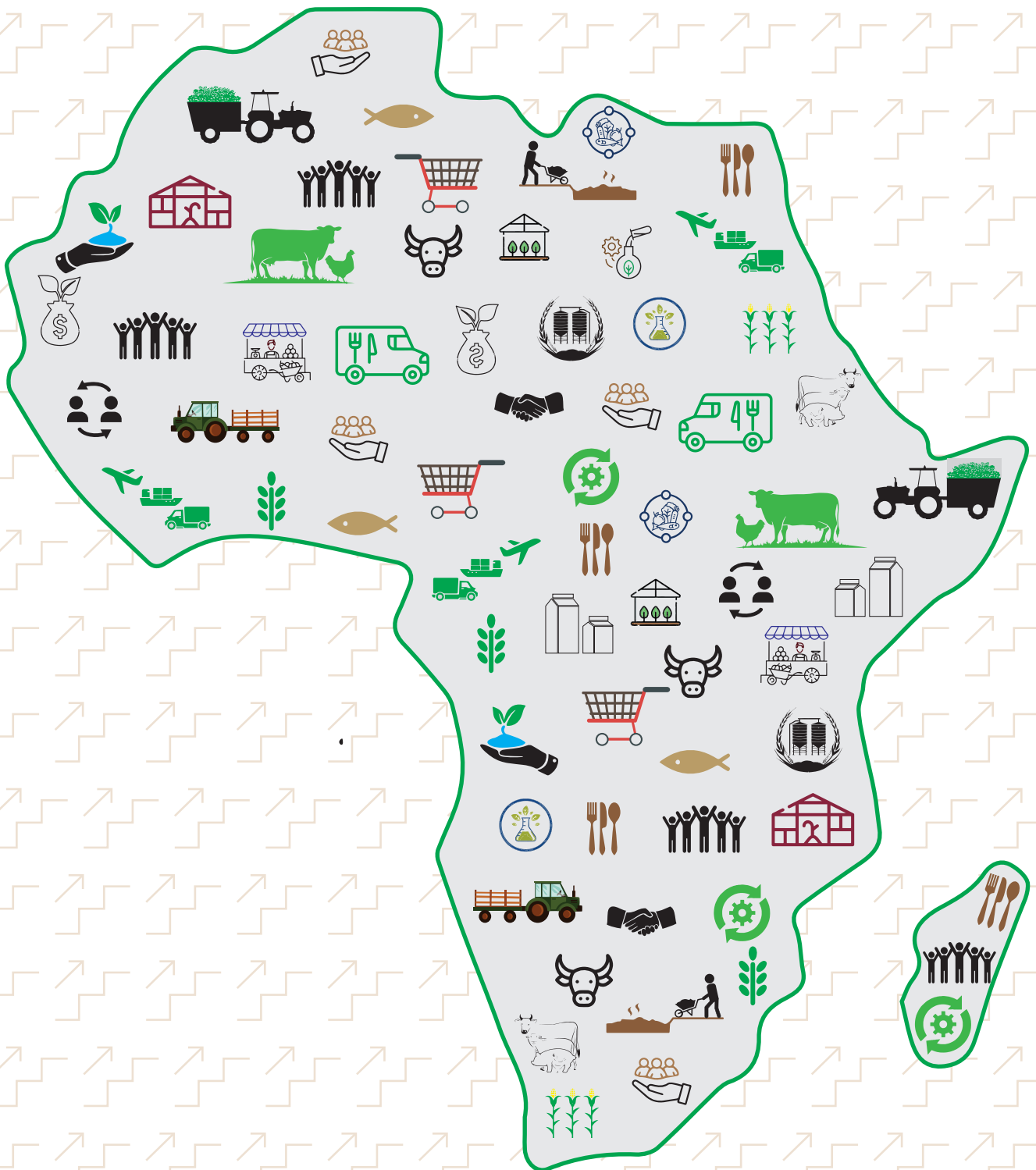


Guidelines for Inclusive Agricultural Value Chains Development in Africa



Guidelines for Inclusive Agricultural Value Chains Development in Africa

Copyright©AU-SAFGRAD,2023

ISBN:

Electronic:978-92-95119-96-3

Print: 978-92-95119-95-6

Table of Contents

Table of Contents	ii
List of Tables.....	vi
List of Figures.....	vii
List of Success Stories.....	viii
List of Abbreviations and Acronyms.....	ix
Foreword	xiii
Acknowledgements	xiv
Executive summary	xv
Chapter 1: Introduction	1
1.1 Overview	1
1.2 Rationale	2
1.3 Methodology.....	3
Chapter 2: Continental commitments and flagship programmes that support iAVCD	6
2.1 Introduction	6
2.2 Maputo Declaration.....	6
2.3 Comprehensive Africa Agriculture Development Programme and the 2014 Malabo Commitments.....	7
2.4 Arusha Declaration 2005 on African Commodities.....	8
2.5 Agenda 2063 – The Africa We Want.....	9
2.5.1 The Continental commodities strategy.....	10
2.5.2 Transportation, information and communication technology	10
2.5.3 African Continental Free Trade Area.....	11
Chapter 3: Cross-cutting issues enhancing successful implementation of iAVC.....	12
3.1 Introduction	12
3.2 Agricultural and fish mechanization	12
3.3 Climate change	13
3.4 Sustainable and inclusive environmental planning and management	14
3.5 Institutional factors for developing inclusive & sustainable AVCs	16
3.6 Establish an interactive e-agriculture alliance program	18
3.7 Urbanization.....	19
3.8 Access to credit.....	19
Chapter 4: Sustainable and inclusive crop, livestock and fish production	20

4.1	Introduction	20
4.2	Drivers of inclusive and sustainable crop production	20
4.3	Inclusive and sustainable livestock production	21
4.3.1	Cattle production	21
4.3.2	Poultry production	23
4.3.3	Small ruminants' production	24
4.3.4	Pig production	25
4.3.5	Drivers of livestock production.....	26
4.4	Inclusive and sustainable fisheries and aquaculture	27
Chapter 5: Post-harvest handling of fish, crops and livestock		28
5.1	Introduction	28
5.2	Drivers of efficient post-harvest handling	28
5.3	Post-harvest handling.....	29
5.3.1	Fish	29
5.3.2	Crop processing.....	30
5.3.3	Horticultural crops	33
5.3.4	Livestock	35
5.4	Agro-industrialization	37
5.5	Game-changing policies and strategies for developing and promoting inclusive and sustainable post-harvest handling	38
Chapter 6: Agricultural products marketing and trade		40
6.1	Introduction	40
6.2	Stages of AVC market transformation	40
6.3	Drivers of AVC market transformation	41
6.4	Strategies to access domestic market and trade	43
6.4.1	Supermarkets and smallholder farmers business relationships	44
6.5	Strategies to access global value chains in Africa.....	45
6.5.1	Types of GVC participation	45
6.5.2	Informal Cross Border Trade (ICBT)	46
6.5.3	Performance of agricultural trade in Africa	47
6.5.4	Livestock trade	48
6.5.5	Fish trade	50
6.6	Game-changing policies and strategies for enhancing marketing and trade	50

6.6.1 National-level marketing	50
6.6.2 Regional and international trade.....	52
Chapter 7: Food consumption	55
7.1 Introduction	55
7.2 Changing food tastes and preferences.....	55
7.3 Drivers of nutritious and healthy food consumption.....	55
7.4 Game-changing policies and strategies for increasing access and consumption of nutrient-dense and healthy foods.....	56
7.4.1 Increase nutrition education	56
7.4.2 Enhance the rural-urban food systems linkage.....	57
7.4.3 Build vertical linkages between producers and consumers.....	57
7.4.4 Exploit the ICT in promoting nutrient-dense and healthy diets	57
Chapter 8: Guidelines for achieving sustainable and inclusive value chains for crop, livestock, fisheries and aquaculture.....	58
8.1 Crop value chain	58
8.1.1 Supply side.....	58
8.1.2 Demand side.....	60
8.1.3 Cross-cutting strategies	61
8.1.4 Create legislations enhancing access and investment in farmland improvement ...	62
8.1.5 Enhance research and extension services	63
8.1.6 Invest in creating and promoting farmer and agribusiness SMEs	67
8.2 Livestock value chain	70
8.2.1 Pastoral and agro-pastoral systems	70
8.2.2 Mixed livestock systems	71
8.2.3 Promote commercialization of livestock production	72
8.2.4 Smallholder dairy systems	74
8.2.5 Small ruminants.....	75
8.2.6 Poultry.....	77
8.2.7 Pigs	78
8.3 Fisheries.....	79
8.3.1 Capture fishery	79
8.3.2 Aquaculture	80
8.4 Post-harvest crop handling	81
8.5 Agricultural marketing and trade.....	82

8.5.1	Domestic markets	83
8.5.2	Developing regional and international markets	84
8.6	Consumption.....	87
END NOTES.....		89

List of Tables

Table 1	Livestock production systems in North Africa	22
Table 2	Stages of AVC transformation	42
Table 3	Common transboundary animal diseases in Africa	49

List of Figures

Figure 1	Agricultural mechanization across the value chain.....	12
Figure 2	Institutional landscape of iAVC	17
Figure 3	E-agricultural alliance.....	19
Figure 4	Livestock by production systems in SSA	23
Figure 5	Top intra-Africa Importers and Exporters for the 2010-19 Period.....	48

List of Success Stories

Box 1: IGAD – Protocol on Transhumance.....	53
Box 2: Success stories of agro-dealer collaboration: East African Banks’ collaboration with Agro-dealers	59
Box 3: Success Story: Combatting counterfeit agricultural inputs	60
Box 4: Case study: Information technology for enhancing farmer and agro-dealers interaction in Kenya and Ghana	61
Box 5: Success Story: Rural code in Niger led to the re-greening of the Sahel.....	63
Box 6: Success story: Morocco Horticultural Production	66
Box 7: Success Story: Tanzania Horticultural Association (TAHA)	68
Box 8: Success story: Opportunity Ghana: Financing Cocoa Farmers.....	69
Box 9: Success Story: Botswana Livestock Sector	70
Box 10: Success story: Index-Based Livestock Insurance in Kenya.....	72
Box 11: Success story: Community-Based Rangeland Rehabilitation in Sudan	73
Box 12: Success story: Dairy hubs in Eastern Africa	75
Box 13: Success story - Karamoja women goat farming	76
Box 14: Success story - Ghana poultry farmers’ vertical integration	78
Box 15: Success story - Mauritius communities cooperate to recover coral reefs	80
Box 16: Success story - Aquaculture North-eastern Nigeria for the Youth.....	81
Box 17: Success story - Purdue Improved Crop Storage (PICS) bag	81
Box 18: Success Story - Warehouse Receipt System in Tanzania	82
Box 19: Success Story - Nando’s business relationship with smallholder farmers in south-western Uganda	84
Box 20: Success story - Agricultural development in Egypt.....	86
Box 21: Success story - Rwandese Hinga Weze nutrition education group.....	88

List of Abbreviations and Acronyms

ABDP	Aquaculture Business Development Programme
AMIS	Agricultural Marketing Information System
ASTI	African Science and Technology Indicator
AUC	African Union Commission
CIAT	International Centre for Tropical Agriculture
CIP	International Potato Centre
EEZ	Exclusive Economic Zone
IBL	Index based livestock
PCA	Principal Component Analysis
PNEEI	National Programme for Saving Irrigation Water
UMA	Union du Maghreb Arabe
3ADI	African Agribusiness and Agro industries Development Initiative
3PLS	Third Party Logistics
4P	Public-private producer partnership
ADG	Annual daily growth
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
AIHSRN	African Integrated High-Speed Railway Network
AMU	Arab Maghreb Union
ASF	African swine fever
AU	African Union
AVC	Agricultural value chain
BRC	British Retailers Consortium
BT	Blue Tongue
CAADP	Comprehensive Africa Agricultural Development Programme
CBBP	Community based breeding programme
CBNRM	Community based natural resource management
CBO	Community Based Organization
CBPP	Contagious bovine pleuropneumonia
CBRR	Community Based rangeland Rehabilitation
CENSAD	Community of Sahel-Saharan States
CMA	Conservation management area

COMESA	Common Market for Eastern and Southern Africa
CSA	Climate smart agriculture
DALY	Disability adjusted life years
DBM	Double burden of malnutrition
DRC	Democratic Republic of Congo
EAC	East African Community
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EEP	Energy and Environment Partnership Trust Fund
EPI	Environmental Performance Index
EV	electronic verification
F&G	Framework and guidelines
FAFH	Food away from home
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FDI	Foreign Direct Investment
FEWSNET	Famine Early Warning Systems Network
FMD	Foot and Mouth Disease
FTT	FAO Thiaroye Technique
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIZ	Gesellschaft fuer internationale Zusammenarbeit
GVC	Global value chain
HPAI	Highly pathogenic avian influenza
iAVC	Inclusive agricultural value chain
IBLI	Index based livestock insurance
ICBT	Informal cross border trade
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Centre
IFPRI	International Food Policy Research Institute
IGAD	Intergovernmental Authority of Development
ILO	International Labour Organization
ILRI	International Livestock Research Institute
ISFM	Integrated Soil Fertility Management

ISO	International Standards Organization
ITU	International Telecommunication Union
IUU	Illegal, Unregulated and Unreported
KfW	Kredit fuer Wiederbau
LSD	Lumpy Skin Disease
LVFO	Lake Victoria Fisheries Organization
MT	Metric ton
NAIP	National Agricultural Investment Plan
NARO	National Agricultural Research Organization
ND	Newcastle disease
NDVI	Normalized Difference Vegetation Index
NEPAD	New Partnership for Africa Development
NFG	Nyabyumba Farmer Group
NGO	Non-Governmental Organisation
NTM	Non-Trade Measures
OECD	Organisation for Economic Cooperation and Development
OSBP	One stop border point
PAE	Public Agricultural Expenditure
PAH4	Polycyclic Aromatic Hydrocarbon
PES	Payment for Ecosystem Services
PICS	Purdue improved crop storage
PMV	Plan Maroc Vert (Green Morocco Plan)
PPP	Public-private partnership
PPR	Peste des petis ruminants
R&D	Research and Development
RAI	Rural access index
RCT	Randomised Control Trial
REC	Regional Economic Community
RESAKSS	Regional Strategic Analysis and Knowledge Support System
RHI	Regional homophily index
SAATM	Single African Air Transport Market
SACCOS	Savings and Credit Cooperative Society
SADC	Southern Africa Development Community
SLM	Sustainable land management
SLWM	Soil, land and water management

SME	Small and Medium Enterprise
SMS	Short Message Service
SPS	Sanitary and Phyto-Sanitary
SSA	Sub-Saharan Africa
SSF	Small Scale Fisher
TAD	Transboundary Animal Disease
TAHA	Tanzania Horticultural Association
TBT	Technical Barrier to Trade
TOSCI	Tanzania Official Seed Certifying Institute
TVET	Technical and vocational education training
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Education, Science and Culture Organization
UNIDO	United Nations Industrial Development Organization
UPF	Ultra Processed Foods
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data
WANA	West Asia and North Africa
WFP	World Food Programme
WRS	Warehouse receipt system
ZEF	Zentrum fuer Entwicklungsforschung

Foreword

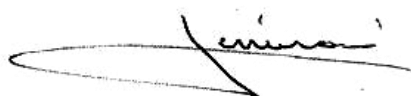
The African agricultural sector has been referred to as the giant needed for African socio-economic growth and development. However, stressors associated with climate shocks, COVID-19 pandemic, local conflicts and crises and global supply chains distortions have exposed the vulnerability and the sad realities of this sleeping giant. This negative appellation is derived from recognizing the huge and latent potential of the sector, associated with adequate and favorable soils and climatic conditions, a young and dynamic labor force and huge market opportunities against its – paradoxically – abysmal performance. Low resource productivity with little or no value addition has been identified as the bane of the sector. It goes without saying that African agriculture cannot be competitive without value addition. Nor can it foster sustainable livelihoods with the present low productivity profile. There are strong linkages and complementarities between high agricultural productivity and agricultural value chains development. The African Union’s Agenda 2063- the Africa We Want- proposes robust agro-led industrialization as a precondition for Africa’s economic transformation. The African common position to the UN’ Food Systems Summit rides on the Agenda 2063 proposal and suggests how the industrialization and value addition of Africa’s food systems, with strong multisectoral linkages to domestic and regional economies, can help African countries achieve higher economic growth rates, economic diversification and transformation, and reduce their exposure to external shocks.

The present “Guidelines for inclusive agricultural value chains development in Africa” publication is the product of peer learning. It assumes that African economies have somewhat related challenges and destinies. It documents success stories of agricultural food systems transformation and recommends requisite institutional and policy prescriptions along the different value chains. It adopts a chain-wide approach to reducing transaction costs and promoting efficiency of value chains to build agricultural products’ competitive advantages. It supports inclusivity and takes into consideration the activities and interests of different actors along the value chains to ensure that no one is left behind. As a development blueprint, the Guidelines provide adaptable and adoptable prescriptions and recommendations needed to transform and reposition African food systems. We recommend the Guidelines to regional and national agricultural development planners, practitioners and implementers. We would like to congratulate the African Union’s Semi-Arid Food Grains Research and Development (AU-SAFGRAD) Office for developing the publication. It is our expectation that governments, at different levels, will take advantage of the Guidelines in planning and developing sustainable and inclusive agricultural value chains.

H.E. Amb. Jossefa Sacko

Commissioner Agriculture, Rural Development
Blue Economy and Sustainable Environment

AUC



Dr. Jyotsna Puri

Associate Vice-President
Strategy and Knowledge Department

IFAD



Acknowledgements

The African Union Commission acknowledges, with appreciation, the contributions of the many organizations, experts and individuals who provided financial and technical supports in the development of these Guidelines. We recognize the financial contributions from the government of the Republic of Korea and the International Fund for Agricultural Development (IFAD). The “Guidelines for inclusive agricultural value chains development in Africa” benefited from the quality inputs and guidance of IFAD experts who were involved from its conception to validation.

The professional contribution of a team of consultants - Mr. Florens Turuka, Mr. Ephraim Nkonya and Mr. Moussa Bokar - is acknowledged. Our gratitude goes to the team of expert reviewers from Member States, the academia and the private sector who provided suggestions, and corrections at the various rounds of revision of the draft. Immense appreciation goes to several individual agricultural commodity and trade development experts and stakeholders who volunteered their time and resources in the independent reviews of sections of the Guidelines. We acknowledge the support and invaluable contributions of AU-SAFGRAD’s staff in developing the Guidelines.

Executive summary

Agriculture is an important sector in much of Africa, accounting for 16% of the GDP and 50% of labor force employment, notwithstanding its low productivity when compared to other continents. It comprises crops, livestock, fisheries, and forest. Africa's population is growing and is predominantly composed of youth aged between 15 and 24 years. Women's participation in agriculture is high, with more of them engaged in the early stages of the value chains associated with production. With much of the future employment expected to come from agriculture and considering the wealth-creating potential of the sector, it is important to ensure that participation in the agricultural value chain becomes more inclusive. Africa's participation in global value chains has lagged, engaged predominantly in exporting raw materials (forward linkage) with little value addition, if any, occurring at the lowest level.

Urbanization is increasing and is highest in North Africa, with about 80% of the population living in urban areas compared with an average of 50% in Africa as of 2015. Urbanization, increasing incomes, changing food preferences, and limited industrialization have increased the level of unmet domestic demand for processed food and other products. Urbanization, increasing incomes, and food preferences have bolstered changing consumption patterns with consequential positive and negative outcomes.

One of the 2014 Malabo's Commitments is to cut the poverty rate by 50% by 2025 through inclusive agricultural growth and transformation. One of the aspirations of the African Union Agenda 2063 is to have inclusive growth and sustainable development. Inclusive value chains development presents a viable way of achieving this, considering the agrarian nature of the economies. African countries should increase commodity value addition as part of the efforts towards industrialization at all levels, focusing on small and medium enterprises (SMEs) and agribusinesses. The 2005 Arusha Declaration on African Commodities emphasizes commodity-led industrialization with the agricultural value chain as a priority investment.

Against this backdrop, these guidelines have three objectives: (i) Assess previous agricultural value chains development efforts across the continent and highlight the associated challenges and successes; (ii) Propose guidelines and game-changing policies and strategies for developing agricultural value chains (crops, livestock, and fisheries) pathways from farm to fork; and (iii) Identify and connect the policy and institutional factors needed for successful implementation. The guidelines have been developed based on empirical evidence and practices in the sense that whatever is recommended has been tested successfully in an African environment.

In terms of methodology, despite the lack of consensus on the definition and meaning of agricultural value chains, these guidelines consider AVCs to encompass the entire value chain from farm to fork, with the fork going beyond conventional consumption to include products such as clothes, fiber, as well as leather. Likewise, the "farm" also includes fishing. Based on the literature review, guidelines for crops, livestock, fisheries, and aquaculture have been developed, accompanied by success stories and experiences to illustrate, and clarify the

proposed guidelines and interventions. Case studies have been identified and shared to help practitioners understand what worked where and under what conditions.

The guidelines reviewed some major continental-wide policies, flagships and strategies that emphasized inclusive and sustainable agricultural value chains development. These include the 2003 Maputo Declaration, 2014 Comprehensive Africa Agriculture Development Programme (CAADP), 2005 Arusha Declaration, Programme for Infrastructure Development in Africa (PIDA) and Agenda 2063 and some related flagships such as African Integrated High-Speed Train Network (AIHSRN); Single African Air-Transport Market (SAATM); Pan-African e-Network; and the African Continental Free Trade Area (AfCFTA).

The guidelines also considered some cross-cutting issues that affect agricultural value chains efficiency. These include issues of urbanization, private sector involvement, mechanization and growth of cheap energy source such as solar-powered equipment, deployment of geospatial and information and digital technology in designing and developing efficient, sustainable, and inclusive AVCs. Others include climate change and the use of Climate-smart agricultural (CSA) technologies, advances in productivity enhancing inputs/technologies, innovative financing technologies, natural resource management, policy, infrastructure and institutional factors. The cross-cutting issues define the scope of the drivers of iAVCD. Drivers of agricultural value transformation included growing middle-income population, urbanization, market-oriented policies, globalization as well as endogenous evolution of practices, standards, and technologies. They offer a plethora of opportunities and strengths that can be manipulated to improve chain efficiency through reducing transaction costs in developing inclusive and sustainable value chains. The guidelines draw largely from lessons learnt and best practices for specific value chain development efforts in the continent. The game-changing policies and strategies were specific for value chains and addressed the supply- and demand-side interventions. The demand-side interventions target increasing production and productivity while the supply-side interventions target postharvest value addition, market access and consumption.

Game-changing policies and strategies for enhancing marketing and trade identified the proximate challenges of marketing and trade as the poor market infrastructure, limited smallholder market participation and limited regional and international trade. To address these challenges, governments and development partners need to consider the following game-changing policies and strategies:

- *Building robust market infrastructure within countries and across countries*
- *Promoting Vertical linkage of value chains*
- *Participation in global value chains*
- *Strengthen linkage of the rural-urban agri-food systems*
- *Formalization of Informal cross border trade (ICBT)*
- *Promoting Intra and extra-Africa trade*
- *Increase nutrition education*
- *Enhance the rural-urban food systems linkage*

- *Build vertical linkages between producers and consumers*
- *Exploit the ICT in promoting nutrient-dense and healthy diets*

Sustainable and inclusive guidelines for crops

- (i) Supply-side strategies include providing training and services to agro-input dealers to deliver appropriate and timely information; streamlining the supply chain to reduce input markets fragmentation and enhance efficiency. It also includes providing incentives to agro-input dealers and service providers to collaborate and increase efficiency in input distribution; and enforcing quality standards to ensure inputs used by producers meet the required minimum standards.
- (ii) Demand-side strategies include the provision of pluralistic advisory services covering the appropriate nodes in the agricultural value chain and not production only; and the provision of targeted incentives for adopting sustainable land management and climate-smart agricultural practices.
- (iii) Cross-cutting strategies include enhancing market infrastructure, including transport, communication, storage facilities as well as power (energy); and planning and developing efficient and sustainable agricultural value chains using geospatial technologies.
- (iv) Sustainable investment of agricultural land strategies include developing national-level policies and legislations that create incentives for the adoption of sustainable land and water management practices.
- (v) Enhancing research and extension service strategies. This requires increased funding for research and development and extension services; revising agricultural college syllabi and retraining in-service extension service providers on new technologies beyond production-enhancing technologies; developing e-Extension services covering the entire agricultural value chain.
- (vi) Developing interactive e-Agriculture alliance program strategies involve promoting R&D and extension services targeted to high-value crops; targeting women, youth, and other land-poor groups. It requires building robust farmer groups to enhance collective marketing, and building robust agricultural value chain and vertical linkages to ensure high-quality produce and minimal post-harvest losses.
- (vii) Investment in the creation and development of farmer and agribusiness SME strategies entail investment in building a robust institutional capacity of farmer and agribusiness SMEs along the value chain; fostering vertical linkages; and developing the capacity of farmers and agribusinesses to provide financial and advisory services.
- (viii) Promoting and improving existing traditional and new post-harvest technologies suitable for smallholder and resource-poor crops, livestock, capture (wild) fisheries,

and fish farmers; providing incentives for the private sector to invest in producing and marketing sustainable and affordable post-harvest technologies.

- (ix) Other strategies include using geospatial technology to identify locations to invest in infrastructures such as rails, roads, electricity, storage, and processing equipment; providing subsidies, tax breaks, and other incentives to the private sector to invest in remote but high potential areas and promoting market and price risk management schemes such as a warehouse receipt system.

Sustainable and inclusive guidelines for livestock

- (i) Pastoral and agro-pastoral production systems strategies developing policies and strategies that recognize and support pastoral production systems.
- (ii) Strategies for the mixed livestock production systems include the promotion of sustainable crop-livestock production systems; promoting animal power technologies to enhance crop-livestock productivity; promoting high-nutrient pasture and agroforestry development and crop residue utilization, and promoting uptake of index-based insurance.
- (iii) Promotion of commercial livestock production strategies including productivity enhancement initiatives; provision of advisory services on livestock marketing; and establishing marketing infrastructure for live animals and livestock products.
- (iv) Smallholder dairy systems strategies include all guidelines under a mixed livestock production system, with adaptation to the dairy production system; establishing robust processing, storage, and transportation systems for smallholder producers; sustainable cleaning and disposal of manure; and promotion of ICT in production and marketing information among smallholder dairy farmers.
- (v) Small ruminants' strategies include genetic improvement, improved feeding systems and supplementation, and improved animal health.
- (vi) Poultry strategies include holistic vaccination, improved management, genetic improvement, and effective linkages to poultry markets.
- (vii) Strategies for pigs include improving local breeds; improving the feeding system and minimizing scavenging; improving veterinary and health services; and enhancing extension and marketing services.

Sustainable and inclusive guidelines for fisheries

- (i) Capture fisheries strategies include designing stronger small-scale fisher country and transboundary fisheries policies; developing and fostering Small-scale fishermen associations; improving fish stock assessment and monitoring using novel and cost-effective data capture approach; incentivizing and promoting

sustainable fish capture, processing, and marketing; and addressing and promoting adaptation to climate change.

- (ii) Aquaculture strategies include mapping areas suitable for aquaculture production; promoting climate-resilient and integrated production systems; supporting the development of small-scale aquaculture organizations; and enhancing sustainable post-harvest technologies.

Sustainable and inclusive guidelines for marketing and trade

- (i) Domestic markets strategies include planning for sustainable and inclusive value chain, analyzing agricultural value chains; and building strong horizontal linkages.
- (ii) Developing regional and international marketing strategies that include reducing and ultimately removing trade barriers, increasing quality standards and fostering trade integration, prioritizing agro-industrialization and quality standards; improving access to market and power in rural areas; diversifying trading partners, and exploiting the powers of ICT.

Chapter 1: Introduction

1.1 Overview

The African region is endowed with natural resources and has the youngest population on earth. It is estimated that by 2050, about 50% of land converted to cropland and grazing land will come from Africa.¹ Agriculture – which includes crops, livestock, and forestry – is a backbone of many African countries. Agriculture accounts for 16% of Africa’s GDP and employs 50% of its labour force.² Livestock play a pivotal role in Africa’s economic, social, and food sectors. The livestock sector in Africa accounts for 24% of the total three billion heads of cattle globally. Over 300 million people in Africa, who earn less than \$2 per day, keep livestock.³ Agricultural processing is limited in Africa compared to other continents.^a It is for this reason that Africa’s Agribusiness and Agro-Industries Development Initiative (3ADI) set an objective of ensuring that by 2020, about 50% of food products sold in the domestic markets would be processed.

The African continent accounts for 24% of the global freshwater fish stocks⁴, and fish accounts for 19% of Africa’s animal protein intake.⁵ Additionally, wild fishing and aquaculture employ 5.5 million people or 1.1% of the region’s total labour force.⁶

In 2015, Africa was home to 226 million youth aged 15 to 24, equivalent to 19% of the corresponding total global population.⁷ About 19% of the sub-Saharan African and 27% of Arab Maghreb Union (AMU)^b youth aged 15 to 24 years, are unemployed and are actively seeking employment.⁸ Underemployment among youth is also increasing.⁸ The corresponding unemployment rate for adults aged 25 years or older is about 6% in SSA and 12% in AMU.⁸ In Africa, women’s participation in the agricultural market is lower than men’s.⁹ In Ethiopia, a study showed that the share of women farmers who sell maize was significantly lower than the share of men.¹⁰ Similarly, women are less likely to grow export crops or other high-value crops, yet, when they grow such crops, their returns are higher than men’s.¹⁰ Building inclusive agriculture demands involving the women and youth along the entire value chain. Women have a comparative advantage in the processing sector, and it is for this reason that targeting them in programs that promote processing will simultaneously enhance efficiency and value addition, create employment, and reduce poverty – especially among women and youth. For example, agro-processing accounts for 30% of the manufacturing sector employment in SSA.

Agricultural productivity in Africa is the lowest in the world and, as a result, has the widest yield gap – the difference between potential and actual yield.¹¹ In addition, even though Africa is well-endowed with wild fish and aquaculture potential, wild fish catch is the lowest in the world and aquaculture development is generally low, dominated by Egypt and Nigeria. The two countries accounted for over 80% of total aquaculture production in the region in 2018.⁶

^a For example, only 30% of agricultural produce in sub-Saharan Africa (SSA) is processed.

^b Arab Maghreb Union

Livestock productivity is equally low. It takes seven African cows to produce one ton of milk per year, while only one American cow produces the equivalent per year.⁶

In terms of value addition, Africa is a global commodity producer, as its integration in the global value chain (GVC) is mainly in supplying raw materials to the world market.¹² Additionally, Africa's industrialization has lagged behind while its urbanization rate has increased at the same pace as Asia's in the last 50 years, especially in oil and mineral-rich countries.¹³ Urbanization without significant industrialization has created a large demand for imported foods and tradable goods (manufactured products and tradable services such as finance) and consumption cities in resource-rich countries alongside-production cities in countries with limited oil and mineral resources.¹³

With fast-growing urbanization and middle-income population, African consumption patterns are quickly changing. Between 2016 and 2020, five of the ten fastest-growing economies in the world were African countries – namely Ethiopia, Guinea, Cote d'Ivoire, Djibouti, and Tanzania.¹⁴ In 2015, about 50% of the African population lived in urban areas. Overall, North Africa is the most urbanized region, with over 80% of its population living in urban areas.¹⁵ Food tastes and preferences of the growing middle-income population are different from the traditional starchy staple foods, prompting an increase in highly processed foods and higher quality standards and grading.¹⁶ Changing food tastes and preferences has been associated with a rise in obesity among urban adults alongside stunting and wasting among urban children under five years.¹⁷ One of the most effective strategies in addressing this double burden of malnutrition (DBM) is improving the agricultural value chain while strongly linking the rural supply with the urban population.¹⁶

1.2 Rationale

African countries, regional and sub-regional bodies have designed and reviewed policies and strategies to increase agricultural productivity, value addition, and market integration. Specifically, one of the seven Malabo Declarations on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihood is to cut the poverty rate by half by 2025 through inclusive agricultural growth and transformation.¹⁸ One of the strategies for achieving this goal is creating inclusive public-private partnerships for priority agricultural commodity value chains. This is strongly linked to smallholder farmers.¹⁸ Likewise, the African Union's Agenda 2063 aspiration is for a prosperous Africa based on inclusive growth and sustainable development. With respect to agriculture, some of the Africa 2063 goals include transforming economies, modernizing agriculture for increased productivity and production, enhancing the blue/ocean economy, and creating environmentally sustainable and climate-resilient economies and communities. Under this, the African Union aims to motivate African countries to increase commodity value addition as part of the efforts toward industrialization at all levels with a focus on small and medium scale enterprises (SMEs) and agribusinesses.¹⁹ In particular, the Arusha 2005 Declaration on African Commodities focused on commodity-led

industrialization where agricultural value addition is one of the priority investment areas aimed at integrating African countries into the global value chains. A secondary goal is to promote vertical and horizontal diversification anchored in value addition and local content development.²⁰

In supporting African Union Member States to achieve their policy objectives, these guidelines have been developed with three main objectives:

- (i) Assess previous agricultural value chains development efforts across the continent and highlight the associated challenges and successes.
- (ii) Propose guidelines for developing agricultural value chains (crop, livestock, and fisheries) pathways based on actors and activities performed (farm to fork).
- (iii) Identify and connect the environmental and institutional factors needed for successful implementation.

These continental guidelines are expected to stimulate the interest of African Union Member States to design sustainable, competitive, and inclusive agricultural value chains directing the formulation and implementation of Regional and/or National Agricultural Investment Plans (NAIPs). The guidelines have been formulated based on empirical evidence and best practices, and they take into consideration the unique situations that Member States face, what worked where, and why.

1.3 Methodology

There is no consensus on the definition of an agricultural value chain (AVC). Some researchers state that “the vast AVC encompasses the whole post-farm gate range of processing, storage, transport, wholesaling, retailing, food service, and other functions that transform the agricultural outputs produced in farms into the foods humans consume (multiple times every day) and other products.”²¹ In the context of these guidelines, AVC encompasses the entire value chain from farm to fork. In this context, fork goes beyond consumption as food/feeds, it also means products such as clothes, fibre, leather, and manures.

The methodology used follows the three main objectives. The **first objective** is to “assess previous agricultural value chains (AVC) development efforts across the continent and highlight its challenges and successes.” In achieving this objective, a systematic literature review has been used in identifying and critically evaluating the literature while analysing the data to determine patterns, relationships, and disagreements that have been reported.^{22,23} The review also included selected country project completion reports with a value chain focus.

In conducting the systematic and grey literature review, selected literature criteria were specified to enable the objective comparison of results and to draw unbiased conclusions. The study also used quantitative methods to analyze one or more of the performance indicators of

the sustainable and inclusive agricultural value chains. Chapters four through seven, which discuss each node of the value chain, used this approach to achieve this objective.

In addition, interviews with regional and national technical staff and high-ranking policy makers were conducted to gain insights into the agricultural value chains. The systematic review helped identify best practices in implementing sustainable and inclusive agricultural value chains with good results.

The **second objective** was “to propose agricultural (crop, livestock, and fisheries) value chains’ development pathways based on actors and activities performed (farm to fork).” In achieving this objective, literature review results were used to prepare the guidelines for inclusive, sustainable, high-performing, and efficient agricultural value chains, which benefit all stakeholders, especially the vulnerable groups who are, in most cases, left outside the value chain. Chapter eight develops the guidelines under value chains (crops, livestock, and fisheries). Some success stories have been highlighted to illustrate guidelines’ effectiveness. Case studies have been identified and shared to help practitioners understand what has worked and what improvements are required for replication in a different environment.

The **third objective** was “to identify and connect the policy, environment and institutional factors needed for successful implementation”. These internal and external factors promote inclusive agricultural value chain’s development in the Member States. This objective, discussed in chapter three on cross-cutting issues, is complementary to the first objective. Accordingly, the guidelines include strategies required to incorporate important cross-cutting issues in developing sustainable and inclusive AVCs.

The rest of the report is organized as follows: Chapter 2 presents policies and strategies for achieving sustainable and inclusive agricultural value chains. Chapter 3 describes cross-cutting issues requiring environmental and institutional factors to achieve an inclusive and sustainable agricultural value chain. The next five chapters follow the value chain, from farm to fork, as illustrated in the diagram below.



Chapter 4 explores the inclusive and sustainable production. Given the diversity of agriculture and fish sectors, eight different groups of commodities are covered under the production node – as illustrated in the diagram below.

Commodities covered at the production value node



Photo Credit: Milo Mitchell

However, the subsequent nodes do not separate the discussion into the eight commodities as their attributes are closely related. Chapter 5 examines the post-harvest handling – which includes storage and processing of crops, livestock, and fish. Agro-industrialization is also covered in this chapter. Chapter 6 explains agricultural marketing and trade issues, while Chapter 7 discusses food consumption (the fork). The last chapter, Chapter 8, presents the guidelines for achieving sustainable and inclusive value chains for crops, livestock, fisheries, and aquaculture.

Chapter 2: Continental commitments and flagship programmes that support iAVCD

2.1 Introduction

Some Continent-level Commitments and flagship programmes that support and complement the development of inclusive agricultural value chains are identified and discussed. They include the Maputo Declaration, the Comprehensive Africa Agriculture Development Programme (CAADP), Agenda 2063 – The Africa We Want, and the African Continental Free Trade Area (AfCFTA).

2.2 Maputo Declaration

Maputo Declaration, signed in 2003, sets ambitious targets guiding Member States in their agricultural investment programs. The declaration is part of the New Partnership for Africa Development (NEPAD) 2001 and the implementation of the Comprehensive Africa Agriculture Development Programme (CAADP). Its most consequential resolution – for which it is well-known – is its target of allocating at least 10% of the government budget to agriculture. Arguably, investment in agriculture, such as expenditures on agricultural research, extension services, value addition and development of support infrastructure such as rural roads, is expected to positively impact AVC performance.

The Maputo Declaration resolutions specific to AVC include:

- (i) Developing inclusive value chains to achieve higher productivity in crop, livestock, forests, and fishery. The “inclusive” statement reflects the region’s challenge of women, youth, and other vulnerable groups who have large potential in enhancing the value chains yet are excluded from the value chain.
- (ii) Empirically-based policy prioritization of flagship AVC projects and action plans at national, regional, and continental levels.
- (iii) Agricultural development, investment, and policy prioritization for establishing broad-based partnerships, consultative and inclusive processes, and implementation at national, regional, and continental levels.

These resolutions are crucial for steering the African Union Member States from production-focused policy design and investment to a broader focus covering the entire AVC.

2.3 Comprehensive Africa Agriculture Development Programme and the 2014 Malabo Commitments

CAADP is closely linked to Maputo Declaration. Its goal is to support African countries in their agricultural development planning and investment to achieve agricultural-led economic growth and end hunger, reduce poverty and expand exports. CAADP is formulated on four closely related pillars, which cover the entire value chain:

- ***Pillar 1: Extending the area under sustainable land management and reliable water control systems.*** This pillar essentially covers the initial stage of the AVC – that is, natural resources and production processes – and emphasizes sustainable management and production.
- ***Pillar 2: Improving rural infrastructure and trade-related capacities for market access.*** This pillar addresses the entire processing and marketing activities and associated market and trade-related infrastructure constraints. This means pillars 1 and 2 cover the major AVC nodes before the consumption node, which is covered in the third pillar.
- ***Pillar 3: Increasing food supply and reducing hunger.*** The pillar aims to increase food production and improve distribution - and ultimately consumption - to reduce hunger. Pillar 3 covers the last node of the AVC, that is, consumption.
- ***Pillar 4: Agricultural research, technology dissemination, and adoption.*** Research and Development (R&D) and extension services are cross-cutting strategies that are important in supporting the performance along the entire agricultural value chain. This pillar is cross-cutting in all nodes of the AVC and is crucial for achieving the objectives of all the pillars.

In marking the 10th Anniversary of CAADP, the African Union declared the year 2014 as the “Year of Agriculture and Food Security”. The climax of the anniversary was the 2014 Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods. The Malabo Declaration is a recommitment to the CAADP. It had seven key Commitments and all the Commitments are directly or indirectly linked to iAVCD. The direct linkage areas include:

- **Inclusive AVC:** Malabo Declaration is committed to building an inclusive agricultural sector that includes women, youth, and other vulnerable groups participating and directly benefiting from the growth and transformation opportunities. The Malabo Declaration set a target to create job opportunities for at least 30% of the youth in agricultural value chains and facilitate preferential entry and participation for women and youth in the agri-business opportunities.
- **Agro-industrialization:** Considering Africa’s limited value addition and the consequent low competitiveness of its agricultural produce, the Malabo Declaration recommended

implementing the 2010 Abuja Declaration on Development of Agribusiness, which endorsed the African Agribusiness and Agro-Industries Development Initiative (3ADI). The 3ADI set an objective of ensuring that by 2020, about 50% of food products sold in the domestic markets are processed. The initiative brought the private sector to centre stage in achieving the goal of mobilizing financial resources for agribusiness and agro-industrial development. The Malabo Declaration further reaffirmed the 3ADI initiative by committing to build a private-public partnership to facilitate local private investors to be engaged in agribusiness and agro-industrialization. The initiative is expected to create jobs for women and youth as well as engage smallholder farmers in the AVC.

- **Tripling of intra-Africa Trade by 2025:** This resolution is key in facilitating intra-Africa trade, which has remained low for decades. If the current trend holds, more efforts are needed for Africa to achieve its target of tripling intra-Africa trade by 2025. However, the faster growth of intra-Africa trade of processed goods shows favourable impact of agro-industrialization and the growing influence of the middle-income consumers who prefer processed agricultural produce. This implies that increasing agro-industrialization will enhance the aspiration of achieving AU's goal of tripling intra-African trade.

Overall, the Malabo Declaration has reinvigorated Member States' commitment to achieving the CAADP goals. As expected, the Biannual review and other studies tracking its targets show both promising and challenging results. However, there is general progress towards achieving the targets.

2.4 Arusha Declaration 2005 on African Commodities

The 2005 Arusha Declaration on African Commodities was formulated to address Africa's predominantly limited value addition to raw commodities traded. The Arusha Declaration specifically focuses on AVC – reflecting the AU's renewed effort of modernizing agriculture. The Arusha Declaration sets a Plan of Action with the following strategies:

- (i) *Improving the commodity situation.* This action aims to reduce commodity tariffs, improve commodity prices, and coordinate with Member States to reduce excess supply of commodities for which African countries are key exporters. Additionally, the action plan includes value addition and improving standards and certification processes, and aggressively promoting African commodities in the international market. The action is expected to increase demand for African commodities in the growing middle-income population and international markets.
- (ii) *Improving the competitiveness of Africa's commodity sector and its contribution to development.* This resolution is expected to be achieved by increasing agricultural productivity, competitiveness, investments in rural infrastructure and logistics, and

enhance land tenure systems. It also aims to increase agricultural technical services to help farmers increase productivity, quality and market participation, and enhance the capacity of small-scale producers and organizations to increase their production and market participation. Additionally, it requires governments to design regulations that reflect the needs of the private sector and facilitate its participation along the value chain, especially those that incentivize conducting business with vulnerable groups.

- (iii) *Improving the participation of African producers and businesses in international supply chains.* The resolution aims to increase efficiency along the agricultural value chains by improving communication and networks among stakeholders and investing in the improvement of sanitary and phyto-sanitary (SPS), quality and standards compliance for small-scale producers for the national, regional, and international markets. The resolution also requires African countries to design policies and measures to address market entry barriers and promote commodity diversification.
- (iv) *Creating enabling environment for market expansion.* The resolution aims to eliminate prohibitive tariff and non-tariff regulatory obstacles, design rules and regulations that enhance competition, and promote South-South and regional trade.
- (v) *Commodity finance and coping with shocks.* The resolution aims to facilitate the participation of smallholder farmers and SMEs in the agricultural value chains; promote the creation of market-based rural financing and risk management mechanisms. In attaining this, governments are encouraged to engage in public-private partnerships to create efficient and market-based finance and shocks-coping strategies.
- (vi) *Commodity exchanges.* The resolution reiterates commitment to the establishment of commodity exchanges amongst African Union Member States aimed at promoting market-based structured marketing systems for smallholder producers and agribusinesses and hence contributing towards inclusive agricultural value chains.

2.5 Agenda 2063 – The Africa We Want

Agenda 2063 is Africa's strategic framework to build an inclusive and sustainable economic growth and development. Agenda 2063 was signed in 2013 and set the goals to be achieved in 50 years – i.e., by 2063. Two of the seven aspirations are directly relevant to iAVC. Thus, the numbering of goals isn't continuous. The first aspiration is "a prosperous Africa, based on inclusive growth and sustainable development." Under this aspiration, Agenda 2063 aims to achieve healthy and well-nourished Africans. This goal is relevant to the consumption node of the iAVC. The fifth goal sets a target of achieving modern agriculture for higher agricultural productivity – which is relevant to the first node of iAVC. The sixth goal is on the blue economy, under which sustainable fish production and biodiversity conservation are emphasized. Likewise, goal seven is about environmentally sustainable and climate-resilient economies and communities. This is a cross-cutting goal that affects all nodes of the iAVC. The sixth aspiration

sets goals that aim to achieve inclusion, emphasizing involving women and youth. Inclusive AVC is one of the major areas of this study. Its first goal is full gender equality and empowerment of women and girls. The second relevant goal is engaging and empowering youth and children.

The Agenda 2063 has 15 flagship projects – whose overarching objective is to accelerate the region’s development, economic growth, and to promote its history and culture. Five of the 15 flagship projects are directly relevant to iAVC^c and will be discussed in this section. The five iAVC-relevant flagship projects include: (i) Continental Commodities Strategy; (ii) African Integrated High-Speed Train Network (AIHSRN); (iii) Establishment of a Single African Air-Transport Market (SAATM); (iv) The Pan-African e-Network; and (v) The African Continental Free Trade Area (AfCFTA).

2.5.1 The Continental commodities strategy

The overarching objective of the African commodities strategy is to transform the region’s agricultural sector from raw material exporter to an exporter of value-added competitive products. The strategy also aims at creating forward and backward linkages to other sectors of the economy. This strategy will eventually integrate Africa into the regional and global value chains by creating horizontal and vertical diversification – with value addition and innovation being the central strategies. This strategy is closely related to the African Agribusiness and Agro-Industries Development Initiative (3ADI), which sets an objective of ensuring that by 2020, about 50% of food products sold in the domestic markets are processed.

2.5.2 Transportation, information and communication technology

Three flagship projects fall under transportation: (a) African Integrated High-Speed Train Network (AIHSRN); (b) Establishment of a Single African Air-Transport Market (SAATM) and (c) The Pan-African e-Network. Each is briefly explained in the following paragraphs.

African Integrated High-Speed Train Network (AIHSRN): The main objective is to establish a modern railway network aimed at facilitating the intra-African trade through the AfCFTA. The existing railway system was largely constructed during colonial era with its main objective of transporting export goods to Europe and other non-African countries. Agenda 2063 has set a target of connecting all African capitals and commercial centres with the High-Speed Train Network. This will reduce the transaction costs for the intra-Africa trade – which is currently high and thus hampering trade.

^c The 15 flagship projects are: Integrated High Speed Train Network; Formulation of an African Commodities Strategy; Establishment of the African Continental Free Trade Area (AfCFTA); The African Passport and Free Movement of People; Silencing the Guns By 2020; Implementation of the Grand Inga Dam Project; Establishment of a Single African Air-Transport Market (SAATM); Establishment of an Annual African Economic Forum; Establishment of the African Financial Institutions; The Pan-African e-Network; Africa Outer Space Strategy; An African Virtual And E-University; Cyber Security; Great African Museum and Encyclopedia Africana.

Related to land transportation, Agenda 2063 also sets a vision and roadmap of connecting Africa through world-class Infrastructure. Under this aspiration, Agenda 2063, a **Program for Infrastructure Development in Africa (PIDA)** has been set with a vision to address Africa's infrastructure deficit – especially the land transport. In addition to AIHSRN program, PIDA aims to build roads and corridors to facilitate AfCFTA implementation and industrialization. PIDA will connect cities and rural areas and open up land-locked countries – which in turn will improve regional and continental trade.

Single African Air-Transport Market (SAATM): The objective is to create a unified African air transport market by fully liberalizing intra-African air transport services such that African air carriers have market access, traffic rights and air services. It is expected that SAATM will increase connectivity, air carrier efficiencies, and improve safety and security standards and fair competition.

Pan-African e-Network: The aim is to develop an intra-African broadband terrestrial infrastructure; and enhance cyber security. This is in response to the growing ICT demand. The Pan-African e-Network aimed to increase broadband penetration by 10% by 2018 and broadband connectivity by 20 percentage points. The e-network also aims at providing access to ICT to school children in rural and metropolitan areas.

2.5.3 African Continental Free Trade Area

The African Continental Free Trade (AfCFTA) was established in 2018 as part of achieving increased intra-African trade and economic integration through the development of a single trade area. African Union Member States have signed AfCFTA, and 36 countries have ratified it – ushering in the beginning of its implementation on January 01, 2021. Its broad objective is to establish an Africa-wide free trade area. AfCFTA has eight general objectives, two of which are relevant to the inclusive and integrative AVCs:

- (i) Promoting and attaining sustainable and inclusive socio-economic development, gender equality, and structural transformation.
- (ii) Promoting industrial development through diversification and regional value chain development, agricultural development, and food security.

AfCFTA seeks to liberalize trade in African countries and design rules and regulations for conflict resolution among trading partners. AfCFTA also seeks to establish intellectual property, investment, and competition rights. Additionally, AfCFTA aims to exploit the ICT to enhance e-commerce.

Chapter 3: Cross-cutting issues enhancing successful implementation of iAVC

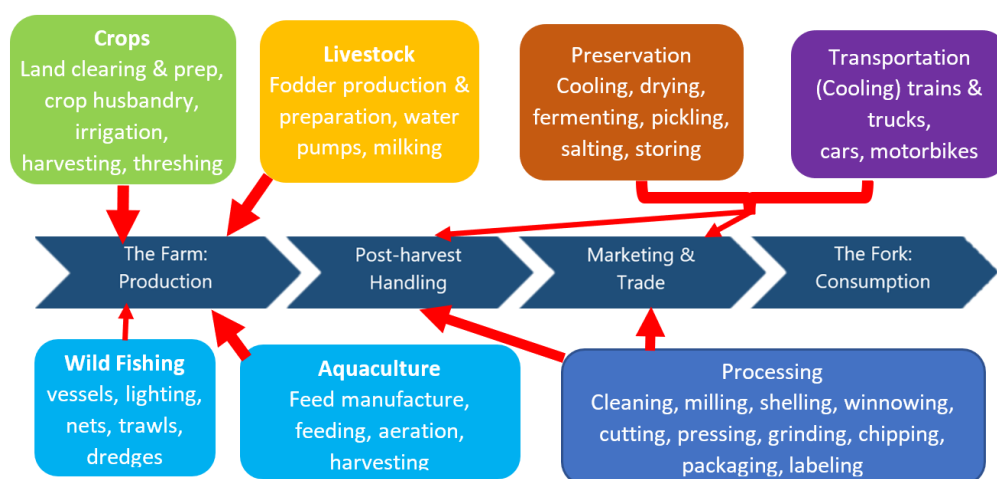
3.1 Introduction

Smallholder farmers heavily depend on natural resources. This means that sustainable and inclusive management of natural resources are important aspects that need to be taken seriously when implementing AVCs.

3.2 Agricultural and fish mechanization

Agricultural mechanization accounts for only 15% of farm power, while animal power accounts for 25%. Human power accounts for the largest share (60%).²⁴ One of the AU's statues is "Retiring the Hoe to the Museum." Accordingly, the AU has designed the Sustainable Agricultural Mechanization for Africa (SAMA) Framework, which lays strategies for retiring the hand hoe and building sustainable mechanization across the entire agricultural value chain. The following part covers agricultural mechanization across all value chain nodes. Figure 1 shows the type of technology and equipment required along the value chain of crop, livestock, wild fishing, and aquaculture. While the type of technology and equipment are specific to production, they tend to overlap beyond this node.

Figure 1 Agricultural mechanization across the value chain



Source: Adapted from Daum & Birner (2020).²⁵

Progress in mechanization has been different along the value chain. There has been significant progress in some nodes, while other nodes have experienced a decline. Over the past two decades, motorbikes from China, India, Vietnam and Indonesia have flooded the African markets.²⁶ In many instances, they have been used as taxi since they can reach locations that

are otherwise not motorable, consequently addressing the transportation challenges. At the same time, mechanical cereal processing has almost replaced the traditional and arduous methods of pounding and stone grinding. Hammer mills have become common in rural areas and are widely used. Cheap solar-powered equipment is also proliferating in Africa – a region which has the highest solar power potential.²⁷ The solar equipment is helping agricultural and fishery sectors. Between 2016 and 2019, 8.5 million people in SSA gained access to solar energy.²⁸ Artisanal fishers have used solar lamps for fishing and powering ice makers for quick cooling to preserve fish.²⁹ Despite these and other impressive achievements, mechanization has been stagnant in some areas. For example, over the past four decades, the number of four-wheel agricultural tractors rose from 172,000 in 1961 to 275,000 in 1990, but declined to 221,000 in 2000.^{30,31}

African countries have tried several government-sponsored tractorization programs, but most of such programs have had disappointing results. New market-led initiatives are bringing a new hope of mechanization for land preparation. Hello Tractor in Nigeria is an uber-like service, where farmers can rent a tractor by calling or texting an agent of Hello Tractor. The agent aggregates the requests and deploys the tractors according to demand and location of the farmers.³² In Zambia, Rent to Own is a nongovernmental organization, which leases equipment such as pumps, presses, tractors, shellers and bicycles to farmers.³³

The major challenge facing agricultural mechanization for land preparation and weeding is the supply side, rather than the demand.³⁴ The four-wheel tractors are too expensive and too big while farmers have small plots which are not amenable for preparation using tractors. Lack of knowledge of servicing and maintaining the tractor is another supply-side challenge of using/accessing/adopting tractor service. However, tractor prices are falling due to increasing acquisition of smaller tractors from Asia. Two-wheeled tractors from Asia are increasingly becoming common in Africa.

3.3 Climate change

Climate change affects the entire value chain, and this calls for action to investigate its effect on production, processing and consumption outcomes in agriculture and fisheries. The African Union has set strategies to ensure climate-resilient growth across all sectors and systems.³⁵ The AU's Agenda 2063, which aims to achieve climate-resilient economies forms the basis for the climate change strategy. The African Climate Change Strategy is aligned to the 55-Member State Nationally Determined Contributions (NDCs), National Adaptation Plans and long-term and climate-resilient development. The strategy emphasizes the importance of harmonized and coordinated response to the impact of climate change and building low-emission and climate-resilient systems.

The strategy's overarching objective of building low-emission and climate-resilient growth pathways across all sectors and systems means that all activities along the agricultural value chain need to be planned in such a way that they reflect the objectives of low-emission and climate-resilient objectives. Production needs to be planned so that it uses the climate-smart agricultural (CSA) practices – which have been proven to simultaneously help producers adapt to climate change. In aquaculture and fishing climate, warming water temperatures and stratification are affecting fishing and fish farming. Joint efforts to manage water bodies and fishing intensity could help communities dependent on fishing. At the same time, aquaculture strategies need to be modified to adapt to climate change. In marine fishing, ocean acidification and sea-level rising is affecting fishing. Oceans tend to suffer from the tragedy of the commons due to its open-access nature. This reinforces the need for collaboration among countries who share the water bodies to manage fishing and prevent destructive practices.

In summary, achieving climate-resilient inclusive agricultural value chains is possible if planners and investors consciously consider climate change in their activities. Additionally, incentives and sanctions could be created for actors along the value chain who adopt climate-smart practices or fail to embrace climate-smart practices respectively.

3.4 Sustainable and inclusive environmental planning and management

In designing sustainable and inclusive AVC, environmental protection needs to be considered. Strategies for achieving environmental protection include the following:

- (i) *Participatory and inclusive environmental planning system*: Empirical evidence has shown that inclusive and participatory planning and implementation leads to successful environmental protection. Successful community-based natural resources management (CBNRM) such as communal grazing lands, forests, wildlife, and water in Africa has been reported.³⁶ The CBNRM model vests decision-making in the hands of the communities that benefit directly and indirectly from the natural resources. However, for this to happen, national-level policies and institutions should give the local communities the mandate through meaningful devolution of power, that is, decentralization. Successful CBNRM has been registered in many cases where there is elaborate co-management of resources, including the following institutions: central authorities, local government, and local communities. All institutions share the rights and responsibilities to manage and equitably share the benefits. For example, in Namibia, CBNRM on land conservancy covers 14% of the landmass and has contributed to the reduction of poaching and wildfire incidences.³⁰ Similarly, in Cameroon, the new forest law gave a mandate to communities to manage up to 5,000 ha of forests under customary laws. Over 100 community forests have been established, and deforestation has declined.³⁰

- (ii) *Strengthen the capacity of the local communities*: One of the most daunting challenges of decentralization and devolution of decision-making has been the technical capacity of the local communities and their institutions.³⁷ Provision of regular and sustained technical support has helped local communities manage the environment and natural resources more sustainably.³⁰ The level of capacity required ranges from biophysical sciences, to socio-economic and political advisory services. A study found that enhanced capacity of local communities to engage with local and national governments increased their capacity to sustainably manage forests.³¹ Legal counsel is also important in ensuring that the communities negotiate legal challenges successfully and fend off opportunistic interest groups. In cases where successful restoration and management of natural resources has occurred, non-governmental organizations (NGOs) and other grass-roots organizations have helped provide technical support.^d
- (iii) *Designing sustainable and Inclusive AVCs using geospatial technology*: Geospatial technology can help in developing more efficient agricultural value chains. Geospatial technologies are advantageous since their data are low-cost - and sometimes free - and data capture frequency is high.³⁸ Geospatial technology is increasingly deployed in monitoring and assessing formulated policies and decision-making. For example, constructing a road using geospatial analysis will ensure the road serves the farmers efficiently and sustainably since its location will be overlaid with other factors that improve decision-making. When planning a road and other AVC infrastructure, it is important to include population, type and quantity of agricultural production, soil fertility, topography, erosion hazard, and other key aspects. An example of how geospatial technology could be used to improve decision-making and sustainable environmental management comes from South Africa – one of the countries that have extensively used geospatial technology and remote sensing in decision support and planning.

Case Study - Building an inclusive and sustainable AVC in South Africa

South African Department of Agriculture, Forestry, and Fisheries use a geographic information system (GIS) to support decision-making and information-sharing among government, farmers and other stakeholders. DAFF initiated the Agricultural Geographical Information System (AGIS) in 1996 (Lindemann and Weir-Smith 2005). Data and information generated and collected by AGIS are used to monitor crop conditions, licensing and certification, labelling, managing inspection process, and tracing agricultural produce. AGIS geodata is freely available to the public, and its use has increased tremendously over time.

^d For example, NGOs and religious organizations provided farmers with technical support to achieve the Niger's success story of greening of the Sahel.

The AGIS has facilitated accurate and low-cost data collection and planning agricultural value chains.

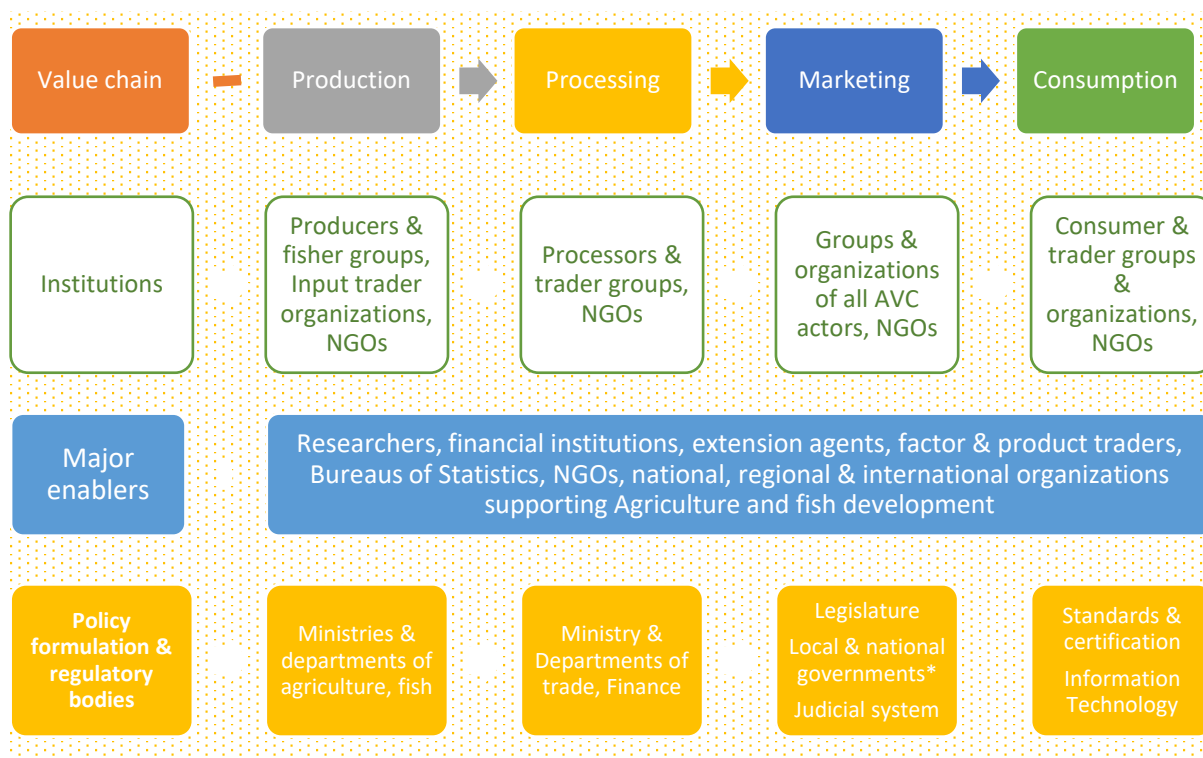
One of the AGIS data products is planning and mapping the location of agricultural supermarkets, agri-parks, and other service infrastructure to support smallholder farmers to participate in the AVC. Accordingly, South African Department of Agriculture, Forestry, and Fisheries has initiated the Agri-Parks Programme to support small and medium-scale agribusiness development, agro-industrialization, and facilitate the efficient AVC.^e The Agri-Parks Programme is developing a networked and coordinated AVC and provides agricultural advisory services and mentorship to smallholder farmers. The smallholder farmers own 70% of the Agri-Parks. Figure 3 shows how geospatial technology could be used to plan the most cost-efficient location of Agri-Parks and other AVC services. The map shows the location of Agri-Parks, supermarkets, and their distance to major cities. The geodata used in planning the Agri-Parks and other services includes spatially-explicitly human population and smallholder farmers, distance to consumers (major cities) and the land's agricultural potential.

3.5 Institutional factors for developing inclusive & sustainable AVCs

The formal definition of institutions, as used in this report, is according to Douglas North, who defines institutions as rules and regulations that shape human behaviour.³⁹ Institutions are required to ensure an inclusive and sustainable agricultural value chain. Figure 2 summarizes the type of institutions required at every node of the iAVC. The institutions are divided into primary, enabling and policy and regulatory institutions. For these institutions to be effective, coordination and engagement are necessary – i.e., involving all stakeholders in decision-making and resource allocation.

^e There are about four million smallholder farmers occupying only 13% of the agricultural land and contributing to only 5% of total value of agricultural production in South Africa (Aliber & Hart, 2009).

Figure 2 Institutional landscape of iAVC



* Excludes local and government ministries and departments listed earlier.

The groups at each iAVC node are the primary institutions that deal directly with activities of the value chain from production to consumption. In some cases, producers and other actors along the value chain may not be involved in groups or associations, but they are still affected by other institutions. Strengthening primary institutions is key to ensuring efficient iAVC.

The primary institutions are supported by enabling institutions that play a key role in providing technical, information, and financial support. For example, research, extension, and microfinance institutions are important in facilitating the operations of the primary institutions, while International organizations provide crucial technical and funding support to chain actors and to the primary institutions towards the development of iAVC. The upper level of the institution is the policy formulation and regulatory bodies – which are at the apex level and provide providing a pivotal role in the operations of the iAVC. They essentially play a governance role. Government effectiveness is defined as the quality of public and civil services and their degree of independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government’s commitment to such policies.⁴⁰ Government effectiveness improves community participation in decision-making.

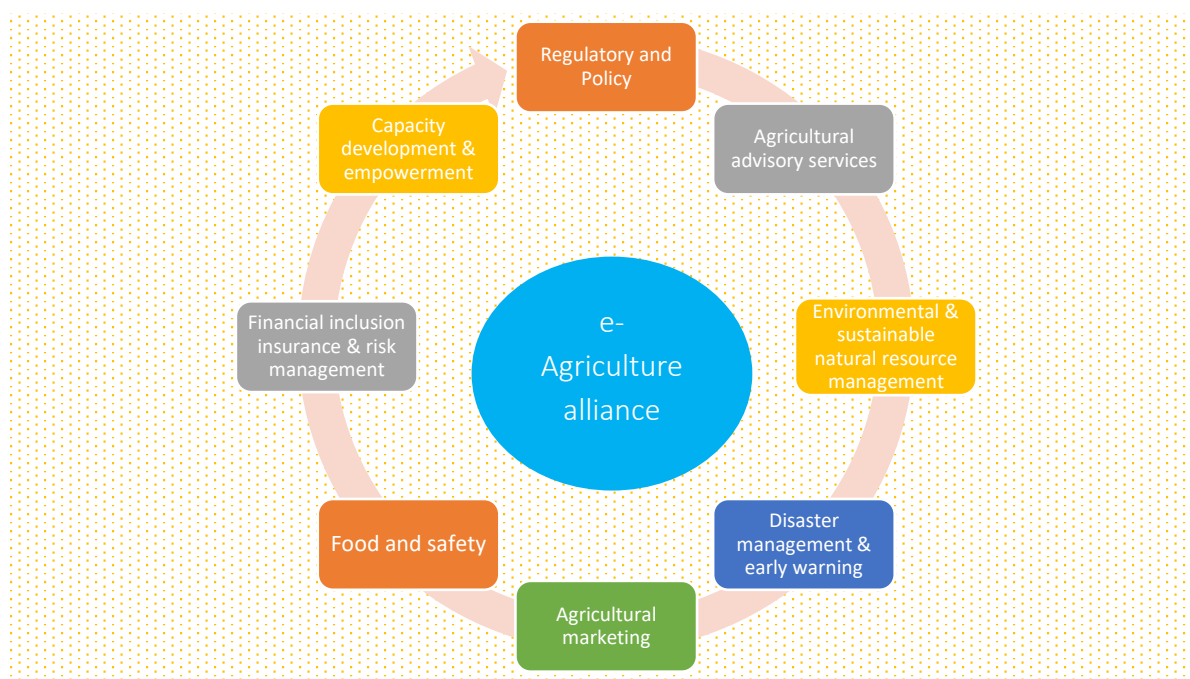
There are specific aspects of government effectiveness that directly contribute to sustainable management of production resources:

- (i) **Inclusive land and water tenure security:** Secure land and water tenure is a crucial factor that contributes to sustainable land management. Secure tenure incentivized land users to invest in long-term land improvement practices. However, one of the biggest challenges of land tenure security is the limited inclusion of women, youth, and indigenous people. In cases where secure land security has been given to women, significant improvement in household welfare has been observed.⁴¹ For example, in Ethiopia, women's income - and consequently household welfare - improved when land certification was given in women's names.⁴² The process to give land tenure security in women's names involved participatory community-level decision-making and planning aimed at empowering women and youth.
- (ii) **National-level policies supporting environmental protection and sustainable land management:** National-level policies play a key role in providing incentives for investment in land improvement and local-level management.
- (iii) **Rewarding environmental conservation and penalizing polluters:** Incentive-based environmental management and regulation have been effective both in high and low-income countries.⁴³ Payments for ecosystem services (PES) programs have been implemented in African countries and found to be effective when implemented based on rigorous analysis. For example, Nyungwe National Park in Rwanda has been paying communities for participating in the protection of wildlife.⁴⁴
- (iv) **Environmentally-friendly AVC:** Sustainable practices along the AVC are always directly attributed to sustainable land and water management. Beyond production, many practices can be made more sustainable. Examples of sustainable practices include pooling transportation to reduce carbon emissions when motor vehicles are used. In general, building AVC requires that environmental protection be taken into consideration and payment for ecosystem services can be included in the AVC – especially where there is strong monitoring and evaluation to ensure equitable and practical verification of ecosystem services.

3.6 Establish an interactive e-agriculture alliance program

It is important to build and foster an e-agriculture alliance in building synergies of rural services. As shown in Figure 3, the e-agriculture alliance developed by FAO and ITU includes eight synergistic and complementary agricultural rural services: Regulatory and Policy, Agricultural advisory services, Environmental and sustainable natural resource management, Disaster management and early warning, Agricultural marketing, Food and safety, Financial inclusion insurance & risk management, and capacity development and empowerment.

Figure 3 E-agricultural alliance



Source: FAO and ITU (2017).

3.7 Urbanization

Urbanization is one of the most profound transformations that the African continent will undergo in the 21st century. Since 1990, the number of cities in Africa has doubled from 3 300 to 7 600 – with their cumulative population increasing by 500 million people. Africa’s cities are the most rapidly growing cities in the world; they are the youngest and changing fast. Their impact on Africa’s economic, social and political landscape in the coming decades is likely to be profound. Urbanisation, therefore, presents immense opportunities for progress towards the 2030 and 2063 development agenda and for promoting continental integration.

3.8 Access to credit

Access to credit is important for purchasing inputs and equipment and starting new agricultural business. Financial inclusion in Africa has improved significantly in the last two decades due to the mobile money banking.⁴⁵ Mobile money account ownership in SSA – where it was invented – is the largest in the world and three times the global average of 10% mobile money account ownership.⁴⁶ Mobile money has been the driver of financial inclusion in SSA – especially for women and youth.

Chapter 4: Sustainable and inclusive crop, livestock and fish production



4.1 Introduction

This chapter analyses the first stage of the AVC (production) and covers all three main commodity sectors: crop, livestock, fisheries and aquaculture. In ensuring that the guidelines developed in Chapter 8 are based on empirical evidence, the discussion focuses on the drivers of achieving sustainable and inclusive production.

4.2 Drivers of inclusive and sustainable crop production

Drivers of sustainable and inclusive crop production include factors that facilitate economic and physical access to productive resources, enabling business and technological environment, facilitating infrastructure and a ready market. Membership of producer' groups, access to technical and market information, wealth index, and access to extension services are important determinants of adoption of sustainable production technologies.

- (i) *Membership of producer groups:* A key factor in the adoption of productivity-enhancing technologies is membership of a strong and independent producer organization. This is important for the resource-poor crop, livestock, and fishermen participating in AVC.⁴⁷ Export crop Producer cooperatives had robust horizontally and vertically-linked production, processing, and marketing systems. The cooperatives also provided input credit, advisory and marketing services. However, after independence, many cooperatives saw state involvement and control and, in some cases, their businesses were taken over by crop development authorities, weakening their financial base, independence, and performance.⁴⁸ Smallholder farmer groups have been developing and expanding beyond the export crops. However, smallholder farmer groups have struggled to grow due to their weak institutional capacity and limited public investment.
- (ii) *Access to information and agricultural extension services:* Lack of information and wrong or outdated information led to low adoption of improved production technologies.⁴⁹ Poor extension services limited the diffusion of appropriate information.
- (iii) *Resource endowment:* Producers with limited resources could fail to use improved technologies even when they knew the associated benefits. Adoption of technologies that require payment of upfront costs is a major constraint to resource-poor producers.

- (iv) *Secure land tenure*: Investments in land improvement - such as the adoption of agroforestry and other long-term land investments - require secure land tenure.^{50,51} However, studies have shown that smallholder farmers could perceive tenure security and eventually commit long-term investment even when they hold their land under customary tenure.⁵² Security perception under customary tenure is strongly associated with national-level policies that protect customary tenure.
- (v) *Access to credit*: Access to finance can help farmers overcome the resource constraints that prevent them from procuring improved production technologies. High uptake of production technologies has been observed when farmers are given loans in-kind for export crops and out-grower schemes.^{53,54}
- (vi) *Off-farm income*: A strong positive relationship exists between non-farm income and investment in agricultural production.^{55,56} Additionally, non-farm activities increase the propensity of poor farmers to escape poverty.⁵⁷
- (vii) *Proximity to roads and markets*: Access to roads reduces transaction costs for buying inputs and selling produce. Rural access remains one of the biggest challenges in achieving efficient AVCs in rural areas. On average, only 44% of the African rural population lives within 2 km of an all-weather road. It has been shown that halving travel costs would double the adoption of production technologies and reduce the adoption-remoteness gradient^f by 39%.⁵⁸ Information technologies reduce the search costs and improve prices received by farmers, especially when they have stronger bargaining power.⁵⁹

4.3 Inclusive and sustainable livestock production

Many animal species serve as sources of meat for African consumers. Cattle contribute about 35% of 21.3 million tons of meat produced in Africa between 2016-20. However, the prominence of cattle has been eroded by the increasing poultry production, especially in the last 30 years, during which chicken production increased more than twofold. The small ruminants (sheep) – which include goats and sheep - account for 18% of total meat production, making it the third most important source of meat in the region. The fourth major source of meat in Africa is the pig, which accounts for about 8% of production.

4.3.1 Cattle production

Cattle production systems in Africa fall into six major groups, and each has common and unique drivers of production (Table 1).

^f Adoption remoteness gradient is the downward sloping rate of adoption from areas with high market access to remote areas.

- (i) *Semi-arid and mixed production system*: This production system is the largest, and accounts for 31% of livestock production (Figure 4). It also accounts for 75% of SSA's tropical livestock units (TLU).⁶⁰
- (ii) *Sub-humid mixed production system*: This production system is the second largest, and it accounts for 22% of livestock production in SSA. It has the same attributes as the semi-arid and mixed system, but its herd size tends to be smaller since it is practiced in sub-humid areas where crop production is given higher priority.

Table 1: Livestock production systems in North Africa

Farming Systems	% of Land Area	% of Agriculture Population	Principal Livestock
Highland Mixed	7	30	Sheep
Dryland Mixed	4	14	Sheep
Pastoral	23	9	Sheep & goats
Arid	62	5	Camels, sheep
Urban	< 1	6	Poultry

Extracted from Mohamed et al. 2019.⁶¹

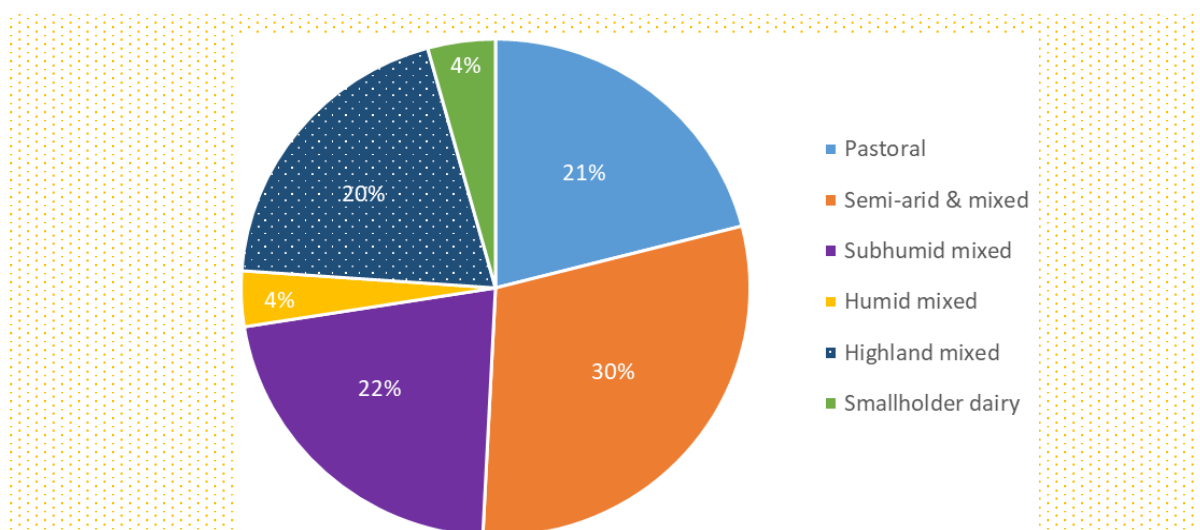
(iii) *Pastoral production systems*: This production is the third largest in terms of production, but it is practiced on 43% of SSA's land area, supports livelihoods of 268 million⁶², and accounts for 21% of Africa's total cattle production.

(iv) *Highland mixed production system*: This production system is characterized by even smaller herds, since land area per household is smaller in the densely populated highlands. The highland production system accounts for 20% of livestock production. Productivity in the highland mixed system is higher due to higher quality pasture and a better feeding system.

(v) *Humid mixed production system*: This production system accounts for only 4% of livestock production. Livestock in the humid areas benefit from better pasture, but smaller land areas. Thus, productivity is relatively higher than the other systems previously discussed.

(vi) *Smallholder dairy production system*: This production system uses mainly exotic breeds and is usually practiced in areas with high market access, with most farmers practicing zero grazing. Smallholder dairy farmers are highly commercialized.

Figure 4 Livestock by production systems in SSA



Source: Extracted from Otte and Chilonda (2002).

4.3.2 Poultry production

Chicken accounts for 97% of the poultry meat production in Africa.⁶³ Smallholder chicken producers in SSA account for 80% of the chicken population in the region.⁶³ Indigenous chicken is the most common type of chicken raised by smallholder farmers. Only 29% of chickens in SSA are raised under intensive systems.⁶⁴ The corresponding share in North Africa is over 57%. Chicken presents a big opportunity to lift women and youth out of poverty and improve household nutrition, since women are the largest chicken producers in Africa.⁶⁵

The drivers of sustainable Chicken production include:

- i. Holistic vaccination: Disease control is the most important intervention in improving local chicken production⁶⁶.
- ii. Chicken management: The most profitable and amenable management practices include creep feeding, i.e., supplementary feeding of chicks, improved housing and hygiene, both of which reduce mortality.
- iii. Genetic improvement: Cross-breeding local chicken with improved breeds - aimed at obtaining improved chicken with desirable attributes that are well-adapted to the local biophysical environment and low-input production systems is an important driver. Indigenous chickens are resistant to diseases and pests and their growth rate is slow. Additionally, egg productivity and the live weight of indigenous chickens are low.

⁶³ Source: <https://www.fao.org/faostat/en/#data/QV>. Other poultry are: ducks, goose, turkey, birds, and guinea.

4.3.3 Small ruminants' production

Small ruminants are the third most important source of meat in Africa. The small ruminants are appropriate for women and youth since their value is low, and they are more likely to survive in difficult environments. The following are key criteria for increasing small ruminant productivity among small-scale farmers and work best when used together to obtain synergy.⁶⁷

a. Genetic improvement: One approach to improving the genetic attributes is the community-based breeding programs (CBBP).⁶⁸ The CBBP approach allows communities to select the breeds which meet their objectives and priorities. The breeds are identified by the ethnic group or geographical location. Other key breed selection criteria are body weight at birth, weaning and adult age, daily milk yield at onset or peak lactation, lactation length, lambing/kidding rates, prolificacy, and pre-weaning survival rates. To ensure acceptability and adaptability, the following CBBP criteria have been successfully tested and have shown promising results in an African environment:⁶⁹

- i. Breeds are widely used by resource-poor farmers in the country.
- ii. Genetically diverse breeds – which have the potential for genetic improvement.
- iii. Availability and interaction of livestock research institutions with the capacity to effectively work with farmers. Access to NGOs for providing grassroot technical support is crucial in ensuring successful community genetic program.
- iv. Availability of key rural services – including extension and veterinary services, drug vendors, and market information systems.

b. Improved feeding systems and judicious supplementation: The quantity and quality of pasture and browse plants in Africa have been decreasing due to land degradation and crop area expansion into pasture lands.⁷⁰ Similarly, the common free-range feeding system leads to low productivity. Supplemental feeds from farm-produce have been found to improve shoats productivity (Table 2).^h

c. Profitability of new technologies: Smallholder farmers are more likely to adopt a new technology if it is profitable. Most of the farmers who received advisory services and had high profits adopted the technologies, underscoring potential uptake.

d. Improved animal health: Small ruminant diseases include bovine rinderpest (helminthosis, peste des petits ruminants (PPR)), contagious ecthyma, goat/sheep pox, pneumonia, anthrax, black quarter, footrot, caseous lymphadenitis, and brucellosis.⁷¹ The cost of diseases is high. This underlines the importance of improving animal health to achieve

^h Small ruminants productivity increases when free-range feeding is supplemented with feeds produced at farm. The on-farm produced supplemental feeds used in the study include cassava peels, locally available leguminous plants (e.g. *Gliricidia sepium*), maize, maize or wheat bran, soybean, fishmeal and cotton seed.

profitable and sustainable production. The strategies that have been recommended for animal health are:

- i. Vaccination. Most of the common diseases have vaccines that have been shown to be more effective than treatment.
- ii. Monitoring and reporting outbreak of diseases. Monitoring can be enhanced by using geospatial approaches. This will help map out infected animal movement and the implementation of quarantines.
- iii. Enhancing availability of veterinary and advisory services and agro-input supplies. As discussed earlier, the availability of veterinary and extension services and agro-input supplies is crucial to animal health. This is especially the case since small ruminants are not given priority in allocating public funds for livestock development.
- iv. Breeding programs to create disease-resistant animal breeds. One of the long-term solutions in addressing animal diseases is breed improvement.

4.3.4 Pig production

Strategies for increasing pig productivity:

- i. Inadequate and poor quality of feeds. This is the main constraint of small-scale pig production in Africa.⁷² Feed supplementation using feeds produced on the farm is the cheapest strategy for increasing pig productivity and litter size. The type of locally-produced supplementation for pigs is the same as those discussed under small ruminants. They include cassava peels, maize, vegetables, maize or wheat bran, soybean, left-over foods, fishmeal, and cottonseed. On-farm produced, or low-cost nutrient-dense, digestible and palatable feeds are required to enhance the productivity of piglets and weaned pigs. This has been shown to significantly increase the slaughter weight. Balanced diets that include protein, energy, and vitamin-rich feedsⁱ are also required to enhance returns to feed investments.
- ii. Animal health. Scavenging pigs are exposed to a variety of diseases and injuries, which calls for frequent medication, deworming, and control for other pig diseases and pest infestation.⁷³ Vaccination against African swine fever and other common pig diseases is necessary.⁷⁴

ⁱ The protein-rich feeds include soybean, sesame, peanut, animal-based feeds (e.g. fish meals, meat and insects) and energy-dense (e.g. cereal-based feeds). Vitamin-rich feeds include Vegetables, grasses, leaves, roots and tubers, fruits (carrot, pumpkin, etc.)

- iii. Improving local breeds. Pig's genetic improvement will lead to increased performance.
- iv. Technology and management practices. Adoption of new technologies and management practices need to be profitable to ensure high uptake.

4.3.5 Drivers of livestock production

Common drivers of livestock production

The major drivers of production systems include:

- i. Improved feeding systems: In all production systems, farmers practice poor feeding systems that are generally inadequate, leading to low productivity. Livestock feeding systems are not associated with significant investment in improving grazing areas. Consequently, the productivity of beef, milk, and other products in Africa is quite low.
- ii. Improved breeds: Adoption of improved pure breeds and mixed breeds is limited in Africa. This is largely due to the predominantly livelihood-oriented production system.
- iii. Collective pasture management and marketing: Farmers who cooperate in managing common grazing lands have higher productivity. Livestock production communities will increase the quality of pasture if they cooperate in controlling grazing using rotation or pasture management strategies such as controlling pasture and bush fires. This will lead to significant pasture improvement. Collective marketing will equally increase the bargaining power and lower search costs for better prices and livestock markets.
- iv. Secure land tenure: Farmers with secure land tenure have an incentive to invest in pasture improvement, which in turn improves productivity.
- v. Access to veterinary services: Animal diseases could ruin farmers' livelihoods, especially those who heavily depend on livestock. Access to quality veterinary services improves livestock productivity.
- vi. Access to advisory services: The Livestock sector in some countries receives low priority in public resource allocation, and this heavily affects the quantity and quality of advisory services. Farmers who receive advisory services improve productivity. Access to advisory services includes information along the value chain on production, postharvest handling, market information, etc.

- vii. Access to credit: Investing in large animals like cattle, buffalo, camel, etc., could be beyond the reach of many resource-poor farmers. This underscores the importance of access to credit. For example, only 56% of farmers in SSA borrowed money, but only 10% of those who borrowed obtained loans from formal institutions.⁷⁵
- viii. Access to markets: Livestock keepers closer to markets tend to have higher off-take and improved pasture management, and higher adoption of improved breeds. For example, all types of production systems around Nairobi City manage livestock better than those in remote areas.⁷⁶
- ix. Inadequate processing facilities: Essential production infrastructure such as cold chain facilities are limited in many countries.

4.4 Inclusive and sustainable fisheries and aquaculture

The African Union's Agenda 2063 recognizes fish as Africa's future in its blue economy statement. This is not surprising given the industry's potential. Presently wild fishing and aquaculture account for about 1.5% of the region's GDP and employ an estimated 12.3 million people, of whom 50% are fishers, 42% as processors, and 8% are fish farmers.⁷⁷ About 59% of fish processors are women⁷⁸ – an aspect which underscores the importance of achieving inclusive development.

Aquaculture development in Africa has been largely significant in two countries – Egypt and Nigeria - both of which account for over 80% of total aquaculture production in the continent.⁶ Development of aquaculture in other countries is limited – even in countries with high aquaculture potential.

Chapter 5: Post-harvest handling of fish, crops and livestock



5.1 Introduction

This chapter is focused on post-harvest handling – essentially storage, processing and marketing.

5.2 Drivers of efficient post-harvest handling

Agricultural produce losses in quantity and quality are driven by inefficiencies in the postharvest handling system.⁷⁹ Post-harvest handling includes all activities after harvesting till the product/produce arrives in the market. Efficient post-harvest handling minimizes postharvest losses in terms of quantity and quality, prolongs shelf life, adds time, form and place utilities to the products and rewards farmers with premium prices. The section below discusses the drivers of efficient postharvest handling for crop, livestock, and fish.

- a. Awareness and availability of efficient postharvest handling (PHH) technologies:** Postharvest losses occur to a large extent due to lack of knowledge on the proper methods of handling produce.⁸⁰ There are many effective traditional – and modern - methods used by smallholder crop and fish farmers, and livestock keepers, but are not used due to lack of knowledge. However, advisory services on postharvest handling are weak and limited.
- b. Attributes of technology or postharvest handling system used:** Postharvest handling technologies that have a clear advantage over traditional technologies are more likely to be adopted than those with limited advantages. The advantages include reducing postharvest losses in terms of quantity and quality, affordability, ease of use, labor intensity, low price or upfront costs of establishment, and other attributes.⁸¹
- c. Infrastructure and logistics:** Infrastructure and logistics for storage, processing, packaging, labelling and transportation are key to protecting agricultural and fish products from quantity and quality losses. This is especially critical for highly perishable produce like fish, horticultural crops, milk, meat, etc. Well-planned infrastructure and logistics are required to help smallholder producers in postharvest handling.
- d. Market access:** Producers are usually located in remote areas and away from markets and consumers. This suggests improvement of market access leading to efficient postharvest handling.
- e. Regulatory, quality control and certification institutions:** Robust regulatory institutions are required to enhance efficient PHH. For example, food safety inspection – set with a well-

defined regulatory framework - could effectively eliminate sale of low-quality foods, such as fish caught using dynamites or poison, maize with aflatoxin, etc. Once such safety regulations are strictly enforced, producers will be obliged to comply and eventually increase uptake of new PHH technologies. The same regulations could increase price premiums of producers and thus enhance adoption of PHH technologies which reduce postharvest losses in quality and quantity. Agricultural produce processing provides an opportunity for agricultural industrialization, which is consistent with CAADP pillar 3, Malabo Resolution and Agenda 2063 – value chains and agro-industrialization. The Abuja Declaration on Development of Agribusiness endorsed the African Agribusiness and Agro-Industries Development Initiative (3ADI), which sets an objective of ensuring that by 2020, about 50% of food products sold in the domestic markets are processed. Post-harvest handling plays a key role in ensuring food security in Africa. Even though post-harvest losses have predominantly focused on quantity losses, quality losses are increasingly receiving attention from consumers, bolstering the need for more investment in processing to enhance quality, shelf life and market value. Agro-processing is especially important in Africa's quest to modernize agriculture as it simultaneously adds value, reduces post-harvest losses, and provides rural and urban employment, especially to women and the youth who are greatly affected by unemployment and underemployment.

5.3 Post-harvest handling

5.3.1 Fish

Fish and its products spoil much faster than most other food types, which translates to enormous post-harvest losses. This also elevates the need to develop efficient and effective post-harvest handling, i.e., processing, packaging, storage, and transportation. Artisanal fisherfolks lose both in quantity and quality terms. Quality losses account for about 70% of the total post-harvest losses in small-scale fisheries.⁸² The quality and quantity losses are interlinked. For example, quality loss leads to lower prices while quantity losses lead to higher prices – if quality remains unchanged. The major causes of losses are poor handling, lack of cooling facilities, and processing. These problems can be solved through the following approaches.

- i) Availability of cheap fish-processing technologies: Generally, there is a lack of infrastructure and equipment for processing (especially lack of drying racks) , leading to quality and quantity loss.
- ii) Targeting women and youth in developing processing technologies. This strategy will simultaneously improve fish value chain, create employment for women and youth, and significantly reduce the quantity and quality losses experienced by artisanal fisherfolks. Given that the majority of fish processors are women, this strategy is likely to be successful.

- iii) Provision of credit and other financial services to enable women and youth groups to buy and establish fish processing centres.
- iv) Encouraging and incentivizing supermarkets and other large consumers to buy locally.

5.3.2 Crop processing

Crop processing varies widely across different types of crops. The following discussion puts the crops into four major groups, each of which has comparable processing methods: (i) cereals and grains, (ii) roots and tubers, (iii) fruit and vegetables, and (iv) oilseeds and pulses. Each of these crop groups has different levels of post-harvest losses and two of the groups are discussed:

i. Cereal and grains processing

Proper handling of cereal and grains before and during the harvest process are important steps required to minimize quality and quantity losses.

Grain drying: The early stage that cereal and grain farmers face is the drying processes before storing. Cereals require specific moisture content to avoid rotting and/or the development of toxic chemicals. For example, aflatoxin – a carcinogenic chemical produced by *Asparagus* fungus - develops in damaged and poorly dried grain. Aflatoxins also develop in grains that are not well-cleaned. Poorly aerated stores, drought, and plant stress increases susceptibility to aflatoxin. Solar dryers have been tested and found to greatly reduce the sun-drying process and improve grain quality.

Grain storage: Improper cereal grains storage has contributed to sizeable post-harvest losses. Among the post-harvest losses (PHL) from harvest to processing stage, storage losses account for the largest share of the PHL for grains in Africa.⁸³ Several low-cost technologies and practices have been developed to reduce stored grain losses. They include the use of synthetic and botanical pesticides, modified atmospheres, storage containers, and combinations of these practices. Similarly, traditional grains storage methods have been effective, especially when modified to address their weaknesses. Among the new low-cost technologies which have been recently advocated are the hermetic – i.e., air-tight - bags.

Grain milling: Mechanical cereal processing has almost replaced the traditional and arduous methods of pounding and stone grinding. Hammer mills have become common in rural areas, and are widely used. However, some farmers travel long distances to a hammer mill. Even though the widespread use of motorbikes for transportation has increased in rural areas, distant hammer mills make grain milling expensive in terms of time and money, especially for women, who do most of the food processing. The energy source of most hammer mills is diesel, but rural electrification could help address the shortage of hammer mills in remote areas. Rural

electrification will also spur the development of small and medium-scale enterprises, which could provide technical support to grain processing.

Storage for better price, risk management, and enhancement of access to credit: Smallholder farmers harvest when they are in financial distress, which forces them to sell immediately after harvesting. This reduces the producer prices right after harvest. Generally, prices increase thereafter, with a negative impact on consumers. The Warehouse Receipt System (WRS) has been introduced to help farmers pool storage – thus capturing markets of larger consumers and better prices. Participating farmers can use the stored produce as collateral for advance payment, usually coming as a loan.

Processing with nutrition enhancement: Loss of nutrients during processing occurs when using both the traditional and improved grain processing (milling). For example, pericarp and germ of maize – which are rich in protein and vitamins – are usually lost during sieving, hulling, and bran removal and milling. This leads to a loss of about 20-50% of non-starchy nutrients.⁸⁴ Strategies for keeping and enhancing grain nutrients have been demonstrated to work well among smallholder farmers and consumers in Africa, including bio-fortification.:

Bio-fortification: Farmers and consumers could mill their grain and mix it with bio-fortification and other nutrient-dense foods. In Senegal, an experiment took place in which sorghum was milled with dry carrot and mango chips. The consumers who were not informed that the sorghum flour was fortified could not distinguish it from ordinary flour⁸⁵. Those who were informed of the bio-fortification and its benefits were willing to pay a higher price for the fortified flour.

ii. Roots and tubers

One of the biggest weaknesses of the roots and tubers value chain in Africa is its weak processing sector. For example, even though Africa is the largest producer of cassava, the region consumes almost its entire harvest, while other producers - namely Asia and Latin America - dominate the processing and export sectors. Root and tuber processing in Africa has largely remained traditional and mainly for human consumption.

Processing to reduce loss and eliminate poisoning: Like the case of cereals, poor storage and processing also results in contamination for some roots and tubers. For example, both sweet and bitter cassava contain cyanogenic glycosides, which can develop poisonous hydrogen

cyanide.^j The dried and pounded cassava flour has very low cyanide contents, and is considered safe for human consumption.

Improving the nutritional content of roots and tuber-based foods: Cassava has low nutrient content beyond its carbohydrates. The methods used to enhance nutritional content during processing include:

- a. *Fortification:* Fortification during processing has been shown to increase its nutrient content. In Nigeria, fermented cassava (gari) is mixed with red palm oil, which is rich in Provitamin A carotenoids. Deliberate promotion of these and other types of fortification is bound to greatly increase the nutritional content of roots and tuber dishes.
- b. *Co-fermentation:* Co-fermentation with legumes and other nutrient-dense foods has been found to improve the nutritional value of roots and tubers. Fermentation has also been shown to help release micronutrients which are otherwise unavailable when unfermented cassava is consumed.
- c. *Bio-fortification:*^k Harvest Plus Program has released a fortified cassava variety, in which vitamin A was added. Vitamin A-enriched cassava provides up to 100% of daily vitamin A needs. Additionally, the new variety has a higher yield than the traditional varieties and is resistant to cassava viral diseases. Harvest Plus Program has also developed and released orange-fleshed sweet potato, which is rich in vitamin A. Like vitamin A-enriched cassava, the orange-fleshed sweet potatoes also provide up to 100% of daily vitamin A needs, are higher-yielding, are resistant to potato viruses and drought tolerant.
- d. *Promotion of consumption of root and tuber leaves:* Leaves of roots and tubers are rich in micronutrients, but they are always thrown away in many parts of Africa. However, in East Africa, the consumption of cassava leaves is common. There is a need to promote the consumption of nutrient-rich cassava leaves.
- e. *Beyond human food consumption:* Cassava is rich in starch, which could be used for industrial purposes. About 25% and 60% of fresh and dry cassava is starch. Yet, even though Africa is a leading producer of cassava, the production of starch in Africa is negligible.

^j Elevated levels of cyanide causes rapid respiration, drop in blood pressure, rapid pulse, dizziness, headache, stomach pain, vomiting, diarrhea, mental confusion, twitching and convulsions, and death when poisoning level is very high.

^k Please see details here <https://www.harvestplus.org/knowledge-market/in-the-news/health-boosting-climate-smart-crops-can-help-address-micronutrient-gaps>

5.3.3 Horticultural crops

Horticultural crops are the most perishable crops and suffer the largest loss. Losses are the highest at the processing level, followed by production and distribution. Smallholder farmers have developed different methods for processing horticultural crops, which have been effective in their resource-constrained environment with no chilling, refrigeration, freezing, and other preservation approaches. In this section, some appropriate practices to be promoted for smallholder horticultural crops are discussed. The emphasis is on the methods that are simple and amenable to resource-poor smallholder farmers with no access to electricity as well as on practices that preserve nutrients and prolong shelf life. They include:

- i. **Drying:** This is the most predominant horticultural post-harvest handling method, which has been used by African smallholder farmers for centuries. Drying simultaneously protects horticultural crops from spoilage and extends availability over a long period of time. Dried vegetables can be available for months. There are many drying methods used by farmers.
 - a. *Solar drying:* Raised and perforated platforms like straw mats and screen trays are the most effective, as they provide ambient aeration. Drying on flat rocks or grounds covered with mats or other easily available weavings is common.
 - b. *Dehydrators:* Different sources are used for forcing air or low-temperature heating in horticultural crops. The energy sources include solar, biofuel, gasoline, diesel, and others. There are start-up companies in Africa that are making dehydrators and distributing them in some African countries.
- ii. **Salting:** Vegetables are dipped in salted water. Dry salting is also common. This process dehydrates vegetables and prevents bacterial growth.
- iii. **Juicing:** Squeezing fruits to make juices is widely used in African countries. The freshly squeezed juices are normally served fresh in rural areas and in restaurants. In urban areas, the availability of low-cost electric and manual juice extractors has increased the consumption of freshly squeezed juices.
- iv. **Chilling and refrigeration.** Several initiatives to develop and promote off-grid solar-powered equipment in Africa have been launched, including the Energy and Environment Partnership Trust Fund (EEP Africa) which operates in 15 African countries. Off-grid solar-powered ice makers are being promoted in rural areas. Solar-powered icemakers have been successfully introduced and integrated into remote areas (of Turkana) in Kenya, Cape Verde, Senegal, and other countries.
- v. **Cold-chain logistics.** This is an advanced stage of horticultural crops (fruit and vegetables) storage and transportation undertaken by large scale fruit and vegetable farmer groups and companies. For it to serve the rural smallholder

farmers, government and donor support are required to design strategic points where cold storage facilities could be installed for use by groups of farmers. A master plan developed jointly by the government, development partners, farmer groups, energy suppliers, transporters, and other stakeholders is required. Different value chains could use cold-chain logistics, and this would enhance complementarity. Success stories of such value chains have been observed in Kenya, Morocco, Senegal, and Tanzania. Even though this successful cold-chain logistics still focuses on exported horticultural produce, efforts are underway to include the growing domestic market.

- vi. **Preservation of nutrients:** During drying, clean equipment and environment are required to ensure that the fruit and vegetables are not contaminated, which could lower their quality. Protection from dust and other airborne impurities is also crucial. Fruit and vegetables have essential nutrients which are labile and could easily be lost during processing. The drying process could include blanching – short-time steaming to halt enzymatic activities as well as minimize nutrient loss. Application of a small amount of sulphur to fruits also prevents darkening and loss of vitamin C and flavour. However, proper labelling is required, as some people are allergic to sulphur.
- vii. **Packaging and labelling:** The growing middle-income and urban population have increased the need for packaging and labelling of fruit and vegetables. Packaging and labelling require proper training of the key players. Food labelling showing nutrition information, where it was produced, and other data is increasingly becoming important. Agro-enterprises in rural areas are required to support new consumers as well as regulators. Similarly, technical support from nutritionists is required for packaging and labelling.
- viii. **Grading and Certification:** Smallholder fruit and vegetable farmers can sell their produce to the domestic and foreign prime markets. This requires appropriate grading and certification on a range of standards. For example, many farmers in Africa grow organic produce, but they are not certified, thus missing prime markets domestically and internationally. Development of efficient and effective grading and certification systems requires government and development partners' support in collaboration with the private sector.

5.3.4 Livestock

Meat, milk, and eggs are the major livestock products consumed in Africa. Like the case of horticultural crops, livestock products are highly perishable. More importantly, they are likely to cause diseases if not properly handled. For example, zoonotic diseases¹ are increasingly becoming common. The World Health Organization (WHO) estimates that about 60% of emerging infectious diseases globally are zoonotic. This underscores the importance of strengthening food safety standards in the livestock industry.

Two major livestock groups raised for food have different processing types that need to be considered separately, namely poultry and meats. The discussion in this section focuses on two animal products, i.e. milk and meats.

Milk processing: Milk processing requires an efficient value chain to reduce spoilage and loss of quality while ensuring food safety. Successful strategies have been implemented by smallholder dairy farmers in East Africa. A dairy hub is the key. This is formed by a group of small-scale dairy farmers with the aim to increase productivity, improve milk quality, reduce spoilage, increase women participation, and assist members to adopt modern technologies along the value chain. Dairy hubs form milk bulking and chilling centres. They help link farmers to milk processors, input dealers, and other service providers. As a strategy to scale out, reference farmers (or lead farmers) are identified and trained by extension agents on the best production, storage, processing, and marketing practices. Lead farmers in turn, train other farmers on these best practices by turning their farms into demonstration farms.

Other strategies to increase productivity, improve milk quality, and reduce spoilage include:

- i. Enhanced extension and veterinary services
- ii. Pasteurization
- iii. Chilling technologies

Meat processing: It is estimated that 80% of meat is bought from informal markets (abattoirs) which use traditional processing with poor infrastructure. The informal markets also adhere to limited health and safety regulations, thereby increasing the health risks to consumers. The informal markets also receive limited support from government and development partners. The location of the abattoirs needs to be carefully planned to ensure they meet required health and safety standards. The following are the common requirements for an abattoir:

- i. Location away from residences, commercial centres, and institutions: To ensure the health and safety of consumers and meat processors, abattoirs should be

¹ Zoonotic diseases are diseases that are transmitted from animals to humans. For example, [Covid-19 is zoonotic](#).

located away from people. This suggests the need to have elaborate zoning of abattoirs.

- ii. Accessibility and, if possible, electricity supply: Given that meat is highly perishable; abattoirs need to be located in areas closer to an all-weather road. Electricity may be required for areas with access to grid power. However, for off-grid remote areas, alternative power options could still be used to maintain an abattoir that meets all health and safety requirements.
- iii. Adequate water supply: This will ensure the hygiene of the meat, processors, and other key players in the value chain.
- iv. Effluent disposal infrastructure: The abattoir needs to have a drainage infrastructure that allows free draining with no waterlogging potential. The effluent should not be directed to rivers and other water bodies used by people or livestock.⁸⁶ It is possible to reuse effluent for agricultural production, but this needs to be done in a way that does not jeopardize human and animal health.
- v. Solid waste disposal: Enough space is required for the disposal of inedible waste, manure, condemned animals, and other waste. It is possible to reuse the solid waste for crop production, but due consideration is required to ensure that there is no contamination of crops or people handling the solid waste. There should be sufficient space available to bury inedible wastes and condemned animals and provide for compost stacks, hide drying frames, etc.
- vi. Veterinary and meat inspection services: African countries are signatories of meat inspection regulations set by the FAO and WHO – (*Codex Alimentarius*). The regulations require that animals need to be inspected (*ante mortem* examination). If it passes the first inspection, meat is inspected again more rigorously (*post-mortem* examination) before slaughtering. The two inspections ensure that the meat is wholesome and does not have diseases that could endanger human health. However, Africa has a weak meat inspection infrastructure. In many countries, the number of inspectors and their technical qualifications need attention. Additionally, despite the increased risk of cross-border infection due to increased informal trade, collaboration across countries is weak.^m.
- vii. Hygiene services for workers (toilets and showers). This will enhance hygiene and help prevent the transmission of diseases from handlers to consumers.
- viii. Cold storage facilities at abattoirs to preserve meat. The same strategies discussed for milk could be used to enhance the adoption of low-cost cold storage.

^m The next chapter discusses cross-border trade.

Labelling and certification: Labelling, branding, and certification are crucially important, given the increasing likelihood of zoonotic diseases. Branding and certification are beneficial to livestock keepers. For example, ILRI estimates that branding and certification of milk vendors in Kenya simultaneously improved milk safety and increased their income by \$33 million.⁸⁷

5.4 Agro-industrialization

Africa has the lowest level of industrialization in the world. However, North Africa and South Africa have made progress in industrialization. Considering manufacturing alone, North Africa reports the highest manufacturing value addition as percent of GDP. Manufacturing value-added growth rate in 2021 in North Africa was equally among the highest in Africa. Manufacturing value-added as percent of GDP is lowest in Central Africa, but its growth was buoyed by Central Africa, Equatorial Guinea and Cameroon, where mining is the major industry.

Agro-processing offers an opportunity to achieve Africa's 3ADI, which sets a target that by 2020, about 50% of food products sold in the domestic markets are processed. The 2014 Malabo Declaration and Agenda 2063 also emphasize agro-industrialization, which is in the very heart of AVC development. Agro-led industrialization promotes value addition and inclusive growth. It is an effective method to reduce food waste, and seasonality of supply by improving the quality and shelf life of nutrient-dense foods. Value addition through processing adds time, place and form utilities to raw agricultural products and offers a powerful means of boosting intra-African trade and competitiveness of agricultural products. A study shows that one-third of the value of purchased food in Eastern and Southern Africa was spent on processed foods – suggesting a stronger need for agro-industrialization.⁸⁸ Agro-industrialization requires reliable access to efficient soft and hard infrastructure, reliable high value markets and an enabling policy environment. Such access helps create agro-related SMEs, which offer many services for improving agricultural produce quality and reduce post-harvest losses. The development of regional agro-parks has been suggested as critical pathway to encourage agro-led industrialization by focusing on regional value chains priorities and logistics costs. An IFAD's rural prospect report identified appropriate policies that can foster the growth and development of inclusive agro-industries to include: ¹⁰⁶

- i. **Facilitating small-scale local agri-food industries.** The local agri-food industries will simultaneously reduce quality and quantity losses, create employment for youth and women, and increase the income of farmers. However, this will be easier when competent technical capacities to support rural agri-food industries are available.
- ii. **Building strong and effective public-private partnerships to foster market-based operations.** This calls for governments to provide the congenial business and investment environment required for private agri-food industries to operate in all

identified areas (for example, provision of electricity where appropriate and possible). Use of geo-referencing technologies in mapping and locating appropriate agri-food industry is indispensable for achieving industrial efficiency. The government could also provide incentives to the private sector to establish agri-food industries in places where it is too expensive to operate without public support.

- iii. **Provision of training to producers, processors, and consumers.** Training has been shown to foster both horizontal and vertical linkages along the value chain. Campaigns and training on food preparation and processing of nutrient-dense foods, micro-nutrients dosing, weaning foods for infants and use of locally available food ingredients have been successful in reversing food insecurity situations. Public enlightenment campaigns and nutritional education outreach should be planned to target different consumers.
- iv **Incentivize SMEs to invest in producing high-quality, healthy and safe foods.** A combination of training, information, and incentives has been shown to increase SME's investment in improving food safety and quality. For example, Nigeria *ogi* (porridge) SME processors were provided training on how to prepare nutritious porridge for weaning infants by using acid fermentation to reduce aflatoxin and fumonisin in maize. The new weaning porridge was also promoted to nursing mothers. Its demand and price increased, rewarding the agro-food SMEs that invested in the production of porridge.⁸⁹

5.5 Game-changing policies and strategies for developing and promoting inclusive and sustainable post-harvest handling

This section covers all value chains and will summarize the policies and strategies for addressing the high post-harvest losses, which are the proximate challenges– both in quantity and quality. Limited processing, labelling, and packaging are the proximate problems in the post-harvest handling node. The underlying issues of these challenges are the limited rural services on post-harvest handling, limited supply of low-cost post-harvest technologies, limited access to power and energy and weak or non-existent inspection and certification.

- i. **Promote cheap and traditional storage and post-harvest handling equipment:** Introducing new storage structures is important, but innovative approaches for ensuring fast uptake need to be used. For example, the method used to promote PICS in West Africa serves as a success story to learn from. PICS promotion involved identification of partners, training of trainers, training farmers, media activities and supply chain development. The PICS uptake was quite fast, and the agribusinesses took over the interventions as NGOs and technical institutions exited the PICS business. This

method could be used to promote the new storage structures and other postharvest handling equipment.

- ii. **Develop and promote agro-industrialization:** Agro-industrialization is the major area which will address the proximate and underlying challenges of post-harvest losses. A good success story is the cashew nut processing in Cote d'Ivoire. Africa produces a significant share (90%) of cashew nuts in the world, with Cote d'Ivoire, Tanzania, Nigeria, Benin, Burkina Faso, Mozambique, and Ghana being the large players in the continent. A large share of cashew nuts is exported in raw form, with India, Vietnam and China being the largest importers. More value addition is done in these countries to meet customers' requirements in European and American markets. Several African countries producing cashews have been striving to add value to cashews through enhancing local processing, but the amount processed is relatively small compared to the quantities processed in countries importing from Africa. A 2021 report on Commodities at a Glance - Special Issue on Cashew Nuts by the United Nations Conference on Trade and Development (UNCTAD), shows that the 2018 export price of cashew nuts from India to the European Union was roughly 3.5 times greater than that paid to Ivorian producers, or about 8.5 times higher than when they left the farm in Côte d'Ivoire. In response to this, the Ivorian government has taken measures to support cashew nuts processing in the country. Processed nuts have been organically certified and exported directly to European and American markets, and enjoy premium prices. Processing capacity has increased from merely 10,000 tons in 2016 to 100,000 tons in 2021. Cashew processing has also created about 6,000 new jobs. Similarly, small-scale cashew nuts processing by cooperatives has had significant impact on the local economies, and there has been improvement in living conditions of the local communities in terms of increased incomes and employment opportunities.
- iii. **Develop and promote SMEs along the value chain:** Development and promotion of SMEs has been discussed in Chapter 4. The SMEs will create the forward and backward linkages to support agro-industrialization and other post-harvest handling activities.
- iv. **Enhance quality control, certification, packaging and labeling:** As discussed earlier, the growing middle-income population requires high-quality agricultural products. Unfortunately, the institutions for quality regulation and enhancement are weak or completely absent. Governments need to respond to the changing agricultural product demand and invest heavily in institutional infrastructure for developing and enhancing quality.

Chapter 6: Agricultural products marketing and trade



6.1 Introduction

In the last 25 years, Africa has seen a transformation in agri-food marketing and trade. The transformation is driven by the fast pace of urbanization and the growing middle-income population, whose food tastes and preferences are constantly changing and different from the traditional starchy staple diets common among resource-poor farmers and urban poor populations¹²⁵. The discussion in the following sections explores the stages and drivers of AVC transformation. The focus is on marketing and trade, but other stages along the AVC are discussed, to underscore the nature of the market transformation.

6.2 Stages of AVC market transformation

Available literature shows that there are generally three transformation stages in agricultural value chains.²¹

Stage 1: Traditional AVC: This stage is confined to the local market area (village and neighbouring communities), thus limiting interaction with urban consumers. This is common in many remote areas in Africa, which have limited access to roads. The value chains are spatially shorter and disjointed. The main commodities in these markets are grain and other staples. Only a limited share of harvested produce is processed, with processing taking place largely in homestead or cottage industries. Production and processing are labour-intensive. Wholesale and logistic sectors' activities are limited under the traditional AVC. Selling and buying are largely based on spot markets – i.e., commodities are bought and sold for immediate delivery. Furthermore, quality differentiation, grading, and standards of the commodities are also limited.

Stage 2: Transitional AVC: Value chains are spatially longer and closely connected to urban consumers. There is a higher demand for nutrient-dense, more perishable animal/horticultural products, and processed foods. The higher demand for processed food, which saves consumers preparation time, is common among growing middle-income consumers.^{16,121} Services for grading, stricter private-based food safety, and standardization and product quality differentiation emerge at this stage of the AVC. This is mainly in response to the growing middle-income population, who demand products with such attributes. Peri-urban production of highly-perishable products also dominates the market and has become more competitive because of their proximity to urban consumers. SMEs in milling, packaging, canning, and other

value addition and logistics activities become more pronounced at this stage. Access to credit and entrepreneurial skills plays a pivotal role in supporting SMEs for logistics and value-addition activities. Even though spot markets still play a prominent role, vertical integration starts to emerge.

Stage 3: Modern AVC. The modern AVC is organized to serve urban consumers through commercial intermediaries and producers. Products are brought from distant areas, predominantly beyond national borders. Also characterized by efficient and elaborate logistics (which provide cold chains, packing, preservation, storage, bulk transport, and others). The food sector is dominated by non-grain supply chains and processed foods. At this stage, product differentiation is sophisticated, and standards and food safety rules and regulations are largely based on the private sector and corresponding public sector regulations. The supermarkets, restaurants, and large processors are much more vertically linked with producers.

Table 2 summarizes the stages of AVC transformation and the corresponding food services, processing, wholesale, logistics, supply chain length, exchange arrangement, technology, and presence or absence of foreign direct investment (FDI).

AVCs in many African countries are either still in the traditional stages or at the beginning of the transition from traditional to transitional stages. A few value chains are found in the modern agricultural value chain category. The emergence of supermarkets in African countries has played a pivotal role in the transformation of the AVCs.¹²⁵ The supermarket “revolution” has come in three waves across Africa. For countries covered by Edge by Ascential data (www.ascentialedge.com), the countries which experienced the first wave of growth are Botswana, Namibia, and South Africa. These countries have high income per capita and a large percentage of urban population. The second-wave countries include Kenya, Madagascar, Malawi, Mozambique, Tanzania, Zambia, and Zimbabwe. These countries have lower incomes per capita. Therefore, urban populations are benefiting from proximity to the first-wave countries. The third-wave countries are Angola, Ghana, Nigeria, and Senegal, which saw a rapid growth in sales and are catching up with wave-1 & 2 countries.

6.3 Drivers of AVC market transformation

Generally, there are five major factors that have been driving the AVC transformation over the past 20 years in Africa.^{126, 49} These are the growing middle-income class, urbanization, market-oriented policy reforms, globalization, and endogenous evolution of practices, standards, and technologies.

Growing middle-income population: The growing middle-income population creates demand for highly-processed food, food away from home (FAFH), and nutrient-dense perishable foods,

namely, animal products and fruit and vegetables.^{90, 125, 49} Demand for perishables requires an efficient AVC with faster processing and transport logistics to avoid spoilage and losses. This has prompted the growth of supermarkets to cater to the growing middle-income consumers, predominantly located in megacities.

Table 2: Stages of AVC transformation

Enterprises	Traditional AVC	Transitional AVC	Modern AVC
<i>Food service</i>	None (home cooking)	Street vendors, independent restaurants	Fast-food chains
<i>Processing</i>	None (home-processing)	SMEs such as small mills ^a	Large processors and food manufacturers
<i>Wholesale</i>	Brokers based in rural villages	Wholesaler based in urban markets	Off-market distribution companies
<i>Logistics</i>	Own-logistics by brokers	SMEs in third party logistics (3PLS)	Large 3PLS companies and freight forwarders
<i>Supply chain length</i>	Short, local	Long, rural-urban	Long, rural-urban, international
<i>Exchange arrangements</i>	No contracts, no standards	No contracts, public standards, some vertical integration	Emerging contracts, private standards, vertical integration
<i>Technology</i>	Labour-intensive	Labour-intensive	Capital-intensive
<i>Foreign Direct Investment (FDI)</i>	None	Emerging	Significant

^a Food processing in the African food value chain includes a wide range of foods: ultra-processed foods with multi-ingredient mixtures formulated by large and SME manufacturers (Monteiro et al., 2017).

Source: Extracted from Barrett et al. (2020).

Urbanization: Africa's urbanization process is different from what has been observed in Asia and Latin America. Africa's urban populations are concentrated in a few megacities with limited structural transformation.^{91,13} The megacities complicate the transport logistics between supply sources (producers) and their demand destination (consumers). This has created a disconnect between rural producers and urban food systems, forcing supermarkets to import significant amounts of high-quality fresh produce which could have been produced and procured from smallholder farmers located in remote areas. For example, the value of fruit and vegetable imports in SSA more than doubled between 2001-2005 and 2010-2016 and skyrocketed the price point as reflected in terms of the value of imports from US\$384 million to US\$810 million (in constant 1983 prices).² Additionally, spatial intermediation which involves long-distance transport, cold storage, preservation, processing, wholesaling and retailing functions are becoming more important, making the supermarkets' system even more necessary and relevant to the African megapolis food systems.¹²⁶

Market-oriented policy reforms: Market-oriented policies enhanced the growth of more efficient AVCs in Africa. Price control on agricultural produce was largely phased out following the structural adjustments which took place in the 1980s. Even though policy reversals occurred and, in some cases, reforms were only partial, generally, reforms increased competition, ushering in more competitive private sectors in the agricultural marketing system.⁹²

Globalization: Capital market integration has been helping companies to integrate market risk and price volatilities. Market integration has stimulated foreign direct investment (FDI) in agri-food value chains, cross-border trade, and globalization in general.¹²⁶

Endogenous evolution of practices, standards, and technologies: In response to the high-quality standards that middle-income consumers require, supermarkets, hotels, and other food outlets have set stringent quality standards regarding the food they buy from farmers. Trends show that in most cases, the agri-food quality standards and grading set by the private sector are more stringent than public (government) standards.¹²⁶ The operation of the multinational companies – who, on average, own 56% of the supermarkets - have also contributed to higher, privately-imposed food quality standards.

6.4 Strategies to access domestic market and trade

Smallholder producers of crops, livestock, fish, and SMEs have had to participate in the transitional and modern markets. The large volume and high-quality standard requirements by supermarkets and large urban consumers crowd out smallholder farmers, whose production systems remain fragmented and basic. In addition, smallholder producers face high transaction costs and post-harvest losses, which further constrain their ability to supply high-quality and perishable animal products, fruit and vegetables to the fast-growing supermarkets and the urban middle-income group. For example, the cost of transporting a ton of goods in SSA is about four times than in other developing countries.⁹³ Bad road networks are the main cause of this expense.⁹⁴ Small-scale farmers also lack economies of scale to supply the big quantities required by the large distributors throughout the year. This is a particularly serious problem for horticultural crops, which are grown on small parcels of land and in certain seasons, and has frequently resulted in compromising potential business with supermarkets, large hotels, and other prime consumers who demand large quantities throughout the year. These challenges are even more serious for women and young smallholder producers, who usually have fewer resource endowments and lower access to various services.

Studies have shown that group marketing - done under horizontal linkages - helps smallholder farmers overcome economies of scale and cross barriers into supermarkets and other agribusinesses.⁹⁵ Furthermore, collective marketing reduces transaction costs, allows smallholder producers to establish vertical linkages, and increases member negotiation skills

whilst improving their ability to produce according to the required higher regulatory standards.^{96,97,98,99} Vertical linkages also help individual farmers, or farmer groups, reduce post-harvest losses and marketing risks as they secure reliable and higher prices than those prevailing in the open market.^{100,101} These conclusions are supported by an observation that transitions from the traditional to transitional and eventually to modern AVC requires smallholder producers and SMEs to be horizontally and vertically linked to help them overcome economies of scale and other notable challenges^{102,103}

6.4.1 Supermarkets and smallholder farmers business relationships

Due to quantity and quality challenges, very few smallholder farmers in Africa sell directly to supermarkets.¹⁰⁴ Supermarkets' procurement systems tend to source their supplies from medium and large processors, and this has induced food processor concentration. Direct purchases from smallholder farmers are largely limited to fresh fruits and vegetables. In such cases, they buy from large and medium-scale producers or groups of farmers who pool their produce and meet the supermarket quality standards. Examples of successful business relationships between supermarkets and smallholder farmers have been demonstrated in cases where SMEs served as aggregators and intermediaries. For example, Eden Tree in Ghana is an aggregator buying fresh fruits, vegetables and herbs from smallholder farmers and then selling aggregated volumes to supermarkets.¹⁰⁵ To meet the required volume and quality standards, Eden Tree has upgraded its pack-house facilities to clean, store and pack supplies ready for delivery to 15 supermarkets in Ghana. Eden Tree buys from more than 200 smallholder farmers and the number of participating farmers is growing.

In addition to vertical linkage between supermarkets or other large consumers or wholesalers, the coordination of logistics is crucial in building successful vertical linkages. Traders, truckers, and retailers are the lifeblood of AVC as they account for 40% of the total gross value of Africa's AVC.¹⁰⁶ They are the logistics SMEs, which must be taken on board in policy formulation and rural development strategies. These SMEs need to be vertically coordinated to be efficient. A study in Nigeria revealed that only 5% of traders' transactions are on contracts and the rest of the business transactions are spot-market based – underscoring a weak vertical linkage. The Nigerian study also showed that retailers use a developed 3PLS (3rd party logistics services) market for picking, packing, warehousing and shipping merchandise. For example, the maize supply chain in Nigeria uses 3PLS market for trucking and warehousing. About 80% of Southern retailers procure 85% of maize volume from Northern "maize basket" and ship it through the 1,000 km distance through 3PLS. The 3PLS are crucial given that only 4% of the retailers covered in the study had their own trucks.

The Nigeria 3PLS system can be used effectively in vertically linking farmers to supermarkets, wholesalers, large consumers like hotels and institutions and other agribusinesses in cities. Governments need to prioritize in addressing the constraints that the SMEs reported – namely

bad road infrastructure, roadblocks, corruption, high fuel prices and limited access to electricity in rural areas, all of which weaken the growing value chain.

6.5 Strategies to access global value chains in Africa

A global value chain (GVC) consists of value addition stages along the value chain, in which at least two stages take place in different countries.¹⁰⁷ GVC is different from international trade, which involves two countries (an exporter and an importer) exchanging goods and/or services. GVC involves goods and services crossing international borders, in some cases multiple times. Africa remains a region whose economy heavily depends on commodities, with low levels of participation in the GVC, although growing in recent years.

6.5.1 Types of GVC participation

Backward GVC participation: A country imports goods, adds value to them, and re-exports. For example, South Africa imports barley from Canada, makes beers and then exports the product to other African countries and the world at large. South Africa, in this case, is an example of backward GVC participation.

Forward GVC participation: A country exports unfinished goods to an importing country, which in turn adds value and then re-exports to a third country. For example, Malawi and Kenya export raw tea to England, which in turn processes and re-exports fully processed tea to third countries.

The countries are further divided into the following groups:

- i. Commodity: The share of total domestic value-added exported manufactured commodities is less than 60%.
- ii. Innovative activities:
 - a. Small countries: Intellectual Property (IP) receipts as a percentage of GDP $\geq 0.15\%$ and R&D intensity $\geq 1.5\%$.
 - b. Medium-size: Intellectual Property (IP) receipts as a percentage of GDP ≥ 0.1 and R&D intensity $\geq 1\%$.
- iii. Advanced manufacturing and services: The share of manufacturing and business services in total domestic value-added towards exports $\geq 0\%$.

The expanding GVC has allowed low-income countries to participate in global markets. African countries can now integrate into a value chain without having an elaborate infrastructure throughout its entirety. Africa accounts for only 3% of the global trade in intermediate goods, and its GVC participation is largely forward – i.e., it is the supplier of raw materials, largely agricultural and natural resources. However, the region has made progress in GVC participation, which involves apparel, food, and automotive industries and in some business

services. Ethiopia, Kenya, and Tanzania have increased their backward GVC participation by at least ten percentage points. Ethiopia and Kenya have seen growth in the backward GVC participation regarding apparel, whilst Tanzania has made progress in backward GVC participation in manufacturing and, to a lesser extent, tourism and transportation.⁹

The value-added agri-food industry accounted for only 5% of the food exported in 2014, but it has generally expanded over time. Agri-food value addition is largely done domestically by local companies or by international companies. For example, between 2000 and 2010, supermarkets in Africa grew significantly due to foreign direct investment (FDI). International trade of agricultural commodities involved in value addition is also less common than capital goods such as electronics and transport equipment.⁹

The agricultural GVC participation has grown significantly (more than 10%) in Ethiopia, Ghana, Kenya, Rwanda, and Uganda. For the agricultural sector, which includes crop, livestock, fish, and forestry – the GVC in Ghana, Burundi, Tanzania, Rwanda, and Ethiopia increased by more than 10% in 2015 from its level in 1990. With respect to the economic regions, the ECCAS region saw the biggest jump in agricultural GVC while IGAD saw the smallest change.

6.5.2 Informal Cross Border Trade (ICBT)

Informal cross border trade (ICBT) is a source of income for about 43% of Africa's population and contributes significantly to enhancing food security and poverty reduction. ICBT is also crucial to international trade in Africa and contributes a large share of intra-Africa trade. For example, ICBT contributes between 30-40% of total intra-SADC trade (AfDB 2022). ICBT contributes significantly to food security for both sellers and buyers. Sellers – mostly women – participation increases their household income and consequently food security. The buyers across the border can buy food at relatively lower prices than corresponding prices from the formal cross-border trade. Because of this advantage, ICBT is increasing, while the corresponding formal trade is declining. For example, informal fish trade across borders is increasing, while formal trade is dropping in East Africa.¹⁰⁸ The small quantities involved in ICBT are traded across borders and are crucial for women and youth, who are always excluded in the formal international trade. The majority of participants in ICBT are women (AfDB 2022). For example, 70% of ICBT in SADC are women.¹⁰⁹ ICBT develops largely due to very weak enforcement of laws and regulations, and corruption.¹¹⁰ For example, a study done in the SADC region found that taking into consideration all border crossing and transit delays, the average speed of a truck traveling from South Africa to Zambia will be only six km per hour, a speed that is slower than a horse and carriage.

6.5.3 Performance of agricultural trade in Africa

One of the 2014 Malabo's Resolutions is to triple intra-regional agricultural trade by 2025. Staple cereals, largely maize, rice, and wheat, account for 40% of intra-Africa trade.¹¹¹ The Africa Agriculture Trade Monitor 2021 draws the following conclusions:

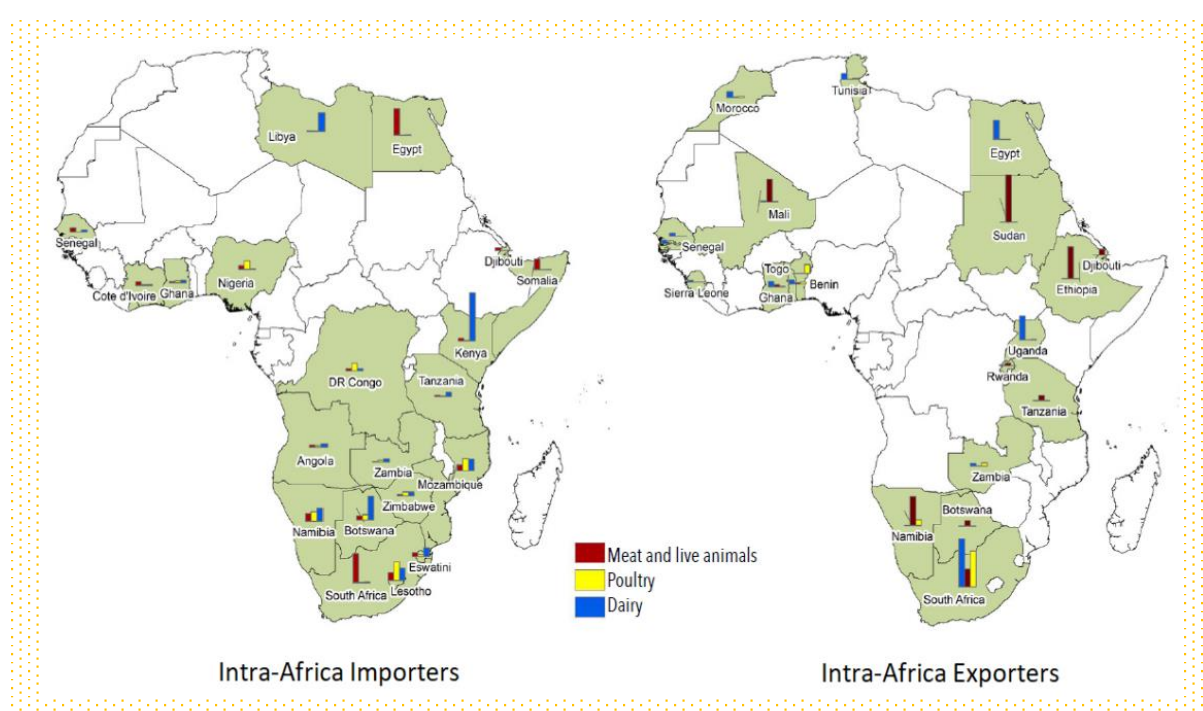
- i. Using the regional homophily index (RHI) – the extent of trade among countries within the REC - with a positive RHI indicating a greater propensity of countries in a REC to trade among themselves than with countries from other RECs, found a positive RHI for all RECs'. This implies that the RECs' primary purpose of enhancing intra-regional trade has been achieved. However, Africa Agriculture Trade Monitor 2021 found that the intra-African agricultural trade is still fragmented. It also means that the Africa-wide trade under the auspices of AfCFTA is likely to face challenges if appropriate measures are not taken.
- ii. Trade within REC countries is enhanced by the low or zero import duties for most agricultural commodities examined, hence the stronger intra-REC trade than extra-REC trade.
- iii. Intra-Africa trade rose significantly from 2003 to a peak in 2013 and fell thereafter. Similarly, raw agricultural products continue to account for the largest share of intra-African trade. However, the growth rate of intra-African trade in processed products is much faster than the corresponding rate for raw agricultural products. This is consistent with the growing demand for processed foods due to the region's fast urbanization, and the growing middle-income population. This also means achieving the 2014 Malabo's target of tripling trade by 2025 will need to focus on processed agricultural products. Africa Agriculture Trade Monitor shows that the share of export of raw agricultural products' export decreased from 12% in 2003-07 to 10% in 2015-19, while the share of semi-processed and fully processed increased during the same periods from 19% to 22% and 48% to 53% respectively.
- iv. Intra-Africa agricultural trade has a low network density.ⁿ There are 55 African countries, implying that a country has a potential of 54 trade partners. In the 2015-2019 period, rice, the commodity which is traded in all 54 countries, Africa's network density was only 8.8%. Only 213 trade networks were observed compared to the potential 2,970 (55x54) possible trade networks. Trade barriers, competitiveness, and quality standards are among the major constraints limiting the growth of network density. Non-tariff measures (NTMs), implemented through sanitary and phytosanitary measures (SPS), technical barriers to trade (TBT), price-controls, quantity-controls, and other export restrictions

ⁿ Share of actual trade links as percent of possible links.

impose the biggest barriers to intra-Africa agricultural trade. It means NTMs need to be harmonized and scaled down to enhance intra-African agricultural trade.

- v. Between 2015 and 2019, intra-African cereal exports (rice, maize, and wheat) dominated, but the rest of the world’s imports dominated, i.e., Africa is a net importer of cereals. For fruits and vegetables, intra-Africa exports dominated, with African countries importing fruits and vegetables from other African countries (Figure 5).
- vi. The two largest exporters (South Africa and Egypt) accounted for over 30% of intra-Africa exports, suggesting limited competition. However, it is encouraging to note that the competition is increasing, albeit at a slower pace.

Figure 5 Top intra-Africa Importers and Exporters for the 2010-19 Period



Source: Extracted from Kurtz et al. (2021).

6.5.4 Livestock trade

A recent study assessed the status of the livestock trade in Africa.¹¹² The study covered the following livestock: camels and camelids, horses, mules, hinnies, asses, cattle, swine, goats, and sheep. The poultry covered in the study includes chicken. The African trade in livestock products and value chains study made the following observations relevant to AVCs:

- i. In 2010-2019, intra-Africa formal annual trade was worth over \$1.3 billion. However, the informal livestock trade is estimated to be 45 times greater than the formal trade in Africa. Exports of live animals account for about 60% of the total intra-Africa export trade, underscoring the limited value addition in the livestock sector. Sudan and Ethiopia are the largest live animal exporters in Africa.

- ii. As in the case of crops, NTMs are the biggest obstacle to the intra-Africa livestock trade. However, the prevalence of informal trade reduces the impact of NTMs on intra-Africa livestock trade. It is worth noting that informal traders are also subject to frequent roadblocks, bribes, and harassment by the security and customs officers.¹¹³
- iii. On livestock value addition, South Africa is the largest exporter of processed meats. The relatively good South Africa's processed meat performance is largely based on its well-advanced agricultural industrialization compared to other African countries, and good infrastructure. The predominance of commercial farmers also contributes to South Africa's unique development of livestock product processing.
- iv. The high reliance on live animal export exposes the region to risks of outbreak of animal diseases and the need for strong control of transboundary animal diseases (TADs), which can have crippling effects if serious. The common transboundary animal diseases (TADs) in Africa and the animals affected are listed in Table 5.

A success story for TADs control is rinderpest, which was eradicated due to the international coordination, national-level efforts, and technical support that provided laboratory tests for assessment of the spatial extent and intensity of TADs outbreak.

Table 3: Common transboundary animal diseases in Africa

Disease	Animals affected
Foot-and-mouth disease (FMD)	Cattle, buffalo, shoat and pigs
Peste des petits ruminants (PPR)	Sheep & goats
African swine fever (ASF)	Pigs
Blue tongue (BT)	Sheep & cattle
Rift Valley Fever (RVF)	Cattle & shoats
Contagious bovine pleuropneumonia (CBPP)	Cattle
Lumpy skin disease (LSD)	Cattle
Sheep and goat pox	Shoats
Newcastle disease (ND)	Poultry
Highly pathogenic avian influenza (HPAI)	Poultry

Source: Otte et al. (2004) & Akalu (2017).

Case Study - Livestock trade between Africa and the Middle East

Livestock trading from the Horn of Africa to the Middle East and Gulf countries is one of the oldest cross-border livestock trading systems in the world and critical for food security and economic growth in the region. However, the trade in live animals is very sensitive to animal diseases. For example, Saudi Arabia and other Gulf States have imposed several live animal import bans from the Horn of Africa due to risks associated with TADs. Bans impact the lives and livelihoods of millions of the region's pastoralists, who rely heavily on the sale of surplus livestock to support their families. Poor pastoral livestock management systems also cause the livestock keepers to get low prices and face high livestock mortality rates.

6.5.5 Fish trade

Intra-Africa trade in fish is only 12% of the total intra-Africa exports.⁶ The major reasons for the low intra-Africa trade in fish are: (i) low production levels; (ii) inadequate infrastructure, especially cold chain facilities required to transport fresh fish and fish products; (iii) policies that impose barriers (e.g., bans) against importing/exporting fish for food safety and security reasons. In addition to compromising food safety, inferior processing methods decrease fish product prices and lower the quality and food safety standards. Cross-border procedures, quality standard certification, and NTMs, in general, have also contributed to limited intra-Africa fish trade.

6.6 Game-changing policies and strategies for enhancing marketing and trade

The proximate challenges of marketing and trade are poor market infrastructure, limited smallholder market participation and limited regional and international trade. To address these challenges, governments and development partners need to consider the following game-changing policies and strategies.

6.6.1 National-level marketing

Building robust market infrastructure within countries and across countries. Africa has a large infrastructure deficit. About 40% of Africa's population is resident in landlocked countries and with limited land transportation infrastructure. Even for countries with a coastline, surface transportation infrastructure is poor. It is estimated that Africa needs to invest at least 1% of its GDP (or \$9.6 billion per year) to build roads to close the infrastructure deficit.¹¹⁴ Narrowing the infrastructure deficit will lead to fast economic growth and such growth will be the highest in countries with superior infrastructure.¹¹⁵ However, given the large infrastructure financing needs, governments will need to crowd in the private sector by creating conducive environment for public-private partnerships in building transport infrastructure. Institutions for transport infrastructure will also need to be strengthened to address issues that increase inefficiencies in the transport sector such as poor infrastructure, unnecessary road blocks, and corruption among others. In line with the Program for Infrastructure Development in Africa

(PIDA) and AfCFTA, investments will need to be coordinated across countries to ensure they are synergistic and connect cities and rural areas across international borders. This will improve regional and continental trade.

Vertical linkage of value chains: Policies and strategies for developing and fostering vertical linkages of farmers with processors, transporters, supermarkets, restaurants and other consumers of agricultural and fish products will enhance the AVC in Africa. The most effective strategies for achieving the vertical linkages involve “push” and “pull” approaches.¹¹⁶ The “push” approaches involve extension and credit services aimed at helping smallholder farmers and fishers to meet quantity, quality and timeliness of supply to strategic markets. The “pull” approaches involve rewarding companies which buy from local smallholder farmers and fishers and/or conducting business with intermediaries who serve as aggregators or processors of agricultural products.

Strengthen linkage of the rural-urban agri-food systems: Most of the existing transport and marketing infrastructure was designed for export crop. Additionally, it is expected that in the next 40 years, Africa’s GDP per capita will rise to an average of \$10,000¹¹⁷ – a level that will increase the middle-income population in urban areas – which in turn will increase several folds the demand for agri-food products. Currently, there is a weak linkage between rural – which serves as source of food, and urban – where consumers are located. While demand for nutrient-dense and higher-quality foods is increasing among urban consumers, producers in rural areas have not responded to exploit the growing demand. To facilitate development of robust rural-urban agri-food systems, the following game-changing policies and strategies need to be pursued:

- i. Promoting road and railway construction that serves consumers within the countries and across countries.
- ii. Enhancing the SMEs which provide transportation, processing, storage and wholesale and retail businesses. This could be done by coordinating and supporting their business relationship, providing reliable data and platforms for business communication. Currently these SMEs do not receive public attention and are referred to as the “hidden middle.” An example discussed earlier is the Nigeria maize SMEs, which move maize from the north to the southern urban consumers.
- iii. Promoting production of fruit, vegetables, fish and livestock products whose demand is increasing. Current policies and strategies have largely focused on production of cereals and other high-starch staple foods. Deliberate efforts and public investment to promote production of the nutrient-dense foods are required to help farmers exploit the growing demand for such foods.

- iv. Increasing quality standards of agri-foods produced locally. This will be achieved by providing advisory services on quality standards of food products and rewarding farmers and fishers who produce high quality agri-food products. For example, a study done in Ghana showed the fish processed using the FAO-Thiaroye Technique (FTT) has significantly higher quality, yet its price was not significantly different from fish processed using traditional simple smoking – which produces much lower fish quality. Provision of information about high-quality agri-foods to consumers and producers will help provide information to attract food products of higher quality commanding premium prices.

6.6.2 Regional and international trade

Informal cross-border trade: Despite its role in food security, women empowerment and its sheer size, ICBT is regarded as illegal in most African countries.¹¹⁸ Game-changing policies and strategies are required to change this attitude and to facilitate ICBT instead of fighting it. Following are the policies and strategies for developing and facilitating ICBT:

- i. Formalization of the informal trade routes through infrastructural development e.g. construction of market facilities, improved road networks, storage facilities. For example, at Tunduma/ Kasumulu border points, One-Stop-Border-Points (OSBP) have been established. The OSBP is an e-data system which is used to process import-export paperwork and harmonize imports and exports documents/requirements in the region.¹¹⁹ It has reduced time spent at borders, which in turn has facilitated processing of highly perishable food products like fish, fruit, vegetables and other products. Likewise, Togo has established an electronic single-window system, which reduces the time for border compliance and documentary compliance for both formal and informal exporters and importers.¹²⁰
- ii. Facilitate ICBT groups to enhance cross-border processing. It is easier to do business with a group of ICBT traders than individual traders (helping ICBT traders to be organized in such a way that the cross-border processing procedure is done in groups). For example, fish cooperatives increased participation in informal cross-border trade and profitability of women along the Ghana-Togo-Benin borders.¹²¹

Intra and extra-Africa trade: Intra-REC trade is increasing and thriving in all RECs largely due to further reduction of tariffs and trade restrictions. Game-changing policies and strategies for increasing intra-REC and inter-REC trade are:

- i. Although most countries have reduced tariffs to foster export, non-tariff measures (NTMs) have become one of the major obstacles to intra and extra-Africa agricultural trade. Tariffs and NTMs need to be removed or significantly reduced to increase intra-Africa and extra-Africa agricultural trade. A success story that has implemented a promising policy is the IGAD Transhumance protocol.

Box 1: IGAD – Protocol on Transhumance

The Intergovernmental Authority on Development (IGAD) Protocol for Transhumance was developed in 2021 with the purpose of exploiting the full social and economic potential of pastoral systems by:

- a) Allowing free, safe and orderly cross-border mobility of transhumant livestock and herders in search of pasture and water as an adaptation mechanism to climate change and weather variability within the IGAD region;
- b) Committing Member States to invest adequate resources to pastoral regions and competent institutions managing transhumance;
- c) Harmonization of national laws and policies related to livestock and pastoral development, land use and governance, disease control and cross-border measures.

The Protocol covers a range of issues including safe cross-border transhumance; transhumance corridors; border crossings; itinerary (certificates indicating transhumance corridors); and identification documents (from competent authorities produced on demand). The Protocol also covers issues on guarding transhumance livestock; grazing areas (defining and determining the maximum grazing capacity of a given grazing area); protection of herders; and access to basic services (such as education and health). The Protocol also provides terms for sale, identification and traceability of transhumance livestock. It also provides disputes settlement mechanisms. Bilateral agreements that strengthen the Protocol have been given space. Member States are expected to harmonize national legislations and policies in order to facilitate implementation of the Protocol.

Member States have adopted the Protocol and at the same time they are working towards addressing challenges inherent in the betterment of the implementation of the Protocol.

- ii. Prioritize agro-industrialization and quality standards. For the intra-Africa trade, the earlier discussion showed that there is a growing middle-income population, which requires more processed foods. This means agro-industrialization will enhance intra-Africa trade. The growth of the middle-income population is also happening outside Africa and for similar reasons. Countries promoting and supporting agro-industrialization, increase the potential to participate in international trade. Furthermore, agro-industrialization increases the quality standards of products, allowing African countries to meet the strict quality standards in the international market.
- iii. Quality standards, certification, and grading require a strategy that supports producers to invest in quality improvement at the early stages of production.

Strategies for incentivizing producers to invest in quality standards at the early stages of production include setting clear standards and regulations to ensure that producers are rewarded for investing in quality improvement. Supermarkets and multinational corporations have been incentivizing farmers to produce high-quality products and reward them by paying premium prices. Institutional infrastructure is also required to help farmers access essential services and facilities such as grading, packaging, and certification along the value chain.

- iv. The expanding GVC has allowed low-income countries to participate in the global value chain. African countries can now integrate into a value chain without having an elaborate infrastructure throughout its entirety. This will allow Africa to move away from its current forward linkage posture i.e., supplier of raw materials. GVC participation will allow Africa to be a trader of manufactured goods.

Chapter 7: Food consumption



7.1 Introduction

Food consumption patterns are rapidly changing in response to population growth, nutritional awareness, urbanization, and income. However, there is a sharp divide between rural and urban consumers, which can be troubling. African urban consumers are increasingly spending more on fruit, vegetables, and animal products, while rural consumers' food expenditure is largely on staple cereals and grain.¹²² The increasing demand for fruit, vegetables, and animal products in urban areas is creating ample opportunity for the rural farmers to respond to this change by increasing supply and fetching higher prices. The changes are also creating agro-industrialization in both rural and urban areas and thus facilitating job creation. This chapter analyzes the consumption patterns and the policies and strategies that could be implemented to ensure both rural and urban consumers have access to diverse and healthy diets.

7.2 Changing food tastes and preferences

Significant food system-related changes are taking place in Africa to respond to the increasing urbanization and growing middle-income population. The African urban population accounts for 47% of the total population, and it doubled in 2015 compared to its level in 1995.¹²³ At the same time, Africa's middle-income population is growing fast. A study showed that the lower middle income in Eastern and Southern Africa is expected to increase by 27%, and the poor (those who live with less than US\$2 per day) will decrease by 53%.¹²⁷ These changes have increased the demand for easy-to-prepare, highly processed foods, which are energy dense and high-fat content.¹²⁴ Another study shows that one-third of the value of purchased food was spent on processed foods, suggesting a stronger need for agro-processing.¹²⁷

7.3 Drivers of nutritious and healthy food consumption

In the face of changing food tastes and preferences, patterns are emerging on the factors that determine consumption of nutritious and healthy foods. The drivers discussed below are based on Kearney (2010).¹²⁵

Income: highly correlated with change from high-in-carbohydrate foods to high-in-fat and energy-dense foods. A substantive shift took place to a diet with more animal products.

Urbanization: Urbanization has improved marketing, greater access to modern mass media, distribution infrastructure, and large supermarkets dominated by multinational corporations.

This results in better transportation systems, thereby improving access to foreign supplies and the importance of imports. The high intake of calories and fat combined with inactivity has been leading to increasing obesity and diabetes. Preference for fast food – which has more carbohydrates, salt, sugar and fats - has increased the risk of obesity and diabetes.

Trade liberalization: Removal of trade barriers has attracted international food chains to be established in Africa. This has enabled the presence of highly-processed foods which are rich in energy, fats, salts and animal products. Additionally, international and domestic food marketing and social media have also contributed to changing preferences for junk food.

Nutrition education: Nutrition education significantly increases the propensity for selection of healthy and nutrient-dense diets. For example, women who were provided with nutrition education were found to feed nutrient-dense and healthy diets to their children.¹²⁶

7.4 Game-changing policies and strategies for increasing access and consumption of nutrient-dense and healthy foods

7.4.1 Increase nutrition education

In most African countries, there is no formal institution that offers robust nutrition education to consumers, except for anecdotal education provided through ministries responsible for health or nutrition. While agricultural production has traditionally been served by agricultural extension services, there is no evidence of the existence of a well-established institution that offers nutrition education. In most cases, nutrition education is offered by the ministry responsible for health through mass media and is not well-targeted. This has led to limited nutrition education among consumers. While high costs and taboos have been some of the major drivers of insufficient intake of livestock products, limited nutrition education has been one of the main reasons for insufficient consumption of fruit and vegetables, especially in rural areas. Likewise, middle-income consumers and urban consumers, in general, consume unhealthy foods, leading to obesity and thus the double burden of malnutrition (DBM). Nutrition education and improving value chains are among the strategies for addressing the DBM challenge.

This calls for building and formalizing nutrition education and extension. Unlike the conventional agricultural extension, which focuses on farmers and livestock keepers, nutrition education is universal as it covers all consumers. As in the case of agricultural extension services, a diversity of approaches will help provide better nutrition education. In-person communication could still be done by increasing the pluralistic extension services that include nutrition education. Such services could remain under the ministry responsible for agriculture for the farmers and by the ministry responsible for health for other consumers in both rural and urban areas. An arrangement could also be made to provide in-person nutrition education at schools, clinics, and other institutions.

7.4.2 Enhance the rural-urban food systems linkage

As noted earlier, there is a disconnect between demand in urban areas and production in rural areas. There is a weak link between rural and urban food and nutrition systems. Consequently, smallholder farmers have not responded adequately to the changing quantity and quality demand of the growing middle-income population in urban areas. Improving rural-urban market infrastructure will greatly reduce the transaction costs and thus allow farmers to transport their produce to urban areas and avoid both post-harvest losses and high transport costs. The value chain transformation examined earlier has shown that large agribusinesses thrive in countries with good market infrastructure since the required logistics necessitate the need for robust road and other market infrastructure. Morocco is a good example since it has built robust roads and cold-chain logistics that are serving well the smallholder farmers in rural areas.

7.4.3 Build vertical linkages between producers and consumers

It has been noted that building vertical linkages greatly enhances the rural-urban food systems. This also requires robust horizontal linkages to allow farmers to meet the high-quality standards and quantity that large consumers and wholesalers need. A good example of such linkage is the Kabale potato success story from Uganda, which will be discussed later. In this example, potato farmers in Kabale districts were able to do business with a large fast-food chain in Kampala city. Technical support was provided by NGOs to help the smallholder potato farmers to meet the quality standards required. Furthermore, the vertical linkages required will need to be supported by robust technical support and, if possible, pro bono legal services^o to enhance their effectiveness. Improved road and market infrastructure also helped significantly in reducing transaction costs and post-harvest losses, especially for highly-perishable produce.

7.4.4 Exploit the ICT in promoting nutrient-dense and healthy diets

The widespread use of mobile phones has enhanced strategies for providing nutrition education to rural and urban consumers. There are already attempts by NGOs and governments to exploit ICT in providing nutrition education. ICT has been used effectively to promote better food preparation, behavioural change, and reminding consumers of measures they need to take to stay healthy. Like the case of seed quality, ICT has also been used to verify the authenticity of food labels and traceability.¹²⁷

^o “Pro bono” are uncompensated legal services performed on behalf of people or communities who cannot afford to pay. A list of pro bono services in Africa is given here <https://www.ptla.org/legal-aid-around-world>

Chapter 8: Guidelines for achieving sustainable and inclusive value chains for crop, livestock, fisheries, and aquaculture

The previous five chapters discussed the empirical evidence of drivers of performance for an inclusive and sustainable agricultural value chain. The conclusions and implications of the last five chapters are the basis of the guidelines development. It starts with highlights of the strategies under each of the three broad groups of commodities – crop, livestock, and fish, and provides guidance on strategies required for achieving an inclusive and sustainable AVC. In most cases, success stories are provided to illustrate the impact of the suggested guidelines.

8.1 Crop value chain

Strategies

Supply-side

- (i) Provide training and services to agro-dealers.
- (ii) Enforce quality and standards of agricultural inputs.
- (iii) Streamline and expand agricultural inputs distribution mechanisms.

Demand-side

- (iv) Provide pluralistic advisory services.
- (v) Exploit ICT to improve smallholder farmers' access to technical information
- (vi) Provide targeted incentives for adopting sustainable land management (SLM) and climate-smart agriculture (CSA) practices.
- (vii) Enhance (short-term and long-term) training on SLM and CSA technologies.

Cross-cutting

- (viii) Improve market infrastructure.
- (ix) Deploy geospatial technologies to plan the location of agricultural and rural services and facilities.

8.1.1 Supply side

Provide training and services to agro-input dealers: Agro-dealers are major providers of agricultural extension services to their clients, the farmers. In providing correct and useful information, it is important to avail agro-dealers with up-to-date technical knowledge and information through training. Training could be provided by the national training and research institutions in partnership with NGOs and other strategic actors.

Streamline supply chain: Agricultural input market is highly fragmented, and such fragmentation increases costs for the farmer. Coordination of transportation and operations among agro-dealers and agri-food dealers will significantly reduce transaction costs and, consequently, prices paid by farmers.

Provide incentives for agro-dealers and service providers to increase the efficiency of inputs distribution: It is important to expand coordination among agro-inputs dealers. Coordination of financial institutions, suppliers, and other rural service providers could significantly enhance the efficiency and coverage of services to farmers.

Box 2: Success stories of agro-dealer collaboration: East African Banks' collaboration with Agro-dealers

The Equity Bank and Kenya Commercial Bank have established business relationships with agro-dealers who serve many farmers. The banks have been using the agro-dealers as their agents to provide loans to farmers. The Banks work with agro-dealers with a significant number of agricultural inputs. The farmers get a lower interest if they get the loan from the agro-dealers.¹²⁸ Similarly, in Tanzania, the Last Mile initiative has brought together the Last Mile Alliance Bayer, NMB Bank, SeedCo, Syngenta, and Yara. The agro-dealers were trained on how to establish business relationships with smallholder farmers and how to serve as a focal point for providing credit and knowledge on improved agricultural technologies. The alliance also helped in creating clusters and the coordination of procurement and transportation of agricultural inputs.

Enforce quality standards: Counterfeit seeds, fertilizers and other agro-inputs are prevalent in African agro-input systems. Strategic measures are required to ensure that farmers buy high-quality agro-inputs. The use of information technology is one of the effective strategies for enforcing quality standards.

Box 3: Success Story: Combatting counterfeit agricultural inputs

Counterfeit seeds, fertilizers, and pesticides have eroded the confidence of smallholder farmers' adoption of improved seeds. E-verification (EV) using electronic labels has been developed. These labels will link the input package to the SMS-based quality assurance system. Codes printed on the labels provide users with information such as brand, input type and concentration, batch number, and date of manufacture and expiry. EV packaging instructs consumers purchasing the inputs to "authenticate" the product by sending an SMS message to the EV system, entering the package-specific code, and receiving an SMS message in return verifying that the product is genuine.

The Tanzanian mobile services company is working with the Tanzania Official Seed Certification Institute (TOSCI) to help smallholder farmers detect counterfeit and adulterated inputs. Through *e-Hakiki*, an e-verification solution for tracking genuine agricultural inputs, farmers can verify the authenticity of seeds or pesticides via their mobile phones at agro-dealer shops. Each packet of seeds bears an *e-Hakiki* verification label with a unique code, with which farmers verify whether the seed packet has been certified by the Tanzania Official Seed Certification Institute (TOSCI) and is suitable for use. The same procedure is used in pesticides, which are subject to verification by the Tanzania Pesticide Research Institute (TPRI). *e-Hakiki* is positively affecting thousands of lives in Tanzania's largest economic sector by reducing the prevalence of counterfeit and adulterated agricultural inputs.

8.1.2 Demand side

Provide pluralistic advisory services: Traditionally, extension services have predominantly been provided by publicly funded agricultural extension services. Research has shown that the focus of such services has largely been on production. Pluralistic extension services will help provide advisory services beyond production activities.

Box 4: Case study: Information technology for enhancing farmer and agro-dealers interaction in Kenya and Ghana

iProcure, a Kenyan company, has built a state-of-the-art market intelligence platform that provides farmers and agro-dealers market intelligence on spatial demand, supply, and price.¹²⁹ The market intelligence is provided in real-time, showing purchases and where such purchases are taking place. This has provided mechanisms to farmers and agro-dealers to improve market linkages by integrating supply chains and improving efficiency and traceability. A similar mechanism is used in Ghana by *e-Soko*, which provides market information along the entire value chain. *E-Soko* also provides e-Extension services and has been used by public programs to provide advisory services. Over half a million farmers have *e-Soko* app and use it to get weather and climate information services.¹³⁰

Provide targeted incentives for adopting sustainable land management and climate-smart agricultural practices: Input subsidies have been common in Africa, yet they have faced challenges of being too expensive, inefficient, misused, as well as crowding out private agro-dealers. The high cost of subsidies could be addressed by giving conditional and targeted fertilizer subsidies, in which qualified farmers receive fertilizer vouchers if they have adopted verifiable good agricultural practices in soil and water management. Similarly, agricultural extension service providers' knowledge of SLM and CSA practices is limited. This means there is need to make deliberate efforts to address this gap.

8.1.3 Cross-cutting strategies

Improve market infrastructure: Transport (rail, roads, and waterways), communication infrastructure, market structures, and storage facilities are crucial in improving farmers' participation and access to both agricultural output and input markets. Access to rail, roads, and waterways lowers transaction costs and allows farmers to reach distant markets and inputs reaching remote areas at relatively lower costs. Likewise, access to storage facilities, market stalls, and other infrastructure greatly improves marketing. Public investment in transport infrastructure networks, with the private sector investing in the rolling stock, is necessary. Public-private partnerships will be required in constructing and maintaining some marketing infrastructure to enhance market participation.

Deploy geospatial technology to plan and develop an efficient and sustainable agricultural value chain. Development of transport infrastructure (rail, roads, and waterways) and other market infrastructure using geospatial analysis will ensure that the infrastructure serves the farmers the most. The technology allows their locations to be overlaid on many other aspects, including population, type, and quantity of agricultural production, soil fertility, and other key data. These attributes make geospatial technologies ideal for planning and policy formulation.

Increase access to credit: Access to credit is important in agricultural value chains where it could be used for purchasing inputs and equipment and starting new agricultural businesses. This is especially important for women and youth, who are less endowed than men. Financial inclusion in Africa is improving with the development of mobile money services. Strategies for increasing financial inclusion mean that mobile money needs innovative approaches to ensure the mechanism becomes more inclusive and benefits more the poorest. This could involve provision of incentives for mobile operators to set businesses in remote areas to increase access to credit for the rural poor.

8.1.4 Create legislations enhancing access and investment in farmland improvement

Strategies

- (i) Create national-level policies and legislations that provide incentives to adopt SLWM practices.
- (ii) Design stable land policies that create incentives to invest in better land management practices.
- (iii) Enact national-level laws and regulations reflective of the country's land policies

Create national-level policies and legislations that provide incentives to adopt SLWM practices: Secure land tenure is essential for farmers to invest in long-term sustainable land and water management practices (SLWM). Farmers feel more secure to invest in tree planting or soil and water management if they expect to have long-term ownership or access to the land. Thus, national-level laws and regulations are required to secure land tenure. Secure land tenure systems also prevent conflicts, especially when they have been designed taking into consideration vulnerable groups of people.

In designing legislations that ensure tenure security, the national level legislative institutions may wish to consider the following strategies:

Design stable land policies that create incentives to invest in better land management practices: Land policies give clear guidance on land ownership and investments. The African Union has created a Framework and Guidelines (F&G) on Land Policy in Africa. The F&G is based on rigorous empirical evidence and was formulated using consultative and inclusive processes. The F&G advocates the customary tenure's taking the lead in land governance.¹³¹ Thus, designing policies using F&G are likely to create policies that will ensure secure land tenure for all stakeholders.

Enact national-level laws and regulations reflective of the country's land policies. The important areas which need to be taken into account are related to sustainable land management, land use planning, and protection and recognition of vulnerable people's rights. Careful land use planning is required in designing and allocating land, reflecting the existing land ownership and

rights. Currently, about 90% of land in most of Africa is under customary tenure,¹³² which justifies AU's Framework and Guidelines in recognition of the central role of the customary land tenure system. Thus, legal pluralism that exploits the strength of each legal system that permits formal and customary laws and regulations to co-exist and operate is inevitable. Studies have shown that enforcement of customary laws and regulations is cheap and very effective, since it is recognized by the local people and operates in fairly uniform cultural and ethnic communities. However, in many cases, customary tenure laws tend to be biased against women. On the other hand, formal laws and regulations are ideal in urban areas and rural areas with diverse cultural environment. However, due to the inadequate capacity of local governments, enforcement of formal laws and regulations is still inadequate and creates a vacuum, which is frequently filled by customary institutions. In some cases, a combination of formal and customary governance has been successful. Nigerien Rural Code is a typical example of this blending.

Box 5: Success Story: Rural code in Niger led to the re-greening of the Sahel

Niger passed the Rural Code in 1993. The Rural Code integrates the customary and formal statutes since it recognizes inherited land as private and provides it with secure tenure. It gives the customary institutions the mandate of land governance. Niger Forest Code gives land operators tree tenure. These two statutes received strong support from civil societies, which provided technical and institutional support to communities. Tree planting and protection programs became very successful. At least three million hectares were reforested in the early 1980s in Niger. The institutional changes and the government and land users' favourable perception of trees led to a dramatic increase in planted forests.

The tree planting and protection contributed to the re-greening of the Sahel, which was associated with the increase in precipitation in the Sahelian region from 1994 to 2012. This occurred because the statutes created incentives for land operators to invest in tree planting and protection. The government did not commit significant financial resources, demonstrating that it is possible to achieve significant land improvement by only creating a conducive environment for land improvement.

8.1.5 Enhance research and extension services

Strategies

- (i) Increase funding for R&D and extension services.
- (ii) Revise agricultural college curricula and retrain in-service extension service providers beyond production-enhancing technologies.
- (iii) Develop e-extension services that cover the entire value chain.

Increase funding for R&D and extension services: The African Union set a target of 1% of agricultural GDP to be allocated to R&D. However, only five countries have achieved this target. Greater investment in R&D will increase Africa's productivity and enhance the AVC performance. Thus, the need to increase R&D funding and reach the AU's target of 1% of agricultural GDP is imminent.

Revise agricultural college syllabus and retrain in-service extension service providers beyond production-enhancing technologies: Public agricultural extension service providers remain the dominant providers of advisory services. Extension messages are largely based on enhancing production, focusing on improved seeds, inorganic fertilizer, agronomy, pest and disease management, and other related traditional messages. Provision of advisory services on climate change, promotion of sustainable land (soil fertility and soil health) management practices, market access strategies, and other technologies along the AVC beyond production has not received adequate attention from public agricultural extension service providers. There is a need to provide (short-term) training to (in-service) agricultural extension agents on the current agricultural knowledge related to climate change, a paradigm shift on soil organic fertility management, agriculture of the future, accessing markets, and other current developments in agricultural value chains. Additionally, training in-service extension agents to provide advisory services on non-production activities is required and needs even more attention. Likewise, such new knowledge and advisory services need to be incorporated into the agricultural college curricula to benefit the new agricultural extension students. The provision of pluralistic extension services could also help provide advisory services along the entire value chain.

Develop e-Extension services that cover the entire value chain: Given the developments in ICT and, more specifically, the widespread availability of mobile phones in rural areas, agricultural extension services can exploit the potential of ICT-based technologies such as mobile phones to reach out to more farmers. Many countries in Africa are already using mobile phones and other ICT-based technologies to provide advisory services. The use of ICT is more pronounced among NGOs and private companies following the rapid expansion of ICT Infrastructure and mobile phones penetration. The areas that need consideration to achieve effective e-Extension services include the following:

- i. **Designing well-targeted short text and voice messages:** Designing impactful short messages requires high-level communication skills. There is a need for developing such skills and allocating resources to engage professional communication experts in developing targeted messages.
- ii. **Know the farmers' needs:** the smallholder farmers in Africa are becoming more diversified, and this increases the need for designing demand-driven and context-specific messaging. This requires a continuous research program that will capture

the context-specificity of the farmers. For example, regular data collection using traditional methods and mobile phones can capture farmers' needs on a regular basis. The need to establish simple and easy methods of collecting opinions of the farmers who receive the extension methods will also help establish efficient and low-cost data capture methods. For example, at the end of each message, a follow-up message could ask farmers to state whether the message received was useful and how they plan to use it.

- iii. **Allocate financial resources for e-Extension services:** The agricultural extension service providers will require smartphones for official use and adequate airtime to allow smooth communication with farmers.
- iv. **Establish a public-private partnership to reach all farmers:** Collaboration with mobile phone service providers is crucial in enhancing e-Extension services. The biggest downside of e-Extension services is the potential to exclude farmers in remote areas with limited mobile phone connectivity. This challenge could be addressed by offering incentives for private mobile phone service providers to establish services in such areas. Private companies with skills and technologies for designing appropriate messages are also required in providing efficient and effective e-extension services.
- v. **Establish an interactive e-Agriculture alliance program.** Many agricultural programs could work together to establish an effective collaboration that will help increase the usefulness of e-communication with farmers.
- vi. **Promote R&D and Extension targeting high-value crops:** Agricultural policies and investments remain centred on staple cereal and high-starchy crops. As noted earlier, only AMU countries provide significant investment in horticultural crops. However, the growing middle-income population and urbanization have created a big demand that has not been exploited by smallholder farmers. There is a need for increasing R&D and extension services for horticultural crops. Morocco offers a success story demonstrating that horticultural crops can enhance inclusivity along the agricultural value chain.

Box 6: Success story: Morocco Horticultural Production

Morocco is a country in the AMU region in which agriculture accounts for the largest share (34%) of the labor force. The country has designed an agriculture and natural resource management plan – namely Plan Maroc Vert (PMV) or Green Morocco Plan – which aims to reduce poverty and increase food and nutrition security. Since most of the poor in Morocco are smallholder farmers, PMV targets them to enhance the productivity and inclusivity of AVCs. Morocco is one of the leading exporters of fruit and vegetables to Europe. Fruit and vegetables account for 95% of Morocco’s raw agricultural exports and 25% of the country’s total export. Morocco has developed an elaborate horticultural crop production, storage, transportation, and processing infrastructure. PMV is facilitating the formation of professional farmer organizations to enhance productivity and collective marketing apart from facilitating vertical linkages. Several factors have contributed to Morocco’s successful fruit and vegetable export to the international market and the inclusion of smallholder farmers.

The following summarizes the major drivers of Morocco’s success story:

- i. *Aggregation and public-private partnership:* PMV has facilitated the formation of a professional trade committee – which helps form a vertical linkage between producers and other actors along the value chain. The government provides necessary incentives and technical support to help the trade committees to vertically link farmers with other AVC actors. Well-planned aggregation centers have been developed to facilitate the processing, transportation, and storage of highly perishable horticultural crops. Large greenhouses are also vertically linked with exporters. Another feature of the public-private partnership (PPP) is public land allocation to smallholder and private operators.

Since PMV’s inception, the government has allocated about 120,000ha of public land to smallholder farmers and private operators under its PPP program. Aggregation of smallholder farmers – the majority of whom own land area below 5ha – has helped increase yields and enabled the use of other modern technologies that cannot be used at a smaller scale. Citrus yield increased by 56%, from 18t/ha to 28 t/ha.

- ii. *Irrigation investment:* PMV has heavily invested in drip irrigation and other water management strategies under its 10-year National Irrigation Water Saving Program, whose objective is to increase water use efficiency. The Ministry of Agriculture invested about 30% of its budget in irrigation development. Drip irrigation has allowed the production of horticultural crops by smallholder farmers around the year. It is estimated that the modern irrigation systems save

2 billion cubic meters of water annually, which is an exceptionally good result in water control.

Quality, sanitary, and phytosanitary and certification: An important effort has been made to improve the quality of fruit and vegetables. Quality certification education and services are offered by the private sector, which responds to the high-quality standards required for export to the European, American, and other international markets. Similarly, domestic supermarkets require high standards to meet the growing middle-income population in Morocco as well as tourism industry requirements, especially hotels. Packing infrastructure has been established in strategic areas to meet the quality standards.

8.1.6 Invest in creating and promoting farmer and agribusiness SMEs

Strategies

- (i) Invest in building a robust institutional capacity of farmer and agribusiness SMEs along the entire value chain.
- (ii) Foster vertical linkages.
- (iii) Develop the capacity of farmers and agribusiness SMEs to provide financial and advisory services.

Invest in building a robust institutional capacity of farmer & agribusiness SMEs along the entire agricultural value chain: There is a need to develop robust and efficient farmer and agribusiness organizations along the entire value chain. This is due to the current market development and changing demand for agricultural commodities. Building the organizations along the AVC needs to focus on the producers and the agribusiness SMEs along the value chain. Fostering growth of agribusinesses SMEs will increase their capacity to provide services to the farmers and improve the performance of the AVC.

Government budgets for the development of farmers' organizations remain small in many countries. Increasing budgetary allocation to support the development of independent farmers and agribusiness development is important. A success story of a farmer and SME agribusiness along the entire value chain in horticulture comes from Tanzania.

Box 7: Success Story: Tanzania Horticultural Association (TAHA)

Established in 2004, Tanzania Horticultural Association (TAHA), a member-based organization, is committed to the growth, promotion, and continued development of the horticulture industry in Tanzania. TAHA's business includes flowers, fruits, vegetables, spices, herbs, roots and tubers, and horticultural seeds. The Association has been behind the success of the horticultural exports industry in Tanzania, and in recent years, the horticultural industry has been one of the leading exports in Tanzania. But how did TAHA grow into the current state-of-the-art horticultural industry? Following are the factors that led to TAHA's growth:

- i. *Together, ordinary people can achieve extraordinary results* (Becka Schoettle). TAHA is an apex organization of 677 smallholder farmer groups, 16 commercial farmers, and 26 agribusinesses providing agricultural inputs and financial services.
- ii. *Quality means doing it right when no one is looking* (Henry Ford). TAHA has developed quality standards that far exceed government regulations. The Association has been instrumental in building compliance with the market standards such as GlobalGAP, British Retailers Consortium (BRC), ISOs, and SPS.
- iii. *Information is power (ipsa scientia potestas est)* (Sir Francis Bacon). TAHA collects and disseminates market information through its mobile app (TAHAKILIMO). Information on investment promotion, technical support, business development services, industry analysis, development of key infrastructure, including on-farm collection and cooling facilities and packhouses to help farmers and other stakeholders make the right decisions.

Foster vertical linkages: There is a limited number of large agribusinesses, hotels, and other large consumers. Fostering vertical linkages of farmer organizations with large agribusinesses, hotels, institutions, and other consumers is helpful in enhancing inclusivity in AVCs. Strategies fostering vertical linkages that have been used successfully in Africa include:

- i. **Training farmer groups and agribusiness SMEs to conduct business.** NGOs and other private sectors have been used by USAID, IFAD, GIZ, AGRA, and other development partners to train farmer groups and agribusiness SMEs to establish vertical linkages and conduct market-based business relationships. Training has enhanced the capacity of AVC actors to establish vertical linkages and conduct businesses.
- ii. **Provision of agricultural databases to facilitate business relationships:** Provision of data helps all AVC actors to make business decisions. iProcure in Kenya offers real-time market intelligence data that helps all subscribers along the value chain to make decisions. Hello Tractor in Nigeria facilitates tractor hiring in a similar way as Uber offers taxi services, which helps smallholder and other vulnerable groups along the value chain to get

services and make decisions. Twiga Foods in Kenya is a business-to-business (B2B) e-commerce platform that has digitized the food supply chain using mobile phone technology, supplying food to over 30,000 consumers monthly. The company has reduced post-harvest losses and lowered consumer prices. Twiga Foods has also increased the efficiency of the fragmented formal and informal retailers in Nairobi, a city with 180,000 food and beverage retailers serving 6.5 million people – or 36 consumers for each retailer. The fragmented retailers increase the consumer price due to high transaction costs. However, Twiga Foods has provided market intelligence to the retailers and helped them reduce the information search costs.

Develop the capacity of farmers and agribusiness SMEs to provide financial and advisory services:

The formation of vertical linkages needs to be strategically promoted to ensure that it helps producers and agribusiness SMEs access financial and advisory services. The financial services have been especially crucial in agribusiness SMEs, particularly for women, youth, and poor entrepreneurs in general. It is estimated that Sub-Saharan Africa has 44 million MSMEs, of which 51% don't have access to financial services to support their businesses. Governments and development partners could help by facilitating concessional loans and guarantees to borrow by agribusiness SMEs and producers.

Box 8: Success story: Opportunity Ghana: Financing Cocoa Farmers

Opportunity Ghana had embarked on an agricultural finance program that initially focused on cocoa farmers. Disbursements at the end of 2010 were 536 agricultural loans under the Cocoa Livelihoods Program (CLP) and Millennium Village Program (MVP). Each farmer received a three-acre package worth approximately \$300 that included fertilizer, pesticides, and protective clothing. Farmers were asked to use the materials on only three acres. The farm mapping was particularly helpful, and subsequent loan clients received inputs based upon the actual acreage of their farm plots to maximize impact. Repayment rates of 100% were recorded for the MVP farmers' group and 99.4% for the CLP farmers' group in the first round of cocoa loans, which demonstrated the effectiveness of the profiling technique. By Dec. 31, 2011, Opportunity Ghana had disbursed 3,572 loans – each with an average value of \$552. The Opportunity Ghana approach hinges on the coordination with all stakeholders in the agricultural value chain as an essential success factor for the farmer and Opportunity's agricultural finance initiative.

8.2 Livestock value chain

The guidelines on livestock are divided across the major livestock types: cattle, poultry, small ruminants, and pigs. Cattle, which is a major livestock in Africa with diverse production systems, is divided into Pastoral and agro-pastoral systems, Mixed systems, Smallholder dairy systems, and Ranching.

8.2.1 Pastoral and agro-pastoral systems

Develop policies & strategies that recognize and support pastoralist production: Pastoralists have been neglected and marginalized before and after African countries' independence. Pastoral land rights have been compromised by privatization efforts and public and private investments. There is a need to change policies and investment strategies that support pastoral livelihood. Botswana is one of the countries that has designed policies and strategies for supporting pastoralism. The case study below demonstrates the policies and benefits of investing in pastoral production systems.

Box 9: Success Story: Botswana Livestock Sector

Botswana spent 48% of its agricultural research and development on livestock. Additionally, Botswana has developed genetic improvement, disease control, and an elaborate infrastructure for livestock health, veterinary services, and watering points for pastoralists. The country has also developed robust quality standards and SPS programs to enable farmers to meet quality standards in the global market. Such developments have been made over a long period by the government, which prioritized and invested in livestock production.

The significant investment in livestock has shown good results in productivity and value addition. Despite its small land and population, Botswana is the third-largest intra-Africa exporter of meat carcasses and cuts (after South Africa and Namibia) and the seventh-largest African exporter to Africa and the rest of the world.

Use of satellite and ICT for sustainable grazing and water management

Satellite and ICT have also been used to provide marketing information and index-based livestock (IBL) insurance^p, and ear-tagged animal traceability. Despite these favourable developments, satellite data are unable to capture some attributes of pasture. Pastoralists' choice of pasture areas depends on a multitude of factors other than vegetation greenness, which are often very site-specific, difficult to assess by telemetry, and yet, insufficiently incorporated in digital decision support systems.

^p For example see IBLI Index based livestock insurance [at https://www.drylandinnovations.com/](https://www.drylandinnovations.com/)

8.2.2 Mixed livestock systems

Strategies

- (i) Promote a sustainable integrated crop-livestock system.
- (ii) Promote animal power to increase crop and livestock productivity.
- (iii) Promote high-nutrient pasture and agroforestry development and crop residue utilization.
- (iv) Promote uptake of Index-Based Livestock Insurance (IBLI).

- i. **Promote sustainable crop-livestock production systems:** crop and livestock production systems offer strong synergistic features that remain under-exploited. In most cases, crop and livestock production policies and strategies are planned independently. For example, it is common to find crops and livestock in two different ministries. Although coordination may bring the two sectors closer, such an institutional setup may weaken the potential for designing synergistic policies, strategies, and investments.
- ii. **Promote animal power technologies to enhance crop and livestock productivity.** The hand-hoe remains the major crop production tool, and this has consistently reduced Africa's labour productivity. Increasing investment in developing animal power technologies to support transportation of bulky manure from kraals and other livestock confinement structures to crop farms in addition to transporting bulky livestock feed and fodder is bound to enhance synergy and add value to agricultural value chains.
- iii. **Promote high-nutrient pasture and agroforestry development and crop residue utilization.** Develop pasture, crops, agroforestry, and other soil improvement technologies that provide nutritious fodder for livestock. Leguminous agroforestry trees and shrubs have been developed and promoted mainly for improving soil fertility for crop production. As these technologies are developed and promoted, emphasis on animal nutrition is necessary.
- iv. **Promote uptake of Index-Based Livestock Insurance (IBLI):** Uptake of IBLI is likely to increase by supporting both the supply and demand of IBLI. Currently, very few private businesses feel comfortable providing IBLI. At the same time, smallholder farmers are reluctant to use IBLI. Governments and NGOs can help increase supply and demand by:
 - a. *Soliciting and support of IBLI providers.* The solicitation could be done by educating potential providers, using success stories, and providing information on the strategies for implementing a successful IBLI. Training seminars for potential private providers will greatly help.
 - b. *Providing guarantees.* Governments and development partners will greatly increase the IBLI supply.
 - c. *Providing IBLI advisory services to farmers:* IBLI-specific advisory services will enhance the IBLI demand.

Box 10: Success story: Index-Based Livestock Insurance in Kenya

Drought can decimate livestock herds, which in turn could plunge livestock keepers into poverty. After careful research involving pastoralists, private businesses, NGOs, and other stakeholders, IBLI was piloted in Marsabit county in Kenya in 2010. Marsabit is one of the driest counties in Kenya, and pastoralists are increasingly facing higher frequency and severe droughts. The International Livestock Research Institute (ILRI) led the IBLI pilot. Despite a slow adoption rate during its first few years, IBLI policies purchased by pastoralists reached \$25 million, and payout to policyholders amounted to US\$10 million. It is estimated that pastoralists account for 13% of the rural population.¹³³ Thus, based on the 2019 census, there are 966,192 pastoral households.¹³⁴ In 2020, it was estimated that more than 80,000 herders hold IBLI policies in Kenya. This means the adoption rate of IBLI is about 8%. One of the drivers of success is the market-driven approach and adaptability to the socio-economic environment in which IBLI operates. For example, in the Wajir area and other predominantly Muslim communities that are opposed to conventional insurance, the Takaful insurance approach was used.¹³⁵ The Takaful is a Sharia-compliant insurance in which policyholders pay a management fee to create a risk pool fund. The pool funds are paid out to policyholders if drought hits the area. If the pool fund is in surplus, an equal distribution is paid out to all policyholders – including those not eligible for the payout. The Takaful insurance approach has been used in other African countries and has shown similar results.

8.2.3 Promote commercialization of livestock production

Strategies

- (i) Increase production.
- (ii) Provision of advisory services on livestock marketing.
- (iii) Establishing marketing infrastructure for live animals and livestock products.

Box 11: Success story: Community-Based Rangeland Rehabilitation in Sudan/Modernization of Namibia Livestock Sector

A success story from Sudan demonstrates how pastoral communities increased livestock productivity. In 1992, the UNDP/GEF (Global Environment Facility) launched a Community-Based Rangeland Rehabilitation (CBRR). Its goal was the prevention of land degradation and carbon sequestration through rehabilitation of degraded and over-exploited rangelands and the preservation of biodiversity. CBRR covered 17 villages with a mixture of agro-pastoralists and transhumant communities. CBRR activities included land rehabilitation, controlling grazing pressure, increasing soil cover by the planting of shelterbelts, stabilizing sand dunes, the establishment of small-scale irrigated vegetable gardens, and construction of wells and water pumps to supply water replanting of trees in rangeland, irrigated green fodder crops. Communities were expected to develop land use and rangeland management techniques on 100 ha of land.

Several factors led to the success and sustainability of the CBRR project. The long-term engagement (9 years) with the communities allowed both the implementers and beneficiaries to learn and unlearn the key aspects of successful rangeland management programs. The multiple local institutions involved, namely, customary, community development committees, and local NGOs, operated in a synergistic manner that enhanced participatory and bottom-up project management and reduced project management costs. CBRR also addressed an overarching challenge of land degradation, which reduced the land productivity upon which most community members heavily depended.

Success story: Modernization of Namibia Livestock Sector

An example from Namibia demonstrates commercialization efforts and the establishment of an effective AVC. Livestock accounts for 80% of Namibia's agricultural GDP, and the country has invested significantly in improving the sector (FAO, 2005). Namibia sells 90% of its live animal and livestock products. Half of the marketed livestock products are exported to Europe and the other half to other South African Customs Union member countries. The large-scale farmers dominate the export to Europe while smallholder livestock keepers export to other African countries and the local market.

The factors that have contributed to Namibia's livestock success story are:

- i. *Namibian government investment in vertically linking smallholder farmers to local and regional markets.* Also, the government invested in marketing infrastructure, and veterinary, and nutritional advisory services.
- ii. *Motivating farmers to invest in quality improvement.* This was done by providing technical advisory services and investing in building infrastructure for testing, grading, and certification. A system has also been established to enforce stringent animal health requirements and a traceability system.

- iii. *Fostering livestock keepers' associations.* The Namibia National Farmers' Union serves as the body for organizing farmers' production, processing, and marketing.
- iv. *Generating and disseminating market information data.* The market data and information are widely disseminated through mass media, SMS messages, and billboards.
- v. *Training farmers to conduct business with wholesalers and big consumers.* A farmers' mentorship program has been established to provide hands-on training for the Northern Communal Areas to enter into contractual agreements with wholesalers and large consumers. Slaughter infrastructure (abattoirs) has also been established to facilitate processing and marketing.

8.2.4 Smallholder dairy systems

The guidelines for the mixed livestock system discussed earlier apply to smallholder dairy producers as well. However, there are specific guidelines for dairy producers. Among the biggest differences between the mixed livestock and dairy producers and the corresponding guidelines for enhancing AVC are as follows:

- i. A majority of smallholder dairy farmers keep exotic breeds that are highly susceptible to diseases. Robust health and veterinary services are inevitable to ensure profitable and sustainable dairy production and marketing. Additionally, since dairy cows are of much higher value than indigenous cattle, it is important to establish and promote insurance to help farmers reduce huge losses, which can easily put them into bankruptcy.
- ii. Smallholder dairy farmers are business oriented. The business orientation of smallholder dairy producers is advantageous since governments could easily implement programs that enhance the marketing of milk and other products. There is a need to establish market-based infrastructure and other services. For example, the government could incentivize the private sector to build storage and marketing infrastructure in strategic areas. This will facilitate the smallholders to be able to effectively market their produce and reduce post-harvest losses.
- iii. Milk and other products are more perishable than mixed livestock products. This makes the establishment of a cold-chain system imperative to assure farmers of an efficient and effective AVC.
- iv. Dairy cows are commonly zero-grazed – i.e., landless production system. The small confinements, which are commonly in close proximity to people, pose a danger of zoonotic diseases, animal diseases, and a poor hygienic environment. Additionally, poor disposal of animal waste contributes to greenhouse gas (GHG) emissions. This makes disposal of manure and other animal waste a crucial undertaking in maintaining health

and environmentally sound production systems. As with the case of mixed livestock production, animal waste could be used for soil fertility improvement.

- v. Market-oriented dairy producers need more market-oriented services than livelihood-oriented mixed livestock producers. Similarly, vertically linking dairy farmers is crucial to help address costly long-term storage and losses.

Box 12: Success story: Dairy hubs in Eastern Africa

The dairy hub is formed by a group of small-scale dairy farmers. The objectives of the dairy hub are to increase dairy productivity, improve milk quality, reduce spoilage, increase women's participation, and help small-scale dairy farmers to use modern technologies along the value chain.^q Dairy hubs form milk bulking and chilling centres. They link farmers to milk processors, input traders, and other services. As a strategy to scale out the strategy, reference farmers (or lead farmers) are identified and trained by extension agents on the best dairy production, storage, processing, and marketing practices. The lead farmers are then tasked to train fellow farmers on the best practices by turning their farms into farms of best practices. Private companies like Tetra Pak, which is a liquid food packaging and distribution company, participated in the training and provision of packaging and distribution of milk. Technical support was provided by the International Livestock Research Institute (ILRI) through its East African Dairy Development Project. NGOs, like Heifer International and TechnoServe, also provided technical and managerial support to facilitate their operations along the entire value chain. This allowed the group members to improve milk quality and achieve economies of scale, which in turn helped in accessing prime markets. Studies have shown that participation in dairy hubs increased milk production and profit by 32% and 45%, respectively.^r Over 230,000 small-scale dairy farmers are members of dairy hubs in East Africa (Kenya, Rwanda, Tanzania, and Uganda).^s

8.2.5 Small ruminants

Strategies

- (vii) Genetic improvement
- (viii) Improved feeding systems & judicious supplementation
- (ix) Improved animal health

^q Source: <https://www.tetrapak.com/insights/cases-articles/improving-livelihoods-in-kenya>

^r <https://www.cgiar.org/innovations/pro-poor-dairy-policy-in-east-africa-and-india/>

^s <https://www.heifer.org/our-work/flagship-projects/east-africa-dairy-development-project.html>

Genetic improvement

Local small ruminants' productivity is low, and the need to improve productivity is crucial. The community-based breeding programs (CBBP) – which were discussed in previous chapters – have been tested in Africa and shown promising results. The success story below demonstrates the approach used.

Box 13: Success story - Karamoja women goat farming

Karamoja region in north-eastern Uganda is one of the poorest areas in East Africa. Compared to the national level of multidimensional poverty index (MPI)^t of 47%, 76% of the Karamoja population, whose livelihood is largely pastoral, are multidimensionally poor, with the highest rates in Uganda.¹³⁶ Farm Africa has been running a goat project in Karamoja and is focused on enabling women to raise goats to help improve household nutrition by introducing crossbreeds using the community genetic improvement. Local female goats from the Karamoja were bred with the exotic dairy buck (Toggenburg – a Swiss dairy goat breed). The formation of Women's Livestock Groups (WLG) was facilitated by Farm Africa. The WLGs served as platforms for extension services, sharing experiences and solutions for improved goat management, nutrition education, and child and maternal health.

Through these WLGs, the improved housing increased from 1% in 2018 to 77%. Similarly, improved feeding increased from 11% in 2018 to 35% in 2021.¹³⁷ Women's income from the sale of live goats, milk, and other goat products increased by 411%, from US\$9 in 2018 to \$46 in 2021. Likewise, the dietary diversity of women and children improved by 38% and 55%, respectively.¹³⁸ A lesson from this success story is that empowering women, even in the most destitute communities, by providing them with technical advisory services, appropriate small ruminants breed and facilitating strong women groups could achieve big impacts on their income and household nutrition.

Improved feeding systems & judicious supplementation: Improving feeding systems accompanied with judicious supplementation greatly improves small ruminant productivity among small-scale farmers. The supplementary feeds need to be those available locally to allow smallholder farmers and resource-poor women and youth to afford them.

Improved Animal health: Veterinary and other animal health services need to be available to smallholder farmers at affordable prices and places easily reachable. For this to happen, deliberate efforts of planning such services need to be designed to ensure that public investments to establish them are placed in strategic locations that maximize access to many farmers and serve multiple types of livestock keepers. For example, dips, vaccination programs,

^t Multidimensional poverty index (MPI) – includes deprivations of three major welfare groups: health (child mortality, nutrition), education (years of schooling, enrollment), and living standards (water, sanitation, electricity, cooking fuel, floor, assets) (<https://indicators.report/>).

and the location of agro-traders need to be strategies places that are planned by all major stakeholders and guided by technical support.

8.2.6 Poultry

Strategies

- (i) Holistic vaccination.
- (ii) Improved poultry management.
- (iii) Genetic improvement.
- (iv) Effective linkage to poultry consumers and agribusinesses.

Holistic vaccination: Poultry diseases and pests devastate smallholder poultry production. Vaccination is the cheapest method for controlling diseases and pests. For a vaccination program to be effective, it must cover many diseases and many farmers in a given community. Isolated vaccination and those focusing on one or two diseases in most cases may not be successful apart from being expensive for smallholder farmers to afford.

Improved poultry management: This involves improved feeding systems using locally available feed resources and better chicken housing. Some of the most important feeding strategies include creep feeding, i.e., supplementary feeding of chicks. Improved housing and hygiene, both of which reduce mortality. Improved poultry management is the second most profitable strategy after vaccination and significantly reduces local chicken mortality.

Genetic improvement. Cross-breeding local and exotic chicken has been shown simultaneously to lead to significant poultry productivity, favourable phenotypic (observable) poultry characteristics (e.g., feather colour), and resistance to local pests and diseases. The community-based breeding programs (CBBP) have been shown to be a cost-effective and affordable approach. However, ancillary services such as breeders, agro-veterinary service providers, and grassroots NGOs are crucial in ensuring successful CBBP.

Effective linkage to poultry consumers and agribusiness: Improved poultry production needs to be market-oriented, and thus it is necessary to have producers vertically linked to major consumers and poultry dealers.

Box 14: Success story - Ghana poultry farmers' vertical integration

About 82% of the poultry farmers in Ghana are horizontally linked, i.e., they are members of poultry farmer groups.¹³⁹ A study in Dormaa municipality in the western part of the Bono region of Ghana – showed that only about 5% of poultry farmers are vertically linked.¹⁴⁰ About 64% of the poultry farmers in Dormaa municipality own and operate their feed mills for mixing feeds and 55% have their own transportation for delivery to urban areas. About 43% of farmers have their poultry retail shops in urban areas. About 70% of the poultry farmers are male, and the rest are women. The high commercialization of poultry farming has been successful due to many projects which have been promoting farmer groups. For example, one study showed that all farmers who are vertically linked belong to a farmer group. This underscores the importance of the formation of farmer groups to exploit economies of scale from small-scale farmers who, by being in a group, are able to supply larger consumers. The study also shows that profit/bird sold for vertically linked farmers was 51% higher than for farmers who are not vertically linked.

8.2.7 Pigs**Strategies**

- (i) **Improve local breeds.**
- (ii) **Improve feeding system and minimize scavenging**
- (iii) **Improve veterinary and health services**
- (iv) **Enhance extension and marketing services**

Improve local breeds: As discussed under small ruminants, improving local breeds is key to increasing the productivity of the local breeds. The same approach (CBBP) is applicable to pigs. Currently, there is no systematic CBBP for most pig farmers, which has contributed to the low pig productivity.

Improve feeding systems and minimize scavenging: Supplementation of scavenging using feeds produced on-farm is the cheapest strategy for increasing pig productivity and litter size. The need to reduce scavenging is also crucial since it takes a lot of energy for pigs to scavenge, and this leads to loss of weight and infestation with diseases and pests from dumpsters.

Improve veterinary and health services: Vaccination against African swine and other common pig diseases is crucial for pig production. This is especially important for the scavenging pigs who are exposed to a score of diseases, pollution and pests, and other morbidity-causing agents. Similar approaches discussed under small ruminants apply to pig production.

Enhance extension and marketing services: Extension and marketing services discussed under small ruminants apply to pig production.

8.3 Fisheries

8.3.1 Capture fishery

Strategies

- (i) Design stronger country and transboundary fisheries policies, legislations, and institutional systems.
- (ii) Design stronger small-scale fishermen (SSF) associations.
- (iii) Improve fish stock assessment and monitoring using novel & cost-effective data approach.
- (iv) Incentivize and promote sustainable fish capture, processing, and marketing.
- (v) Address and promote adaptation to the effect of climate change

Design stronger country and transboundary fisheries policies, legislation, and institutional systems: Smallholder fishers and fish traders are poorly represented in the policy development process, and public investment in supporting their development is limited (FAO 2020). The declining fish stock is threatening the livelihoods of small-scale fishers, raising the need for governments and development partners to provide policy support and investment. Stronger policies and institutional systems also promote harmonization and cross-sectoral integration, regulations, and standards. This is especially crucial for shared water bodies to ensure harmonized fishery resources management, tenure rights, and communication among fishers. This will ensure sustainable fishing as emerging stock depletion is a common problem that transboundary countries share. It will also reduce potential conflicts. Lake Victoria Fisheries Organization (LVFO) is a good example of transboundary water resources management system.

Design stronger SSF associations. SSF does not have a voice in the policy development and investment forum. Just as in the successful cases of producer groups discussed earlier, SSF associations have been shown to increase the political clout and improve associations' value chain performance.

Improve fish stock assessment and monitoring using novel and cost-effective data capture approach. There is a need to improve fish stock assessment using novel and cost-effective data capture approaches and monitoring. Satellite data capture can be used to assess and provide global coverage of fish stock assessment. For example, Copernicus sentinel 1 & 2 provide global coverage of fish stock assessment. The collected data help design sustainable fishing strategies and regulate illegal, unregulated, and unreported (IUU) fishing. Satellites can also help low-income countries to monitor foreign vessels conducting unauthorized fishing. For example, Mauritania is one of the countries that is heavily affected by unauthorized fishing by foreign vessels. The Government of Mauritania – in collaboration with KfW of Germany - deployed satellite and supporting coast guards activities to protect its 200-mile zone from foreign vessels.

Incentivize and promote sustainable fish capture, processing, and marketing: SSF livelihoods depend on fish. It means that if they are involved in policy formulation and are well-educated about fish stock and incentivized, they can cooperate to achieve sustainable fishing practices.

Address and promote adaptation to the effect of climate change: The recent COP26 starkly reminded the world of the reality of global warming and the increasing threat to the planet and aquatic food systems. The world is witnessing a significant increase in the frequency, intensity, and severity of extreme climate events, including cyclones, variable rainfall patterns, floods, droughts, forest fires, etc. These incidences affect productivity, profitability, incomes, and food prices, worsening the vulnerability of small-holder fishermen, aquaculture producers, and those engaged in post-harvest fish processing and trade. This raises the need to give prominence to climate considerations in the formulation and implementation of interventions, paying attention to technologies and practices that incorporate climate resilience.

Box 15: Success story - Mauritius communities cooperate to recover coral reefs

Mauritius designed conservation management areas (CMA), whose main objectives were to control invasive species and other threats of habitat restoration programs on the Round Island – home to the highest density of endangered vertebrates in the world (Parnell et al. 1989). The CMA program was also implemented in other parts of Mauritius. This program has resulted in the significant recovery of the native vegetation and fauna (Florens 2013). The importance of integrated land and wilderness protection in SIDS, especially the CMA program in Mauritius, has demonstrated the crucial role it plays in achieving effective and cost-effective results.

8.3.2 Aquaculture

Based on Egypt's and Nigeria's experiences, the following strategies have shown to be effective in developing and operating aquaculture production and marketing in Africa.

Strategies

- (i) Map areas suitable for aquaculture production.
- (ii) Promote climate-resilient and integrated production systems – e.g., crop-fish farming.
- (iii) Support the development of small-scale aquaculture (SSF) organizations.
- (iv) Enhance sustainable post-harvest technologies.

Box 16: Success story - Aquaculture North-eastern Nigeria for the Youth

An initiative was implemented by FAO to encourage youth and women to practice aquaculture in the conflict-ravaged north-eastern part of Nigeria. The FAO aquaculture program promoted aquaculture and vegetable farming in Borno state in 2019. FAO offered training to youth and women on safe, sustainable, and integrated aquaculture practices. FAO also provided youth and women with 3,000-liter fish tanks. Additionally, they were trained on how to use the FAO-Thiaroye Technique (FTT) smoking kiln, which produces high-quality fish using fuel-efficient methods. FTT also reduces post-harvest losses. The nutrient-rich water from the tank is used for irrigating horticultural crops – allowing year-long horticultural production. In addition to increasing the dietary diversity and nutrition security in the community, this practice has created 200 jobs for youth and women and built their entrepreneurial skills in integrated aquaculture production. Plans are underway to upscale the good practice in the north-eastern area. The plan is to scale up to 100,000 households that have been affected by the civil unrest in the area.

8.4 Post-harvest crop handling

Development of Warehouse Receipt System (WRS): The Warehouse Receipt System (WRS) increases access to credit and farmer prices, and it reduces market risks and post-harvest losses. Member States need to foster the development and operation of WRS to reap its benefits. The success story from Tanzania demonstrates the benefits of WRS to smallholder farmers.

Box 17: Success story - Purdue Improved Crop Storage (PICS) bag

The PICS technology is a simple, low-cost (US\$2.00–\$3.00 for a 100 kg bag) storage method for smallholder farmers and it preserves grain without using insecticides. It is made of a three-layer bag that includes two liners and an outer woven layer. By creating a hermetic (airtight) seal inside the bag, PICS bags eliminate insect pests, stop mold growth, and maintain grain and seed quality. PICS bags were first developed and disseminated in West and Central Africa for cowpea (black-eyed pea) storage. Later, the bags were tested and disseminated to other crops, including maize, rice, common beans, peanuts, wheat, sorghum, pigeon peas, mung beans, and other dry grains. The use of PICS bags for grains storage provides an opportunity to: (i) improve food security by allowing farmers to store grain or other foodstuffs through the lean season when supply is low, (ii) increase the incomes of smallholder farmers by providing the flexibility to store grain until prices are higher, and (iii) improve health by mitigating the impact of aflatoxin while reducing insecticide use. The PICS bags also help farmers preserve their seeds for planting, thus increasing availability and improving affordability.

Box 18: Success Story - Warehouse Receipt System in Tanzania

The warehouse receipt system was introduced in Tanzania after seven years of successful piloting and the enactment of the Warehouse Receipt Act in 2005. Operationalization of the systems in raw cashews started in 2007/08 season and aimed at addressing cashew nut price risk facing smallholder producers due to unscrupulous traders who were buying raw cashew nut at prices very well below the world market prices and using exploitative measures locally known as *kangomba*. A warehouse receipt system involves storing raw cashews in a designated warehouse run by registered warehouse operators in anticipation of better prices on selling the crop, usually by auction. Producers are informed of the expected prices based on the world market situation. Cooperatives, on behalf of farmers, oversee the stored cashews and guide farmers participating in the auction as well as follow up payments from buyers on behalf of farmers. Based on the expected price, farmers in need of cash are advanced part of the expected raw cashew nut proceeds while waiting for the finalization of sales through auction. Financial institutions participate in transaction processes involving buyers and cooperatives and indirectly increase producers' access to financial services. The higher prices received incentivized farmers to produce more and better-quality cashew nuts. Apart from bringing better prices for producers, it is now possible to trace the source of cashews and respective producers via their cooperatives and buying catalogs. Producers have been registered to ensure that those involved in cashews production benefit directly from cashews sales. Quality of the production has improved as proportion of under-grade cashews is declining, with much of the cashews being in the standard grade.

The warehouse receipt system has been successfully expanded to other crops such as green gram and sesame, which has not only improved producer prices and production but has also increased producer's confidence. In both green gram and sesame, better prices provided incentives to producers to increase production. Some of the issues that require attention include the resistance and distortion campaigns against the system by unscrupulous traders who want to go back to the exploitative buying arrangements, inadequate storage facilities, and delays in paying producers.

8.5 Agricultural marketing and trade

This section is divided into three sub-sections: domestic, regional, and international markets.

Strategies

- (i) Planning for a sustainable and inclusive value chain.
- (ii) Invest in closing Africa's infrastructure gap
- (iii) Analyse agricultural value chains.
- (iv) Build strong horizontal linkages.

8.5.1 Domestic markets

Planning for sustainable and inclusive value chain: Plan collaboratively – including all key stakeholders. Use geospatial approaches to identify and map suitable areas, cost-effective, and impactful locations of processors, agro-industries for value addition – and provide incentives for private investment if such services are not yet developed.

Invest in closing Africa's infrastructure gap: As recommended by the Program for Infrastructure Development in Africa (PIDA), countries need to invest heavily in transport and marketing infrastructure to reduce the high transaction costs and become competitive in the intra-Africa and extra-Africa trade. As discussed earlier, the infrastructure investments need to be the outcome of a planned collaborative approach – in which all major stakeholders are involved in deciding on the placement of roads, market infrastructure. This will build robust market infrastructure within and across countries. The level of investment that Africa needs to make is 1% of its GDP (or \$9.6billion per year). Narrowing the infrastructure deficit will lead to fast economic growth and such growth will be the highest in countries with the most serious infrastructure. However, given the large infrastructure financing needs, innovative approaches to crowd in the private sector in building transport infrastructure are necessary.

Analyse agricultural value chains: Identify constraints, potential, profitability, stakeholder mapping, power relations, position and location of the poor, women, youth, and marginalised groups, distribution of production, input dealers, processors, consumers, market infrastructure, potential markets as well as risks.

Build strong horizontal linkages: Enhance members' negotiation skills, economies of scale, access to credit, extension, and rural services; link producers to emerging niche markets, e.g., supermarkets, school feeding programs, WFP programs. As discussed earlier, farmer groups help small-scale producers to access prime markets and take advantage of economies of scale. A success story of potato farmers in South-western Uganda demonstrates the impact of horizontal linkages and technical support in vertically linking poor and remote smallholder farmers to prime markets.

Box 19: Success Story - Nando's business relationship with smallholder farmers in south-western Uganda

Located in the Kabale district in south-western Uganda, the Nyabyumba Farmer Group (NFG) was formed in 1998 with support from Africare, the Uganda National Agricultural Research Organization (NARO), and International Potato Center – or Centro Internacional de la Papa (CIP). NARO and CIP provided production technical support, while CIAT provided marketing advisory services. With a group membership of 20 farmers, 50% of whom were women, NFG signed a contract with Nando's in 2003. Nando's is an international fast-food chain. The salient features of the NFG-Nando's contract included the following:

- i. Supply 112 bags of potato (equivalent to about 10 tons) every month – delivered in two bi-weekly instalments – each 5 tons.
- ii. Potatoes should be delivered unwashed.
- iii. Bags should contain only one potato variety, but the size of each potato tuber should be about 80g with few eyes.
- iv. Price fixed at Uganda Shillings (UGX) 322 per kg or (\$170/MT) payable by check on the 15th of every month after delivery. Price renegotiation is possible if a significant price change occurs.
- v. If NFG fails to supply the required quantity or quality, Nando's will buy from other sources, and NFG will pay the difference if the price of the alternative source is higher than US\$170/MT. The agreement did not penalize Nando for late payment or refusal to buy potatoes from NFG.

8.5.2 Developing regional and international markets

Strategies

- (i) Reduce trade barriers and foster trade integration.
- (ii) Legalize and support informal cross-border trade (ICBT)
- (iii) Prioritize agro-industrialization and quality standards.
- (iv) Quality standards, certification, and grading
- (v) Improve market and access to power supply in rural areas.
- (vi) Diversify trading partners
- (vii) Exploit ICT

Reduce trade barriers and foster trade integration: Tariff and non-tariff measures have contributed to poor intra-Africa and extra-Africa agricultural trade performance. While most countries have reduced tariffs to foster export, non-tariff measures (NTMs) have become one

of the major obstacles to intra and extra-Africa agricultural trade. Tariffs and NTMs need to be removed or significantly reduced to increase intra-Africa and extra-Africa agricultural trade.

Legalize and support informal cross-border trade (ICBT): The informal cross-border trade plays a key role in intra-Africa trade, but is generally regarded as illegal. The ICBT has been shown to increase income and food security and is mainly done by women and youth. Legalizing and supporting ICBT will help achieve the AcFTA, reduce poverty, and empower women and youth. Given that it is easier to do business with a group of ICBT traders than individual traders, helping the ICBT traders to form groups will greatly enhance efficiency in processing ICBT. For example, fish cooperatives increased participation in informal cross-border trade and profitability of women along the Ghana-Togo-Benin borders. Some countries have also formed One stop border point, which has helped the ICBT traders to quickly process paperwork at the border. The governments also can collect tax revenue, which traders always evade.

Prioritize agro-industrialization and quality standards: For the intra-Africa trade, the earlier discussion showed that there is a growing middle-income population, which requires more processed foods. This means agro-industrialization will enhance intra-Africa trade. The growth of the middle-income population is also happening outside Africa and for similar reasons. Countries, which develop agro-industrialization, increase the potential to participate in international trade. In addition, agro-industrialization increases the quality standards of products, allowing African countries to meet the strict quality standards in the international market.

Quality standards, certification, and grading require a strategy that incentivizes producers to invest in quality improvement at the early stages of production. Such strategies include setting clear standards and regulations to ensure that producers are rewarded for investing in quality improvement. Supermarkets and multinational corporations have been incentivizing farmers to produce high-quality products and reward them by paying premium prices. Institutional infrastructure is also required to help farmers access some common services and facilities such as grading, packaging, and certification along the value chain.

Improve market and access to power supply in rural areas: Inadequate markets are one of the major constraints to Africa's trade integration. Improving rural markets is key to reducing production and processing costs, which in turn increases the competitiveness of agricultural produce. Agro-industrialization also requires reliable access to electricity. Such access helps create agro-SMEs, which offer many services for improving agricultural produce quality and reduce post-harvest losses in addition to other supporting services.

Diversify trading partners: In determining how many trading partners a country has, network density is used. Network density is the number of trading partners that trade with a share of possible partners. For example, each of 54 African countries has a total of 53 potential trading

partners. Intra-African network density varied between 4.3% and 8.9% for the most common intra-African trade.¹⁵⁰ This is a very low rate of network density, and it demonstrates the unexploited trading potential that exists in Africa. Increasing trading partners within and outside Africa help countries to effectively exploit their comparative advantage.

Exploit ICT: The African Union has designed a strategy for digital transformation 2020-30, in which the region plans to transform African economies using ICT. ICT has helped increase intra and extra-African trade. SMEs have been able to advertise their produce using low-cost product promotion, market intelligence, and other benefits. The ICT has also allowed women, youth, and other vulnerable groups to have access to knowledge and power to communicate with potential buyers. However, ICT use among the vulnerable groups require champions who would help them be connected to the market.

Box 20: Success story - Agricultural development in Egypt

Agriculture accounts for about 12% of Egypt's GDP, while manufacturing accounts for 42% of the agricultural GDP and employs about 6% of the labor force. While most country export sector is dominated by cash crops (coffee, cocoa, tea, and cotton) and niche products (cashew nuts, kola nuts, vanilla, sesame seeds, etc.), only two African countries – Egypt and South Africa – have a diversified export portfolio (i.e. countries that have diversified export basket and trading partners). Egypt also accounted for 40% of intra-Africa rice export and is among the three net exporters of meat, dairy, and poultry.^u The following are among the most salient drivers of Egypt's success in regional and international trade:

- i. *Advanced agro-industrialization:*
- ii. *Centuries-old agricultural production developed through multi-pronged investment objectives:*
- iii. *High rural market access and electric power:* Egypt has the second-highest rural access index (RAI) – with 77% of the rural population within two kilometers of an all-weather road.
- iv. *Private-sector-led agricultural development.* By 2021, the private sector will account for over 90% of the agricultural sector. Prices were fully liberalized, and subsidies were eliminated to build an efficient and market-led agricultural economy.
- v. *Quality, grading, and certification:* Export-oriented and capital-intensive agriculture has tapped markets with high certification standards (supermarkets and export).
- vi. *Inclusive policies.* Agriculture is one of the few sectors in which women's participation is highest. In 2019, 23% of the labour force in agriculture were women. In 2018, in the government's SME support program, in which 3 million people

^u Others are Sudan and South Africa.

benefited, 70% were women. Women's agricultural labour force participation contributes 75% of the post-harvest activities, namely harvesting, handling, sorting, and packing processes. Additionally, women account for 40% of labour force in the fish sector. These steps enhance gender inclusiveness directly or indirectly in agro-industrialization and consequently, regional and international trade.

8.6 Consumption

Strategies

- (i) Build and formalize nutrition education and extension.
- (ii) Use ICT to provide nutrition education.
- (iii) Build stronger linkages between rural and urban nutrition systems.
- (iv) Policy issues, e.g., nutrition-sensitive production approaches that give more attention to resources and foods for local nutrition.

Build and formalize nutrition education and extension: One of the major drivers of double burden malnutrition is the lack of nutrition education. This suggests that governments and development partners invest in nutrition education.

Use ICT to provide nutrition education: ICT knowledge could be used to easily target nutrition education to consumers. Using well-designed messages, ICT could be used to extend nutrition education to many people at once and at a low cost. In enhancing effectiveness, such an arrangement could be made in a private-public partnership. For example, mobile phone companies could be used to disseminate nutrition education, such as the importance of the intake of essential nutrients and associated benefits. It should be noted that ICT has been abused by some multinational companies in high-income countries to promote the consumption of unhealthy, highly processed food and beverages. However, the same method could be used to promote healthy nutrition education.

Build stronger linkages between rural and urban nutrition systems: A carefully prepared food and nutrition masterplan can be built in each country in such a way that countries take full advantage of the domestic production as well as those of neighbouring countries. The masterplans will ensure that the roads, market infrastructure, cold-chain logistics, electricity, and other rural services are placed in strategic places that exploit the production potential of the foods in high demand. Currently, it is common to find areas with a high agricultural potential to have the poorest road infrastructure. For example, mountainous areas with high potential for producing fruits and vegetables are always located in remote areas with poor road infrastructure.

Box 21: Success story - Rwandese Hinga Weze nutrition education group

The US Feed the Future project initiated a nutrition education campaign in Rwanda. The campaign formed a group called Hinga Weze Care Group (CG). The CG carried out cooking demonstration classes and basic nutrition practices, food safety, and best practices to fight malnutrition. The CG is facilitated by trained community-based volunteers (CBVs). Hinga Weze has supported 173,422 households. An impact assessment showed that the nutrition education classes improved the nutrition of participants. One of the methods used for communication with members was ICT, and this increased the training efficiency.

END NOTES

- ¹ Alexandratos, N., & Bruinsma, J. (2012). World agriculture towards 2030/2050: ESA Working paper No. 12-03. Rome: FAO.
- ² <https://www.fao.org/faostat/en/#data/MK>
- ³ ILRI 2012. Promising Interventions for Livestock Production and Productivity Improvement in Smallholder Systems in Developing Countries
- ⁴ Leroy, B., Dias, M.S., Giraud, E., Hugueny, B., Jézéquel, C., Leprieur, F., Oberdorff, T. and Tedesco, P.A., 2019. Global biogeographical regions of freshwater fish species. *Journal of biogeography*, 46(11):2407-2419.
- ⁵ Chan, C.Y., Tran, N., Pethiyagoda, S., Crissman, C.C., Sulser, T.B. and Phillips, M.J., 2019. Prospects and challenges of fish for food security in Africa. *Global food security*, 20:17-25.
- ⁶ FAO 2020 The State of World Fisheries and Aquaculture: Sustainability in Action. FAO, Rome
- ⁷ UNDP. 2015. Youth population trends and sustainable development (<https://www.un.org/esa/socdev/documents/youth/fact-sheets/YouthPOP.pdf>).
- ⁸ ILO. 2020. World Employment and Social Outlook Trends 2020.
- ⁹ World Bank, 2020. Trading for Development in the Age of Global Value Chains, World Development Report 2020. Online at <https://www.worldbank.org/en/publication/wdr2020> Accessed on September 20, 2021.
- ¹⁰ Gebre, G.G., Isoda, H., Rahut, D.B., Amekawa, Y. and Nomura, H., 2021. Gender gaps in market participation among individual and joint decision-making farm households: Evidence from Southern Ethiopia. *The European Journal of Development Research*, 33(3):649-683.
- ¹¹ Nkonya E., J. Koo, and P. Marennya and R. Licker. 2011. Land under Pressure 63-68. In IFPRI 2011 Global Food Report. IFPRI Washington DC. 113pp
- ¹² African Development Bank, OECD, and United Nations Development Program. African Economic Outlook 2014: Global Value Chains and Africa's Industrialization, Editions OCDE, Paris.
- ¹³ Gollin, D., Jedwab, R. and Vollrath, D., 2016. Urbanization with and without industrialization. *Journal of Economic Growth*, 21(1), pp.35-70.
- ¹⁴ World Bank, 2021. Trade raw data. Available at <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>
- ¹⁵ OECD & FAO 2020. OECD-FAO Agricultural Outlook 2020-2029.
- ¹⁶ Ruel, M.T., Garrett, J.L. and Yosef, S., 2017. Food security and nutrition: Growing cities, new challenges. In IFPRI. Global Food Report 2017, pp.24-33.

- ¹⁷ Reardon, et al. 2021 The Processed Food Revolution in African Food Systems and the Double Burden of Malnutrition. *Global Food Security* 28
- ¹⁸ African Union. 2014. Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihood
- ¹⁹ African Union. 2015. Agenda 2063. The Africa We Want. Popular Version.
- ²⁰ African Union. 2005. Arusha Declaration and Plan of Action on African Commodities.
- ²¹ Barrett et al. 2020 Socio-technical Innovation Bundles for Agri-Food Systems Transformations. Report of the International Expert Panel on Innovations to Build Sustainable, Equitable, Inclusive Food Value Chains (Cornell Atkinson Center for Sustainability and Springer Nature, 2020).
- ²² Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta analyses of studies that evaluate health care interventions: Explanation and elaboration. *Annals of Internal Medicine*, 151, W-65. <https://doi.org/10.7326/0003-4819-151-4-200908180-00136>.
- ²³ Davis, J., Mengersen, K., Bennett, S., & Mazerolle, L. (2014). Viewing systematic reviews and meta-analysis in social research through different lenses. *SpringerPlus*, 3, 511. <https://doi.org/10.1186/2193-1801-3-511>.
- ²⁴ FAO & AUC (African Union Commission). 2018. Sustainable Agricultural Mechanization: A Framework for Africa. Addis Ababa. <https://www.fao.org/3/CA1136EN/ca1136en.pdf>
- ²⁵ Daum, T. & Birner, R. 2020. Agricultural mechanization in Africa: myths, realities and an emerging research agenda. *Global Food Security*, 26: 100393. <https://doi.org/10.1016/j.gfs.2020.100393>
- ²⁶ Kumar, A., 2011. Understanding the emerging role of motorcycles in African cities: a political economy perspective. World Bank
- ²⁷ ESMAP. 2020. Global Photovoltaic Power Potential by Country. Washington, DC: World Bank.
- ²⁸ Mwirigi C. 2022. Africa's winners and losers in the bid to go solar. <https://www.pv-magazine.com/2022/01/25/africas-winners-and-losers-in-the-bid-to-go-solar/>
- ²⁹ Krüger J. 2021. Ice from the Sunshine: Made in your Country, Engineered in Germany. <https://solar-cooling-engineering.com/ice-from-the-sunshine-made-in-your-country-engineered-in-germany/>
- ³⁰ FAO. 2022. State of Food and Agriculture. Leveraging Automation in Agriculture For Transforming Agrifood Systems.
- ³¹ FAO & AUC. 2018. Sustainable Agricultural Mechanization: A Framework for Africa. Addis Ababa. 127pp. License: CC BY-NC-SA 3.0 IGO

- ³² Daum T. 2022. Agricultural mechanization and sustainable agrifood system transformation in the Global South Background paper for The State of Food and Agriculture 2022.
- ³³ Daum T. 2022. Agricultural mechanization and sustainable agrifood system transformation in the Global South Background paper for The State of Food and Agriculture 2022.
- ³⁴ Diao, X., Takeshima, H. & Zhang, X. 2020. An evolving paradigm of agricultural mechanization development: How much can Africa learn from Asia?. Washington, DC, International Food Policy Research Institute.
<https://ebrary.ifpri.org/digital/collection/p15738coll2/id/134095>
- ³⁵ AU. 2022. African Union Climate Change and Resilient Development Strategy and Action Plan (2022-2032).
- ³⁶ Roe, D., F. Nelson, and C. Sandbrook. 2009. Community Management of Natural Resources in Africa: Impacts, experiences and future directions. Natural Resources Institute Issues No. 18. International Institute for Environment and Development, London, UK.
- ³⁷ Wright G.D., K. P. Andersson, C.C. Gibson, and T.P. Evans. 2016. Decentralization can help reduce deforestation when user groups engage with local government. *Proceedings of the National Academy of Sciences of the United States of America* 113 (52) 14958-14963
- ³⁸ Kimura, R., 2018. Global distribution of degraded land area based on dust erodibility determined from satellite data. *International Journal of Remote Sensing*, 39(18):5859-5871.
- ³⁹ North, D.C., 2016. Institutions and economic theory. *The American Economist*, 61(1):72-76.
- ⁴⁰ Kaufmann, D., A. Kraay, and M. Mastruzzi. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. Policy Research Working Paper 5430. The World Bank.
- ⁴¹ Doss, C. and R. Meinzen-Dick. 2020. Land Tenure Security for Women: A Conceptual Framework. *Land Use Policy* 99 (December 2020). 105080
- ⁴² Higgins, D., Balint, T., Liversage, H. and Winters, P., 2018. Investigating the impacts of increased rural land tenure security: A systematic review of the evidence. *Journal of rural studies*, 61:34-62.
- ⁴³ Piñeiro, V., Arias, J., Dürr, J., Elverdin, P., Ibáñez, A., Kinengyere, A., Morales Opazo, C. 2020. A scoping review on incentives for adoption of sustainable agricultural practices and their outcomes. *Nature Sustainability*, 3: 809–820.
- ⁴⁴ Gross-Camp, N., A. Martin, S. Mcguire, B. Kebede, and J. Munyarukaza. 2012. Payments for ecosystem services in an African protected area: Exploring issues of legitimacy, fairness, equity and effectiveness. *Oryx* 46(1), 24-33

- ⁴⁵ Eijkman F. Kendall J. and I. Mas. 2010. Bridges to Cash: The Retail End of M-PESA. *Savings & Development*, 34(2):219-252. <http://dx.doi.org/10.2139/ssrn.1655248>
- ⁴⁶ Demirgüç-Kunt A., L. Klapper, D. Singer, and S. Ansar. 2022. *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. Washington, DC: World Bank. doi:10.1596/978-1-4648-1897-4.
- ⁴⁷ World Bank. 2016. *The Uganda Poverty Assessment Report 2016. Farms, cities and good fortune: assessing poverty reduction in Uganda from 2006 to 2013*.
- ⁴⁸ Wanyama F. O. 2013. Some positive aspects of neo-liberalism for African development: The revival of solidarity in co-operatives. *International Journal of Arts and Commerce*, 2(1): 126-148.
- ⁴⁹ de Janvry A., E. Sadoulet. 2019. Transforming developing country agriculture: Removing adoption constraints and promoting inclusive value chain development. hal-02287668
- ⁵⁰ Deininger, K. and Jin, S., 2006. Tenure security and land-related investment: Evidence from Ethiopia. *European Economic Review*, 50(5):1245-1277.
- ⁵¹ Deininger, K., D. Ali, and T. Alemu. 2011. Impacts of Land Certification on Tenure Security, Investment and Land Market Participation: Evidence from Ethiopia. *Land Economics* 87(2), 312-334.
- ⁵² Barrows, R. and Roth, M., 1990. Land tenure and investment in African agriculture: Theory and evidence. *The Journal of Modern African Studies*, 28(2), pp.265-297.
- ⁵³ Dorward, A., Kydd, J., Lyon, F., Poole, N., Poulton, C., Smith, L. and Stockbridge, M., 1998. Commercial financing of seasonal input use by smallholders in liberalised agricultural marketing systems. *Natural Resource Perspectives*, 30:1-4.
- ⁵⁴ Brüntrup, M., Schwarz, F., Absmayr, T., Dylla, J., Eckhard, F., Remke, K. and Sternisko, K., 2018. Nucleus-outgrower schemes as an alternative to traditional smallholder agriculture in Tanzania—strengths, weaknesses and policy requirements. *Food Security*, 10(4), pp.807-826.
- ⁵⁵ Reardon, T., E. Crawford, and V. Kelly. 1994. "Links between nonfarm income and farm investment in African Households: adding the capital market perspective," *American Journal of Agricultural Economics*, 76 (5), 1172-1176.
- ⁵⁶ Adelekan, Y.A. and Omotayo, A.O., 2017. Linkage between rural non-farm income and agricultural productivity in Nigeria: A Tobit-two-stage least square regression approach. *The Journal of Developing Areas*, 51(3):317-333.
- ⁵⁷ Efobi, U.R., Beecroft, I. and Atata, S.N., 2019. Female Access and Rights to Land, and Rural Non-farm Entrepreneurship in Four African Countries. *African Development Review*, 31(2):179-189.

- ⁵⁸ Aggarwal, S., Giera, B., Jeong, D., Robinson, J. and Spearot, A., 2021. Market access, trade costs, and technology adoption: evidence from Northern Tanzania (No. w25253). National Bureau of Economic Research.
- ⁵⁹ Aker, Jenny. 2010. "Information from markets near and far: Mobile phones and agricultural markets in Niger." *American Economic Journal of Applied Economics* 2(3): 46-59
- ⁶⁰ Otte, M. J., & Chilonda, P. (2002). Cattle and small ruminant production systems in sub-Saharan Africa: A Systematic Review. Food and Agriculture Organization, Rome.
- ⁶¹ Mohamed, A.H., El Hawy, A., Sawalhah, M.N. and Squires, V.R., 2019. Middle East and North Africa livestock systems. *Livestock: Production, Management Strategies and Challenges*. Hauppauge, NY, USA: Nova Science Publishers.
- ⁶² FAO 2017. Improving governance of pastoral lands. Food and Agriculture Organization
- ⁶³ FAO. 2020. Gateway to poultry production and products. Available at <https://www.fao.org/poultry-production-products/production/production-systems/family-poultry-production/en/>
- ⁶⁴ Robinson, T.P., Thornton P.K., Franceschini, G., Kruska, R.L., Chiozza, F., Notenbaert, A., Cecchi, G., Herrero, M., Epprecht, M., Fritz, S., You, L., Conchedda, G. & See, L. 2011. Global livestock production systems. Rome, Food and Agriculture Organization of the United Nations (FAO) and International Livestock Research Institute (ILRI), 152 pp.
- ⁶⁵ Kryger, K.N., Thomsen, K.A., Whyte, M.A. and Dissing, M. 2010. Smallholder poultry production – livelihoods, food security and sociocultural significance. FAO. Network for Smallholder Poultry Development (available at: <http://www.fao.org/docrep/013/al674e/al674e00.pdf>)
- ⁶⁶ FAO and IAEA. 2006. Improving farmyard poultry production in Africa: Interventions and their economic assessment. Proceedings of a final research coordination meeting (No. IAEA-TECDOC--1489). Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.
- ⁶⁷ Armson, B., Ekiri, A.B., Alafiatayo, R. and Cook, A.J., 2020. Small ruminant production in Tanzania, Uganda, and Ethiopia: a systematic review of constraints and potential solutions. *Veterinary Sciences*, 8(1):5.
- ⁶⁸ Mueller J.P., B. Rischkowsky, A. Haile, J. Philipsson, O. Mwai, B. Besbes, A. Valle-Zárate, M. Tibbo, T. Mirkena, G. Duguma, J. Sölkner, M. Wurzinger M. 2015. Community based livestock breeding programs: Essentials and examples. *Journal of Animal Breeding and Genetics* 132: 155-168.
- ⁶⁹ Haile A., M. Wurzinger, J. Mueller, T. Mirkena, G. Duguma, M. Rekik, J. Mwacharo, O. Mwai, J. Sölkner and B. Rischkowsky. 2019. Guidelines for setting up community-based small ruminants breeding programs Second edition. Beirut, Lebanon: ICARDA.

- ⁷⁰ Byerlee D, Stevenson J and Villoria N 2014. Does intensification slow crop land expansion or encourage deforestation? *Global Food Security* 3, 92–98.
- ⁷¹ Kusiluka, L. and Kambarage, D., 1996. Diseases of small ruminants: a handbook. Common Diseases of sheep and goats in Sub-Saharan Africa.
- ⁷² Ouma, E., Dione, M., Lule, P., Pezo, D., Marshall, K., Roesel, K., Mayega, L., Kiryabwire, D., Nadiope, G. & Jagwe, J. (2015). Smallholder pig value chain assessment in Uganda: results from producer focus group discussions and key informant interviews. ILRI Project Report, Nairobi Kenya, ILRI. Available at: <https://hdl.handle.net/10568/68011>
- ⁷³ Mwaikono, K.S., Maina, S. and Gwakisa, P. 2018. Fecal microbiota of free-range pigs (*Sus scrofa domesticus*) scavenging on a municipal dumpsite is a potential reservoir of pathogens. *Journal of Applied and Environmental Microbiology* 6(2):42-50.
- ⁷⁴ Stein, L., Bishop, R., Okoth, E., Svitek, N. and Riitho, V. 2016. Pig vaccines and diagnostics for African swine fever in Uganda. *Livestock and Fish Brief* 26. Nairobi: ILRI.
- ⁷⁵ World Bank. 2020. Digitization of Agribusiness Payments in Africa. Building a Ramp for Farmers' Financial Inclusion and Participation in a Digital Economy.
- ⁷⁶ Kopper, S.A. and Jayne, T.S., 2019. Market access, agro-ecological conditions, and Boserupian agricultural intensification patterns in Kenya: Implications for agricultural programs and research. *World Development*, 124;104649.
- ⁷⁷ Obiero, K., Meulenbroek, P., Drexler, S., Dagne, A., Akoll, P., Odong, R., Kaunda-Arara, B. and Waidbacher, H., 2019. The contribution of fish to food and nutrition security in Eastern Africa: Emerging trends and future outlooks. *Sustainability*, 11(6):1636
- ⁷⁸ FAO. 2014. The Value of African Fisheries. Online at <https://www.fao.org/3/i3917e/i3917e.pdf>
- ⁷⁹ FAO, 2013. Food wastage footprint! impacts on natural resources, Summary Report, 61 pp., <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>.
- ⁸⁰ Bekele D. 2021. Role of postharvest management for food security: A review. *Adv. Crop Science and Technology*, 9:1-6.
- ⁸¹ Viola, A., 2017. Scaling up post-harvest losses interventions in Uganda through market forces (Doctoral dissertation, Harvard University).
- ⁸² Akande, B. and Diei-Ouadi, Y., 2010. Post-harvest losses in small-scale fisheries. Food and Agriculture Organization of the United Nations.
- ⁸³ Kumar, D. and Kalita, P., 2017. Reducing post-harvest losses during storage of grain crops to strengthen food security in developing countries. *Foods*, 6(1):8-29.

- ⁸⁴ Ranum, P., Peña-Rosas, J.P. and Garcia-Casal, M.N., 2014. Global maize production, utilization, and consumption. *Annals of the New York academy of sciences*, 1312(1):105-112. DOI: 10.1111/nyas.12396.
- ⁸⁵ De Groote, H., Kariuki, S.W., Traore, D., Taylor, J.R., Ferruzzi, M.G. and Hamaker, B.R., 2018. Measuring consumers' interest in instant fortified pearl millet products: a field experiment in Touba, Senegal. *Journal of the Science of Food and Agriculture*, 98(6):2320-2331.
- ⁸⁶ Mujere, N., 2020. Water Quality Impacts of Abattoir Activities in Southern Africa. *Waste Management: Concepts, Methodologies, Tools, and Applications*, pp.405-415.
- ⁸⁷ Grace, D., 2017. Post-harvest handling and technologies for livestock products.
- ⁸⁸ Tschirley, D., Reardon, T., Dolislager, M. and Snyder, J., 2015. The Rise of a Middle Class in East and Southern Africa: Implications for Food System Transformation. *Journal of International Development*, 5(27):628-646
- ⁸⁹ Reardon, T., Tschirley, D., Liverpool-Tasie, L.S.O., Awokuse, T., Fanzo, J., Minten, B., Vos, R., Dolislager, M., Sauer, C., Dhar, R., Vargas, C., Larrey, A., Raza A. and Popkin, B.M. 2021. The processed food revolution in African food systems and the double burden of malnutrition. *Global Food Security* 28:100466.
- ⁹⁰ Kearney, J. 2010. Food consumption trends and drivers. *Philosophical transactions of the royal society B: biological sciences*, 365(1554), 2793-2807.
- ⁹¹ Sow M. 2015. Foresight Africa 2016: Urbanization in the African context. Brookings Africa Growth Initiative. Online at <https://www.brookings.edu/blog/africa-in-focus/2015/12/30/foresight-africa-2016-urbanization-in-the-african-context/>
- ⁹² Kherallah, M., Delgado C., Gabre-Madhin, E.Z., Minot, N., and Johnson, M. 2002 Reforming Agricultural Markets in Africa: Achievements and Challenges. International Food Policy Research Institute, Washington, D.C.
- ⁹³ Foster, V., & Briceño-Garmendia, C. 2010. Africa's infrastructure: a time for transformation. World Bank
- ⁹⁴ Teravaninthorn, S., & G. Raballand. 2009. Transport prices and costs in Africa: a review of the main international corridors. World Bank
- ⁹⁵ Biénabe, E., & Sautier, D. (2005). The role of small scale producers' organizations to address market access. In International seminar beyond agriculture: Making markets work for the poor. London, UK
- ⁹⁶ Musoke, C., Byaruhanga, J., Mwesigwa, P., Byarugaba, C., Kaganzi, E. & Best, R. (2004). Linking farmers to markets: The case of the Nyabyumba potato farmers in Uganda. Paper presented at the Conference on Integrated Agriculture Research for Development. Kampala, Uganda, 1–4 September 2004.

- ⁹⁷ Best, R., Ferris, S., & Schiavone, A. (2005). Building linkages and enhancing trust between small-scale rural producers, buyers in growing markets and suppliers of critical inputs. In *Beyond Agriculture-making markets work for the poor: Proceedings of an international seminar* (Vol. 28, p. 176).
- ⁹⁸ Kwapong, N. A., & Korugyendo, P. L. (2010a). Revival of agricultural cooperatives in Uganda. International Food Policy Research Institute Policy Note, (10).
- ⁹⁹ Kwapong, N. A., & Korugyendo, P. L. (2010b). Why a few agricultural cooperatives survived the crisis in the cooperative movement in Uganda while many others collapsed. International Food Policy Research Institute Policy Note, (11)
- ¹⁰⁰ Kaganzi E., S. Ferris, J. Barham, A. Abenakyo, P. Sanginga, and J. Njuki. 2009. Sustaining linkages to high value markets through collective action in Uganda. *Food Policy* 34: 23–30.
- ¹⁰¹ Develtere, P., Pollet, I. and Wanyama, F., 2008. Cooperating out of poverty. The renaissance of the African cooperative movement. Geneva: ILO.
- ¹⁰² Fafchamps, M. (2003). Market institutions in sub-Saharan Africa: Theory and evidence. MIT Press.
- ¹⁰³ Fafchamps, M. and Hill, R.V., 2008. Price transmission and trader entry in domestic commodity markets. *Economic Development and cultural change*, 56(4):729-766.
- ¹⁰⁴ Reardon T., T. Awokuse¹, S. Haggblade, T. Kapuya, S. Liverpool-Tasie, F, Meyer, B. Minten, D. Nyange, J. Rusike, D. Tschirley, and R. Vos. 2019. The Quiet Revolution in Agri-food Distribution (Wholesale, Logistics, Retail) in Sub-Saharan Africa. In AGRA. (ed). Africa Agriculture Status Report: The Hidden Middle: A Quiet Revolution in the Private Sector Driving Agricultural Transformation (Issue 7). Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA).
- ¹⁰⁵ World Bank. 2017. Creating Markets in Ghana. Country Private Sector Diagnostic. https://www.ifc.org/wps/wcm/connect/90fe56dd-58dc-4c22-8162-90889d6e9365/CPSD-Creating-Markets-in-Ghana-Nov-2017_v1.pdf?MOD=AJPERES&CVID=l.attQE
- ¹⁰⁶ Reardon T., T. Awokuse¹, S. Haggblade, T. Kapuya, S. Liverpool-Tasie, F, Meyer, B. Minten, D. Nyange, J. Rusike, D. Tschirley, and R. Vos. 2019. The Quiet Revolution in Agri-food Distribution (Wholesale, Logistics, Retail) in Sub-Saharan Africa. In AGRA. (ed). Africa Agriculture Status Report: The Hidden Middle: A Quiet Revolution in the Private Sector Driving Agricultural Transformation (Issue 7). Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA).
- ¹⁰⁷ World Bank. 2021. World Development Indicators 2021.

- ¹⁰⁸ Fulanda B. 2018. Impact of International Fish Trade Flows in Africa. <http://repository.au-ibar.org/handle/123456789/1152>
- ¹⁰⁹ Lowitt S. 2017. Cross-Cutting Logistics Issues Undermining Regional Integration Across SADC. https://www.tips.org.za/research-archive/item/download/1473_91d4526dad0f252ee8ee21cd10a60705
- ¹¹⁰ Bouët A., B. Cissé, and F. Traoré. 2020. Informal Cross-Border Trade in Africa. In Bouët, Antoine, Odjo, Sunday Pierre, and Zaki, Chahir, eds. Africa Agriculture Trade Monitor 2020. Washington, DC: International Food Policy Research Institute (IFPRI).
- ¹¹¹ Goundan A. and G. Tadesse. 2021. Intra-African Agricultural Trade. In Bouët, A., Tadesse, G., and Zaki, C., eds. 2021. Africa Agriculture Trade Monitor 2021. Kigali and Washington, DC: AKADEMIYA2063 and International Food Policy Research Institute.
- ¹¹² Kurtz J., L. Mitik, and C. Zaki. 2021. African Trade in Livestock Products and Value Chains. In Bouët, Antoine, Tadesse, Getaw, and Zaki, Chahir, eds. 2021. Africa Agriculture Trade Monitor 2021. Kigali and Washington, DC: AKADEMIYA2063 and International Food Policy Research Institute.
- ¹¹³ UNCTAD (2019). Borderline: Women in Informal Cross-Border Trade in Malawi, the United Republic of Tanzania and Zambia. United Nations Conference on Trade and Development. Walking in the Dark: Informal Cross-Border Trade in the Great Lakes Region.
- ¹¹⁴ Foster, V. and Briceño-Garmendia, C., 2010. Africa's infrastructure: a time for transformation. World Bank.
- ¹¹⁵ Calderón C., C. Cantú, P. Chuhan-Pole. 2018. Infrastructure Development in Sub-Saharan Africa: A Scorecard. World Bank Policy Research Working Paper 8425. <https://openknowledge.worldbank.org/bitstream/handle/10986/29770/Infrastructure-development-in-Sub-Saharan-Africa-a-scorecard.pdf?sequence=5&isAllowed=y>
- ¹¹⁶ Ruben, R., Kuijpers, R. and Dijkxhoorn, Y., 2022. Mobilizing the Midstream for Supporting Smallholder Intensification. *Land*, 11(12):2319.
- ¹¹⁷ AU. 2015. Programme for infrastructure development in Africa. Interconnecting, integrating and transforming a continent. Addis Ababa: African Union.
- ¹¹⁸ Afrika, J.G. and Ajumbo, G., 2012. Informal cross border trade in Africa: Implications and policy recommendations. *Africa Economic Brief*, 3(10):1-13.
- ¹¹⁹ Hara, M., Greenberg, S., Thow, A.M., Chimarito, S. and du Toit, A., 2017. Trade and investment in fish and fish products between South Africa and the rest of SADC: Implications for food and nutrition security.
- ¹²⁰ Traore, F., Laborde, D. and Bouët, A., 2022. Informal Cross-Border Trade in Africa: by how much does it change the estimated impact of the African Continental Free Trade Area?

- ¹²¹ Ayilu, R.K. and Nyiawung, R.A., 2022. Illuminating informal cross-border trade in processed small pelagic fish in West Africa. *Maritime Studies*, 21(4):519-532.
- ¹²² de Bruin, S., Dengerink, J., Randhawa, P., Wade, I., Biemans, H. and Siberius, C. 2021. Urbanising Food Systems: Exploring Opportunities for Rural Transformation in India and sub-Saharan Africa. Background paper for the Rural Development Report 2021. IFAD. Rome: Italy.
- ¹²³ Makombe T., J. Collins and O. Badiane. 2017. Regional Developments, Africa. In IFPRI. Global Food Report 2017, pp.60-63.
- ¹²⁴ FAO, IFAD, UNICEF, WFP and WHO. 2021. The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all. Rome, FAO. <https://doi.org/10.4060/cb4474en>
- ¹²⁵ Kearney, J., 2010. Food consumption trends and drivers. *Philosophical transactions of the royal society B: biological sciences*, 365(1554):2793-2807.
- ¹²⁶ Jardí, C., Casanova, B.D. and Arija, V., 2021. Nutrition Education Programs Aimed at African Mothers of Infant Children: A Systematic Review. *International Journal of Environmental Research and Public Health*, 18(14):7709.
- ¹²⁷ Prinsloo, T. and De Villiers, C., 2017. A framework to define the impact of sustainable ICT for agriculture projects: The Namibian livestock traceability system. *The Electronic Journal of Information Systems in Developing Countries*, 82(1):1-22.
- ¹²⁸ Nagarajan, Latha, Thomas Muesembi, Alexander Fernando 2021. Review of Existing Last Mile Seed Delivery Models and Approaches. A Feed the Future Global Supporting Seed Systems for Development activity (S34D) report.
- ¹²⁹ Akademiya and ZEF 2020. From potentials to reality: Transforming Africa's food production Investment and policy priorities for sufficient, nutritious and sustainable food supplies.
- ¹³⁰ Partey, S.T., Dakorah, A.D., Zougmore, R.B., Ouédraogo, M., Nyasimi, M., Nikoi, G.K. and Huyer, S., 2020. Gender and climate risk management: evidence of climate information use in Ghana. *Climatic Change*, 158(1):61-75.
- ¹³¹ Chimhowu, A., 2019. The 'new' African customary land tenure. Characteristic, features and policy implications of a new paradigm. *Land Use Policy*, 81:897-903.
- ¹³² Boone, C., 2017. Sons of the soil conflict in Africa: institutional determinants of ethnic conflict over land. *World Development* 96, 276–293.
- ¹³³ Krätli S. and J. Swift. 2014. Counting Pastoralists' in Kenya.
- ¹³⁴ Kenya National Bureau of Statistics. 2020. 2019 Population and Housing Census.

- ¹³⁵ Banerjee, R.R., Khalai, D.C., Galgallo, D. and Mude, A. 2017. Improving the Agency Model in distribution of Index Based Livestock Insurance (IBLI)—a study of Takaful Insurance of Africa. ILRI research report 45.
- ¹³⁶ UNICEF. 2022. Going Beyond Monetary Poverty Uganda’s Multidimensional Poverty Profile. Online at <https://www.unicef.org/esa/media/6146/file/UNICEF-Uganda-Multi-dimensional-child-poverty-2020.pdf>
- ¹³⁷ Farm Africa. 2021. Goat Husbandry by Pastoralist Communities: Factors Affecting the Adoption of Improved Practices in Karamoja And South Omo. Online at <https://www.farmafrica.org/downloads/2022/goat-husbandry-by-pastoralist-communities-final.pdf>
- ¹³⁸ Farm Africa. 2021. Impact of Increased Women’s Incomes on Nutrition in Karamoja Uganda and Omo Ethiopia. Online at <https://www.farmafrica.org/downloads/2022/impact-of-womens-increased-income-on-nutrition-final.pdf>.
- ¹³⁹ Nimoh F, Tham-Agyekum EK, Awuku SM 2012 Factors influencing access of poultry farmers to credit: The Case of the Agricultural Development Bank (ADB) in Ga East Municipality, Ghana. *Management* 3(1): 54-58 doi: 10.5923/j.mm.20130301.11
- ¹⁴⁰ Adams, F., Mensah, A., Etuah, S., Aidoo, R. and Mensah, J.O., 2021. Determinants of Vertical Integration in Poultry Production in Ghana: Application of Count Data Models. <https://orcid.org/0000-0002-2225-5501>



AFRICAN UNION UNION AFRICAINE

African Union Common Repository

<http://archives.au.int>

Department of Rural Economy and Agriculture (DREA)

African Union Specialized Technical Office on Research and Development

2023-09

Guidelines for Inclusive Agricultural Value Chains Development in Africa

AU-SAFGRAD

AU-SAFGRAD

<https://archives.au.int/handle/123456789/10484>

Downloaded from African Union Common Repository