrigation practices and technologies are brought to scale, it is important that they be designed to use water efficiently and prudently.⁵⁶

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Box 1: Benefits and risks of irrigation

Benefits	Risks
<p>Increased water supply and farm productivity. Irrigation in Africa has the potential to boost agricultural productivity by at least 50 percent.⁵⁷ Maize yields could increase by 141–195 percent compared to rain-fed agriculture.⁵⁸</p> <p>Improved household resilience. Irrigation offers a critical coping mechanism for farmers to respond to the adverse impacts of climate change.</p> <p>Higher incomes and better nutrition. Smallholders using irrigation frequently grow vegetables and fruits rich in micronutrients. These crops add to household dietary diversity and are also sold to raise household income.</p> <p>Women's empowerment. Irrigation policies and programs geared to the needs of women farmers can enhance the control that women have over household resources and reduce the need to fetch water, freeing up time for other productive activities.⁵⁹</p> <p>Employment opportunities. High-value irrigated crops such as citrus or tomatoes require more workers per hectare than grain crops, thereby creating job opportunities on farms. Modern irrigation may also make agriculture more attractive, in particular to Africa's youth,⁶⁰ and create employment in the design and construction of irrigation schemes and services.</p>	<p>Water competition. Inefficient water use and use of potable water for irrigation may exacerbate competition for water, particularly drinking water. Across the continent, less than 2 percent of irrigated land uses treated wastewater.⁶¹</p> <p>Environment and health. Where fertilizer application is connected to drip irrigation systems and results in overapplication and leaching into local water bodies, irrigation can increase the pressure on agroecosystems and the environment.⁶²</p> <p>Exclusion and conflicts. Conflicts among water users can occur when too much water is abstracted upstream, leaving little or no water available for downstream users for agriculture or household consumption.⁶³</p>

5.3 Opportunities for innovation in irrigation

In many countries across Africa, irrigated areas rely on traditional methods such as rope-and-bucket irrigation, gravity-fed systems, motorized pumps and treadle or pedal pumps powered by users stepping up and down on the levers of the pump. However, there are signs of increasing uptake of on-farm pressurized irrigation technologies, such as sprinklers and micro-irrigation, that have potential to reduce water consumption and significantly improve the productivity and quality of horticultural crops. Although many new technologies are still out of reach for most smallholder farmers, Africa now has the opportunity to leapfrog to more technologically advanced and environmentally friendly irrigation systems, bringing them to scale to make them more affordable and accessible.

Innovative irrigation technologies

Drip irrigation. Drip irrigation systems slowly release water through small-diameter pipes directly to the roots of plants in order to lower evaporation and reduce water loss. Drip irrigation can improve soil moisture conditions, resulting in yield gains of up to 100 percent over conventional irrigation systems.⁶⁴

Center-pivot. Center-pivot irrigation uses a long pipe (overhead sprinkler or nozzles) attached to a mechanically rotating pivot. Installing these systems on small farms is still too expensive, but this could be overcome through sharing schemes, or the technology could be adapted to smaller plots of land.⁶⁵

Solar-powered pumps. Solar technology in combination with pumping systems is a more environmentally friendly alternative to motorized pumps, with lower maintenance costs. With high up-front costs, solar-powered technologies may still only be affordable for farmer cooperatives or larger-scale government-led irrigation systems.⁶⁶

Irrigation apps. Mobile apps are becoming increasingly prominent in the agricultural sector, including in irrigation. The Nigerian National Space Research and Development Agency (NASDRA) recently unveiled a solar-powered automated irrigation system. The technology comes in combination with a soil sensor and a solar-powered water pump and uses signals from a navigation satellite. Once the soil moisture falls below a certain threshold, the pump is automatically triggered.⁶⁷

Hyperspectral imaging camera. The Nigerian company Zenvus distributes hyperspectral imaging cameras, which can analyze images and identify stressed crops, droughts, and outbreaks of pests and diseases. Farmers can use this technology to evaluate the effectiveness of their irrigation and fertilizer application. The camera costs US\$190 and is currently only available in Nigeria.⁶⁸

Box 2: Solar-powered pumps for irrigation

Solar technology in combination with pumping systems for irrigation is a more environmentally friendly alternative to diesel- or gas-powered pumps. In northern Benin, solar-powered drip irrigation pumps were installed on plots of 0.5 ha and tested against similar plots reliant on hand-watering methods. On the solar-power irrigated plots, yields, incomes, and household consumption of vegetables were significantly higher. Overall, the standard of living for beneficiaries increased by 80 percent relative to non-beneficiaries. But with high up-front costs, solar-powered technologies may only be affordable for farmer cooperatives or larger-scale government-led irrigation systems.⁶⁹

5.4 Funding models and commercialization of irrigation

The significant up-front costs of some modern irrigation tools and equipment put them well beyond the reach of many smallholders and may deter governments from making much-needed investments in irrigation. However, given that yields from irrigated crops are up to twice or more than yields for comparable rain-fed crops, water control investments can be profitable. Studies suggest that if governments were to meet the 10 percent CAADP expenditure target for agriculture and allocate just 1–5 percent of this to irrigation development, they can mobilize considerable funding (including private finance) towards investments in irrigation infrastructure.⁷⁰

Innovative financing for small-scale, farmer-led irrigation

Hiring services for irrigation equipment. The hiring-service market, especially for engine-driven pumps, is still in its early stages in most African countries, and both medium-scale farmers and non-farmer entrepreneurs face uncertainty about whether sufficient demand exists. While mechanization more broadly has benefitted greatly from hiring schemes, further development and trials are needed to make hiring schemes profitable for irrigation.⁷¹

Public–private partnerships (PPPs). The private sector needs to be incentivized to enter PPPs for irrigation development through financial securities, smart subsidies, or tax waivers to promote engagement with smallholders. In addition, solid public investments in irrigation could trigger further private sector investment in supportive infrastructure. Build-Operate-Transfer (BOT) models could help to mobilize new sources of capital to accelerate the development of water and irrigation projects and introduce innovation and technology transfer from the private sector.⁷²

Multiple-use water systems (MUS). Large-scale irrigation developments can be very expensive to design and implement. In this context, MUS can provide low-cost water for domestic use, agriculture, and rural enterprise.⁷³ By allowing water to serve different purposes and by sharing the same infrastructure, MUS can increase water productivity while at the same time reducing water stress.^{74,75} To establish effective MUS, multistakeholder “Learning Alliances” have been proposed as a new form of collective development to foster more inclusive decision making and to strengthen stakeholders’ capacity and commitment to act.

5.5 Country analyses

Several countries across Africa have a high level of irrigation infrastructure, have made good progress in improving their level of irrigation uptake, or both. Their experience in terms of institutional innovations, policy design, and implementation on the ground is reviewed here. Countries have been selected based on their total area equipped for irrigation and on the extent to which irrigated areas expanded from 2002-2014, reflecting progress in irrigation uptake. (Note: The information used in these analyses was accurate at the time of publication.)

Ethiopia

Between 2002 and 2014, the area under irrigation in Ethiopia increased by almost 52 percent. In 2015, the estimated total area equipped for irrigation was 858,340 ha. In addition, around 1.1 million ha were estimated to be cultivated through farmer-led irrigation.⁷⁶

Institutional innovations

The Ministry of Water, Irrigation and Electricity (MoWIE) leads on federal irrigation policy and is the main actor to handle medium- and large-scale irrigation schemes. The Water Works Design and Supervision Enterprise (WWDSE), a MoWIE subsidiary, conducts studies related to irrigation, basin development master plans, and other water projects. The Ministry of Agriculture and Natural Resource Development (MoARD) is responsible for developing community-managed small-scale irrigation schemes (up to 250 ha), while the Ministry of Environment, Forest and Climate Change (MoEFCC) is in charge of investigating the environmental impact of irrigation projects. The Ministry of Finance and Economic Cooperation (MoFEC) is responsible for allocating capital budget for the construction of such projects.⁷⁷

In 2013 the Agricultural Transformation Agency (ATA) began mapping over 32,400 km² to identify water resources and identified nearly 3 billion m³ of water at a depth of less than 30 meters. This could allow approximately 100,000 ha of land to be brought under irrigation, benefiting 376,000 households.⁷⁸

Policy innovations and programmatic interventions

In 1999, the Government of Ethiopia issued the first Water Resources Management Policy (WRMP) of its kind. To translate the WRMP into action, the Ministry of Water Resources (MoWR) issued the Ethiopian Water Sector Strategy (EWSS) in 2001.⁷⁹ Within the strategy, an Irrigation Development Program aims for environmentally and financially sustainable expansion of agricultural land under irrigation, through measures including micro dams, pumping stations and greater participation of the private sector in the management of water resources.⁸⁰ Data from the Ethiopian Revenue and Custom Authority state that around 800,000 motor pumps were imported between August 2004 and December 2010.⁸¹ The government imports these pumps free of duty and tax and sells them through cooperatives.⁸²

Irrigation is also captured in the Policy and Investment Framework (PIF) in Ethiopia's 2010-2020 National Agriculture Investment Plan (NAIP). The plan seeks to increase the area under irrigation by 8 percent annually.⁸³ In addition to the goals set in the NAIP, the Growth and Transformation Plan (GTP II) 2015-2020 aims to increase irrigation-based agriculture to 4.1 million ha for small-scale and to 954,000 ha for medium- and large-scale schemes, including the use of alternative energy sources like solar and wind power.⁸⁴

The government has worked with various development partners to set up irrigation projects across the country. For example, between 2008 and 2015, the US\$58 million Participatory Small-Scale Irrigation Development Programme (PASIDP), largely funded by the International Fund for Agricultural Development (IFAD), aimed to develop a sustainable, farmer-owned and -managed system of small-scale irrigated agriculture.^{85,86} Interventions under PASIDP developed 116 small-scale irrigation schemes reaching more than 311,000 people. Beneficiary households doubled their average crop yields and revenues.⁸⁷

In 2003, a collaboration between the MoWR and the Ministry of Education initiated the Water Works Technical and Vocational Training Programme, with 480 trainees in six training centers in four regional states. During the three-year program, students are trained on irrigation, water supply, and electromechanics.⁸⁸ Some universities also provide specialized courses and general training on aspects of irrigation and water resource management.⁸⁹

Kenya

In 2010, Kenya had an estimated total area equipped for irrigation of 150,570 ha.⁹⁰ According to data on three-year averages, Kenya increased the area under irrigation by about 37 percent between 2002/2004 and 2012/2014. Currently, the share of arable land equipped for irrigation accounts for just 2.6 percent.⁹¹

Institutional innovations

Kenya's National Irrigation Board (NIB) was formed in 1966 to manage public irrigation and private community-based schemes.⁹² Responsibility for water management lies with the Ministry of Agriculture, Livestock, Fisheries and Irrigation, replacing the former Ministry of Water and Irrigation. Under this Ministry, the Irrigation and Drainage Directorate (IDD) is responsible for the overall coordination of irrigation activities, specifically for the development of smallholder irrigation.⁹³

At the national level the Water Resources Authority (WRA), formerly the Water Resources Management Authority (WRMA), is responsible for the allocation of water and delivery of water permits for various needs, including agriculture.⁹⁴ At subnational level, the six Regional Development Authorities (RDAs), based on the main river basins of the country, plan, coordinate, and promote investment for integrated natural resource use, including irrigation projects.

In 2017, the government issued an Irrigation Bill, intended to set up a national irrigation development authority responsible for developing and improving irrigation infrastructure, providing irrigation services to private, medium-scale, and smallholder schemes, and for technical advisory services during the development of irrigation schemes.⁹⁵

Policy innovations and programmatic interventions

Vision 2030, launched by the government in 2008, is the long-term development blueprint for the country.⁹⁶ Several other policies and plans have been linked to Vision 2030, such as the Agricultural Sector Development Strategy 2009–2020 (ASDS). Within the ASDS the water and irrigation subsector aims to implement a national irrigation policy and legal framework, including an increase in the government's financial allocation to irrigation of at least 2 percent of gross domestic product annually.⁹⁷

Meanwhile, KawiSafi Ventures, a project co-financed by the Green Climate Fund and Acumen Fund, is investing in off-grid solar power in Kenya and East Africa. Investments totaling US\$110 million are scheduled to develop 10 to 15 alternative energy small- and medium-sized enterprises. Solar power can be useful for various agriculture-related activities, including powering irrigation pumps. The project estimates that savings for households can range from approximately US\$75 to US\$200 per year, depending on the daily cost of kerosene and the amount of kerosene displaced.⁹⁸

The US company SunCulture, based in Nairobi, has also been selling solar drip irrigation kits to Kenyan smallholder farmers since 2013. Its AgroSolar system costs US\$2,500, including the solar pumping system, drip irrigation equipment for 0.4 ha, and training on how to operate the system. According to experience, farmers can increase their yields by 300 percent or more and save over US\$10,000 per year compared to using petrol or furrow systems.⁹⁹

For more manual irrigation, KickStart, an international company headquartered in Kenya and operating in 17 African countries, markets two different types of pumps – a treadle pump and a hip pump. The hip pump irrigates up to 0.5 ha of land per day, while the treadle pump can irrigate up to 0.8 ha per day. Costs for the larger treadle pump range between US\$150–250, while the hip pump is sold for around US\$50. By September 2018, about 327,000 pumps had been sold.¹⁰⁰

Morocco

With institutions dedicated to irrigation and strong PPPs, Morocco has proven itself to be a leader in irrigation development on the continent. It is estimated that nearly 20 percent of Morocco's arable land is currently equipped for irrigation.¹⁰¹ Irrigated agriculture comprises one-half of Morocco's agricultural gross domestic product (GDP), indicating its higher productivity compared to rainfed agriculture.

Institutional innovations

The Directorate of Irrigation and Development of the Agricultural Area within the Ministry of Agriculture is in charge of the design, implementation, monitoring, and evaluation of irrigation policies and programs. The Directorate also leads on the promotion and regulation of public-private partnerships focused on irrigation.¹⁰² Morocco started to transform its institutions in 1966 with the creation of the Regional Offices of Agricultural Development (ORMVA), situated within the Ministry of Agriculture. A public institution with legal status and enjoying financial autonomy, ORMVA is responsible for technical studies, project execution and management of hydro-agricultural equipment, management of water resources for agricultural use, and dissemination of new farming technologies. In addition, a law for the creation of associations of irrigation professionals was passed in 1990.¹⁰³ Represented on the management board of ORMVA, the associations participate in the development of annual irrigation programs and in the rehabilitation and maintenance of equipment.

Policy innovations and programmatic interventions

Morocco has incentivized irrigation uptake by, for instance, exempting irrigation equipment from VAT (value-added tax), thereby making it more affordable.¹⁰⁴ In addition, subsidies of approximately 17 percent were offered for irrigation infrastructure from 1985 to expand irrigation across the country. In 2006, the subsidy rate was raised to 60 percent of the investment cost for drip irrigation. As a result, at the end of 2008, the total area equipped with modern water-saving irrigation technologies by the private sector amounted to 196,500 ha, including 165,000 ha of drip irrigation, up from 108,400 ha in 2000. Currently, the government subsidizes investment in infrastructure and technologies for drip irrigation through the Agricultural Development Fund. The subsidy rate is 80 percent for individual farmers and 100 percent for groups of farmers and smallholders cultivating on less than 5 ha.¹⁰⁵

In 2008, as part of the Plan Maroc Vert (Green Morocco Plan), the Program of Irrigation Expansion (PEI) was initiated to upgrade 1.5 billion cubic meters (m³) of water through hydro-agricultural developments, covering an area of 160,000 ha by 2020.¹⁰⁶ The Plan Maroc Vert also emphasizes public-private partnerships (PPPs) for irrigation development: in 2008, the government launched the Innovative Public-Private Partnerships Program, which seeks to encourage greater private sector involvement in the irrigation sector. For instance, the program offers long-term leases on land for private investors to develop new agricultural projects.¹⁰⁷ The program also encourages irrigation schemes in zones with high agricultural potential through the desalination of seawater.¹⁰⁸

The expansion of land under irrigation and the adoption of modern technologies have greatly contributed to the growth and increased resilience of Morocco's agriculture sector. For instance, the 2015-2016 agricultural season was marked by a drop in rainfall of over 50 percent compared to the usual average. However, agricultural GDP fell by only 7 percent, a tangible indicator that the irrigation program has increased farmers' resilience and protection against climatic variations.¹⁰⁹

Niger

Between 2003 and 2013, Niger witnessed a rapid increase in the uptake of irrigation: the share of arable land under irrigation increased by 20 percent.¹¹⁰ Up to 20 percent of Niger's agricultural gross domestic product (GDP) is generated through irrigated agriculture.

Institutional innovations

Within the Ministry of Agriculture, the General Directorate of Rural Engineering is responsible for developing and implementing a national policy on agricultural land development, surface and groundwater mobilization, rural infrastructure construction, and irrigation development. In 2006, recognizing the importance of the private sector in transforming agriculture, the government set up the Network of Regional Chambers of Agriculture (RECA). RECA constitutes a platform for advocacy and dialogue between stakeholders to strengthen agricultural organizations and producers, including those of irrigated agriculture.¹¹¹ Furthermore, in 2012, Niger created an office in charge of implementing the Nigeriens Nourishing Nigeriens (I3N) initiative aimed at strengthening national capacities for food production, food supply, and resilience. The I3N initiative includes irrigation programs to mobilize funding through collaboration among public, private, technical, and financial partners.¹¹²

Policy innovations and programmatic interventions

In 2002, Niger implemented the Accelerated Development and Poverty Reduction Strategy, aimed at halving poverty levels. The strategy considered irrigation, in particular small-scale irrigation, as one of the main priority areas to accelerate economic development and reduce poverty.¹¹³ In addition, in 2003, the government launched the Rural Development Strategy which led to the development of an irrigation development program. The program encourages private investment in small-scale irrigation through construction of community infrastructure needed to mobilize surface and groundwater resources, and the establishment of appropriate financing mechanisms.¹¹⁴

In 2005, the government developed the National Strategy for the Development of Irrigation and Collection of Runoff Waters (SNDI/CER), aimed at improving the share of irrigated agriculture in agricultural GDP. The government developed a framework to attract investment and private sector involvement in irrigation activities, as well as to encourage integrated and sustainable management of water and land resources. The framework also defines the roles and capacity-building activities of public and private actors involved in irrigation development and the collection of runoff water.¹¹⁵

In 2012, under the I3N initiative, a program for increasing agricultural production under irrigation sought to raise the contribution of irrigated crops to GDP from 20 percent in 2011 to 30 percent by 2015 by expanding the land under irrigation.¹¹⁶ By 2015, Niger had developed the Strategy of Small Irrigation, which seeks to harmonize interventions and funding approaches in small-scale irrigation to develop a decentralized mechanism for the development of sustainable small-scale irrigation.¹¹⁷

Between 2003 and 2008 the Nigerien Agency for the Promotion of Private Irrigation (ANPIP) implemented the Private Irrigation Promotion Project. Its objective was to promote farmer-led, small-scale irrigation and increase the production and profitability of high value-added irrigated crops for small producers by using simple, low-cost technologies. Farmers received access to advice, equipment, and inputs through input shops. Equipment was subsidized between 50–90 percent. The project included a capacity-building program for national private sector operators such as input suppliers, transporters, agrifood industries, wholesalers, retailers, and some decentralized government services. Horticultural yields of onions and peppers improved considerably, and revenue per hectare increased by nearly 80 percent.¹¹⁸

5.6 Conclusion

The Malabo Declaration includes a commitment to facilitate “efficient and effective water management systems, notably through irrigation”, while SDG 6.5 aims to “implement integrated water resources management at all levels”. For countries to expand irrigation sustainably across the continent and deliver on these targets, collective and individual action is needed at all government levels, from the private sector, and among farming communities. This includes everything from small-scale schemes to farmer-led innovations and large-scale irrigation systems. In the parts of Africa most vulnerable to climate change, irrigated agriculture means that farmers can extend the growing season(s), increase productivity and incomes, and improve their livelihoods. But irrigation development must be planned carefully to avoid adverse impacts on the environment and human health.

Several common features distinguish those African countries that have made significant progress in increasing their irrigation potential: interventions targeted at increasing collaboration with the private sector, strengthening regulation governing the use of water in agriculture, and elevating irrigation to a top policy priority. The experience of the case study countries analyzed in this section can help other African governments develop country-specific strategies to effectively take irrigation to scale in order to increase resilience and improve livelihoods in Africa’s rural communities and beyond. This will require targeted and concerted action by both public and private sector stakeholders.

5.7 Recommendations

- ✓ Elevate irrigation to a top policy and long-term investment priority to ensure a holistic consideration of its role in food systems transformation.
- ✓ Build the capacity of the private sector to design, develop and distribute innovative, smart technologies for irrigation while ensuring that public and private sector actors work collaboratively to develop locally adapted technologies for the benefit of smallholder farmers.
- ✓ Ensure effective regulation governing the use of water in agriculture to improve the economic efficiency and environmental effectiveness of irrigation practices.
- ✓ Use financial securities, smart subsidies, or tax waivers as incentives for the private sector to engage with smallholders and take irrigation to scale through effective public–private partnerships.
- ✓ Increase investment in institutional and physical infrastructure to expand access to skills development.
- ✓ Ensure a supportive fiscal regime to remove barriers for smallholders in accessing finance for equipment and services, and to facilitate access to micro-credits and leasing arrangements.

MECHANIZED

Transforming Africa's Agriculture
Value Chains

CHAPTER 6 - MECHANIZATION

6.1 Introduction

Currently, Africa is the region with the least mechanized agricultural system in the world. The use and power of tractors in Africa has barely increased over the past 40 years and remains negligible compared to other regions in the world. In 1980 there were just two tractors per 1,000 hectares; by 2003 this had fallen to 1.3. By comparison, in Asia and the Pacific region there were 7.8 tractors per 1,000 hectares in 1980, with 14.9 by 2003.¹¹⁹

State-led mechanization efforts across Africa in the 1950s and 1960s failed largely due to widespread governance challenges, such as lack of access to locally adapted tools and machinery and limited or no access to spare parts, qualified operators, and technicians. Some countries in Africa are now embarking on new efforts towards sustainable agricultural mechanization.

It is important to note that mechanization is not just about tractors: successful mechanization covers the entire value chain. Mechanization also requires more than technology alone; its success depends on organizational innovations, such as the availability of reliable maintenance and repair services, access to energy and marketing infrastructure, and cooperation arrangements for and with farmers. This section looks at what countries at the forefront of progress in mechanization have done right, and identifies policies and practices that, if brought to scale, could have a significant impact on food systems transformation in Africa.

6.2 An overview of agricultural mechanization in Africa

Mechanization along the agriculture value chain ranges from the most basic hand tools to the most innovative technologies, from the production to the processing and marketing stages. Provided it is adapted to local contexts and needs, mechanization can result in increased farm incomes, improved livelihoods for smallholder farmers, and new employment opportunities, particularly for women, who continue to dominate the informal food processing and trading sectors. It can also unlock demand for other nutritious foods, reduce losses at the post-harvest stage, and improve food safety standards. Based on the power sources, three levels of mechanization can be differentiated: human power-based mechanization, animal power-based mechanization, and mechanical power-based mechanization.

Box 1: Human, animal and engine power for mechanization

Across Africa, 50 to 85 percent of farm work is through human power alone, with the average female labor share in crop production estimated at 40 percent.¹²⁰ The most widespread tools and hand machines include machetes, hoes and spades. Meanwhile, 25 percent of power for land preparation – such as plowing, seeding, and mowing – is derived from animal-powered tools. Compared to manual farm work, animal-power-based mechanization increases the capacity of production by five to 20 times.¹²¹ Engine-powered machines currently provide an estimated 10 percent of the total power for land preparation in sub-Saharan Africa. Estimates show that a farmer using a combination of power-based mechanization and animal power can provide enough food to feed up to 50 people, compared to just six when using draught animal power alone.¹²²

The costs of non-mechanizing

The absence of mechanization translates directly into lost opportunities and economic losses. Over half of fresh fruits and vegetables produced in sub-Saharan Africa are lost or wasted, and nearly half of these losses occur during post-harvest handling and processing.¹²³ Across sub-Saharan Africa, around one million tons of additional milled rice could be made available by halving on-farm post-harvest losses through the use of appropriate – locally available, suitable, and adapted – milling machines. This translates to 17 percent of current rice imports per year.¹²⁴

Post-harvest and processing benefits

In addition to its benefits at the production stage, mechanization can contribute significantly to the development of more efficient and inclusive food systems. Good storage and drying technologies help reduce food losses, improve food safety, and preserve the nutrient content of crops. Machinery can also facilitate crop transformation and processing, quality enhancement, and value addition, while, cooling, storage facilities and transport services allow smallholders to sell their crops and products more widely.

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Mechanization is not just about tractors: successful mechanization covers the entire value chain

With less than a decade left to achieve the SDG target of a 50 percent reduction in food loss and waste, mechanization is key to making further inroads. Harvesting, drying and processing technologies can all reduce post-harvest losses and deliver economic, social and environmental benefits. As such, this form of mechanization should be seen as low-hanging fruit in food systems transformation, bringing multiple benefits with few trade-offs.

Figure 1. Mechanization potential in the food value chain.

Adapted from: T. Breuer, K. Brenneis and D. Fortenbacher. 2015. Mechanisation – a catalyst for rural development in sub-Saharan Africa. Rural 21,2: 16-19. http://www.rural21.com/uploads/media/rural2015_02-S16-19.pdf

Contribution to food safety, health, and nutrition

Food safety can be improved through modern technologies and processing techniques, but also at the very early stages of the production process. For example, the correct application of fertilizer, with the help of modern machines, reduces the chemical contamination of food. Moreover, cooling and drying technologies, as well as storage and transport technologies, play an important role in reducing aflatoxins and other fungus contamination, while modern post-harvest technologies and storing facilities help to preserve the nutrient contents of crops.

6.3 Opportunities and challenges for agricultural mechanization

Opportunities

The emergence of medium-scale farmers. Although smallholder farmers continue to make up the largest share of farmers in Africa, medium-scale farms (5-100 ha) now control roughly 20 percent of total farmland in Kenya and more than 50 percent in Zambia.¹²⁵ The increased number of medium-scale farmers who are also tractor owners creates new potential for hiring-out services to cater to the needs of smaller farmers.

Urbanization and the rise of the processing sector.

Africa is rapidly urbanizing, with the number of people living in cities projected to increase from 470 million in 2015 to 770 million by 2030.¹²⁶ Capital cities are growing, but so too are smaller cities, towns, and villages. This means an increase in market outlets closer to farmers, which could generate new opportunities for smallholders if they are able to participate in value-adding activities.

The rise of the non-farm economy. In some countries, migration from rural to larger urban areas has led to a shortage of manual labor. This can lead to a rise in rural wages. Between 1991 and 2013, agricultural real wages across Ghana grew by nearly 7 percent per year. With the rising cost of labor, farmers are more inclined to invest in machinery or to make use of machinery and technology-hiring services where they are available and affordable.¹²⁷

The rise of public-private partnerships for mechanization. Mechanization offers opportunities for new and innovative models of public-private partnerships (PPPs) at every stage of the agriculture value chain. There might also be partnerships between the public and the private sector and research institutions to identify new markets, and to engage in the manufacturing, maintaining, and repairing of new technologies.

Youth employment. Currently, Africa is home to 1.2 billion people, of whom 60 percent are under the age of 35. If governments can develop clear strategies on how to attract Africa's rural youth to succeed in agriculture, the youth bulge could yield a powerful dividend. Mechanization offers a pathway for this, generating much-needed and profitable opportunities for young people along the value chain. But while mechanization can open new opportunities, governments also need to ensure that mechanization does not have a reverse effect on employment, impacting social and political stability. Mainstreaming formal vocational training is needed to turn young people and farmers in the food system into skilled entrepreneurs who can run their farms or businesses as economical, productive, sustainable enterprises. At the same time, mechanization pathways that are intensive in employment, both in agriculture and in related rural industries, must offer the prospect of transitioning smallholder farmers and rural youth into other employment opportunities outside agriculture or off the farm.

Challenges

Low investment in research and development. In most African countries, the public sector remains the key driver of scientific research, and these research institutions could benefit from working more closely with the private sector in the development of machines and frugal technologies that are appropriate to local contexts.

Limited access to financing. One of the biggest challenges to successful mechanization across Africa is access to finance. Upfront capital investments are prohibitive for smallholders, and many rely on the nascent rental market. Innovative modalities to lower the cost of access through "Uberization" and other hiring-service models offer real opportunities.

Meeting local needs. Currently, most of the more advanced machinery is imported from outside Africa and is not always appropriate to local conditions. For example, smaller plots can mean that certain technologies are not suitable.¹²⁸ In order to meet the needs of smallholder farmers and other operators along the value chain, the capacity to manufacture and adapt technologies and machines needs to be urgently scaled up. Aligning the complexity of equipment with the local conditions, available skills, and the cost of production with financial realities, would boost adoption rates.

Maintenance and repair. With little extension support, many smallholder farmers still lack the skills to operate or repair mechanized equipment.¹²⁹

Low literacy rates may further hamper efficient use of mechanization.¹³⁰ Increased investment in institutional and physical infrastructure for skills development is therefore critical.

6.4 Successful mechanization practices and innovative technologies

Although the level of mechanization remains low across the continent, there are also examples in all segments of the food value chain of innovative technologies and successful mechanization practices improving the capacity of smallholders and other operators to grow, store, process, transform, and transport their crops and products.

At the production level

The Pedal Pump (PEP). The Pedal Pump (PEP) is a mechanical irrigation tool that can be easily assembled and manufactured locally. A study conducted in Magoma, Tanzania, revealed that with the use of the PEP the average farm size was tripled, 58 percent of farmers had diversified their crops, and on average farmers had doubled their yield.¹³¹

Rice thresher-cleaner. In Senegal, the introduction of a thresher-cleaner machine has transformed what was once a labor-intensive task mainly carried out by female rice farmers. Whereas manual threshing yields one ton of paddy per day, the thresher-cleaner produces six tons of paddy. The price for one thresher-cleaner is approximately US\$5,000, with a lifetime of five years. The thresher-cleaner is used for more than 50 percent of the total paddy produced in the country.¹³²

At the post-harvest and storage level

Solar-powered cold stations. In Nigeria, solar-powered cold stations for storage and preservation have been introduced in major markets. Farmers pay a daily fee of US\$0.28 per crate, each crate having a capacity of three tons. The cold stations extend the freshness of perishable foods from two days to 21 days and reduce post-harvest loss by up to 80 percent, increasing farmers' incomes by up to 25 percent.¹³³

Solar tunnel dryers. In 2016, Sosai Renewable Energies set up two Innotech 18-meter solar tunnel dryers in Kaduna State, Nigeria, which are rented by local pepper farmers to dry their produce. The dryers dry the harvest in half the time required by traditional methods. Since 70 percent of post-harvest activities are undertaken by women, the company aims to work mainly with female farmers, putting them in charge of renting out the dryers and handling the installments.^{134,135}

In the processing sector

Cereal processing. La Vivrière is a Senegalese processing company marketing millet, maize, and cowpea products. In 1996, La Vivrière started mechanizing the processing segment to increase its daily production capacity, with 80 percent of the most strenuous tasks gradually mechanized through the use of dryers and mills. Its products can now be found in supermarkets across the country and in Europe, the United States, and Asia.¹³⁶

Mango processing. In Kenya, the Arid Lands Resource Management Project (ALRMP) has worked with women mango farmers to facilitate the processing of surplus mangoes. Training and an advance of US\$4,200 allowed the 40 members of the women's group to invest in a fruit processor. This has greatly improved the women's income since mango juice sells for US\$1 per liter, compared to a mere US\$0.01 for four mangoes.¹³⁷

In the transport sector

Motorized tricycles. In 2015, the Ghanaian government introduced motorized tricycles with a small load-carrying capacity to facilitate the transportation of crops in the Brong Ahafo Region. A subsequent survey of 137 farming families found that 97 percent were able to access a means of transport within 24 hours of harvest, compared with 50 percent before. The tricycles are now

assembled in Ghana, reducing their cost and increasing their availability.¹³⁸

Milk collection and processing. In 2005, a Senegalese company, the Laiterie du Berger, set up a milk collection system using motorized tricycles to collect milk from about 800 herders within 50km of their factory. The company provides fodder, veterinary support, and a guaranteed price for milk. It now employs more than 100 people across the country and its products are distributed nationwide.¹³⁹

Emerging technologies

Agricultural mechanization will be radically augmented by emerging digital technologies such as robotics, artificial intelligence (AI), machine learning, Internet of Things (IoT), intelligent sensors, Big Data, and autonomous agricultural and farming equipment. While many such applications may still be out of reach for most African farmers, now is the time for governments to invest in creating the policy, regulatory, and institutional conditions as well partnerships with the private sector to harness and encourage their use for the benefit of African farmers. How African countries position themselves to harness and deploy digital technologies will determine the future competitiveness of African agriculture and its contribution to African economies.

6.5 Country analyses

Several countries across Africa have made remarkable progress in improving the level of agricultural mechanization since the 2000s. Their experiences are reviewed in detail here to draw out lessons for other African countries. These countries were selected in part based on their average annual machinery growth rates and agricultural output growth rates from 2005 to 2014, as a measure of efforts in mechanization and their likely impact in food value chains. (Note: The information used in these analyses was accurate at the time of publication.)

Ethiopia

Ethiopia's strong institutional commitments, programmatic interventions, and an emphasis on hiring services have been effective in advancing the uptake of mechanization. During 2005-14 the average annual agricultural output in Ethiopia grew by more than five percent, while average annual machinery growth rate was almost three percent.¹⁴⁰

Institutional innovations

Ethiopia has an Agricultural Mechanization Research Unit situated within the Ethiopian Institute of Agricultural Research (EIAR). Besides the federally organized EIAR, Ethiopia also has several Regional Agricultural Research Institutes, each with its own structure and mechanization research programs.¹⁴¹ Ethiopia's Agricultural Transformation Agency (ATA), set up in 2010, also sees mechanization as a fundamental element of agricultural growth and transformation.¹⁴² Although Ethiopia's National Agricultural Investment Plan (NAIP) for 2010-2020 failed to explicitly address the need for agricultural mechanization,¹⁴³ the external midterm review by the Working Group on Rural Development and Food Security and Ethiopia's Growth and Transformation Plan (GTP) both acknowledge the need to implement mechanization in order to achieve the objectives set out in the NAIP.¹⁴⁴

Policy innovations and programmatic interventions

Ethiopia's public and private sector are both engaged in the agricultural technology supply system, rental services, and tractor imports.¹⁴⁵ Private dealers have expanded and are now dominating the tractor sales market. Together with the public operation MetEC, the value of imported machinery increased rapidly from US\$ 10 million in 2005/06 to US\$ 70 million in 2013/14. Some private companies, cooperatives and several larger commercial farmers also provide rental services to smallholder farmers.¹⁴⁶

In fact, rental agreements remain a key element of mechanization in Ethiopia, as almost 70 percent of machinery-using farmers rely on them to plow their fields. In 2004, with initial capital of US\$750,000, the Agricultural Mechanization Service Enterprise (AMSE) was established through regulation No. 97/2004, issued by the Council of Ministers, mainly for the provision of agricultural mechanization services on a rental basis. By 2012, AMSE had about 70 tractors and operated through four service centers across the country.¹⁴⁷

Since 2010, the SAA/SG 2000 (Sasakawa Africa Association/Sasakawa Global 2000 Ethiopia) country program, which focuses on strengthening capacity for extension service delivery along the value chain,¹⁴⁸ has trained farmers in the use and operation of mechanical harvesters, threshers, cleaners, improved solar and mechanical dryers, rice mills, and on-farm storage. The introduction of post-harvest technologies has encouraged more farmers to grow rice, allowing them to process the crop quickly and maintain high quality.¹⁴⁹

Training in the domestic production and maintenance of machinery has been supported by the Heavy Duty Equipment and Commercial Vehicles Academy (HDECoVA), launched in 2012. The academy provides vocational training for heavy machinery and trains 25 to 30 young girls and boys annually. During a four-year course, students access modern machinery and are directly involved in the production and maintenance of machines.

Mali

Mali is one of the countries in West Africa that has shown noticeable growth in agricultural mechanization. Strong institutional and programmatic commitments to enhance mechanization have contributed to this progress. Between 2005 and 2014, Mali observed an average agricultural machinery growth rate of five percent, and its agricultural output growth rate was also five percent.¹⁵⁰

Institutional innovations

The passing in 2006 of Mali's Loi D'orientation Agricole introduced a focus on creating an institutional and economic environment favorable to the development of agricultural mechanization, including strengthening the role of the private sector.¹⁵¹ The Ministry of Agriculture had already created a division dedicated to agricultural mechanization in 2005, aimed at equipping smallholders with appropriate equipment to increase agricultural production.

The private sector plays an important role in the production of agricultural equipment. Blacksmiths have organized themselves into a Société coopérative des forgerons de l'office du Niger (Socafon) since the 1990s, and have put in place an efficient structure to ensure the supply of quality tools, at low prices, adapted to local needs.¹⁵² The Institute of Training and Applied Research (IPR/IFRA), a public institution, has offered education and training in agricultural machinery and agricultural equipment since 2015.¹⁵³

Policy innovations and programmatic interventions

In Mali, smallholders growing staple crops such as millet and sorghum – unlike cotton and rice producers – are usually unable to obtain credit for purchasing agricultural equipment. Under a government scheme, interest-free loans of up to US\$1,000 have been made available for the purchase of a pair of draught animals, a plow, and an animal-drawn cart. Farmers are requested to plant trees, with the wood from them serving as a guarantee for the loan. The rate of repayment has been estimated at about 90 percent.¹⁵⁴

In 2016, with the aim of creating more employment opportunities and adding value in the agricultural sector, the government set up an agribusiness incubation center. The incubation center aims to promote entrepreneurship in rural areas based on agribusiness opportunities such as seed marketing and the processing of agricultural products. The goal is to integrate smallholder farmers and young people into the agriculture value chain by facilitating access to resources and new markets and by providing education and skill development.

The government also provides support to small agricultural processing companies through its Agricultural Competitiveness and Diversification Program (PCDA), which provides technical and financial support. Dado Production, a grain processing company, received technical support and a grant of US\$6,180 from the PCDA in 2009 to enable it to upgrade its processing capacity. Its staff grew from four to 16 and the company now offers eight different products, up from just four.¹⁵⁵

Rwanda

Rwanda is committed to transforming its agriculture sector and meeting a target of mechanizing 25 percent of farm operations, envisaged under the country's second Economic Development and Poverty Reduction Strategy (EDPRS 2, 2013-2018).^{156,157} From 2005 to 2014, average agricultural output grew by more than five percent, while the average annual machinery growth rate was almost three percent.¹⁵⁸

Institutional innovations

Traditionally, Rwanda's government has played a dominant role in the import and distribution of agricultural inputs, including seeds, pesticides, and mechanization equipment. However, under its Strategic Plan for the Transformation of Agriculture Phase 3 (PSTA 3), the government is moving toward an expanded role for the private sector in the entire agriculture value chain. In addition, a lease law passed in February 2015 paved the way for small entrepreneurs, including smallholder farmers, to acquire farm machinery. Under the program, more than 33,500 hectares of land have been mechanized so far, and more than 1,500 farmers and agronomists have been trained in modern farming technology.¹⁵⁹ All mechanization activities in the country are coordinated under the Mechanization Unit within the Rwanda Agriculture Board (RAB).¹⁶⁰ Meanwhile, the Agricultural Department at the Development Bank of Rwanda (BRD) has an agro-processing development program to strengthen linkages along the entire value chain. With a budget of US\$170 million from 2017 to 2022, the program is expected to leverage more than US\$24.7 million worth of investments from the private sector.

Policy innovations and programmatic interventions

The Agricultural Mechanization Program (2009-2013) within the Ministry of Agriculture and Animal Resources (MINAGRI) was created to increase agricultural productivity in Rwanda as part of the wider flagship Crop Intensification Program (CIP).¹⁶¹ With a budget of approximately US\$7 million, the program acquired 81 tractors, 250 power tillers, 35 rice planters, five combine harvesters, and other farm implements and sold them to farmers and cooperatives. To make hiring services more readily available, the government also set up 16 Village Mechanization Service Centers (VMSCs), where smallholder farmers could hire or buy farm machinery. In addition, 136 farmers across the country were trained in power tiller operation, maintenance, and repair.¹⁶²

Further down the value chain, initiatives such as Muhanga Food Processing Industries (MFPI), a women-only agro-processing company established by the local NGO COCOF in 2004, are contributing to mechanization efforts. MFPI buys soya, maize, sorghum, and wheat from five cooperatives (totaling 2,805 farmers, 83.5 percent of whom are women) and six additional local producers to cover gaps in raw material supply. MFPI directly supports 18 full-time jobs, and COCOF manages farmer contracts on behalf of MFPI and arranges training for farmers and access to inputs.¹⁶³

In 2017, the government signed a deal with a Nigerian investor, BlackPace Africa Group, to develop the country's potato industry and help make Rwanda a key producer and exporter of potato products. The five-year, US\$120 million project involves the construction of two potato processing factories, processing 80,000 to 100,000 ton of potatoes into frozen french fries, potato flakes, and crisps for export markets in Africa and the Middle East. Production capacity is expected to rise to 10 million tons of potato by the fifth year of the project.¹⁶⁴

Zambia

Zambia performs remarkably well in terms of mechanization, with an average agricultural machinery growth rate of over three percent from 2005-14 and agricultural output growing on average by 8.5 percent over the same period.¹⁶⁵ With strong national research capacities and a recognition of the role of the private sector in mechanization, Zambia has shown itself to be effective in advancing the uptake of mechanization along the value chain.

Institutional innovations

Starting in the early 1990s, agricultural policy has undergone major changes in Zambia, with a shift from solely governmental interventions to a liberalized system aiming to integrate the private sector in various aspects of agricultural production.¹⁶⁶ In 2015, the Ministry of Agriculture and Livestock was divided into the Ministry of Agriculture and the Ministry of Fisheries and Livestock. Since then, the Ministry of Agriculture has been mandated to provide technical services on irrigation, farm power, mechanization, and land husbandry. The Zambia Agriculture Research Institute (ZARI), the largest agricultural research entity in Zambia, is situated within the Ministry of Agriculture and aims to provide high-quality, appropriate, and cost-effective services to farmers, generating and adapting crop, soil, and plant-protection technologies and machines to fit with socio-economic conditions.¹⁶⁷

The promotion of agricultural mechanization was also one of the key policy objectives of Zambia's NAIP, with the aim of increasing the area under mechanized agriculture from 375,000 hectares to 3,000,000 hectares by 2018.¹⁶⁸ In addition, the Second National Agricultural Policy (SNAP) sought to promote farm power and mechanization for smallholder farmers and to establish Farm Power and Mechanization Centers.^{169,170}

Policy innovations and programmatic interventions

In addition to the government-led research center, the Indaba Agricultural Policy Research Institute (IAPRI), a nonprofit center, was established in 2011, enabling collaboration between public and private stakeholders in the agricultural sector. IAPRI conducts research on mechanization and on agricultural productivity to analyze effects on smallholder productivity and poverty reduction.¹⁷¹

NWK Agribusiness is a private Zambian company that specializes in supplying a full range of up-to-date general agricultural goods. NWK was founded in 2000, and 12 years later the business started to engage in a business model with a broader agri-services focus, aiming to provide farmers with easier access to mechanized technologies and to post-harvest storage solutions. Through its Yield/COMPACI program it has assisted in the pre-financing of machines like tractors to increase smallholders' net earnings per hectare. By 2013, this program showed encouraging results, with more than 120,291 farmers trained through it since its inception (23,132 of them female farmers).¹⁷² This success led to a re-launch of the project in 2014.

Another company – Rent to Own (RTO), founded in 2010 – enables farmers to acquire assets and repay them through payment schedules tailored to their income streams. Products include water pumps, dehullers/hammermills, maize shellers, oil presses, tractors, flatbed trucks, bicycles, and solar lights. To date, RTO has financed over 7000 high-impact assets in Zambia and has achieved a 96 percent repayment rate.¹⁷³ It aims to reach one million beneficiaries by 2022.

6.6 Conclusion

It is a promising sign that several African countries have been able to increase the uptake of mechanization along the entire value chain, thereby increasing their agricultural output growth and generating new off-farm employment opportunities. Given the emerging dynamics, with a rising processing sector fueled by rapid urbanization and a growing middle class, derived demand for processing technologies is high. Governments must therefore develop creative and innovative interventions to promote technologies for product and process innovation. For now, this remains the weakest link in the mechanization agenda.

Interventions targeted at increased collaboration with the private sector, skill development and training of youth, and support for emerging domestic agricultural machinery industries are just some of the examples that have enabled countries to make considerable progress. The experiences of the countries highlighted in this section can help other governments develop country-specific mechanization strategies and policies that favor collaboration between the private sector, research institutions, and the government.

6.7 Recommendations

- ✓ Integrate agricultural mechanization investment strategies into national agriculture investment plans and broader development visions.
- ✓ Design mechanization pathways in a way that ensures they are socially sustainable.
- ✓ Prioritize mechanization in every segment of the agriculture value chain, from production, through to post-harvest handling and processing.
- ✓ Increase investments in the development of supportive infrastructure and vocational training at scale.
- ✓ Incentivize the private sector to take mechanization to scale by creating a conducive business and services environment.
- ✓ Develop an African agricultural machinery industry through greater investment in training and capacity building.
- ✓ Empower smallholder farmers' and women's groups to make it easier for individuals to access mechanization rentals, training and finance.

BYTE BY BYTE

Policy Innovation for Transforming Africa's
Food System with Digital Technologies

CHAPTER 7 - DIGITALIZATION

7.1 Introduction

The growing use of digital technologies, tools and services is widely visible in Africa, including across food systems, where digitalization is already having a considerable impact on how food is produced, processed, marketed, traded and consumed. Relatively simple information and communications technology (ICT) can provide farmers with access to tailored information and insights enabling them to optimize their production, access appropriate products and services, and explore new linkages with markets. At the other end of the scale, more complex technologies and platforms can help governments better understand the agricultural economy and improve macro-decision policymaking.

How African countries position themselves to harness and deploy digital technologies will determine the future competitiveness and sustainability of African agriculture and its contribution to African economies. Efforts need to be supported by governments and the private sector, and crucially, any agriculture digitalization strategy needs to be designed to fit local environments and meet the needs of all value chain actors. Bringing impactful digitalization solutions to scale across the continent will be crucial in helping governments meet the targets and goals under the African Union Agenda 2063, the Malabo Declaration on agricultural transformation and the Sustainable Development Goals (SDGs).

7.2 An overview of digitalization in Africa

Emerging digital technologies include blockchain, big data, robotics, and the Internet of Things, as well as more low-tech, frugal innovations are proving particularly useful in supporting agricultural transformation in Africa, from production to post-harvest handling and access to finance. Digitalization has the potential to ensure that Africa's food system transformation is both sustainable and inclusive. It can help empower women farmers and the way in which they engage with the sector, and it can support new employment opportunities along the value chain for young people.

As of 2019, there were at least 390 active digitalization solutions operating across Africa with nearly 60 percent of them launched in the previous three years. These solutions had already registered over 33 million smallholder farmers and pastoralists across the continent (13 percent

of the total number) and spanned advisory services, market linkage solutions, financial access, supply chain management and macro agricultural intelligence.¹⁷⁴

The falling cost of advanced technologies and mobile internet has been playing a major role in accelerating innovation. For example, the price for mobile internet in Africa has dropped by 30 percent since 2015.¹⁷⁵ However, while Africa has seen a rising level of mobile technology adoption in recent years, it continues to lag in technology development and content creation. The growing IT skills gap and lack of digital literacy, as well as limited funding for agtech start-ups will, if not addressed, limit the region's efforts to join or even lead the Fourth Industrial Revolution. African governments need to prioritize their education systems to ensure that they are developing the skills that match the growing trend toward technology adoption in the agriculture sector.

7.3 Opportunities and challenges for digitalization in African agriculture

Digital technologies offer a plethora of opportunities for agriculture value chain actors to make more informed decisions, increase productivity and incomes, and achieve improved nutrition and health outcomes. It is estimated that in developing countries, each additional 10 percent of internet penetration can lead to a 1.35 percent increase in per capita GDP growth.¹⁷⁶ But the introduction of new technologies also entails challenges, limitations and risks. Policies and regulations are needed in order to create an environment that allows everyone – including the most remote rural communities – to benefit from new digital technologies.

Opportunities

Planning. Smartphones, cameras or drones using GPS systems are useful tools for land mapping.¹⁷⁷ Rwanda's Land Tenure Regularisation program (2009-13), for example, used satellite data to create a digital land registry which improved land tenure security, particularly for women.¹⁷⁸ Weather information is also crucial to planning decisions, and digital weather technologies and prediction models make faster and more accurate forecasts available.¹⁷⁹

Inputs. New financial services technologies (such as M-Pesa, MyAgro, FarmDrive and FarmCrowdy) offer farmers easier access to banking, savings, loans and transfer functions. These in turn facilitate

investment in inputs.¹⁸⁰ ICT is enabling the “uberization” of the agriculture sector with several platforms such as TROTRO Tractor in Ghana offering tractor hiring services. Thirty percent of TROTRO Tractor users are women.¹⁸¹

Production. Digital technologies can support sustainable productivity growth. For example, on-farm sensors can connect to an automated drip irrigation system, freeing time for other tasks.¹⁸² Digital extension services can ensure access to advice and services when most needed: in Kenya, such services, delivered by SMS to sugarcane farmers, were associated with an increase in yields by 11.5 percent.¹⁸³ Drones and satellites can also help farmers by providing timely warnings on pests and plant diseases.¹⁸⁴

Post-harvest. Access to efficient transport logistics reduces post-harvest loss and waste, and has been found to increase farmers’ income by 10 and up to 100 percent.¹⁸⁵ Lori Systems – known as the “Uber of trucks” – uses a cloud-based platform to connect companies wanting to shift cargo with the truck drivers who can move it. Having launched its services in 2019, the match-making service now operates in Kenya, Uganda and Nigeria.¹⁸⁶

Consumption. Digital technologies can play an important role in improving nutrition outcomes.¹⁸⁷ The SMS-based mNutrition service, for example, targets women and young children to change child feeding and dietary practices and to promote nutrition-sensitive agriculture practices. About 81 percent of long-term mNutrition service users were found to have exclusively breastfed their babies for the first six months, compared to 69 percent of new users.¹⁸⁸ Tracing technologies (such as blockchain) can also improve food safety by combating aflatoxins and can enable farmers to participate in certification schemes that can result in higher incomes.¹⁸⁹

Informing better policymaking. Data on soils and weather can be used to inform policies and provide advice on fertilizer applications, pest management and weather predictions, while data on nutrition could provide a better picture of problems and support interventions. However, governments need to ensure that smallholder farmers and farmer organizations are included and given a voice to benefit from the opportunities that an enhanced use of digital technologies can bring to the sector.

Challenges

Accessibility. The digital divide between Africa’s urban and rural areas is striking, characterized by limited access to electricity, weak networks and poor basic connectivity. However, combined

solutions offering solar-powered charging points with WiFi connectivity are becoming more common. Examples include the Shiriki Hubs in Rwanda¹⁹⁰ and Microsoft’s Mawingu project in Kenya.¹⁹¹ 4G coverage still lags behind that in other parts of the world, with just under 50 percent of the population within reach of a 4G network in 2019. However, this represents almost double the level of 4G coverage compared to 2017.¹⁹²

Affordability. High prices have a significant impact on the uptake and use of internet and mobile services among smallholder farmers. In 2019, the poorest 20 percent of Africans would have had to spend on average more than 16 percent of their monthly income on 1GB of data: significantly higher than the 2 percent target set by the UN Broadband Commission. The adoption of smartphones also remains low, especially in rural areas, but is increasing: smartphone adoption among adults grew from 26 percent in 2017 to 38 percent in 2019.¹⁹³

Risks. As an increasing number of digital services use and collect personal data, data privacy laws and data ownership regulations are urgently needed. The protection of Intellectual Property is also necessary,¹⁹⁴ while recognizing the realities of local seed sectors and the contributions of smallholder farmers to agricultural innovation.¹⁹⁵ Governments also need to consider how automation and computerization could cause an increase in unemployment if the number of workers replaced with machines is greater than the number of jobs created. To harness new employment opportunities generated through digitalization, particularly for young people, training and ICT skill development will be essential.

Box 1: Affordable smartphones

One of the key drivers of improved affordability of mobile devices in Africa is the emergence of the ‘smart feature phones’ category. These lack the full capabilities of a smartphone, but typically do allow for the installation of popular apps. In 2019, KaiOS Technologies started partnering with mobile operators to introduce smart feature phones in several sub-Saharan African markets. This included Vodacom’s Smart Kitochi 4G phone in Tanzania, and the MTN Kamunye in Uganda (priced at or close to US\$20). The emergence of smart feature phones is helping overcome the affordability barrier for low-income users and making digital tools more accessible to all, including farmers.¹⁹⁶ Meanwhile, Mara Corporation produced the first high-quality, affordable smartphone for local markets in Rwanda in 2019, with a second manufacturing site opening in Durban, South Africa shortly after.¹⁹⁷

Box 2: Women and digital empowerment

In 2017, women in SSA were on average 14 percent less likely to own a mobile phone than men,¹⁹⁸ and 25 percent less likely to have internet access.¹⁹⁹ Making digital ecosystems more accessible to women can unlock their economic potential as value chain participants. One study in Ghana showed that increasing women's access to buyers through mobile technologies in the shea nut butter sector reduced the dependency on middlemen and led to an 82 percent increase in profits.²⁰⁰ While access to ICT is important, it is not enough on its own. Closing the gender gap will require concerted action by the mobile industry, government and women's groups, and targeted policies that ensure women are not excluded from agricultural digitalization, and profit from the potential benefits of ICTs.^{201, 202}

7.4 An enabling environment for digitalization

Leveraging the potential benefits of digitalization and avoiding the pitfalls will require cooperation between governments and the private sector to create an enabling institutional environment. Some key elements of such an environment are outlined below.

Regulation

Existing regulatory frameworks may no longer be suitable as countries across Africa start embracing a digitized agriculture sector. Licensing regimes, competition, fair use guidelines and cybersecurity must be updated to keep up with structural changes in the telecommunications sector, as well as the impact of rapid digitalization in African societies. Several countries including Kenya, Nigeria and Morocco have chosen to open their telecommunications sector to stimulate foreign investment in infrastructure. For imported technologies, regulations are useful to define quality standards. Effective regulations on safe disposal of technologies on the continent are urgently required to prevent environmental damage. There is untapped potential in Africa for recycling technology and developing a circular economy for new innovations.

Financing for digitalization

The upfront costs associated with technology adoption, including the cost of internet and mobile handsets, as well as limited last-mile infrastructure, severely hinder the uptake of digital solutions by farmers who continue to rely on personal savings to purchase them. A supportive fiscal regime where barriers to market entry are removed is urgently required. Private sector accelerator funds will also be important in speeding up the development of promising technologies and solutions.

Digital literacy readiness and skill development

Now, more than ever before, Africa must become a creator, and not just a consumer, of technology. Skill development and digital readiness need to be strengthened at all levels, from farmers and other food system actors through to digital entrepreneurs and up to government officials. Policies and programs must aim to provide African youth with skills for employment and leadership, and to create an enabling environment for entrepreneurship.

Digital infrastructure

Digital infrastructure refers to access to international bandwidth, mobile-network coverage, internet and mobile-phone penetration, and the costs of broadband and mobile-phone access. More needs to be done to better connect countries, to provide universal access to the internet, and enable easier smartphone penetration.²⁰³ In particular, governments must work with the private sector to build and improve last-mile infrastructure.²⁰⁴

Innovation hubs

Technology innovation hubs and incubators have been playing a crucial role in developing digitalization environments. In 2019, there were 643 such hubs across Africa²⁰⁵, up from 442 in 2018²⁰⁶ and 314 in 2016. The start-ups fostered in these environments are filling important gaps by improving services only partially addressed by governments or the private sector, such as making financing accessible to farmers. Governments and larger private sector companies need to actively seek out innovative forms of public-private partnerships to maximize the impact of these start-ups.

7.5 Country analyses

Several countries across Africa demonstrate a relatively high degree of digitalization in their economies, including in the agriculture sector. Their experience in terms of policy and institutional innovation and interventions on the ground provide important lessons for other African countries seeking to develop and strengthen the use of digital tools and services for an agricultural transformation. In the following case studies, the World Bank's 2017 Enabling the Business of Agriculture (EBA) ICT Index²⁰⁷ (scored 0-9) is used as an indicator to identify the best performing countries based on their regulatory frameworks. The 2019 Mobile Connectivity Index (MCI) of the Global System for Mobile Communications (GSMA)²⁰⁸ (scored 0-100) is used as another indicator, reflecting countries' ability to adopt and use mobile internet. (Note: The information used in these analyses was accurate at the time of publication.)

Côte d'Ivoire

Côte d'Ivoire's EBA ICT score of 5.5 indicates a strong enabling digital environment with regard to laws, regulations and policies, while its score of 45.7 in the GSMA Mobile Connectivity Index (MCI) highlights wide adoption and use of mobile internet.

Institutional innovations

The Ministry of Communication and Digital Economy and Post (MICENUP) oversees the development and promotion of ICTs and the creation of a conducive business environment²⁰⁹ while the state-owned National Society of Computer Development (SNDI) oversees the Information Technology and Information System projects run by the government. The Universal Service National Agency (ANSUT), created in 2012, ensures universal access to ICTs and drives digital development, making Côte d'Ivoire a model for ICT usage and contributing to the development of the eAdministration (the use of ICTs in public services). The Telecommunications Regulatory Authority of Côte d'Ivoire (ARTCI), created in 2013, enforces laws and regulations governing the telecommunications and ICT sector.

Policy innovations and programmatic interventions

Côte d'Ivoire developed a comprehensive national e-agriculture strategy in 2012, designed jointly by the Ministry of Agriculture and MICENUP, and updated it in 2014.²¹⁰ The strategy set out plans to build an ICT infrastructure for the agriculture sector and develop a legal and institutional framework for the adoption of ICTs to facilitate the use of agricultural information services. It includes the One Citizen, One Computer, One Internet Connection program, implemented under a public-private partnership involving the country's mobile operators. Under the program, a computer costs around US\$110, compared to US\$330 to \$440 when bought at a shop.^{211,212}

Between 2013 and 2016, the Côte d'Ivoire Coffee-Cocoa Council and ANADER, with the support of World Education Inc., implemented the CocoaLink program, which uses voice messages and SMS to deliver agricultural and other useful practical information to cocoa farmers in remote areas. It offered advice on good farming practices, farm safety, laws on child labor, health, pest and disease prevention, postharvest handling, and crop marketing.²¹³ In addition, since 2012, the government has been implementing a stabilization mechanism for the sale of coffee and cocoa using a web platform. The objective is to optimize international sales, to ensure that the benefits accrue to smallholders, rather than being captured by intermediaries.^{214,215}

While few cocoa farmers have a bank account, over half now have access to a mobile money account thanks to a partnership between the microfinance institution Advans Côte d'Ivoire and the mobile operator MTN. In 2016, more than 7,000 cocoa farmers from 58 cooperatives had subscribed to the service and were able to open a savings account with a formal financial institution.²¹⁶ Furthermore, since 2014, Orange Côte d'Ivoire has been operating m-Agri, a platform providing farmers with information on product prices, cultivation techniques and national and international price trends.²¹⁷

The government of Côte d'Ivoire has shown a strong commitment to increasing the uptake of digitalization in the economy. However, more specific institutional and programmatic innovations targeting the agriculture sector are required to fully benefit smallholder farmers. Public-private partnerships need to be facilitated and promoted to scale up interventions that have been shown to be effective in the coffee and cocoa sector.

Morocco

Morocco's EBA ICT score of 6 indicates a strong enabling digital environment with regards to laws, regulations and policies, while its score of 58 in the GSMA MCI highlights its strength in the adoption of mobile internet.

Institutional innovations

The Moroccan Telecommunications Regulatory Agency (ANRT), created in 1997, oversees the granting of telecom licenses and develops legislative and regulatory ICT frameworks.²¹⁸ The Ministry of Industry, Investment, Trade and Digital Economy oversees the design and implementation of government policy related to monitoring and promoting the use of ICTs and investment in the ICT sector through the Agency of Digital Development (ADD), housed within the ministry.²¹⁹ The ADD empowers public administrations, companies and citizens to use digital tools and services.²²⁰ In addition, Morocco has emphasized equipping public agencies in charge of agricultural development with ICTs to achieve a high-quality and timely service provision.

Policy innovations and programmatic interventions

Morocco's Note d'Orientation Generale (NOG) is a periodic roadmap for all the stakeholders in the ICT sector and aims to sustain the growth and use of ICTs. For the period 2015–2018, it aimed to expand universal access to broadband and high-speed broadband.

The Moroccan government's specific programs for the agriculture sector include an information system (ASAAR) set up in 2011 through the Ministry of Agriculture to provide farmers, traders and consumers with updated information on market prices. In addition, the system enables coordination and integration of farmers into the value chain, allowing them to add value to their crops along the value chain. In 2014, Morocco established a training, research, advisory and communication network (Ardna) under pillar II of the country's Plan Maroc Vert (PMV). Through the user-friendly platform, farmers can seek advice from researchers and agricultural extension agents on agricultural best practices and farming techniques. The program facilitates knowledge-sharing and creates links and synergies among all actors in the agriculture value chain.^{221,222, 223}

The National Office for Sanitary Safety of Food Products (ONSSA) introduced a new national system for animal identification and traceability (SNIT) in 2015 as part of the PMV. Livestock can be identified using electronic technology loops that communicate with the national SNIT database via mobile phone networks. The system serves as a tool to increase transparency and traceability while promoting Moroccan animal products on international markets such as the European Union.²²⁴

Morocco's enabling digital environment and access to the internet has allowed the private sector to take an active role in the digitalization of the agriculture sector. One example is the Moroccan platform for the sale or purchase of new or used agricultural equipment, AgriAffaires.ma, developed in 2017 by the start-up AgriSolutions SARL. The platform connects farmers and sellers of farming and livestock equipment, including secondhand machinery, and agricultural land.²²⁵

Overall, the government of Morocco's institutional and programmatic innovations have contributed substantially to increased digitalization in the whole economy, including agriculture. Its challenge now is to ensure that public-private partnerships are more actively facilitated and promoted for sustainable agricultural digitalization.

Nigeria

Nigeria's score of 4.5 on the World Bank's EBA ICT Index indicates a prospering enabling digitalization environment.²²⁶ And with a score of 45.9 in GSMA's MCI, Nigeria is performing particularly well in providing affordable handsets, reducing mobile-specific taxation, and creating gender equality in the labor market.²²⁷

Institutional innovations

Nigeria's Federal Ministry of Communications Technology (FMCT) leads on the infrastructure and regulatory aspects of ICT, while the Federal Ministry of Agriculture and Rural Development (FMARD) focuses on its application in the agriculture sector. FMARD works in close collaboration with the Agricultural and Rural Management Training Institute (ARMTI), a parastatal providing training and development to employees to manage agricultural and rural development projects.²²⁸ A national e-Agriculture portal provides an overview of the food and agriculture industry in Nigeria for potential investors and stakeholders. The FMCT also works with Nigerian Communications Satellite Ltd (NIGCOMSAT), which owns and operates the Nigerian Communications Satellite systems, including the NigeriaSat2, which is an earth observation type satellite used for mapping, water resources management, and monitoring agricultural land use.

Policy innovations and programmatic interventions

Digitalization in Nigeria's agriculture sector is emphasized in two key policy interventions: the National ICT Policy and the Agriculture Promotion Policy (APP) 2016–2020, nicknamed "The Green Alternative." The National ICT Policy outlines key objectives to create a conducive environment for digital solutions in the agriculture sector with appropriate fiscal and financing support. The APP focuses on the development of a knowledge system and data center with an emphasis on weather, input costs and crop prices, as well as improving extension services through the use of electronic means including SMS.²²⁹

In 2012, the government introduced a new digital delivery mechanism, the eWallet program, to manage the delivery of subsidized fertilizer and seeds to farmers, redeemed via agro-dealers. The eWallet program made transactions traceable and offered an avenue to contact farmers and deliver additional benefits, including vouchers for nutritional supplements. By 2017 the eWallet system was benefiting 17 million farmers (many of whom were women), 2,500 agribusinesses, 800 e-extension workers, and over 2,500 service points in Nigeria.²³⁰

To receive financial services, Nigerian farmers are required to register for a Bank Verification Number (BVN), for which it is essential to have a mobile phone. However, in remote parts of Nigeria few smallholder farmers own a mobile phone. To bridge the gap to these last-mile farmers, AFEX Commodities Exchange Limited (AFEX) – established in 2014 through a public-private partnership with FMARD – has developed a platform which, in partnership with the Nigeria Inter-bank Settlement System, creates offline profiles of farmers to generate BVN numbers for them. By May 2019, the company had already reached 20,000 farmers.²³¹

Nigeria's drive to engage the private sector in digitalization for agriculture has also spawned a number of successful start-ups. These include Farmcrowdy, a crowdfunding platform launched in 2016 to connect potential investors to farmers,²³² and Hello Tractor, which enables smallholder farmers to rent machinery which would otherwise be unaffordable.²³³

Nigeria has ensured a prospering enabling environment for digitalization in agriculture, with FMCT and FMARD holding clear mandates on infrastructure and program implementation. Looking ahead, further coordination is required between the government and private sector to ensure that the ICT industry delivers maximum impact to smallholder farmers.

Senegal

Senegal's EBA ICT score of 4.5 indicates a strong enabling digital environment with regard to laws, regulations and policies, while its score of 37.3 in the GSMA MCI reflects relatively good performance on the affordability of connections and handsets, as well as network coverage.

Institutional innovations

Senegal's Ministry of Digital Economy and Telecommunications promotes the application of ICTs in all sectors through the Directorate of Information and Communication Technologies (DTIC).²³⁴ In 1997, Senegal put in place a legislative and regulatory framework to promote the use of ICTs while minimizing their risks, including cybercrime.²³⁵ This facilitated the entry of new mobile network operators and the share of the population using the internet increased from less than 1 percent to 59.38 percent between 2000 and 2017.²³⁶

Policy innovations and programmatic interventions

In 2007, Senegal created the Universal Telecommunication Service Development Fund (FDSUT) to provide financial support to any public agency for the provision of ICT services. FDSUT funding has led to innovative ICT solutions being developed for the agriculture sector, such as DARAL Technologies, which launched in 2014 to support farmers dealing with livestock diseases and theft. The project uses traceable nose rings on livestock to monitor, track and communicate about herd movement through SMS alerts. By 2016, DARAL had been active in 10 villages in southern Senegal, equivalent to 2,553 farmers.²³⁷

The government's Digital Senegal 2025 strategy has guided the dissemination of digital technologies in all sectors of the economy since 2016. As part of this, the government is implementing a system to modernize agricultural activities by developing mobile telephone, GIS, and satellite imagery-based applications to allow forecasting throughout the production cycle, send shocks alerts, raise awareness on prevention measures and provide geolocation of livestock.²³⁸

Liberalization, the availability of human resources and the entrepreneurial spirit of a growing number of young Senegalese have successfully fostered digitalization in the country's economy. However, more effective cooperation with the private sector is needed for digital technologies to make a greater impact on the agriculture sector.

7.6 Conclusion

The use of digital technologies, platforms and services in the agriculture sector can be an opportunity for African countries to leapfrog and create smart agriculture value chains. However, there is an urgent need for long-term public investments in infrastructure, digital skill development and smart regulations in order to provide the ecosystem that the private sector, including smaller start-ups, needs for innovation to flourish and to drive a food systems transformation. Ongoing evaluation and impact assessments will ensure that investments continue to deliver financial, social and environmental returns effectively.

As the country analyses above have shown, key factors for success include a strong enabling digitalization environment, including a sound regulatory and fiscal regime, coupled with a growing role for the private sector in the design, development and dissemination of innovative, smart technologies and an innovation ecosystem that particularly encourages young people to develop locally adapted digital solutions and services. The challenge now is to replicate and scale up successful interventions that have worked on the ground in African countries. Doing so in a critical mass of countries across the continent would help meet the targets and goals under the African Union's Agenda 2063 and the Malabo Declaration.

7.7 Recommendations

- ✓ Integrate digitalization into agricultural growth strategies and broader development visions to cement its role in driving food systems transformation.
- ✓ Regulate to create a transparent environment that facilitates digital development, limits risks, and promotes collaboration between multiple stakeholders.
- ✓ Elevate research and development (R&D) capacity and nurture talent for the design of smart, frugal and cutting-edge digital solutions that meet the needs of all value chain actors, particularly youth and women.
- ✓ Stimulate investment in supportive and last-mile infrastructure by supporting the private sector in the development of technologies that can allow rural communities to leapfrog more traditional infrastructure approaches.
- ✓ Introduce fiscal incentives, including lower import duties initially, to facilitate market entry and the import of technologies until local markets are developed.
- ✓ Develop digital agriculture innovation hubs to create an innovation ecosystem to spur the digital transformation of the agriculture sector.
- ✓ Expand university curricula to spur digital innovation and the development of an African agtech sector.
- ✓ Strengthen skill development and digital literacy training for farmers and other actors in the food system as technologically more advanced innovations are being developed.
- ✓ Carry out evaluation and impact assessments of specific technologies and e-services in rural areas to highlight gaps and opportunities for further skill development and capacity strengthening.

ENERGIZED

Policy innovations to power the transformation of Africa's agriculture and food system

CHAPTER 8 - ENERGY

8.1 Introduction

Access to energy has a transformative impact on the livelihoods of the rural poor, reducing their reliance on manual labor and enabling them to generate higher incomes. But in 2019, the proportion of the population with access to electricity was just 48 percent in sub-Saharan Africa, and 56 percent for Africa as a whole, far lower than other regions in the world.²³⁹ In rural areas, the average electrification rate is just 29 percent.²⁴⁰ Meanwhile, Africa is the largest consumer of traditional solid biomass such as fuelwood, charcoal, and farm residues (including animal dung) in the world.²⁴¹ This is taking a toll on the continent's forests and soils and is a major cause of indoor air pollution, with damaging health effects.

Since 2013, the number of people without access to electricity had been steadily decreasing on the African continent. COVID-19 put this progress into reverse, with the number of those lacking electricity in Africa rising to more than 590 million people in 2020, an increase of 13 million people from 2019.

Sustainable Development Goal (SDG) 7.1 calls for *universal access to affordable, reliable and modern energy services by 2030*. Based on current trends, Africa is not on track to achieve this target by 2030 or even 2040.²⁴² However, as this section explains, important lessons can already be learnt from several African countries where off-grid and mini-grid technologies for hydro, wind, and solar power are disrupting energy landscapes and enabling consumers to leapfrog outdated and dirty technologies.

Box 1: The impacts of COVID-19 on access to electricity

Since 2013, the number of people without access to electricity had been steadily decreasing on the African continent. COVID-19 put this progress into reverse, with the number of those lacking electricity in Africa rising to more than 590 million people in 2020, an increase of 13 million people from 2019. COVID-19 has forced governments to reduce financing for electricity infrastructure and has led to reduced sales for solar home systems and mini-grids. The pandemic is also making energy less affordable, meaning millions of households are at risk of slipping back to charcoal, kerosene or fuelwood. To ensure sustainable progress, it will be important for governments and donors to make sure access remains a priority and to include it in recovery plans.²⁴³

Figure 1. Total primary energy supply % by source, Africa 2017

Source: IEA data 2019.

Note: Includes North Africa.

8.2 An overview of energy needs in African food systems

Access to clean, affordable and reliable energy is critical across the food system, ranging from production to food consumption.

Production

Access to energy can significantly improve the capacity of farmers to deploy new technologies, tools, and machinery in tillage, plowing, and weeding. A typical farm family can cultivate up to 1.5 ha per year when relying on manual power. This increases to 4 ha per year when using draught animal power and 8 ha per year when using tractors.²⁴⁴ Upgrading irrigation technologies to gas-, diesel-, or solar-powered water pumps can also save significant time and labor – particularly for girls and women – and lead to improved yields and incomes.

Food storage and transformation

Energy can transform production processes and allow farmers to adopt modern technologies for food transformation and value addition, thereby facilitating their integration into high-value and export-oriented value chains such as dairy, meats, fruits, and vegetables.²⁴⁵ Electricity can power cold chains, improving the storage of highly perishable produce. This reduces waste and increases incomes. Furthermore, energy can significantly improve food transformation, including cleaning, drying, milling, pressing, crushing, and pulping.

Transport and Distribution

One of the largest energy costs in the food value chain is associated with transport and distribution. The so-called “first mile” (the distance from the farm to the collection point) often only represents only 0.4 to 10 percent of the logistics chain length, but 20 to 37 percent of the transport cost for high-value crops such as French beans, bananas, and potatoes.²⁴⁶ Improved transport systems are therefore essential to minimize the time lag between harvesting, processing and retail. In addition, adequate temperature control is required to preserve perishable products as they are transported to markets.²⁴⁷

Food consumption

At the household level, the availability and use of energy has a direct impact on what food can be consumed, and thus on the nutritional status of household members. Limited or no access to appropriate cooking fuel means that eating and cooking habits need to be adjusted by reducing the number of meals, switching to foods that require less cooking time, undercooking food, or using some food crops as fuel instead.²⁴⁸ Conversely, access to energy, particularly electricity, improves the ability of a household to store and consume more nutritious food.

8.3 Creating an enabling environment

It is critical that Africa’s public and private sectors, and local communities, work hand-in-hand to deliver an energy transition that will accelerate the transformation of Africa’s agriculture and achieve wider development objectives. However, an appropriate enabling environment must also be put in place to ensure that the outcomes are environmentally and socially sustainable.

Holistic and inclusive policymaking

To provide the policy certainty that investors and implementation partners require, the World Bank recommends that governments devise a long-term commitment to electrification of at least 15 to 20 years.²⁴⁹ Energy and electrification plans must also define clear policies for stimulating the uptake of improved energy services in food and agricultural systems, rather than simply addressing the supply side of energy. Policies must also recognize that fuelwood, coal, and agricultural waste constitute the largest sources of primary energy in much of rural sub-Saharan Africa, with detrimental impacts on women and girls who are largely responsible for their collection and use. Making improved energy and technologies available to women can

significantly increase the time that can be devoted to other economic activities.²⁵⁰

Infrastructure and new technologies

The World Bank estimates that countries in sub-Saharan Africa experience annual outages ranging from 50 to 4,600 hours, requiring use of expensive and polluting generators.²⁵¹ For the agricultural value chains, power outages reduce efficiency of machinery and equipment, disrupt irrigation, and spoil refrigerated food.²⁵² While grid extension programs are gaining renewed support, including from the New Deal for Energy in Africa, off-grid and mini-grid technologies continue to disrupt African energy landscapes. Well-constructed mini-grid systems are less prone to outages and connect consumers at a much lower cost than extending national grids to rural communities.²⁵³ Energy strategies for agriculture would benefit from an integrated approach including grid, mini-grid, and off-grid solutions to ensure that energy access targets are achieved in good time.²⁵⁴ Although renewable energy sources tend to be more readily available, widely dispersed throughout rural areas, reliable and affordable, their potential remains largely untapped.²⁵⁵ Policies to support their commercialization and scale-up are essential.

Africa is the largest consumer of traditional solid biomass such as fuelwood, charcoal, and farm residues (including animal dung) in the world. This is taking a toll on the continent’s forests and soils and is a major cause of indoor air pollution, with damaging health effects.

Private sector

Africa’s private sector, especially small and medium-sized enterprises (SMEs), are already playing a key role in providing access to energy, particularly to rural and remote communities. Innovative businesses and social enterprises are increasingly integrating skills and knowledge from energy providers and agribusinesses to establish “one-stop-shops” offering products and services for a range of farmers’ needs.^{256,257,258} The private sector is also leading the way in creating innovative business and payment models. For instance, mini-grid and off-grid solutions now integrate additional services such as remote monitoring, Uber-like scheduling, mobile money, and various pay-as-you-go models, including rent-to-own, leasing, service for fee, and agricultural extension support, to ensure that costs are covered and enterprises remain viable.²⁵⁹ At present the private sector continues to be deterred by the high-risk, low-returns of providing energy solutions to

smallholder farmers. Clear policy signals such as an easing of red tape surrounding business registration could bolster the sector to further enhance its capacity and reach.²⁶⁰

Financing Africa's agricultural energy revolution

Among the most financially sustainable energy businesses are the ones that share risk via an "ABC(D) approach": safeguarding their demand on a creditworthy **anchor** client such as an agroprocessor; developing and supporting small **businesses** including irrigation systems, which can grow into anchor businesses; and connecting **community** facilities and **consumers** for **domestic** use. While these enterprises can be financially sustainable in the long-term, they usually require co-financing during the pilot stages. Several alternative sources of "patient" capital have become available, such as impact and angel investors and venture capital. Such sources of capital allow small and medium-sized enterprises to establish themselves and develop payment models that work with local consumers, including smallholder farmers. Crowdfunding can also play an important role in funding small projects, as can support from domestic and local financial institutions.²⁶¹

8.4 Capacity strengthening and employment opportunities

While the success of rural electrification programs is often measured by the number of poles, meters, or MW installed, these programs cannot translate into positive effects for rural households without a robust effort to educate and build their skills in the use, repair, and maintenance of connected

technology. The Barefoot College Initiative teaches women to be solar engineers and partners this with other income-generating activities such as bee-keeping and sewing. The initiative was conceived in India, but is now replicated across rural areas in Burkina Faso, Senegal, Liberia and Madagascar.²⁶² The capacity of installers to provide quality services also needs support: in Kenya, the problem of poor workmanship in solar installations has been addressed by the Energy Regulation Commission (ERC), which published solar PV and solar water-heating regulations in 2012. Solar PV installers and designers are now legally required to be qualified and licensed by the ERC.

In the long-term, building a thriving agricultural energy sector will require significant investments and focused efforts in building the knowledge and skills capacity of Africa's youth to enable them to play a meaningful role in the sector. Africa has the youngest global population in the world, and an estimated 15 to 20 million young people are expected to join the workforce over the next three decades. As improved energy solutions take hold and Africa's agriculture sector becomes more mechanized, it will be necessary to ensure that the youth are trained to design, assemble, and repair new technologies.

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A typical farm family can cultivate up to 1.5 ha per year when relying on manual power. This increases to 4 ha per year when using draught animal power and 8 ha per year when using tractors.

8.5 Country analyses

Several countries in Africa have demonstrated a high level of commitment to sustainable energy use in their economies, including in the agriculture sector. The following four case studies were selected on the basis of nighttime lights (as a proxy for greater and more reliable access, particularly in rural areas), the agricultural value added per worker growth rate, and the Regulatory Indicator for Sustainable Energy (RISE). RISE combines 27 indicators across three pillars: access to modern energy, energy efficiency, and renewable energy.²⁶³ Countries with a value above 34 but below 67 are considered at least “middle” performers in terms of good national policy and regulatory frameworks for sustainable energy. (Note: The information used in these analyses was accurate at the time of publication.)

Ethiopia

With a score of 48 out of 100 on RISE in 2017²⁶⁴, Ethiopia rates as a middle performer in terms of policies and regulations that support access to modern energy, energy efficiency and renewable energy. Nevertheless, within sub-Saharan Africa, Ethiopia is a leader on policy frameworks for energy access.

Institutional innovations

Responsibility for the production of energy and electricity is shared by the Ministry of Water, Irrigation and Electricity (MoWIE) and the Ministry of Mines and Petroleum (MoMP). The key functions of MoMP include facilitating mining investment, and licensing and regulation of mining operations.²⁶⁵ MoWIE promotes the expansion of electricity supply in Ethiopia from hydropower and other renewable energy sources such as solar, biogas, and micro-hydro, through the National Electrification Program (NEP), initiated in 2017.²⁶⁶ The Ethiopian Electric Utility (EEU), a directorate under MoWIE, manages the NEP and is responsible for electricity distribution across the country.²⁶⁷

Policy innovations and programmatic interventions

Ethiopia's Sustainable Development Poverty Reduction Programme (SDPRP) 2002/3–2004/5 acknowledged the constraints that limited access to electricity place on establishing a strong agro-processing sector, commercial enterprises, and irrigation facilities in Ethiopia's rural areas. The SDPRP began the process of liberalizing the power generation sector to complement government initiatives to achieve universal access by 2025.²⁶⁸ Subsequent five-year plans – the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) 2005/06–2009/10, the Growth and Transformation Plan (GTP) I (2010–2015), and GTP II (2015–2020) – have provided targets for electrification, generation capacity, and guidelines for agricultural development.

In addition, Ethiopia's National Electrification Program (NEP) sets 2025 as the target year for universal access to electricity, five years earlier than the target set by the SDGs. In order to meet this target, the EEU will manage a fast-paced grid and off-grid rollout program to scale up connectivity, at a cost of about US\$1.5 billion. It is expected that approximately 65 percent of the population will be connected to the grid while the remaining remote communities will benefit from individual solar and mini/micro grid solutions.²⁶⁹ So far, efforts under PASDEP and GTP I have already seen access to electricity in Ethiopia double between 2010 and 2016, from 21.9 percent to 42.9 percent. Rural electrification grew threefold, from 6.6 percent in 2010 to 26.5 percent in 2016.

Ethiopia has also implemented several programs to improve the efficiency of its energy use. For example, the Sustainable Rural Energy Technologies for Households and Productive Uses project, launched in 2016, aims to disseminate 200,000 solar home systems and 600,000 improved cook stoves in rural communities by 2020. The project is managed by MoWIE and is estimated to cost more than US\$5.5 million.²⁷⁰

Ethiopia is clearly on a pathway for rapid transformation in its energy and agriculture sectors. Importantly, there is a recognition of the links between these two sectors at the highest levels, as demonstrated in the national development plans. Significant steps have been taken to diversify Ethiopia's energy mix, but the country still relies largely on biomass and waste, and on hydropower. Since both these sources are extremely vulnerable to climate change, there is an urgency to further and rapidly diversify the sector.

Morocco

Morocco's RISE score of 74 for 2017²⁷¹ reflects its strong performance in setting good national policy and regulatory frameworks for sustainable energy access and use. This progress is largely due to the government's institutional and programmatic commitments to enhance access to and use of energy across the country.

Institutional innovations

The Ministry of Energy, Mining, and Environment (MEME) oversees energy policy design and implementation.²⁷² Meanwhile, several other agencies work towards increasing overall energy access and use. The National Office of Electricity and Drinking Water (ONEE), for example, owns the country's transmission network and is the sole authorized buyer of electricity generated by other parties, including independent power producers (IPPs). The National Agency for Energy Efficiency (AMEE), formed in 2016, promotes energy efficiency as a whole and specifically encourages the adoption of solar-powered irrigation pumps.²⁷³ The Moroccan Agency for Solar Energy (MASEN), created in 2010, was initially responsible for managing the deployment of solar energy but in 2016 was renamed the Moroccan Agency for Sustainable Energy and its responsibilities were extended to cover the use of all renewable energy technologies.²⁷⁴

Policy innovations and and programmatic interventions

Morocco has limited fossil fuel deposits, leaving it entirely dependent on imported fossil fuels for energy production. The government's 2009 National Energy Strategy therefore foresees the development of the renewable energy sector to increase energy independence.²⁷⁵ By 2014, Morocco had increased the share of renewable energy in its electricity generation capacity mix to 32 percent.²⁷⁶ As of the end of 2020, this had risen to 37 percent, below the target of 42 percent by this date. However, the government expects renewable energy sources to provide 52 percent of the total installed capacity by 2030.²⁷⁷ These efforts are complemented by a National Energy Efficiency strategy 2014–2030, with ambitious targets for reducing final energy consumption by 25 percent by 2030. In the agriculture sector, the strategy aims to reduce energy intensity by 0.2 percent per year until 2030.²⁷⁸

Private sector participation through IPPs has been important in achieving the objectives of Morocco's rural electrification program (PERG). Under Act No. 13–09 of 2010 amended and supplemented by Act No. 58–15 in 2016, the government of Morocco allows private companies to produce electricity from renewable sources and to buy it from the market.²⁷⁹ The IPP model has significantly increased the share of the private sector in power generation²⁸⁰ and improved electricity access in remote, rural communities.

In 2013, a National Solar Irrigation Program was launched to subsidize solar pumping over an area of 100,000 ha over three years, reflecting the objectives of the National Energy Efficiency Strategy. An evaluation in three zones – Marrakesh, Midelt, and Tata – found that the time required for return on investment in solar pumping was between 2.7 and 3.6 years, and the increased profit margin ranged from US\$839 to US\$12,500 per hectare.

Overall, Morocco's electrification program has been extremely successful because of its focused and coordinated approach. The involvement of the private sector through public-private partnerships has increased the share of renewable energy in the energy mix, facilitating the development of locally adopted solutions.

South Africa

South Africa has made significant progress in improving access and use of energy to foster economic growth. A score of 76 out of 100 on the RISE index in 2017²⁸¹ makes South Africa a strong performer and reflects the government's commitment to setting good national policy and regulatory frameworks for sustainable access to and use of energy.

Institutional innovations

South Africa's Department of Energy (DoE) takes the lead in the formulation and implementation of energy policy. The DoE also controls the generation, transmission and distribution of energy by Eskom, a parastatal, and Independent Power Producers (IPPs), and ensures energy is consumed efficiently. The South African National Energy Development Institute (SANEDI), created in 2008, oversees R&D in the energy sector and leads on the development of new technologies.²⁸² The National Energy Regulator of South Africa (NERSA) regulates the electricity, gas and petroleum pipeline industries. South Africa's energy mix also includes nuclear energy since the introduction of a nuclear power program during the 1970s.

Policy innovations and programmatic interventions

South Africa has, over time, developed an efficient, large-scale, coal-based power generation system providing comparatively low-cost electricity through a grid system that extends to rural areas. However, in 2011 the government adopted the Integrated Resource Plan (IRP) 2010-2030 (generally known as the IRP 2010) as the official long-term plan for building new electricity generation capacities. The IRP seeks to double South Africa's electricity generation capacity through a diversified energy mix including coal, gas, nuclear and renewables. Meanwhile, the National Development Plan (NDP) of 2013 calls for improving energy infrastructure in a sustainable way, and aims for 90 percent grid access by 2030 with the remaining 10 percent to be met through quality off-grid technologies.²⁸³

Past programmatic interventions had already seen South Africa make strong progress in energy provision. In 1999, the electricity access rate was almost 80 percent in urban areas but just 46 percent in rural areas.²⁸⁴ To reduce this gap, access to electricity in remote areas was facilitated through the use of alternative approaches to main grid extension, alternative energy sources for electricity generation, and decentralized provision. Between 2002 and 2014, more than 80,000 households were supplied with off-grid energy technologies (primarily solar).^{285,286} In 2011, an evaluation showed that improved access to electricity in South Africa's rural areas increased employment rates, with a notable impact on women's labor market participation.²⁸⁷

In 2011, the government launched its renewable energy procurement program (REIPPPP), inviting IPPs to tender for licenses to sell electricity to Eskom under a 20-year purchase agreement. By October 2016, 54 renewable energy power plants with the capacity of 2,800 MW were fully operational.²⁸⁸ There is also evidence that energy production from agricultural waste is increasing in South Africa. In 2015, the Bronkhorstspuit Biogas Project was launched by Bio2Wat, a South African IPP. Roughly 120,000 tons of feedstock are processed annually by the plant to generate a capacity of 4.6 MW.²⁸⁹

South Africa is among the leading countries in Africa in terms of electrification. However, rising demand and the near full-capacity operation by Eskom have been causing significant shortages of electricity. The programs for energy diversification therefore require urgent scaling up to transition to a cleaner energy system and reduce the country's reliance on its deteriorating fleet of coal fired power plants.

Zambia

Zambia scored 43 out of 100 on the RISE index in 2017²⁹⁰, making it a middle performer in terms of policies and regulations that support access to modern energy, energy efficiency and renewable energy.²⁹¹ By 2017, 75 percent of Zambia's urban population and 14 percent of the rural population had access to electricity.²⁹²

Institutional innovations

Zambia has a dedicated Rural Electrification Authority (REA), established in 2003. The REA is mandated to increase access to electricity to 51 percent by 2030 by providing infrastructure and appropriate technology to all rural areas. The establishment of the REA came after a liberalization process in the sector in the 1990s, during which the Zambian government created the Ministry of Energy and Water Development, later rationalized as the Ministry of Energy (MoE) in 2016. An Energy Regulation Board (ERB) was another outcome of the liberalization process. Although the energy sector was largely liberalized, Zambia Electricity Supply Corporation Limited (ZESCO) remains the key national energy supply utility. Hydropower provides 99 percent of ZESCO's electricity, and the rest is from diesel-powered generators.

Policy innovations and programmatic interventions

Zambia's 2008 National Energy Policy (NEP), still in effect, provides policy and implementation guidelines to increase access to modern energy in rural areas, including from alternative and renewable energy sources. The 2008 NEP emphasizes implementation of the Rural Electrification Master Plan (REMP). Effective from 2008 to 2030, the REMP provides a detailed strategy for expanding electrification using a combination of grid extension and off-grid solutions. By 2017, a combination of grid extension projects, solar home systems, mini-hydro plants and solar mini-grids had resulted in rural electrification increasing from 5.3 percent to 14 percent.²⁹³ The National Agricultural Investment Plan (NAIP) 2014–2018 also recognizes the importance of agricultural development in reducing poverty. Targets to introduce 1,900 renewable-energy-based irrigation pumps have been proposed within the "sustainable use of the natural resource base" pillar in the NAIP.

Power Africa, an initiative led by USAID, has further supported the Zambian government's electrification program. In addition to strengthening regulatory frameworks, Power Africa invested US\$2 million to provide approximately 100 MW of new solar power in 2016.²⁹⁴ Similarly, a collaboration between Sweden and the Netherlands provided grid extensions to 11 locations across Zambia, which led to a proliferation of enterprises and mills and to an improvement in health services and education, as children were able to study for longer hours.²⁹⁵

Private sector business models have been supported through the Beyond the Grid Fund for Africa, founded to foster models offering affordable and clean energy access across the continent. Initiated in 2016, Beyond the Grid for Zambia (BGFZ) "de-risks" costs of operating and expansion while companies establish themselves in the market. BGFZ has also formed an Off-Grid Energy Task Force, composed of stakeholders from the government, development partners, finance, and the private sector. This has already assisted with the drafting of a new national mini-grid policy and the initiation of discussions to improve the affordability of off-grid energy solutions.^{296, 297}

While strong progress has been made, Zambia's continued reliance on hydropower and bioenergy have further exposed the country's energy system to climate change and contributed towards rapid deforestation. Strengthening climate-smart agriculture programs would ensure that farmers are both more efficient in their energy use and resilient to climate change impacts. More attention to off-grid, mini, and micro solutions would potentially also enable Zambia to reach its electrification targets more quickly and at a lower cost.

8.6 Conclusion

Energy is a key input for sustainable food systems transformation. Ensuring the availability of affordable, clean, reliable and continuous supply of energy plays a vital role in transforming agriculture, improving food security and reducing hunger and malnutrition across the continent. Furthermore, the use of improved energy services will also support continental and global efforts on tackling poverty, employment, food loss, air pollution and environmental degradation.

Although some African countries have made significant headway in electrification through the extension of central grid infrastructure, the rapid increase of off-grid and mini-grid technologies for hydro, wind and solar power is already disrupting African energy landscapes and enabling Africa's consumers to leapfrog outdated and dirty technologies. It is estimated that by 2063, renewable energies, including wind, solar, hydro, bio, tidal and geothermal energies will represent more than half of the energy consumed by African households and businesses.²⁹⁸ Combined with Africa's mushrooming digital market, small-scale, micro and nano solutions offer tailored services for the specific needs of farmers.

Energy provision in rural areas can have a transformative effect on people's livelihoods and Africa's food system as a whole. The experiences of countries that have made significant progress can enable other African governments to develop country-specific strategies to increase the provision and use of energy in rural areas to benefit food systems and rural populations.

8.7 Recommendations

- ✓ Integrate energy strategies into long-term national agricultural strategies and broader development visions as part of the food systems transformation process.
- ✓ Scale investments in off-grid and mini-grid solutions especially via start-ups and businesses to leapfrog outdated and dirty technologies.
- ✓ Adopt gender-responsive energy strategies for the design and implementation of energy strategies as well as the choice of technologies and tools applied.
- ✓ Address the multiple challenges of biomass-based energy use to ensure that biomass is produced more sustainably, and that indoor cooking is redesigned to be more environmentally friendly and not harmful to human health.
- ✓ Develop cross-border policies for energy security to help reduce countries' reliance on imported fuels while diversifying the energy mix.

MEAT, MILK AND MORE:

Policy innovations to shepherd
inclusive and sustainable livestock
systems in Africa

CHAPTER 9 - LIVESTOCK

9.1 Introduction

An increased demand for more animal-sourced foods across the continent, such as dairy, eggs, and (processed) meat, has been driven by a growing middle class. In 2013, the average African consumed 19 kg of meat and 44 kg of milk. By 2050, this is projected to increase to 26 kg of meat and 64 kg of milk.^{299,300,301} Meanwhile, Africa's livestock sector also forms the basis of the livelihoods of millions of people, with the potential to generate much-needed employment opportunities, especially for women and young people.

However, these developments are occurring against a backdrop of demographic pressures and growing scarcity of land and water.³⁰² Much of Africa's livestock production is dependent on rainfed fodder, and pastures are often of poor quality. Adhering to basic biosecurity standards is also a challenge for many small livestock keepers, and is an obstacle to market participation. Under current projections, African producers will be unable to satisfy the growing demand for livestock products.³⁰³ But government strategies and policies that factor in environmental, health and socioeconomic aspects to sustainably strengthen Africa's livestock sector can boost economic growth and improve livelihoods.

9.2 An overview of livestock in Africa

Africa is a livestock-rich continent representing about one-third of the world's livestock population,³⁰⁴ primarily cattle, sheep, goats, donkeys, camels, and poultry. Livestock provides an important source of income and insurance against socioeconomic and climatic shocks, and contributes significantly to food security and improved nutrition outcomes.^{305,306} The sector contributes between 30 and 80 percent to the agricultural GDP of countries in Africa³⁰⁷, and generates more than US\$ 1 billion per year through the export of live animals and meat to the Middle East and North Africa for East Africa alone. Production broadly takes the form of pastoral systems, mixed crop-livestock systems, and commercial livestock systems, each with their distinct characteristics, challenges, and opportunities.

Pastoralism is an extensive livestock production system, characterized by mobility and shared use of natural resources.³⁰⁸ Pastoralism is one of the most viable livelihood options in Africa's drylands,³⁰⁹ and is the primary livelihood of an estimated 268

million people in 36 African countries.³¹⁰ It is estimated that pastoralism contributes between 10 and 44 percent of GDP in African countries.³¹¹ Mixed crop-livestock systems, in which crops and livestock are produced on the same land, account for nearly 40 percent of all livestock farming in the IGAD region.³¹² Livestock in mixed crop-livestock systems also contribute to cropping. For instance, 23 percent of nitrogen for crop production in crop-livestock systems comes from manure, and about 15 percent of farms in Southern Africa and 81 percent in Northern Africa rely on traction for plowing.³¹³

Unlike pastoralist or mixed livestock-crop systems, in which livestock hold sociocultural values too, commercial systems produce livestock purely for generating income.³¹⁴ Although most commercial systems produce ruminants, much of the increasing demand for livestock products has been met with an expansion of commercial poultry production. It is estimated that pork, poultry and egg consumption will grow as much as sevenfold in sub-Saharan Africa by 2050.³¹⁵ While this offers a number of benefits and opportunities, the possible negative impacts – including on health, climate, and conflict – need to be carefully addressed when devising continental, regional and national livestock sector growth strategies.

Box 1: Women and livestock

There are approximately 249 million women livestock keepers in Africa for whom livestock represents a major source of income and an opportunity for wealth accumulation.³¹⁶ It is the only non-land asset that women in most countries can own relatively easily. Ownership of livestock also means that women are more likely to be taking important decisions on how livestock-derived income is spent, thereby increasing the probability that households, especially children, consume animal-sourced foods that are rich in proteins and other micronutrients.^{317,318,319} Evidence shows that where women own livestock, the number of months that households have sufficient and nutritious food increases and the frequency of meat consumption is significantly higher than in households where women do not own livestock.³²⁰

9.3 Livestock – benefits and risks

The livestock sector has high potential to reduce poverty in Africa's rural and peri-urban areas and to contribute to positive nutrition outcomes.

However, there are also challenges linked to both animal and human health, environmental sustainability, and conflict.

Benefits

Livestock ownership is an important source of employment and income. Evidence from seven countries in sub-Saharan Africa shows that almost two-thirds of rural households are involved in livestock keeping, ranging from 44 percent in Nigeria to 79 percent in Niger.³²¹ At the household level, livestock products provide an important source of protein and essential micronutrients such as vitamins A, D, and E and zinc, as well as highly bio-available iron and amino acids. These are difficult to obtain in adequate amounts from a plant-based diet alone.³²²

Livestock are also a source of inputs in the form of fertilizer and draught power. Fertilizer derived from manure is more widely available and affordable than synthetic fertilizer. Draught power for agricultural production and transport can significantly enhance productivity: in 2007, a study in Kenya found that farmers using draught animal power on average obtained over 1,200 kg of maize per ha, while farmers who manually tilled their land harvested around 880 kg per ha.³²³

Finally, the export of livestock products or live animals can be an important source of foreign exchange revenue for some African countries. The eight East African countries of the IGAD region are the leading exporters of livestock, accounting for 42 percent of the continent's livestock exports.³²⁴ However, compliance with international standards can be an obstacle for small producers and pastoralists.³²⁵

Risks

The unsafe production, storage, and consumption of livestock products can have adverse impacts on people's health through pathogens responsible for zoonoses. In addition, inadequate storage for livestock products may increase the incidence of food poisoning,³²⁶ and the excessive use of antimicrobials in livestock may be a source of antimicrobial resistance (AMR).

Enteric methane and the production of feed and other inputs are also significant contributors to global human-induced GHG emissions and hence climate change. Africa's "agriculture, forestry and other land use" (AFOLU) emissions accounted for 15 percent of global GHG emissions from agriculture for the period 2005-2014.³²⁷ Other environmental risks include overgrazing and land degradation.

Finally, conflict between crop farmers and pastoralists is frequent largely due to a combination of land-use dynamics, pressure on natural resources (grassland, water), and land tenure. During the first half of 2018, more than 1,300 people died in Nigeria in violence involving herders and farmers.³²⁸ Conflicts also severely limit private sector investment by increasing the risk and uncertainty associated with the stability of a region or country.

9.4 Interventions to strengthen livestock value chains and food systems

The livestock value chain needs to be sustainably intensified to meet increasing demand and to capitalize on the potential for inclusive growth. This section provides an overview of the challenges and potential interventions for strengthening livestock value chains across Africa.

Production

Livestock productivity in Africa, measured in terms of yield per animal, is below other developing regions, and much lower than developed countries. One of the major challenges is the lack of reasonably priced, high-quality feed, which undermines productivity as animals suffer from low birth rates, body weight, and output.³²⁹ A viable commercial feed and forage subsidiary value chain is critical.

Meanwhile, diseases such as animal trypanosomiasis, bovine pneumonia, and East Coast fever kill thousands of livestock in Africa each year and reduce overall productivity among the surviving herds.³³⁰ Addressing the challenges of animal health in Africa requires comprehensive data collection and transmission, reform of the veterinarian value chain, and training of professional and community-based animal health workers (CAHWs) as part of a wider program of upgrading extension services, including integrating livestock and agricultural extension services. In addition, effective vaccination programs require training and awareness-raising through outreach services and technical extension programs; and context-specific technology such as diagnostic tools, single-dose and thermostable vaccines.

Government strategies and policies that factor in environmental, health and socioeconomic aspects to sustainably strengthen Africa's livestock sector can boost economic growth and improve livelihoods.

Box 2: CowTribe's digital animal health services

CowTribe in Ghana was founded in 2016 to deliver animal vaccine and other livestock last-mile services and information delivery to farmers via phone. CowTribe also sends SMS alerts to farmers with information on disease outbreaks and offers practical advice. In 2016–2017, CowTribe was piloted with 10,000 farmers in 119 communities in northern Ghana and has since scaled up to reach 29,000 farmers. In less than two years, vaccine coverage among CowTribe users increased from 18 to 65 percent.

Genetics

Africa's livestock are well adapted to the harsh conditions under which they live,³³¹ including the diseases to which they are exposed.³³² But careful breeding could still improve the productivity, fertility and resilience of livestock. Artificial insemination, for example, has remained generally underexploited across Africa. And although livestock producers – including pastoralists – have long practiced selective breeding strategies,³³³ without accurate and continuous data it is difficult to identify which breed compositions work best. Digital technology plays an important role in reducing costs and simplifying data management.³³⁴ Investment in local research capacity and technology is urgently required. Corresponding training programs for extension workers and CAHWs to communicate the opportunities more widely are also essential.

Commercialization

Despite increases in livestock production, Africa has not been able to translate its vast livestock potential into value-added products that can generate higher income and well-paid employment opportunities. Rapid growth in demand for animal-sourced foods presents a great opportunity for Africa's livestock producers to transition into a market-oriented production system, if certain challenges are overcome. Access to cooling, storage and processing facilities may allow farmers to supply more and safer products to markets and increase their bargaining power (see box).

Better market information would also allow producers to make more well-informed decisions on when and where to market their products, and at what prices. Widespread use of mobile communications technology combined with increasing satellite and satellite television capacities can help to bridge this information gap.³³⁵

Regional livestock trade is also constrained by high transport costs, corruption, and nontariff barriers.³³⁶ Overcoming barriers to movement of livestock and livestock products through enforcement of agreements under regional economic communities could increase the livestock trade flow within Africa and create more income and employment opportunities.

Box 3: The East African Dairy Development (EADD) project

The EADD project seeks to boost milk yields and incomes of small-scale farmers through the formation of producer organizations. Each hub can include several collection points within a 30 km catchment area, where milk is collected, measured, tested, and stored in chillers prior to sale and transportation to processors. Farmers negotiate better prices for their produce because each hub – managed by a cooperative – provides a guaranteed supply of quality milk. From 2008–2013, 82 farmer-owned dairy enterprises were established and supported, representing 200,000 farmers in Kenya, Uganda, and Rwanda. Of these, 51 went on to become self-sufficient enterprises, 29 continued to require support, and only two were unsuccessful.³³⁷ Dairy income per household increased by 164 percent in Uganda, 124 percent in Kenya, and 64 percent in Rwanda.³³⁸

Consumption

Rising incomes and urbanization are facilitating a transition toward the consumption of higher-value foodstuffs like dairy, meat, and eggs in Africa. This presents various challenges related to the safety and quality of products.³³⁹ In 2015, WHO concluded that Africa had the highest per capita incidence of foodborne illnesses, leading to 137,000 deaths and 91 million acute illnesses annually.³⁴⁰ In the dairy sector, in the short-term, interventions to improve safety can include training farmers, hawkers, traders, and dairy cooperatives on applying higher hygienic standards. Access to reliable energy is also critical to ensure that animal products are appropriately pasteurized and processed by producers and consumers prior to consumption. As women often participate in the informal dairy sector, it is essential that training be gender sensitive.³⁴¹ But it is also essential to improve safety without restricting informal commercialization of milk. Cost and price increases are likely to lead to a fall in milk consumption within poor households where consumption levels are already very low.³⁴²

9.5 Country analyses

In the following case studies of three African countries, policy and institutional innovations and interventions provide important lessons for other countries seeking to develop and strengthen their livestock sector. They have been selected in part based on their stock of animals (tropical livestock units/TLU per 100 people) and on the growth rate of the livestock subsector, both of which are indicators of a high commitment to strengthening the role of the livestock sector in improving food security and nutrition and economic growth. (Note: The information used in these analyses was accurate at the time of publication.)

Ethiopia

Ethiopia has the largest livestock population in Africa, with nearly 63 million cattle, over 31 million sheep and 33 million goats, and 61 million chickens in 2018.³⁴³ Between 2000 and 2016, the average stock of livestock, measured in tropical livestock units (TLU) per 100 people, stood at 50.970 TLU, more than double the continental median of 23.44 TLU. The average growth rate of gross production value during the same period was 4.54 percent – also twice the continental median of 2.2 percent.

Institutional innovations

The primary institution responsible for livestock is the Ministry of Agriculture (MoA), while the Ministry of Peace, established in 2018, oversees pastoralist issues. The MoA assumed responsibility for the livestock sector following a merger between the Ministry of Livestock and Fisheries (MoLF) and MoA in 2018, meant to align priorities and deliver joint agriculture and livestock targets simultaneously.³⁴⁴

Veterinary services were first boosted by the establishment of the National Veterinary Institute (NVI) in 1964 to develop, manufacture, and disseminate vaccines. By 2020, NVI was producing 20 different vaccines for domestic use. At the same time, the Ethiopian Institute of Agricultural Research (EIAR) has invested in the development of several new breeds, new varieties of forage and pasture, and husbandry methods.

Forming strong marketing institutions has long been a focus of Ethiopia's livestock sector development. The Livestock Marketing Agency (LMA) was established in 1998 within the Ministry of Trade and has since evolved into the Ethiopian Meat and Dairy Industry Development Institute (EMDIDI), which facilitates private sector involvement in the meat and dairy industries.³⁴⁵

Policy innovations and programmatic interventions

Ethiopia's National Development Plans (NDPs) have steered progress in the livestock sector through improved extension and financial support, liberalization of markets, and a more supportive macroeconomic framework.³⁴⁶ The NDPs have included a specific focus on supporting pastoralism through provision of veterinary services, access to water resources, enhancing extension services, and improving access to markets.

Adjustments to successive NDPs have guided attention toward the development of a commercially viable and sustainable sector. Each NDP sets out targets for production and a commensurate allocation of national funding for the whole agricultural sector. From 2010-2015, the number of crossbred cattle and milk cows more than doubled. The NDPs have also formed the basis for a Livestock Master Plan (LMP) – developed by the MoA in partnership with ILRI – with a series of five-year budgeted roadmaps (covering 2013 to 2028) that identify priority investment interventions, such as better genetics, feed, and health services. Fiscal incentives introduced since 2012 have also driven private sector investment: China, for example, now has an operation in Ethiopia producing shoes from locally sourced skins and hides.

Guided by these governmental strategies, several value chain interventions have been implemented in Ethiopia's cattle and small ruminant value chains by the public sector and development partners. For example, the Feed Enhancement for Ethiopian Development (FEED) project, implemented by ACDI/VOCA in 2009, worked with local government offices and the private sector to establish new nurseries and rehabilitate existing ones to expand the production of quality forage seeds. The use of improved feed raised milk production by 80 percent per household.³⁴⁷ In a second phase (FEED II, 2013-2017) 26,000 smallholder farmers – 32 percent of whom were women – were trained in sustainable forage production.³⁴⁸

Between 2013 and 2017 the MoA collaborated with SNV – the Netherlands Development Organisation – to implement the Enhancing Dairy Sector Growth in Ethiopia (EDGET) project. The project aimed to expand production, processing, and marketing to double household income and improve the nutritional status of children by promoting dairy consumption. Some 52,000 households developed forage plots with at least two different types of forage³⁴⁹ and average household net income—for the households supplying dairy processing units—increased from ETB 792 (US\$ 42) to 6,221 (US\$ 268).³⁵⁰

Ethiopia's livestock sector has benefitted substantially from comprehensive government action at the institutional and policy levels for both pastoralist and non-pastoralist livestock keepers and producers. As it builds on this success, streamlining the overall system that supervises the sector will also ensure that it is nimble enough to provide leadership in responding to future challenges.

Mali

Livestock is an important component of Mali's agriculture sector, contributing more than 40 percent of agricultural GDP.³⁵¹ Between 2000 and 2016, the average livestock stock, measured in tropical livestock units (TLU) per 100 people, is estimated at 70.9 TLU, three times the median for African countries of 23.44 TLU. Average growth rate of the gross production value of livestock is 3.87 percent, which is also above the median for African countries of 2.2 percent.³⁵²

Institutional innovations

Mali's Ministry for Livestock and Fisheries (MEP), created in 2004, is the main institution governing the livestock sector. In 2013, the government also created the Madina Diassa Center for the Conservation, Multiplication and Dissemination of Endemic Ruminant Livestock (CCMD-BRE), followed in 2015 by the National Center for Animal Artificial Insemination (CNIA).³⁵³ The Central Veterinary Laboratory (LCV), established in 1979, performs diagnostic and research activities for animal diseases and the development of animal vaccines,³⁵⁴ while the National Directorate of Veterinary Services (DNSV) oversees the design of the national policy. The Institute of Rural Economy (IER) is the government's main agricultural research institute. For the livestock sector, its six regional agricultural research centers carry out research programs on cattle, small ruminants, and poultry. This decentralization allows IER to respond to local needs more effectively.

Value chain actors are represented through several livestock federations. These include the National Interprofessional Federation of the Livestock Meat Value Chain (FEBEVIM), the National Milk Producers Federation of Mali (FENALAIT), and the Poultry Sector Stakeholders Federation of Mali (FIFAM).

Policy innovations and programmatic interventions

Over the last few decades, Mali's policy emphasis for the livestock sector has been on reducing the impact of animal diseases and improving productivity through access to inputs, services and markets – particularly for pastoralist and agro-pastoralist communities. In 2001, the Pastoral Charter was passed, acknowledging the right of pastoralists to move their herds in search of water and fodder, including into neighboring countries.

In 2006, the government passed the Agriculture Orientation Law (LOA), which is the overarching document guiding government actions in the agriculture, livestock, fisheries, and forestry sectors.³⁵⁵ Then in 2013, the Agricultural Development Policy (PDA) (2013–2020) was approved by the government as the strategic framework of the LOA.³⁵⁶ The PDA provides the framework for all policies and sectoral strategies governing the agriculture sector, including livestock.³⁵⁷ Finally, in 2015, Mali finalized its CAADP 10-year investment plan, the National Agricultural Investment Plan (PNISA), for 2015–2025.³⁵⁸ PNISA provides the framework for all investments in the agriculture sector, including strategic investments in livestock value chains.³⁵⁹

These policy instruments have guided numerous programs to develop the livestock sector for economic growth and to improve food security and nutrition. For example, from 2014 to 2019, the Livestock for Growth Project (L4G), implemented jointly by the governments of Mali and the United States, implemented vaccination campaigns, supported farmers in buying and selling animals, and provided training.³⁶⁰ L4G also facilitated access to microfinance loans for producer organizations to fund animal fattening activities. The project generated 1,800 full-time jobs (65 percent held by women) in fields such as animal fattening, fodder production and sale, and veterinarian assistance.³⁶¹

The government of Mali has also participated in regional interventions to develop its livestock sector. Mali is part of the Regional Sahel Pastoralism Support Project (PRAPS) initiated in 2015 and being implemented in Mauritania, Senegal, Burkina Faso, and Niger. PRAPS aims to improve access to important productive assets, services, and markets for pastoralists and agro-pastoralists in cross-border areas. It is expected that the project will directly benefit 440,000 pastoralists and agro-pastoralists, including 132,000 women and young people in Mali by 2021.

The Malian government has recognized the potential of the livestock sector to deliver economic growth and meet food security and nutrition targets. However, it is still strongly dependent on imports to meet demand for dairy products. Efforts to boost dairy productivity and incentivize private investors will enable the country to make significant progress toward achieving self-sufficiency in milk.

Uganda

The government of Uganda has been ambitious in developing policies and regulations to strengthen the livestock, meat, and dairy sectors. Between 2000 and 2016 the average livestock stock, measured in tropical livestock units (TLU) per 100 people, is estimated at 28.33 TLU, which is above the African median of 23.44 TLU. The average growth rate of the gross production value of livestock for this period is 4.39 percent, which is double the African median of 2.2 percent.³⁶²

Institutional innovations

The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) oversees Uganda's policies and plans for the agriculture sector, including livestock. Specifically, the Directorate of Animal Resources (DAR) situated within MAAIF, is responsible for spearheading the development of the livestock sector.³⁶³ Dairy and meat are the main sub-sectors, as evidenced by the formation of a dedicated Division of Dairy and Meat (DDM) in the Department of Animal Production (DAP).

The Division of Animal Nutrition within DAP provides technical and regulatory support for a sustainable animal nutrition sector, working alongside national research institutes such as the National Agricultural Research Organisation (NARO) and the National Livestock Resources Research Institute (NaLIRRI), one of Uganda's 16 semi-autonomous public Agricultural Research Institutes.

The institutional strength of livestock in Uganda is also evidenced by the statutory body for dairy – the Dairy Development Authority (DDA) – and separate associations for different livestock production sectors. These include the Uganda Dairy Processors Association (UDPA), Uganda Meat Producers Cooperative Union (UMPCU), and the Poultry Association of Uganda.

Following liberalization of the sector since 2000, the private sector also plays a key role in dairy sector development including growing exports to neighboring countries, the Middle East and Asia.

Policy innovations and programmatic interventions

The government of Uganda has been implementing various policies and strategies to enable the sustainable growth and transformation of the livestock sector.³⁶⁴ These policies and strategies build on the overall ambition to become an upper middle-income country by 2040 (Vision 2040).

A series of National Development Plans (NDPs) covering 2010-15 and 2015-20 have fed into the 2013 National Agricultural Policy (NAP) which includes an objective of increasing farming households' incomes from livestock production by raising output, improving quality and increasing collective organization. An Agricultural Sector Strategic Plan (ASSP) 2015-20 prioritizes investments in beef, dairy cattle, poultry, and goats.³⁶⁵ In terms of animal health, a recent key policy is the 2018 Antimicrobial Resistance National Action Plan (AMRNAP) (2018- 2023).³⁶⁶ which is part of an effort to decrease the prevalence of zoonotic diseases and AMR by 50 percent by 2022.³⁶⁷

These policy instruments have guided numerous programs with the private sector, cooperative societies, and local and international NGOs. For example, in 2016, the Inclusive Dairy Enterprise (TIDE), was created in collaboration with the Dutch government to increase dairy farming productivity and reduce poverty for 20,000 dairy farmers in six districts across Uganda. TIDE worked closely with local dairy cooperatives and achieved a significant improvement in the quality of milk delivered. To date, 640 farmers have been trained at three Practical Dairy Training Farms, of whom approximately a third were young people and 19 percent women.

In 2017, the International Finance Corporation (IFC) collaborated with Pearl Dairy Farms – the largest of seven dairy processing companies in Uganda – to introduce the Dairy Development Programme. The program facilitated the training of 50 dairy development executives, who are now providing guidance to 500 farmers on techniques to enhance productivity and implement good agricultural practices.³⁶⁸ The objective is to generate a stable supply base of 1,000 dairy farmers supplying high-quality raw milk, transforming them into competitive commercial dairy farmers.

Uganda has shown strong commitment to improving its livestock sector through institutional and policy innovations, especially in the dairy industry. However, more emphasis will be needed on strengthening responses to zoonotic diseases and AMR to enable and sustain the growth of the Ugandan livestock sector. There is also significant opportunity to raise the productivity of its beef sector through focused interventions on feed and nutrition, allowing it to gain a foothold in export markets within Africa and beyond.

9.6 Conclusion

The consumption of animal-sourced foods is projected to increase significantly across Africa by 2050. A thriving and sustainable livestock sector will play an instrumental role in meeting targets on food security and nutrition and contributing to food systems transformation across the continent. To benefit from the potential of inclusive growth in the livestock sector, livestock production and the entire value chain need to be sustainably intensified. Although there has been progress towards improving feed for livestock, access to high-quality feed remains a significant challenge to increasing livestock productivity. In addition, limited technology adoption, low yielding breeds, and stringent biosecurity standards for human and animal health continue to present a challenge.

As more and more African countries move toward growing their livestock sectors, important lessons can be learned from successful government actions taken across the continent. The case studies in this section have shown that success has been most effective where governments have provided integrated policies, supportive infrastructure, and well-funded research capacity. In many cases these interventions were combined with a more prominent role for the private sector in the dissemination of modern technologies to increase productivity and enable the commercialization of livestock production.

9.7 Recommendations

- ✓ Design an overarching policy framework to support the development of an inclusive, profitable and sustainable livestock sector, and integrate this into broader development visions.
- ✓ Regulate input and output markets to ensure that the livestock sector maintains high safety, quality, and welfare standards for sustainable growth and participation in regional and global trade.
- ✓ Stimulate private sector-led investments in the livestock sector, including in infrastructure and the commercialization of livestock products and inputs.
- ✓ Design financial services, including insurance, to meet the special requirements of livestock producers.
- ✓ Invest in data and research capacity to provide a strong evidence base for policies and regulations, relevant to local and national circumstances.
- ✓ Apply a holistic approach to tackle the root causes of conflicts between pastoralists and crop farmers.
- ✓ Promote the transition of large ruminant keepers to producers with context-specific, supportive strategies and incentive structures.
- ✓ Leverage employment and entrepreneurship opportunities in the poultry sub-sector particularly for the benefit for women and young people.
- ✓ Mobilize investments in the dairy industry for countries to specialize in dairy production and to strengthen intra-African trade.

TRADING UP:

Policy innovations to expand food
and agriculture trade in Africa

CHAPTER 10 - TRADE

10.1 Introduction

In 2018, African governments signed an agreement establishing the African Continental Free Trade Area (AfCFTA), which is regarded as a turning point for African regional and international trade. Trade is a critical enabler of socioeconomic activity, resulting in positive impacts on income, livelihoods and welfare along the agrifood value chain. Currently, about 80 to 90 percent of African exports are destined for global markets, mostly minerals and petroleum.³⁶⁹ In comparison, intra-African trade remains at under 20 percent, composed also primarily of minerals and petroleum products, and dominated by a small number of countries. Although over half of the labor force is engaged along the agriculture value chain, Africa continues to import approximately US\$72 billion in food and agricultural products a year. If organized and managed carefully, strengthening intraregional agricultural trade in Africa could reduce the need for globally-sourced imports and improve socioeconomic development across the continent, benefitting all actors along the value chain.

The AfCFTA, which came into effect on 1 January 2021, has the potential to increase intra-African trade by over 50 percent.³⁷⁰ African nations have already made determined efforts to increase trade among themselves, including through the eight regional economic communities (RECs) that are officially recognized by the African Union (AU), and a plethora of additional regional trade agreements. Three leading RECs – COMESA, ECOWAS, and SADC – have adopted unique and contextualized approaches in the design and operationalization of their institutions. Important lessons can be learned from them, not only for the remaining RECs, but also for the implementation of the AfCFTA. Challenges remain, but as this section explains, countries across Africa are now in a strong position to unlock the substantial benefits of intraregional agricultural trade.

10.2 An overview of African agricultural trade

About 80 to 90 percent of African exports are destined for global markets.³⁷¹ Minerals and petroleum make up a large share of this, but exports of agricultural products have increased over the last two decades and have entered new markets including Saudi Arabia, the UAE, Malaysia and Viet Nam. Intra-African trade is less than Africa's trade with the rest of the world and is composed largely of agricultural products. In 2017, intra-African exports were 16.6 percent of total exports.³⁷² The

largest share of this agricultural trade across Africa is channeled through the RECs, driven by trade liberalization programs.

Key products traded

About 38 percent of all intercontinental agricultural trade is made up of only 20 products. Of these, the most exported products include sugar and sugar products, tobacco (cigarettes), tea, maize, and palm oil. Between 2005 and 2018, the proportionate values of sucrose and sugars, black tea, wheat, flour, maize seed, soups and broths, food preparations, and vegetables in intra-African trade increased. Conversely, the shares of maize (other than seed), tobacco products, rice, beer, coffee, and cotton, by value, all decreased.³⁷³ Half of intra-African exports are processed products while 90 percent of extracontinental exports are primary commodities or semi-processed products.³⁷⁴

The role of informal cross-border trade

Informal cross-border trade (ICBT) represents a significant share of intraregional trade in Africa, sometimes higher than official registered trade. A vast range of merchandise is exchanged through ICBT, including unprocessed goods, manufactured goods, and re-exported goods. Staples such as beans, rice and maize, as well as livestock, are particularly popular items for exchange, and add substantially to the volume of intraregional agricultural trade. Across the Kenya–Somalia border, informal traders earn nearly US\$12 million per year from informal livestock sales while in eastern Ethiopia, this value reaches US\$25 million.³⁷⁵

If organized and managed carefully, strengthening intraregional agricultural trade in Africa could reduce the need for globally-sourced imports and improve socioeconomic development across the continent, benefitting all actors along the value chain.

While ICBT supports many livelihoods, informally traded goods not subject to customs clearances or sanitary and phytosanitary (SPS) measures might pose health, safety and environmental risks. It is also important to recognize that women account for about 60 percent of informal traders at border checkpoints in West and Central Africa, and 70 percent in SADC.³⁷⁶ The elimination of non-tariff barriers (NTBs) would likely generate several benefits for female informal cross-border traders as it would minimize the conditions that can be

manipulated against them. For instance, the provision of ID cards can improve both safety and access to markets and services, as has been done for 8,000 women in EAC.³⁷⁷

Trade in times of crisis

Intraregional trade can increase the resilience of countries to crises or shocks. However, crises can also disrupt trade. Measures taken by governments to combat COVID-19 – including border closures and curfews – have significantly disrupted intraregional trade, with an especially strong impact on ICBT. For instance, the average price of maize in Nairobi rose by 10 percent from US\$312 per ton in April 2019 to US\$343 in April 2020 due to sanitary controls at borders and curfews.³⁷⁸ Moreover, uncoordinated policy responses within RECs during crises can negatively impact intraregional trade. For instance, in August 2019, when Rwanda closed its border with the DRC after a second death linked to Ebola, the price of fruit and vegetables surged in border towns.³⁷⁹ But COVID-19 has also demonstrated the effectiveness of RECs in times of crisis: the SADC, for example, encouraged its members to put in place policies and procedures at the ports of entry to identify and give priority to the clearance and transportation of essential goods and services. It also proposed initiatives to reduce interactions between border officials and trader's representatives, for example by accelerating the use of online platforms.³⁸⁰

Box 1: Barriers to African agricultural trade: tariff and nontariff barriers

One key challenge in increasing intracontinental and intraregional trade in Africa is the high prevalence of tariff and nontariff barriers. In 2016, tariffs on intraregional agricultural exports within the eight AU-recognized RECs ranged between 0.1 percent in EAC and 16.6 percent in Arab Maghreb Union (AMU).³⁸¹ In addition, a study of 23 countries estimates that nontariff measures add on average 21 percent to the cost of goods, reaching as high as 52 percent in Algeria and 44 percent in Senegal.³⁸² The combination of tariff and nontariff measures represents exorbitant costs for trade in Africa. For instance, in COMESA and SADC, total ad valorem import duties on agricultural products can be as high as 25.5 and 13.56 percent, respectively. In comparison, in the Association of Southeast Asian Nations (ASEAN) and the European Union, these costs are estimated at just 8.54 percent and 10.63 percent, respectively.³⁸³

10.3 The case for strengthening intraregional agricultural trade in Africa

Strengthening intraregional trade can foster economic growth through productivity increases, while generating new and much-needed employment opportunities. For smallholder farmers, it can reduce entry barriers to regional value chains and markets, while potentially improving food security and nutrition by facilitating access to more affordable, diverse and nutritious foods.

Access to inputs and technologies

Intraregional trade can give farmers easier access to affordable and high-quality inputs and to new technologies that can improve their productivity and market knowledge. Evidence from Ethiopia shows that the use of improved hybrid maize traded within COMESA has the potential to quadruple productivity. Moreover, improved access to modern inputs can facilitate the integration of smallholder farmers into regional value chains with greater income opportunities, at times more than global markets.³⁸⁴

Agricultural value addition

The potential of intraregional trade to generate economic growth is greater when agricultural products are processed. The export of cocoa butter or chocolate, rather than cocoa beans, is generally more profitable.³⁸⁵ A study in Tanzania found that investment in agro-processing had a more sizable impact on the total economy than investment in any other industry.³⁸⁶ Intraregional trade can therefore act as a catalyst to developing processing industries that could tap into regional, continental and global markets.

Food security and nutrition

Increased trade has the potential to lower prices for consumers by linking food-deficit areas with food-surplus areas and improves the diversity and quality of products available.³⁸⁷ For example, the uneven distribution of livestock across the continent – with over half of Africa's livestock located in East Africa^{388,389} – presents great potential for increasing intraregional and intra-African trade of animal-sourced products and live animals to improve food security and nutrition.

Resilience and risk management

Uninterrupted intraregional trade functions as a critical risk management and resilience tool during times of crisis or shock.³⁹⁰ For example, farmers in countries that are less severely affected by particular weather outcomes may be able to sell excess supply to meet the excess demand from

consumers in the more severely affected regions. Evidence shows that the 2007/08 food crisis was exacerbated in Africa by export bans and trade restrictions.^{391,392} Learning from that experience, some countries across Africa have rapidly developed and implemented interventions at scale to minimize disruptions to food trade during the current COVID-19 pandemic.

Women's empowerment through trade

Intraregional trade is an opportunity to generate new employment opportunities along agriculture value chains and thus can be an opportunity to significantly reduce gender inequalities in labor market participation. A 2020 ex ante evaluation of the implementation of the AfCFTA found that its implementation would increase wages, in particular the remuneration of unskilled labor, which would grow at a faster rate than that of skilled labor in East, West, and Central Africa. Furthermore, women would benefit more, particularly in unskilled professions.

10.4 Strengthening national-level participation in intraregional trade

For agricultural trade to flourish, buyers and suppliers must be well connected, either in person or virtually. As well as this "hard" infrastructure, "soft" infrastructure such as regulations and institutions must also be strengthened to ensure that people have the knowledge and capacity to exploit the opportunities created.

Transport: ports, roads, rail and air

Ports are critical access points for domestic markets, including Africa's 16 landlocked countries. The development of rail and rural roads expedites the adoption of productivity-enhancing technologies.^{393,394} Africa's aviation sector remains underdeveloped, especially for regional trade, but the signing of an agreement among 23 states to co-operate in a Single African Air Transport Market (SAATM) in January 2018 and the establishment of the AfCFTA is expected to significantly improve the continent's aviation supply chains.³⁹⁵

Productive infrastructure: energy, irrigation and telecommunications

Most businesses in sub-Saharan Africa cite the lack of energy access as a major obstacle to their growth and development, particularly in the food sector. More reliable access to water through irrigation would help farmers combat the impacts of erratic rainfall, and enable them to better engage in value addition activities. Information and communications technologies (ICTs) also increasingly play an important role in agricultural

development and specifically in trade facilitation, giving value chain actors access to market information and buyers.

Trade logistics and facilitation

The use of nontariff barriers (NTBs) such as cumbersome customs procedures, roadblocks, import quotas and sanitary and phytosanitary (SPS) rules continues to constrain the smooth flow of goods and services. The ePhyto Solution, which launched in 2019, could help change this. An electronic phytosanitary certificate, it allows countries to exchange phytosanitary information quickly and accurately at a low cost. This will translate into lower costs for exporters and fewer shipments detained at customs.³⁹⁶ Several countries are also fast-tracking the creation of one stop border posts (OSBPs) where instead of enforcing checks and bureaucracy on both sides of a border, there is a single facility – usually at the point of entry – where goods undergo necessary controls.

Human capital: technical, business management and enterprise skills development

The future of food systems will almost certainly be knowledge and technology intensive and will require a wider range of professional, technical and artisanal skills. Addressing the skills gap must be a priority for African governments. In Morocco, strengthening technical education and vocational training in agriculture is a key element of the Plan Maroc Vert (PMV), and has included setting up a network of 52 institutions with 24 different curricula to improve the development and efficiency of agribusinesses.

Adjustment costs and risks of greater trade liberalization

Economies may incur costs in adjusting to new trading relationships for example through a fall in revenue collection from tariffs and border taxes or a relocation of labor and capital. Upskilling, greater access to modern production inputs, technologies and methods, innovative sustainable supply chain models³⁹⁷ and the development of complementary activities and productivity-enhancing investment in agriculture must accelerate in the lower-income countries and proceed at least in tandem with the movement of workers off the farm elsewhere. Additional resources to mitigate the costs of trade liberalization are also available at REC-level, for example through COMESA's Regional Integration Support Mechanism (RISM) and East African Commission (EAC) Customs Union Common Markets, as well as through the WTO-led Aid for Trade initiative.^{398, 399}

10.5 Regional Economic Communities Analyses

Regional economic communities (RECs) play a decisive role in driving Africa's regional and continental integration process and are the pillars of a successful African Continental Free Trade Area (AfCFTA). Eight RECs are officially recognized by the AU, and three of these – Common Market for Eastern and Southern Africa (COMESA), Economic Community of West African States (ECOWAS), and Southern African Development Community (SADC) – are included here as case studies. This is based on their high levels of intraregional agricultural exports and their important coordinating role for the implementation of the Comprehensive Africa Agriculture Development Programme (CAADP) and NEPAD. *(Note: The information used in these analyses was accurate at the time of publication.)*

COMESA - Common Market for Eastern and Southern Africa

Founded in 1981, the Common Market for Eastern and Southern Africa (COMESA) is the largest regional economic community (REC) in Africa by membership, encompassing 21 member states. Agriculture is one of the main economic activities in COMESA, employing nearly 60 percent of its total workforce and contributing over 20 percent of total GDP.⁴⁰⁰ The three largest items of agricultural trade are black tea, sucrose and live animals – which together account for over 20 percent of intraregional trade.⁴⁰¹

Institutional innovations

Stimulating agricultural trade in COMESA is a cross-institutional endeavor. The agriculture and industry division within the Secretariat focuses on the productivity and marketing of agricultural products. Meanwhile, the trade and customs division drives economic integration by reducing trade barriers, and the infrastructure and logistics division aims to expand physical connectivity and improve ICT, energy and transport infrastructure.

To support the integration program, COMESA has established financial institutions to provide not just much-needed credit (the Trade and Development Bank), but also to provide insurance for noncommercial risks (the African Trade Insurance Agency), to facilitate international payments (the Regional Payment and Settlement System), and to underpin competition in the region (the COMESA Competition Commission). These institutions now operate at a significant scale: in 2018, the Trade and Development Bank held assets worth over US\$5.6 billion, and 25 percent of its loan disbursements went to the agribusiness sector.⁴⁰²

COMESA established a Gender and Social Affairs Division in the Secretariat in 2009. In addition, an institution connected to the COMESA governance system – the Federation of National Associations of Women in Business (FEMCOM) – works to integrate women into trade and development activities in eastern and southern Africa.⁴⁰³

Policy innovations and programmatic interventions

In 2014 COMESA signed a regional CAADP compact with an overarching goal to contribute to regional food security and integration through better policy co-ordination, effective policy implementation, and budget support. The regional compact enables COMESA to initiate programs that are transboundary in nature, such as enhancing the productivity of commodity value chains along transport corridors to enable the free flow of staples from surplus to deficit areas.⁴⁰⁴

COMESA also drove the formulation of a Regional Agricultural Investment Plan (RAIP) covering the period 2018–2022 and formulated in partnership with FAO. The RAIP is a pragmatic, instrument-based investment plan that identifies specific, targeted and costed interventions.⁴⁰⁵ COMESA also publishes Medium Term Strategic Plans (MTSP) to drive its regional integration process.

The COMESA Business Council (CBC), established in 2005, is a membership-based organization to promote business participation in regional integration. CBC convenes sectoral and multisectoral dialogues to engage the public and private sectors on constraints and challenges faced by businesses in the region.⁴⁰⁶ It has implemented several projects to address trade-related challenges in the region, and since 2015 has been implementing a project to build the technical capacity of agrifood SMEs on quality standards and to promote linkages into the supply chains of larger businesses.⁴⁰⁷

In 2012, COMESA designed and implemented a Regional Customs Guarantee Scheme (RCTG) to facilitate the movement of transit goods under customs seal within the COMESA region. Under the RCTG, customs

bonds are developed and are used as guarantees to ensure that countries recover duties and taxes from the guarantors. COMESA has also introduced a Virtual Trade Facilitation System (CVTFS), an electronic platform developed to monitor consignments along transport corridors. The system is important for perishable products as it considerably reduces delays in transport and hence food loss.

Overall, COMESA has adopted a pragmatic approach to addressing key barriers to agricultural trade. Focusing on unlocking finance for trade through robust banking and insurance institutions is an innovative approach. Complementing this with a wide range of solutions to ease transit across and between countries has further strengthened intraregional trade. However, there is a need to frame interventions in long-term policies that are subsequently evaluated independently to monitor implementation and accountability.

ECOWAS - Economic Community of West African States

Created by the Treaty of Lagos in 1975, the Economic Community of West African States (ECOWAS) is the oldest regional economic community (REC) in Africa and unites 15 West African countries with the aim to “promote co-operation and integration, leading to the establishment of an Economic Union of West Africa.”⁴⁰⁸ The main agricultural commodities traded within the region are cereals, roots and tubers, and livestock products, while coffee, cocoa, cotton, rubber, fruits, and vegetables are mostly exported outside the region.⁴⁰⁹

Institutional innovations

In 2013, ECOWAS set up the Regional Agency for Agriculture and Food (RAAF), a specialized agency tasked with implementing the ECOWAS Agricultural Policy (ECOWAP). RAAF strengthens the technical capacity of the ECOWAS Commission to implement the Regional Agricultural Investment Programme (RAIP). Its capacity-strengthening activities focus on providing strategic direction, training on trade law and regulation, monitoring and evaluation, and strategic intelligence.⁴¹⁰

The ECOWAS Community Court of Justice (ECCJ) has jurisdiction over investor–State disputes under a Supplementary Act on Investments, which gives the usual range of protections to intra-ECOWAS investors.⁴¹¹ Through this Act, investors can bring their case to the ECCJ to protect their investments against actions of their host States. Decisions made at the ECCJ are final and binding on all parties involved.⁴¹²

In 2008, ECOWAS adopted the Regional Competition Rules to promote, maintain, and encourage competition and enhance economic efficiency in production, trade, and commerce at the regional level. In 2019, the Competition Rules were institutionalized with the establishment of the ECOWAS Regional Competition Authority (ERCA), headquartered in Gambia, which aims to implement the rules. A Consultative Committee on Competition (CCC) was created as a technical body to help direct the affairs of ERCA.⁴¹³

Policy innovations and programmatic interventions

The process of establishing a free trade area (FTA) within ECOWAS began in 1979, but because of significant delays in implementation, a new trade liberalization scheme was adopted at the ECOWAS Summit of January 2003. Under the scheme, products exempted from custom duties also have to comply with the ECOWAS rule of origin (RoO) – with agriculture and animal-sourced products exempted from the RoO requirement. ECOWAS also initiated the formation of a customs union to achieve greater economic integration, setting a common external tariff (CET) in 2013.⁴¹⁴

Since the turn of the century, ECOWAS has embarked on an ambitious program to design and implement a regional quality system. The first two phases of the West Africa Quality System Programme (WAQSP) covered 2001–2005 and 2007–2012 and made good progress in compliance with international trade rules and technical regulations. The current phase of WAQSP, implemented since 2014, continues to drive the establishment of quality infrastructure and national quality policies to protect consumer health and the environment.⁴¹⁵

In 2005, ECOWAS developed a regional agricultural policy (ECOWAP) to improve livelihoods and reduce food insecurity and malnutrition as well as import dependencies. An evaluation after 10 years found a

productivity increase in cereal production estimated at 21 percent between 2005 and 2014, compared with an increase of 15 percent in the 10 years preceding ECOWAP implementation. This increase was mainly driven by rice and maize, which increased by 96 and 68 percent.⁴¹⁶

ECOWAS also introduced an initiative specifically targeted at improving the transit of food in the region. The Food Across Borders Program (ProFAB), launched in 2015, seeks to build a stronger understanding of trade patterns and barriers with enhanced data collection; support the implementation of agreements on free movement of agricultural products and people; and where required, contribute to the formulation of regional policies and strategies to promote agricultural trade. The primary focus of the initiative has been on addressing the barriers to trade such as checkpoints, illegal taxes, and red tape along specific trade and transport corridors.⁴¹⁷

Overall, ECOWAS has created a strong enabling environment for intraregional trade that attracts investment, facilitates access to finance, and ensures fair competition, in tandem with a judiciary to settle investor–government disputes. However, increasing the volume of intraregional agricultural trade remains a challenge for the ECOWAS region, requiring increased agricultural productivity, larger investments in trade infrastructure, and continued dedication to reducing trade barriers, along with more effective enforcement of regional trade rules and regulations.

SADC - Southern African Development Community

The Southern African Development Community (SADC), launched in 1992, includes 16 countries, representing nearly 354 million people, over 40 percent of whom are employed in the agriculture sector. Intraregional trade within SADC is among the largest on the continent.⁴¹⁸ In 2019, intra-SADC trade was valued at US\$16.5 billion, about 45 percent of which went through South Africa alone.⁴¹⁹ Intra-SADC trade is largely in petroleum, agricultural products, electricity, and some textile products. Beyond SADC's borders, most trade is with the Asia–Pacific markets, followed by the European Union.

Institutional innovations

SADC's institutional framework includes both a top-down approach for smooth coordination and an inclusive approach that empowers stakeholders within member countries. Overall policy direction is overseen by the Summit of Heads of State or Government, in turn managed by a troika comprised of the former, current, and forthcoming (current deputy) chairpersons, who rotate on an annual basis.⁴²⁰ A Council of Ministers representing every member country ensures effective domestic implementation.⁴²¹

The coordination function of SADC is primarily funded by member states, proportionate to the share of their GDP in the combined SADC GDP. Development activities are funded by International Cooperating Partners (ICPs), including the EU, African Development Bank, the World Bank and other global institutions.⁴²² In 2017, SADC launched an SADC Regional Development Fund (RDF) to provide seed funding and mobilize additional and new resources for infrastructure development.⁴²³ This was due to become operational from August 2021.⁴²⁴

A Gender Unit within the Secretariat, accountable directly to the Executive Secretary, was established in 1998 to facilitate, coordinate and monitor the implementation of SADC's gender commitments.⁴²⁵ The Protocol on Gender and Development requires national trade and entrepreneurship policies to be gender-responsive and calls on member states to develop subsidized training programs to develop women's entrepreneurial skills.⁴²⁶

Policy innovations and programmatic interventions

The Regional Indicative Strategic Development Plan (RISDP) is a 15-year roadmap of policies, strategies, principles and targets to deepen integration, accelerate poverty eradication, and meet economic and social goals. It was implemented from 2005 over three five-year phases. An independent review of the RISDP, completed in 2014, recorded moderate progress toward enhancing SADC intraregional trade and economic diversification. The 2015–2020 RISDP focused on regional value chains and value addition for agricultural and non-agricultural products, and on intraregional and intra-African trade.

A Regional Agricultural Policy (RAP) was approved by the SADC Council in 2014 as the overarching framework for the region's agriculture sector. The RAP is founded on the direction set in the RISDP and implemented in five-year cycles. The approach of the RAP is to support and complement member states

to achieve related national goals. Where national goals require updating to align with regional plans, the RAP proposes support for their development, as well as financial and technical assistance toward their implementation.⁴²⁷

To operationalize the RAP, the Secretariat launched a program of support in March 2019, in partnership with the EU and FAO. The EUR 9 million (US\$10 million) program titled Support Towards Operationalization of the SADC Regional Agricultural Policy (STOSAR) has three key components: evidence-based decision-making with more robust agricultural information systems; managing transboundary plant pests and diseases to improve access to markets; and executing the Regional Food and Nutrition Security Strategy.⁴²⁸ The program provides technical assistance to the Secretariat's ongoing efforts to create a regional Agricultural Information Management System (AIMS).

In 2020, STOSAR funded biopesticide trials in Tanzania against the fall armyworm, the successful completion of which paved the way for its registration in June 2020.⁴²⁹ Tanzania's livestock sector is also benefitting from interventions to strengthen disease surveillance and control in the north and central zones of the country, thereby contributing to the sector's sustainable growth.⁴³⁰

Intraregional trade in SADC is among the highest within the eight RECs officially recognized by the African Union. With more committed implementation of SADC's protocols and policies, the region has the potential to achieve even greater success in improving agricultural trade. In the immediate term, there is an urgent need to invest in greater data collection, particularly on the impact of NTBs, so as to unblock trade, particularly in agricultural products.⁴³¹

10.6 Conclusion

Agricultural trade has the potential to generate much-needed employment opportunities and wealth, thereby significantly improving socioeconomic development and livelihoods across the continent. It can also reinforce the resilience of African countries to better withstand socio-economic, climatic and health shocks.

As the case studies have shown, important lessons can be learned from trading blocs to boost agricultural trade in Africa. COMESA has developed a sound institutional framework that supports agricultural development as well as agricultural trade. Its focus on unlocking finance for trade through robust banking and insurance institutions is a unique and innovative approach. Meanwhile, ECOWAS is financially self-sufficient. This provides immense capacity to lead and implement policies and programs that benefit intraregional agricultural trade. SADC stands out with an inclusive approach that empowers stakeholders within member countries to engage in the formulation of regional policies.

In addition, it remains critical to have systems in place for technical and institutional innovations in the sector and regulations to spur intraregional agricultural trade while accounting for the adjustment costs and safeguarding the environment, maintaining quality standards, and ensuring that smallholder farmers, youth and informal traders are included in opportunities.

10.7 Recommendations

- ✓ Invest in information and data on cross-border trade to ensure that governments and trading partners can make informed decisions.
- ✓ Fast-track trade facilitation arrangements at REC level and expedite the elimination of NTBs and facilitate trade and greater integration.
- ✓ Mobilize public and private investment in infrastructure, including transport infrastructure and productive infrastructure such as energy, irrigation and telecommunications.
- ✓ Accelerate intraregional agricultural trade and integration agendas through greater emphasis on aligning national and regional priorities, reflected in National Agriculture Investment Plans (NAIPs) and Regional Agricultural Investment Plans (RAIPs).
- ✓ Enhance value chain competitiveness by supporting the design and development of innovative technologies to improve both the quantity and quality of food.
- ✓ Coordinate policy responses within RECs and at the continental level to strengthen crisis preparedness and resilience in order to maintain intraregional trade even in times of crisis.

11. CONCLUSION

Africa is at a critical juncture in its development trajectory. Following decades-long progress in reducing hunger and malnutrition, the continent is now seeing these development gains stalling or even reversing. Within the past few years, the combined impacts of climate change, conflict and COVID-19 have exposed the interconnectedness of various sectors – food, agriculture, nutrition, health, employment and the environment – and the vulnerability that comes with this interconnectedness.

Although recent setbacks are problematic, they are also an opportunity to reassess pathways to food systems transformation and progress towards future targets such as under the AU's Agenda 2063, CAADP, and the Sustainable Development Goals. What can African countries do to get back on track towards accelerating the pace of economic growth recovery and achieving imminent targets of halving poverty and ending hunger?

This monograph, bringing together the research carried out by the Malabo Montpellier Panel between 2017-2020 on seven key development strategy areas, has highlighted both the complexity of the challenge as well as the existence of successful interventions and policy responses. The rich set of policy and institutional innovations described in this report and covering key strategic areas – nutrition, irrigation, mechanization, digitalization, energy, livestock and trade—illustrate viable options to transforming Africa's food systems for reduced poverty and improved food security and nutrition.

The wealth of evidence of what individual countries have done in a number of thematic areas - as presented in the monograph reveals synergies, overlaps and feedback loops among successful policies and programs. It has highlighted how, for example, digitalization can be applied to improving the productivity across entire value chains, and how this in turn requires infrastructure and market access if it is to translate into improved livelihoods, and improved nutritional outcomes. It reminds us of cross-cutting themes such as youth employment and the crucial role of women. Re-thinking and re-aligning policies in a way that leverages these synergies and turns the trade-offs of food systems transformation into multiple-win situations must be a priority in the months and years ahead. Doing so will require evidence-based experimentation, policy innovation, and high-level commitment to cross-sectoral and cross-departmental cooperation. In short, the complexity of food systems transformation must be reflected in its governance.

The analyses, case studies and action points put forward in this monograph can help navigate this complexity and support policymakers as they adopt holistic, nuanced policies that reverberate across sectors and reorient development trajectories. This work has just begun, but if it is implemented now and sustained it will become a powerful driving force in ending hunger and food insecurity in all its forms.

The work of Malabo Montpellier Panel between 2017 and 2020, summarized in this report, has identified a set of actions summarized below that, if brought to scale, could have a significant impact on livelihoods, food and nutrition security and the overall sustainable growth and transformation of Africa's food systems.

INTEGRATE food systems transformation into long-term national vision, growth and development agendas.

ELEVATE African science and technology priorities and create research capacity for home-grown solutions.

INNOVATE to create the policies and technical solutions that will support the transformation of food systems.

CO-ORDINATE action across government for increased policy cohesion, and more broadly across sectors for greater impact.

OPTIMIZE conditions for sustainable growth through smart regulations that amplify complementarities and create synergies across the food system.

STIMULATE holistic investment in infrastructure including addressing the constraints that might deter private sector investments.

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