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Strategies for Transforming Smallholder Farming in Africa

By
FATUNBI Abiodun Oluwole, AJAYI Tunde and AKINBAMIJO Yemi

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Citation
Fatunbi AO, Ajayi MT and Akinbamijo OO (2020). Strategies for Transforming Smallholder farming in Africa. Forum for Agricultural Research in Africa (FARA), Accra Ghana. PP 1-121

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ISBN: **978-9988-8373-3 - 6**

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Acronyms

ADP	Agricultural Development Programme
AEZ	Agro-Ecological Zone
AGRA	Alliance for a Green Revolution in Africa
AfDB	African Development Bank
AIS	Agricultural Innovation System
ARD	Agricultural Research and Development
ASARECA	Association for Strengthening Agricultural Research in East and Central Africa
AU	African Union
CA	Conservation Agriculture
CAADP	Comprehensive Africa Agriculture Development Programme
CBO	Community Based Organisation
CCARDESA	Centre for Coordination of Agricultural Research for Development for Southern Africa
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CORAF/WECARD	West and Central African Council for Agricultural Research and
CP	Challenge Programme
CRST	Cross Site Research Support Team
DFID	Department for International Development
DONATA	Dissemination of New Agricultural Technology in Africa
DRC	Democratic Republic of Congo
EAC	East African Community
ECOWAS	Economic Community of West African States
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FARA	Forum for Agricultural Research in Africa
IAR4D	Integrated Agricultural Research for Development
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
IP	Innovation Platform
IPTA	Innovation Platform for Technology Adoption
IS	Innovation System
KALRO	Kenya Agricultural and Livestock Research Organisation
KKM	K ano Katsina Maradi

NARO	National Agricultural Research Organisation (Uganda)
NARS	National Agricultural Research System
NASRO	Northern Africa Sub Regional Organisation
NGO	Non-Governmental Organisation
NGS	Northern Guinea Savanna
NOGAMU	National Organic Agricultural Movement of Uganda
NRM	Natural Resources Management
OTSP	Orange Fleshed Sweet Potato
PARI	Programme of Accompanying Research for Agricultural Innovation
PLS	Pilot Learning Site
PSTAD	Promotion of Science and Technology for Agricultural Development
R&D	Research and Development
SADC	Southern African Development Community
SRO	Sub Regional Organisation
SSA	Sub Saharan Africa
SSA CP	Sub-Saharan Africa Challenge Programme
TAAT	Technology for African Agricultural Transformation
TCS	Target Country Site
TF	Taskforce
TFs	Task Forces
UNBS	Uganda National Bureau of Standards
UNDP	United Nations Development Programme
USAID	United States of America International Development
USDA	United States Department of Agriculture
WAAP	West Africa Agricultural Productivity Programme
WHO	World Health Organisation

Preface

The picture of Africa agriculture is one that calls for concern over the years. This is because of the protracted problems affecting the sector in the last five decades. Although the sector seems to have recorded a few successes in recent years, the level of transformation still falls short of the requirement to affect a meaningful social and economic development. The statistics on the population involved in agriculture (65%) and the average contribution of the sector to country GDP (35%) tells a story of poor sectoral productivity and the need for urgent institutional treatment. Many development thinkers have opined that the agricultural sector will be the trigger for Africa's economic development, this is mainly because it engages the largest share of Africa's population. While this appeals to reasoning, established knowledge in development economics classified the agricultural sector as one with low labour productivity. As such national economies tend to develop as labour is shifted from the farm to a more industrial and service sector. This scenario suggests that if Africa's development will be built on the agricultural sector, it must run its production in a more industrial and business mode rather than the current rudimentary systems which are largely unsustainable. The emerging needs for a proactive response to socio-economic issues such as growth in youth population and its associated demand for employment opportunities; The growth in the middle class and surge in egalitarian lifestyle and associated demand for more nutritious and semi-processed food products; The increased use of ICT in all walks of life and the reduction in farm labour, all calls for an upward shift in the kind of agriculture that is practiced in Africa.

Apparently, the smallholder agricultural system cannot respond effectively to the current demand of the sector, hence, the need to develop a syste -matic approach to transform the smallholder system to a more business-oriented agriculture. The current smallholder system is largely unprofitable, yielding very low returns on investment and cannot be considered as a commercially viable venture. Largely, returns from farming activities are only satisfactory where the economy of scale is maximized. The small farm size and the associated difficulty in accessing agricultural lands is also a major difficulty confronting the transformation of the smallholder systems. This is outside the well-known problems of access to technologies, access to affordable finance, dysfunctional input and output market system and need for supportive policies.

The smallholder's transformation needs to consider all these issues and develop a robust strategy that is capable of fostering a rapid shift from subsistent farming to a more commercialized farming.

The strategy needs to consider the system realities in the agricultural sector and engaged the full compliments of stakeholders along the agricultural innovation sphere

The use of the innovation systems approach as well as the innovation platforms as its operational framework would play a key role in this regard It will foster good synergy and complementarity among the stakeholders It will also facilitate effective public and private sector partnership in developing Africa agriculture

This book comprises ten chapters that run an exhaustive analysis of all the issues in smallholder agriculture It reviewed the state of knowledge on the different components of the systems that require a change to ensure a smooth transformation for the smallholders It finally proposes a country-based stepwise action to ensure a systematic transformation of smallholder farming

I wish you a fruitful reading

Director of Research & Innovation, FARA

Acknowledgements

The studies and intellectual analysis documented in this book was carried out within the cluster five research action of the Program of Accompanying Research for Agricultural Innovation (PARI) www.research4agrinnovation.org . The cluster five research aims at Improving the policy context and contributing to evidence-based policy processes in Africa agriculture. The PARI project is coordinated by the Center for Development Studies (ZEF), University of Bonn, Germany and the Forum for Agricultural Research in Africa (FARA) is partnering to coordinate the participation of 12 Africa countries in the project. The funding for PARI and by implication this book is provided by the German Federal Ministry of Economic Cooperation and Development (BMZ).

The authors wish to acknowledge the efforts and contribution of the different individuals that contributed to the technical review of this book to ascertain its peer review status.

We acknowledge the contributions of Dr. Godfrey Onagwa for the language editing. The layout and graphics design were carried out by Christoph Esikpe and Daniel Peprah of the FARA communication unit.

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CHAPTER 1
Introduction

Agricultural Development Efforts in Africa: Current Status and Imperative for Change

There has been a general concern on why the Green Revolution has not taken place in Africa after 50 years of such revolution in Asia and other developed continents of the world. This is because in the sixties and seventies, many African countries were net exporters of major food and cash crops, not importers as they are today. About 20 per cent of national budgets at that time went to agriculture (Nwanze, 2013). It was like Africa was on the cusp of eliminating poverty and hunger, and taking its place in the world of research and development. These were also the years when India was described as a hopeless case, when Chinese died of famine, Brazil depended on food aid and massive food imports and South Korea received assistance from some African countries. Ten years later, agricultural productivity in Africa began a decline.

AGRA (2018) has indicated that agriculture is key to Africa's future; the continent has most of the world's arable land, with over half of the population employed in the sector. It is also the largest contributor to total gross domestic product (GDP). According to NEPAD (2013), however, agricultural production in Africa has increased steadily over the last 30 years, its value almost tripling (+160%). The sector shows an increase that clearly exceeds the growth rate for global agricultural production over the same period (+100%), almost identical to that of South America (+174%), and below but comparable to growth in Asia (+212%). However, the Africa Green Revolution is yet to happen; even though there are pockets of successes, as reported by NEPAD (2013), these are not in the desired scale to trigger significant change. This could be partly due to the lack of access to input and output markets, to technologies and finance; poor infrastructure and advisory services, and inadequate coordination structures in the sector. It is speculated that even if all the identified constraints are resolved at optimum level, the income profile of a smallholder farmer in Africa may be unable to support sustainable livelihood.

Agricultural growth in Asia over the last 30 years was due largely to intensive agriculture (greater use of improved varieties and irrigation), while in South America, it was due to a significant increase in labor productivity through gradual mechanization. Conversely in Africa, there has been very little improvement in production factors (labor and land), except in North Africa and, to a lesser extent, West Africa (NEPAD, 2013).

Cornway (2016) observed that in sub-Saharan Africa, there has been virtually no growth in agricultural labor productivity since 1961. Indeed, there has been a widening of the gap between labor productivity in the agricultural and non-agricultural sectors. For a variety of reasons, not least the heterogeneity of the African agricultural environment, the Asian model is not immediately relevant to Africa's needs. This variability across the continent does not change the general trend; despite the growth, agricultural production has been unable to meet the higher and more diversified food requirements of the population. In fact, in many countries and regional blocs, population growth has exceeded growth in agricultural production. Thus, food deficits have increased in countries that have traditionally been importers of food, while those that have traditionally been self-sufficient struggle to maintain this status.

According to NEPAD (2013), despite higher levels of urbanization, the agricultural and rural population is growing in Africa. Small farms are tending to shrink with every generation. Small farms that are dependent on family labor, with very little machinery and several activities, reflect the dominant type of agriculture in the continent. In addition to the prevalence of subsistence, a significant portion of that production is sold through informal channels capable of accommodating non-standardized products delivered in small quantities. Non-agricultural revenue generated locally, in cities or abroad, provides a significant and growing share of income for most families working in the agricultural sector.

Sennhauser (2015) indicated that despite agriculture being a crucial sector in many economies in Africa, agricultural productivity in the continent is very low. Yields of maize and other staple cereals have typically remained at about one ton per hectare for about one-third of the farmers, compared to what obtain in Asia and Latin America. In the past 30 years, the competitiveness of many sub-Saharan African export crops has declined and the region's dependence on imported food crops has increased. In the years ahead, global warming is expected to intensify the constraints on food production. Sennhauser (2015) also emphasized that in most of sub-Saharan Africa, where farming systems are more complex across various agro-ecological zones, quality seed and fertilizer are not backed by irrigation support or mechanization inputs. As a result, the region is largely bypassed by the Green Revolution that helped transform agriculture and reduce poverty in Asia and Latin America.

According to NEPAD (2013), there are a few African countries that have initiated good agricultural transformation processes, but which did not rely on a number of considerable extractive sectors. Global economic competition, soaring population growth and the impact of climate change are challenges that must be overcome in order to begin the sustainable process of economic transition. However, some countries with very different historical and geographic realities seem to be setting out on such a path: Ghana, since the 1990s and, more recently, Ethiopia and Rwanda, have experienced periods of economic development accompanied by poverty reduction. In these three cases, agriculture was given a near central role in economic development; however, its economic promises were not fully realized due to the absence of clearly articulated sectorial policies.

Furthermore, it has been pointed out that to achieve accelerated agricultural development, each government must put in place the necessary enabling environment. Consequently, AGRA (2018) highlighted the importance of micro policies and regulatory reforms for African agribusiness approach (Table 1).

Table 1: The Micro Policy and Regulatory Reforms for African Agribusiness Approach (MIRA)

Country	Reforms completed or in advanced stage
Burkina Faso	· Agricultural marketing regulations for public procurement · Agricultural Sector Investment Code · Strategy for a warehouse receipt system (WRS) for agricultural products
Ethiopia	· Taxes on agricultural machinery spare parts, irrigation/drainage equipment · Import duties on agricultural machinery spare parts · Cereals export restrictions · Contract farming · Develop and approve a National Seed Policy
Ghana	· Ratification and gazetting of the harmonized Economic Community of West African States (ECOWAS) seed regulation · Ratification and gazetting of the harmonized ECOWAS fertilizer regulation · Passage and gazetting of Ghana Seed Draft Regulations · Development and approval of electronic data base for improving the efficiency of the fertilizer subsidy program
Nigeria	· Passage and enactment of the revised Seed Act · Passage and enactment of the Fertilizer Quality Control Bill · Institutional arrangements to reach millions of smallholder farmers with soil and crop specific fertilizer blends ·Institutional arrangements to reach millions of smallholder farmers with certified seed of improved varieties and hybrids

Country	Reforms completed or in advanced stage
Tanzania	· Improve access by private seed companies to public protected pre-basic and basic seeds · Remove barriers to registration of new fertilizer products · Improve the delivery of fertilizers · Improve institutional arrangements in the management of issuance of grain export permits · Development of an umbrella contract farming legislation

Source: AGRA (2018)

Despite the setback in African agriculture in the last 50 years, the sector remains prominent in most African economies, as well as the main creator of jobs.

1.2 Roles of Continental Initiatives in Smallholder Farming Transformation

There are many initiatives that have contributed to the transformation of smallholders in Africa.

The Comprehensive Africa Agriculture Development Program (CAADP)

In 2003, the African Union's heads of state and government committed to a Comprehensive Africa Agriculture Development Program (CAADP) with the aim of tackling hunger, food insecurity and poverty in Africa. To this effect and through in the 2003 Maputo Summit Declaration on Agriculture and Food Security, they adopted sound policies and committed to allocating at least 10 percent of national budgetary resources to agriculture and rural development. The message was clear: Agriculture and Africa's self-determination are intertwined. This agreement proceeded from an understanding that the difficulties facing agricultural transformation in Africa came less from the lack of resources than from the management of available resources. CAADP helped to mobilize all the key stakeholders around a coordinated response to Africa's agricultural development challenges.

The result of a decade of efforts shows that CAADP has in many ways been transformational; although, progress was generally slow because, despite the willingness to do what was right, many African countries were grappling with capacity challenges with regard to implementing this transformative agenda. Expenditures allocated to agriculture increased by an average of 7.4 percent per year since the adoption of the program, doubling the volume of public funding on agriculture. Increased investments have spurred agricultural growth from the stagnation and decline of the previous decades to an average of 4 percent per year since 2003. Countries that have consistently reached or exceeded the 10 percent public-expenditure allocation target of the Maputo Declaration, such as Ethiopia and Rwanda, saw a substantial reduction in poverty figures and inequality levels (AGRA, 2018).

These results corroborated the conclusion of a World Bank study that in sub-Saharan Africa, agricultural investments are eleven times more efficient in poverty reduction than investments in other sectors.

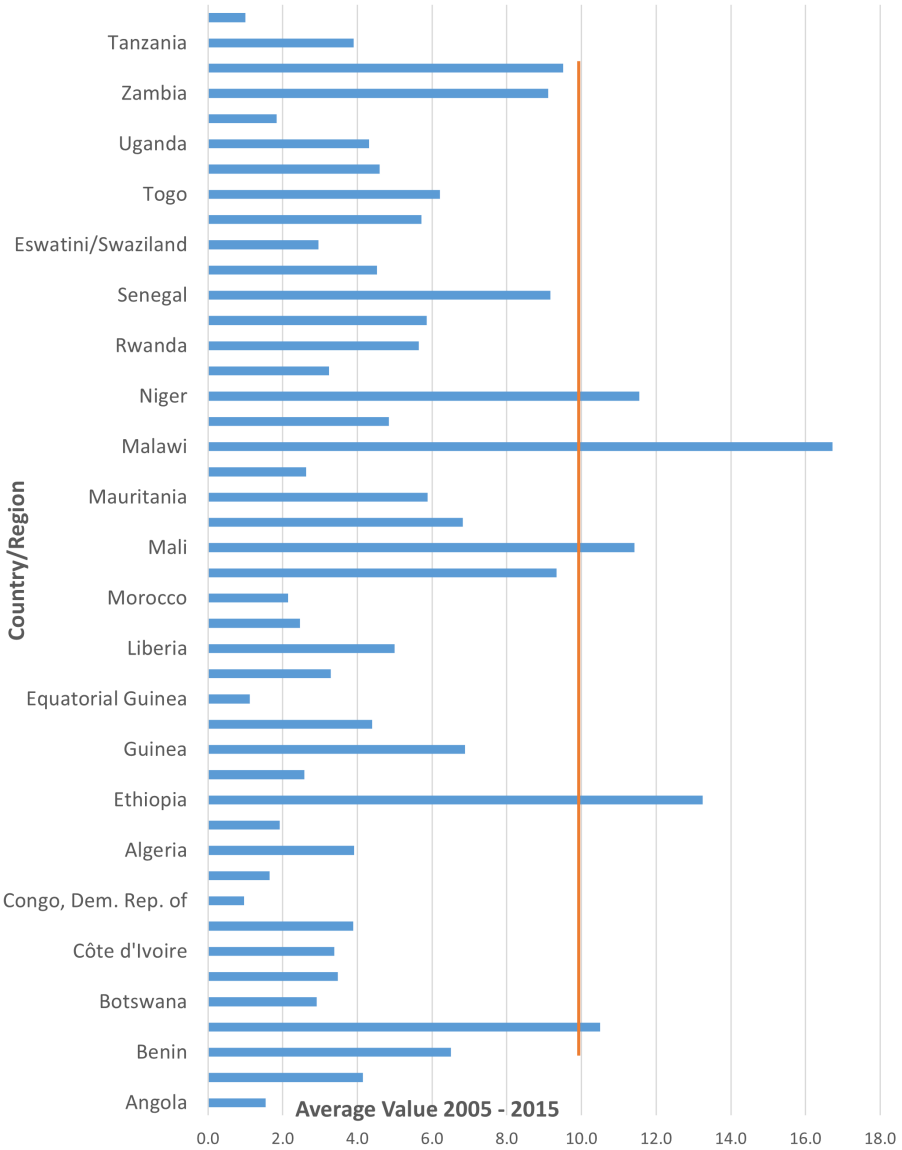


Figure 1. Government expenditure on agriculture as percent of total expenditure (average value 2005 – 2015).

Note: The orange line marks the CAADP target of 10%

Source: Calculated based on data from ReSAKSS (http://www.resakss.org/node/11, accessed July 10, 2019

One World, No Hunger Initiative

(PARI and Green Innovation Center)

The PARI program brings together partners from Africa, India and Germany to contribute to sustainable agricultural growth and food and nutrition security in Africa and India. PARI also offers independent scientific advice to the special initiative of the German government's "One World No Hunger" (SEWOH) initiative which, among other activities, supports the improvement of food and nutrition security and sustainable agricultural value chains by setting up Green Innovation Centers (GICs) in 12 African countries. The specific goals of PARI are to promote and support the scaling of proven innovations in the agrifood sector in partnership with all relevant actors; to support and enhance investments in the GICs through research and, thereby, contribute to the development of the agrifood sector in Africa and India through the identification, assessment, and up-scaling of innovations. The core topics and thematic research priorities of PARI have been identified in alignment with the African Union's CAADP goals. The current PARI's collaborative work includes:

1. Analyses of the potential and impact of innovations (which innovations to invest in, where and for whom)
2. Identification and assessment of supportive measures to strengthen the framework / policy conditions for the generation and dissemination of promising agriculture and rural areas development–related innovations
3. Engaging with food, nutrition, agriculture and rural areas development policymakers on reforms and investment decisions that improve job creation, food and nutrition security.

The current thematic focus areas include:

Other areas are:

1. Potential and drivers of livestock production in Africa
2. Facilitating access to seeds through decentralized seed production, multiplication, treatment, and dissemination
3. Mobilizing investment in fertilizer production and distribution in sub-Saharan Africa

The Science Agenda for Agriculture in Africa (S3A)

The Science Agenda for Agriculture in Africa (dubbed 'Science Agenda' / S3A) is an African-owned and led process that articulates the science, technology, extension, innovations, policy and social learning that Africa needs to apply in order to meet its agricultural and overall development goals. The strategic thrusts of S3A in the short to medium term are: the implementation of CAADP; increase domestic public and private sector investment; creating the enabling environment for sustainable application of science for agriculture; and doubling current level of Agricultural Total Factor Productivity (ATFP) by 2025 through the application of science for agriculture. In the medium to long-term the science agenda is to build systemic science capacity at national and regional levels, capable of addressing evolving needs for farmers, producers, entrepreneurs and consumers, especially given strategic and foresight issues, such as climate change and urbanization.

The Forum for Agricultural Research in Africa (FARA) and constituent partners are leading the development and operationalization of the Science Agenda for Agriculture in Africa (S3A). The S3A document was prepared by an African-led expert group through a consultative process involving the broader agricultural science community and rural development professionals in Africa, as well as high-level decision-makers on the continent. The agenda, now ratified by the Heads of States in Malabo, signals Africa's clear intent to commit to a science-led process at the national level to secure agricultural transformation and Africa's future. According to Nwanze (2013), the development of a 3SA under the auspices of FARA is an important step on the road to a strong agricultural sector. It is all the more important because it is Africa-owned and led, and holds the promise of African farmers and citizens reaping the benefits of African research. But it will only translate to stronger nations and better lives for the people of Africa if it is supported by coherent investment in agriculture for development.

Technologies for African Agricultural Transformation (TAAT)

Technologies for African Agricultural Transformation (TAAT) supports Feed Africa by providing the needed and proven agricultural and food processing technologies and implementation strategies for inclusion within AfDB's loans to Regional Member Countries (RMCs). TAAT's approaches are to revitalize and transform agriculture while restoring degraded land and maintaining or strengthening the ecosystems that underpin agriculture; these area also to modernize and more fully commercialize agriculture. Investments in TAAT will be greatly compounded by much larger loans/ grants awarded to RMCs through Feed Africa, Bank-financed country programs, the World Bank and AGRA programs. It has been estimated that, overall, TAAT will lead to 120 million tons of additional raw food production per year and contribute to lifting about 40 million people out of poverty.

TAAT is essentially a knowledge and innovation-based response to the recognized need for scaling up proven technologies across Africa. It is a Regional Technology Delivery Infrastructure (RTDI) made up of CGIAR centers, National Agricultural Research Systems (NARS), represented by their continental umbrella, the Forum for Agricultural Research in Africa (FARA), African Agricultural Technology Foundation (AATF), and subregional organizations (SROs), with an emphasis on agroecological zones and their priority commodities.

The principal implementation units of TAAT are Commodity Technology Delivery Compacts (CTDCs), which comprise all actors in the seed, primary production, and primary processing components of agricultural commodity value chains. The CTDC is a compact between the lead CGIAR centers with mandate for the commodity value chains, NARS with farmer organizations, aggregators, processors, seed companies, fertilizer companies, equipment manufacturers, ministries of agriculture of RMCs, regulatory bodies of agro-inputs, public and private extension entities on crop outreach campaign to reach tens of millions of farmers on the continent in the next 5 to 8 years. The clearinghouse is the decision-making body of RDTI when it comes to selecting which technologies to disseminate and scale up. The objective of the clearinghouse is to decide which proven agricultural technologies proposed by each crop/livestock compact group can be rolled out and taken to scale.

Alliance for Green Revolution in Africa (AGRA)

According to AASR (2017), AGRA was founded in 2006 to trigger a uniquely African Green Revolution, one that would learn from and build on previous revolutions elsewhere. At the time, the outlook for African agriculture was bleak; food security, livelihoods and farm productivity were deteriorating; international and domestic investments in agriculture were low; a few actors in regional and national systems had the capacity to deliver; and there was no strong advocacy for change. During the first decade of its existence, AGRA's vision and strategy was to: (i) design technologies and delivery systems that were appropriate to the complex agroecologies of the continent; (ii) put smallholder farmers first on the agenda while promoting sustainability and advancing equity; (iii) build capacities of institutions around the farming environment to deliver on improved agriculture; and (iv) strengthen the technical capabilities of research and development (R&D) institutions. For instance, AGRA supported over 400 projects in areas of seed systems development and supply of quality seeds, soil health and fertility management, development of storage infrastructure, modernization of market information systems, capacity strengthening for farmer organizations, access to finance by value chain players, and improvement of policy and regulatory frameworks in favor of African smallholder farmers. In addition, AGRA has contributed to building professional capacity in the public and private sectors. Today, there is newfound belief in African agriculture. In recent years, the private sector has joined the effort, marking the beginnings of a private sector-led, government-enabled African green revolution. The continent has seen crop yields rise significantly in many food insecure parts of the continent, though gaps still exist for most staple crops. AGRA has contributed significantly to the progress and positive outlook of the continent over the last 12 years.

CHAPTER 2

The State of Smallholder-farming in Africa

2.1 Concepts and Typologies of Smallholder-Farming in Africa

Smallholder farmers are defined in various ways, depending on the context, country and ecology. Often, the term 'smallholder' is interchangeably used with 'small-scale', 'resource poor' and 'peasant' farmer. Thus, the term generally is used to refer to the farmer's limited resource endowment, relative to other farmers in the sector. Smallholder is also defined as a farmer owning small plots on which he grows subsistence crops and/or cash crops, relying almost exclusively on family labor.

Some scholars defined smallholder farming according to the scale of production. With the majority of the units being generally small in size, the subsector is aptly referred to as "small-scale agriculture" (Gilimane, 2006; Obi and Seleka, 2011). However, Gilimane (2006) defines small-scale agriculture as the sector of developing economies that presents the most difficult development problems. Ellis (1988) defines smallholder as a farm household whose limited access to the means of livelihoods and production resources means that they must rely primarily on family labor for farm production to produce mostly for subsistence. Fanadzo et al. (2010) identified several terms that are used to describe smallholder farmers, notably, "small-scale", "resource-poor", "peasant" and "food-deficit" farmers, as well as "household food security farmers", "land-reform beneficiaries" and "emerging farmers". This means, an array of criteria is used to classify farmers, including land size, purpose of production (subsistence or commercial) and income level.

Consequently, FAO (2015) indicated that, although there is no unique definition of smallholder, scale, often measured in terms of the farm size, is used to classify farmers generally into small and large. A number of analysts, therefore, classified smallholders based on a threshold of 2 hectares. As a way of operationalization, the term treated in this section as 'smallholder farmer' was based on this 2-hectare threshold. However, across countries, the distribution of farm sizes depends on a number of agro-ecological and demographic conditions, as well as on economic and technological factors. Two hectares in an arid region of sub-Saharan Africa, for example, would not produce as much as two hectares of high quality soil in the Black Sea region. In Kenya, adding up all smallholders who farm on less than 2 hectares would nearly result in the entire arable sector.

The 2-hectare threshold used in this review, therefore, does not mean it should be used uniformly in analysis across countries (Department of Agriculture, Forestry and Fisheries, 2012). Furthermore, ILO (2018) has observed that the vast majority of the world's farms are small or very small, with farms of less than 1 hectare accounting for 72% of all farms but controlling only 8% of all agricultural lands; while farms between 1 and 2 hectares account for 12% of all farms and control 4% of the land. In contrast, only 1% of all farms in the world are larger than 50 hectares, but they control 65% of the world's agricultural land, suggesting that agricultural products are largely from large farms.

It is noteworthy, therefore, that the definition of "smallholder agriculture" cannot be rigid or a "one-size-fits-all"; there are variations in each context at the regional, national and local levels, and also over time as economies transform (HLPE, 2013). Thus, a classification that is based only on farm size can be misleading; a smallholding is "small" because resources are scarce; hence, using it to generate a level of income that helps fulfil basic needs and achieve sustainable livelihood. On many measures where quantification is possible, however, most African agriculture takes place on a small-scale.

Characteristics of Smallholder Farming

Smallholders are crop farmers, pastoralists, forest keepers, and fishers who manage a small area, on the average. They are characterized by family-focused motives, such as favoring the stability of the farm household system, using mainly family labor for production and using part of the produce for family consumption (FAO, 2012). According to Gollin (2014), smallholder farming is highly heterogeneous and includes farms that are quite commercial in orientation, as well as those that are rooted in quasi-subsistence livelihoods.

The main characteristics of production systems of smallholder farmers are that they are simple, use outdated technologies, have low returns, high seasonal labor fluctuations and women play a vital role in production. Smallholder differ in individual characteristics, farm size, and resource distribution between food and cash crops, livestock and off-farm activities; and their use of external inputs and hired labor, the proportion of food crops sold and household expenditure patterns (Department of Agriculture, Forestry and Fisheries, 2012).

HLPE (2013) stated that off-farm activities play an important role in providing smallholders with additional income and are a means of diversifying risk and, thus improving their resilience to the shocks that impact on agriculture. Off-farm activities are a common feature of rural economies, both in developed and developing countries, and offer opportunities for investments in support of smallholders.

Moreover, the family is a social unit of production and consumption and the source of labor for smallholder agriculture. The productive and domestic sides of smallholders are closely linked. This linkage explains some of the constraints faced by smallholders regarding investments, as shocks and risks can spread between the production side and family side; it also explains the resilience of rural societies because of reciprocal ties relying on kinship and social proximity.

The small land area of these farms should not obscure their importance in livelihood strategies. Small farms are not only sources of employment, but are also obvious sources of food and sustenance. One reason for the persistence of smallholder agriculture in Africa and elsewhere in the world is that small family-operated farms benefit from a number of advantages related to incentives, information and management effectiveness. These have been widely discussed for many decades in the economic literature. Small farms also face a number of disadvantages related to missing markets for credit, insurance and information,

as well as to economies of scale in marketing and transportation.
According to Lipton (2005), a smallholder farmland is more intensive than large farms, resulting in high levels of productivity per unit of land. The use of family labor rather than hired labor solves many incentive issues that affect the agricultural labor market: family labor do not experience shirking and costly monitoring, as experienced by hired labor; family labor supply is also very flexible during peak periods, as labor can be mobilized nearly around the clock during slack times, even as activities are also worked around other commitments, including off-farm employment. A family member can take half an hour each evening to feed a flock of chickens; because of labor market indivisibilities, this is a difficult task to hire in.

Typology of Smallholder Farming

A simple means of differentiating farmers was revealed through a series of studies (Ferris *et al.,* 2014) on smallholder farmers in Eastern and Southern Africa, which showed a consistent pattern in farmer segmentation based on land size (Table 2).

Table 2: Typology of smallholder farms

Type of Farm		Charateristics
Subsistence farm	With profit potential	· Soft constraints to land size and agricultural production · Limited access to markets and information · Limited financial capital · Limited access to infrastructure · Limited access to smallholder friendly technologies
	Without profit potential	· Soft constraints plus hard constraints to land size and agricultural production · High population density · Low quality soil · Low rainfall and high temperatures · Remote location
Commercial smallholder farms		· Soft-constraints · Limited access to capital, insurance, and other risk reduction tools

Source: Shenggen Fan *et al.* **(2013).**

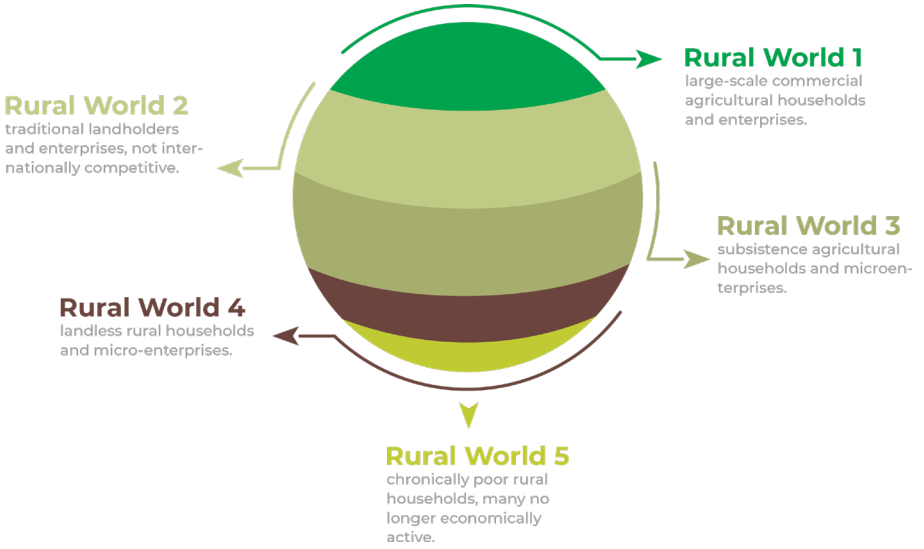
This typology in Table 2 suggests there is a group of progressive smallholders who work towards incremental, though long-term, livelihood gains, as well as a larger section of farmers with a more limited livelihood horizon but who require higher levels of basic support to enable them to play a more active economic role in the farming community.

Table 3: Maize farmers' segmentation in East and Southern Africa

Farmer type	Share of farming population	Land holding (in acres)	Market sales	Other key assets
Commercially active smallholder farmers	2 %	10 – 30	Sell more than 98% of their produce and contribute 50% of traded grain	Consistent market access Established trade networks Mechanized Tertiary education Cash assets Manage water resources Access to credit
Periodically market-linked smallholders, "market ready"	15-20 %	5-10	Regularly sell in the market when they have surpluses	Periodic market access Technology access Favorable eco-zone Strong market access Some secondary education Some access to credit
Vulnerable, but market-viable, farmers	25 %	2-5	More opportunistic market transactions often market neutral to negative	Periodic market access Some primary education Unbanked
Vulnerable farmers "market challenged"	40-45 %	1-2	Net buyers	Infrequent market access Limited land assets Limited education Unbanked
The ultra-poor	5-10 %	<1	Net buyers who regularly need food assistance	Opportunistic market access Limited land assets High levels of illiteracy and innumeracy Unbanked

Source: Ferris et al. (2014)

According to HLPE (2013), smallholders are very diverse, and there are many ways to describe them, especially using criteria that play a role in facilitating or impeding their capacity and willingness to invest. Thus, three dimensions have been used to classify the constraints to smallholders' investments: assets, markets and institutions (Figure 2).
The reference document of Organization for Economic Cooperation and Development – Development Assistance Committee (OECD-DAC) on pro-poor growth in agriculture (2010) describes five rural worlds:



The committee further indicated that understanding these rural worlds is critical to developing appropriate value chain opportunities and implementing strategies for leveraging these opportunities to increase benefits

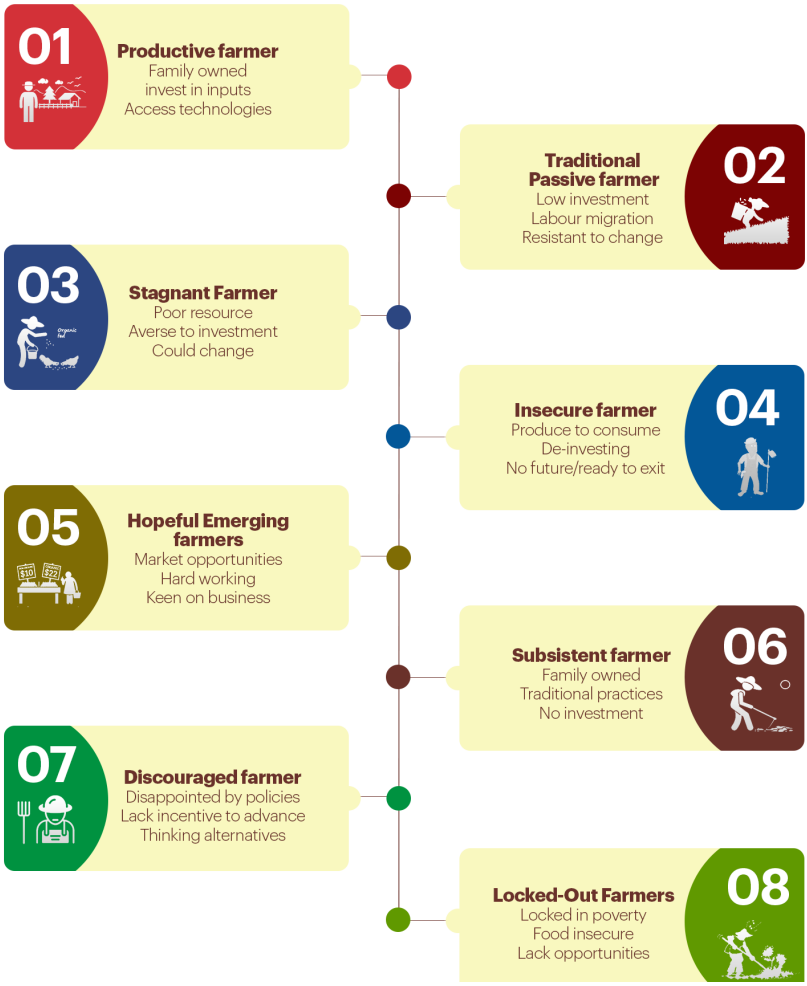


Figure 2: Typology of smallholders based on assets, markets and investment opportunities

Inspired by HLPE (2013).

2.2 Current Challenges of Smallholder Farming in Africa

Smallholder farmers in Africa face various challenges that impede their growth and ability to effectively contribute to food security relative to the commercial farmers. Some of the constraints they face relate to lack of access to land, poor physical and institutional infrastructure. Most smallholder farmers are located in rural areas or homelands, where lack of physical and institutional infrastructure limits their expansions. The lack of access to good road networks, for example, limits the ability of a farmer to transport inputs and produce, as well as access information. Such infrastructure as markets for agricultural inputs and outputs are often missing and unreliable for smallholder farmers. This means that the acquisition of agricultural resources and supply of market services are limited. The lack of assets, information and services hinders smallholders' participation in potentially lucrative markets (Department of Agriculture, Forestry and Fisheries, 2012).

According to Ehui (2016), smallholder face two major challenges today. One is that they are at disadvantage with regard to linkage with modern value chains because of their low production, volumes of sales, poor market information and contacts, and limited ability to meet standard requirements of many high value markets. Tow, owing to their small size and reach, they are considered high-risk farmers by private agro-dealers and financial institutions. These smallholders thus do not receive adequate returns on investment as their produce are underpriced and they lack marketing information and skills, as well as the ability to recognize opportunities for product diversification. In South Africa, for example, the Department of Agriculture, Forestry and Fisheries has found that the lack of human capital is a constraint to smallholder farmers. They are often illiterate and have poor technological skills, which affect access to services of formal institutions with advisory and knowledge dissemination capacity. Majority of smallholder farmers are not empowered financially and with marketing skills; hence, they cannot meet the quality set by fresh produce markets and food processors.

As a result of low endowment in production factors, such as land, water and capital, majority of smallholder farmers produce low quantities and quality of products, leading to high rejection rates by output markets. Increasing concentration in the food value chain is a global trend, caused by increasing consumers and concern on food safety. Low quality produce makes it difficult for smallholder farmers to access high-value markets. Inconsistency in production, coupled with the lack of bargaining power, is also a major challenge faced by smallholder farmers. Most smallholders are not consistent in their production and supply of fresh produce to markets and agro-processing industries; the few that make such supply have low bargaining power owing to poor access to market information and financial markets.

Ferris et al. (2014) also indicated the lack of reliable markets as a constraint faced by smallholders. Many of these farmers receive low prices for their products, because they sell at the farm gate or local markets. However, they can receive much higher prices by selling in groups. Smallholders also find it difficult to access formal sector credit and insurance (Jack, 2013), and are often unable to integrate with commercial marketing channels and formal sector retailers, mainly due to their inability to meet the required standards (Reardon et al., 2012). In dynamic zones, where new marketing channels are targeting urban consumers or export markets, smallholders have strong competitive pressures from larger farms.

Obi (2016) summarized some of the challenges confronting smallholders as: low and declining production and productivity, rural poverty, environmental degradation, poor access to land and production resources, poor physical and institutional infrastructure, poor policy support, lack of access to finance, poor market access, climate change and natural resource management constraints.

2.3 Transformation Patterns in the Livelihood of Smallholder Farmers

As a result of the challenges highlighted in the previous section, there have been different forms or patterns of agricultural transformation to improve the livelihood of smallholders in Africa. These pattern are a combination of multiple development initiatives or projects and national initiatives to improve the welfare of the poor people in rural areas. The patterns have also been in the form of providing one intervention or a combination of interventions by different initiatives to improve the livelihoods of smallholder farmers. That is, there have been cross-cutting interventions by different initiatives which are centered on providing sustainable /improved technologies, land reforms, linkages to markets and industries, and developing smallholders to becoming entrepreneurs and commercial farmers. Empirical evidence has shown that national initiatives in various countries have helped transform rural economies and livelihoods.
Otuska (2016) has pointed out that the fundamental source of agricultural transformation in Africa is technological change or innovation, which accompanies the introduction of modern agriculture and improved cultivation practices. The Comprehensive African Agriculture Development Program (CAADP) aims to 'raise the capacities of smallholders to meet market requirements' (Lambrechts and Montgomery, 2013).

In addition, the priority work of accelerated African agricultural growth and transformation drive, based on the post-Malabo CAADP roadmap and strategy, comprises: i) supporting implementation of the CAADP national agricultural investment plans at country level; ii) engaging the policy agenda on fertilizer, seed, agribusiness, value chains and food markets; iii) strengthening institutional systems for knowledge management, innovation systems and platforms at national, regional and continental levels; and iv) developing foresight capabilities for megatrends for R&D (FARA, 2015). These are all in favor of transforming smallholder farmers in Africa.

Moreover, Feed Africa (2017) opined that African agricultural transformation can substantially improve the quality of life for the people of Africa and support economic growth. The Feed Africa transformation targets three areas: disseminating yield-enhancing technologies, developing input and output markets, and structures and incentives that stimulate increase in production and a well-functioning competitive private sector that can allocate skills and capital. Another initiative for improving the livelihoods of smallholders in Africa is the Integrated Agricultural Research for Development, which is managed by the Forum for Agricultural Research in Africa (FARA). The initiative is to study the past major constraints or failures of agricultural markets, inappropriate policies and natural resource degradation in Africa; it entrenches agricultural research into a broader innovation system in where knowledge from various sources can be integrated and put to use.

The specific objectives are to develop technologies for sustainably intensifying subsistence farming systems, develop smallholder production systems that are compatible with sound natural resource management, improve the accessibility and efficiency of markets for smallholder and pastoral products, and catalyze the formulation and adoption of policies that will encourage innovation to improve the livelihoods of smallholders and pastoralists.

The PARI program brings together partners from Africa, India, and Germany to contribute to sustainable agricultural growth and food and nutrition security in Africa and in India. PARI also offers independent scientific advice to the special initiative of the German Government's "One World, No Hunger" (SEWOH) initiative, which, among other activities, supports the improvement of food and nutrition security and sustainable agricultural value chains by setting up Green Innovation Centers (GICs) in 12 African countries.

The specific goals of PARI are to promote and support the scaling of proven innovations in the agrifood sector in partnership with all relevant actors; to support and enhance investments in the GICs through research and, thereby, contribute to the development of the agrifood sector in Africa and India through the identification, assessment, and up-scaling of innovations.

AGRA has supported more than 400 projects, including the development and delivering of better seeds, increasing farm yields, improving soil fertility, upgrading storage facilities, improving market information systems, strengthening farmers' associations, expanding access to credit for farmers and small suppliers, and advocating for national policies that benefit smallholder farmers. AGRA plays a central role in transforming the agricultural sector in Africa and its food system and places strong emphasis on safeguarding the environment. To this end, AGRA is building an alliance of farmers and their organizations, governments, agricultural research organizations, the private sector, local nongovernmental organizations, and civil society, among others, to significantly and sustainably improve the productivity and incomes of smallholder farmers, many of whom are women.

2.4 Factors and Interventions that Contributed to the Transformation Pattern

Literature has shown that some agricultural transformation efforts were not as successful as planned, perhaps due to the fact that piloting the complexity of transformation is consistently tough for governments, even when agricultural investments are prioritized. This is often the case when a government is seeking agricultural transformation that simultaneously meets multiple goals. Sara Boettiger et al. (2017) reiterated that the drivers of agricultural transformation are multidimensional, interrelated, and change over time; and they can be organized into categories to provide a better opportunity for pragmatic diagnostics and decision making on national priorities. Based on their diagnostic experience in 30 countries, they found that the drivers of transformation fall into three main categories. First, there are elements of "transformation readiness," changes to a country's institutional framework, governing mechanisms, and political environment can significantly accelerate an agricultural transformation. Second, the quality of the national agricultural plan or strategy is critical. Third, there are drivers related to delivery mechanisms; this category focuses on what is needed to translate a national agricultural plan into on-the-ground impact. This includes the ways in which countries manage decision making and progress against targets, as well as how they use change agents to support large-scale behavior change among smallholders.

According to Sylvia Mwichuli, AGRA's director of communications and public affairs, some interventions of AGRA address farmers' lack of access to good seeds, especially for staple crops, such as maize, sorghum and cassava. They provide operational support to African crop breeding teams to develop, through conventional approaches, higher-yielding, locally adapted varieties that are suited to Africa's ecologies.

AGRA also works to help small companies breed, multiply, and market high-quality hybrid seeds that farmers can afford.

Box 1 presents an example of intervention in forming farmers into cooperatives.

Box 1: Mobilization of smallholder farmers into various cooperatives

The framework presupposes that smallholder farmers are into production of various commodities mainly in the rural areas where there are no formal sources of employment. Farming, therefore, becomes the main source of their livelihood. Mobilization of smallholder farmers into cooperatives takes place at two levels: primary level (where smallholder farmers can either be mobilized into single purpose primary cooperatives or multipurpose primary cooperatives providing different services to farmers); and secondary level, which involves mobilizing the already existing primary cooperatives into second-level cooperatives, otherwise known as secondary cooperatives. The formation of second-level cooperatives is informed by the needs of primary cooperatives. The Directorate: Cooperatives and Enterprise Development within the Department of Agriculture, Forestry and Fisheries in collaboration with Provincial Departments of Agriculture (of South Africa) is responsible for mobilizing smallholder farmers into cooperatives to take advantage of economies of scale.

The rationale behind establishment of secondary cooperatives at district level is to benefit primary cooperatives through the provision of the following services or functions:

- Improved sustainability and scope of products offered through creation of economies of scale;
- Improved logistics in terms of storage and transportation facilities;
- Compliance with food safety and quality assurance standards;
- Improved market intelligence;
- Improved bargaining power to ensure fair trade;
- Lowering of transaction costs as a result of bulk buying;
- Improved access to best available technology to improve production efficiencies and quality of products; and
- Availability of value adding and agro-processing facilities.

Source: Department of Agriculture, Forestry and Fisheries, South Africa (2013).

2.5 Current Frameworks for Transforming the Livelihoods of Smallholders in Africa

The IAR4D concept was developed and proposed by FARA to overcome the shortcomings of the linear approaches for implementing agricultural research and development.

There have been different frameworks of interventions and initiatives on smallholder transformation in Africa. The current framework for sustainable agricultural technology dissemination among smallholder farmers is the Technology for Africa Agricultural Transformation (TAAT). According to African Development Bank, TAAT is a dynamic framework that assists African countries in their agricultural transformation agenda by raising productivity of crops and livestock through the deployment of proven agricultural technologies. A collaborative TAAT clearinghouse approach is proposed as a mechanism to ensure that accepted technologies are comprehensively deployed and the expected transformative impacts achieved, with millions of farmers and other stakeholders lifted out of extreme poverty. The TAAT clearinghouse works on strategic and evolving assortment of investment interventions that consolidate agribusiness opportunities along the eight priority agricultural value chains. These interventions are largely based on proven technologies, developmental approaches and agribusiness investment mechanisms established by International Agricultural Research Centers and their partners in Africa but may also be adopted and adjusted from successful agricultural development interventions elsewhere. It incorporates past research and development findings and successful pilot projects, but necessarily extends well beyond them, as each module is expressed as a readily-scaled investment option.

The framework for the Integrated Agricultural Research for Development (IAR4D) is the establishment of innovation platforms. The IAR4D concept was developed and proposed by FARA to overcome the shortcomings of the linear approaches for implementing agricultural research and development. The concept appraises agriculture as a system that is made of many subsystems that must work together to foster development. Thus, the concept engages all actors, organizations and institutions that are involved in the agricultural sector to interact and jointly foster the development of the sector. It uses both system and commodity approaches and engages all actors along the commodity value chain, including external actors like policymakers, financial institutions, meteorologist, and insurance that influence the chain to interact and proffer solution to the jointly identified constraints on the platform (FARA, 2013).

The IAR4D concept uses innovation platform (IP) as its operational instrument. The IP is a forum for group of relevant actors selected along the value chain of specific commodity or system of production. The actors include farmers, researchers, extension agents, traders, processors, financial institutions, policy makers, regulators, output market operators, consumers and others. They interact to jointly identify problems and investigate solutions, leading to generation of innovations and their socioeconomic benefits. The impact of agricultural research and development activities using the IAR4D concept is derived from the complementary effect of the different competences of actors on the IP. Essentially, all actors on the platform make a contribution and benefit from the activities of the platform. This helps sustain their involvement until innovations that benefit all are generated.

Research activities on an IP are all-encompassing, covering natural resources management, productivity, market, policy, product development, nutrition and gender. These activities often yield technological innovations, which are complemented by institutional and infrastructural innovations, leading to accelerated socioeconomic benefits, including poverty reduction among smallholder farmers.

AGRA's strategic framework is to facilitate the creation of an efficient African food system through grants and capacity-building assistance to institutions that are helping to improve the productivity of smallholders. AGRA carries out its activities in 16 countries, with emphasis on Ghana, Mali, Mozambique and Tanzania. The aim is to improve production of staple crops in "breadbasket" areas that have relatively good soil, adequate rainfall and basic infrastructure, and then replicate successful approaches in other areas and countries with similar conditions. AGRA also supports programs in Malawi, Zambia, Uganda, Kenya, Ethiopia, Rwanda, Nigeria, Niger and Burkina Faso; it recently ventured into three post-conflict locations: Sudan, Sierra Leone and Liberia.

2.6 What Works from the Initiatives and What Did Not Work and Why?

For some, agricultural transformation has not advanced as planned or has stalled. Navigating the complexity of transformation is invariably tough for governments, even though they may prioritize agricultural investment. According to HLPE (2013), smallholder agriculture, in particular, and agriculture as a whole are often left to undergo great transformations that could be positive or negative for smallholders and their food security. These transformations are the result of explicit or implicit political choices and, very often, of vital national relevance. Such political choices recognize and support the important socio/ economic/ ecological functions of smallholder farming. Appropriate choices and policies result from transparently determined political processes that involve smallholder organizations. Mudhara (2010) gave the example of South Africa, where the government has adopted a variety of initiatives to develop smallholder agriculture. These include placing extension officers in the various wards and mandating them to implement government programs nationally and provincially.

Feed Africa (2017) have noted that the conditions for transformation are beginning to show in a number of African countries.

In KwaZulu-Natal, the government developed several cycles of "massification" programs, in which lands are identified and government contracts external service providers to put them to productive use in a given season. The land owners then harvest and take ownership of the produce. The hypothesis of this approach is that the beneficiaries acquire know-whow and income to "kick-start" their agricultural production activities. Mudhara (2010), however, noted that the results have been disappointing in that the program has largely turned out to be a government transfer program rather than cultivating productivity. In addition, this and other programs are not accompanied with the supporting measures that ensure sustainability.

Feed Africa (2017) have noted that the conditions for transformation are beginning to show in a number of African countries. Liberalization of input markets, expansion of innovative agricultural finance, and policy reforms have allowed significant progress to be made, leading to pockets of transformation across the continent; such as horticulture in Kenya, floriculture in Ethiopia, Rwanda's rapid and material reduction in the level of malnutrition, Nigeria's large-scale registration of farmers onto an electronic wallet system to facilitate fertilizer subsidy payments and Senegal's transformation of its rice sector.

Similarly, the IAR4D initiative has worked well in many African countries by improving the livelihoods of smallholders. For example, IAR4D was established with the aim of increasing the impact of agricultural research and development (ARD) for improved rural livelihoods, food security and sustainable natural resource management in sub-Saharan Africa. With the proof of IAR4D's success, there have been reports of partners committing more resources to IP processes, including scaling up activities in other areas (Adekunle et al., 2015). The Agricultural Research Council of Nigeria is providing grants to Nigerian research institutes based on IAR4D approaches. The Sierra Leone Government is also using similar strategies for its agricultural research activities. Reports so far on the TAAT Program indicate positive and sustainable transformation.

In the same vein, small entrepreneurs in the seed business have increased significantly, producing about one-third of the seed used by smallholder farmers in Africa. This effort also involves getting seed and fertilizer to small village shops of entrepreneurs supported by AGRA. This reduces the distance (some, being more than 50km or 31 miles) that farmers walk to buy these items (https://www.gatesfoundation.org).

CHAPTER 3
Indicators of Transformed small-holder Farmers

Organizations work with smallholder agricultural supply chains in different ways. Some purchase raw materials from smallholders through a chain of traders, while others provide technical assistance and access to inputs (seeds and fertilizer) in addition to buying. Others invest in certification, value addition and capacity building of farmer organizations. Sustainable Food Lab (2015) stated that these models of engagement and investment with small-scale producers have underlying theories of change, often illustrated with a results chain. Also known as theory of change, impact pathway, log frame, or casual model, a results chain is a set of causal assumptions about how activities lead to outcomes and, eventually, impacts. Standard theory-based measurement approaches are grounded in specific purposes and goals of each effort. A combined framework are used for all the sections in this chapter. For example, Shenggen Fan et al. (2013) created a typology that reflects the diversity of possible liveli¬hood strategies and development pathways for smallholder farmers (Table 5).

3.2 Achieving the Desired Income and Livelihood Conditions for Farmers

The African Center for Economic Transformation (ACET) defined agricultural transformation as a process that leads to higher productivity on farms and commercially oriented farming, and strengthens the link between farming and other sectors of the economy. Agricultural transformation starts with higher productivity, which implies that households have surplus food for consumption and market to meet their dietary and non-food needs. As productivity increases, households acquire more assets and become more confident to invest in value-addition activities to further increase income and their socioeconomic status (Mulangu, 2016). However, the Zero Hunger Challenge Working Groups (2015) agreed that, given the heterogeneity of smallholder agriculture and rural livelihoods, there is no one-size-fits-all approach to achieving the established target of a "100 per cent increase in smallholder productivity and income". This is because each country is guided in policy decision-making by its own understanding and peculiar way of categorizing small farms and small-scale farmers.

Table 5: Typology of the diversity of possible livelihood strategies and development pathways for smallholder farmers

Type of Farm		Characteristics	Strategies
			Agriculture-based
Subsistence farm	With Profit Potential	Soft constraints to land size and agricultural production Limited access to markets and information Limited financial capital Limited access to infrastructure Limited access to smallholder friendly technologies	Productive social safety nets · Investment in infrastructure, agricultu search and extension, and smallholder- and -smart technologies · Access to innovative financial services
	Without profit	Soft constraints plus hard constraints to land size and agricultural production * High population density * Low quality soil * Low rainfall and high temperatures *Remote location	Social safety nets · Nutrition-focused crop production for own consumption · Education and training for nonfarm employment · Migration to urban centers and other agriculture areas with greater profit potential
Commercial Smallholder farmers		Soft-constraints · Limited access to capital, insurance, and other risk reduction tools	Vertical and horizontal market coordina to meet safety, quality, and quantity sta · Smallholder-focused, climate-smart, a tion -enhancing technologies · Investment in infrastructure, agricultu R&D, and extension

	Transforming	Transformed
ral re- friendly	Flexible arrangements for land transfer · Risk reduction and management tools · Access to market information (e.g., ICTs) · Pro-smallholder, nutrition-sensitive value chains · Social safety nets and improved access to housing, education, and health services for rural migrants · Vertical and horizontal coordination to meet safety, quality, and quantity standards · Enhanced role of farmers' organizations, particularly for women farmers	High-value production · Reduced trade restrictions and subsidies · Flexible arrangements for land transfer · Efficiency and quality enhanced production systems · Vertical and horizontal coordination to meet safety, quality, and quantity standards
	Social safety nets · Improved access to housing, education, and health serviced for rural migrants · Education and training for nonfarm employment · Flexible arrangements for land transfer	
ation ndards nd nutri- ral	High-value and nutrition sensitive food chains · Flexible arrangements for land transfer · Links to urban and global markets · Vertical and horizontal market coordination · Enhanced role of farmers' organizations, particularly for women farmers	High-value crops · Flexible arrangements for land transfer · Clear regulatory frameworks and intellectual property rights to link private sector with smallholders

Sustainable Food Lab (2017) showed that farm size, asset base and family size are all critical determinants of a smallholder's income and, therefore, economic wellbeing. Thus, to ultimately improve incomes, the quality of family life must be improved; hence, incomes alone does not necessarily improve the quality of life nor promote economic development. Besides income, a farmer must have increased access to basic public services, such as health and education. This leads to a consideration not only of what goods and services for improving incomes, but also support for access to basic public services, such as health and education, along with other critical determinants of wellbeing (Sustainable Food Lab, 2017).

Livelihood is a very broad concept, encompassing many aspects of one's life. A study of livelihood often includes disaggregated analysis of livelihood systems for different socio-economic groups and wider social issues, such as health, children in school, and access to clean water. According to DFID (2001), "livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base." However, according to Chambers (1995), livelihood perspectives start with how different people in different places live. Similarly, by increasing output per hectare, agricultural intensification increases the quantity and/or quality of livelihoods, as well as livelihood sustainability. For most people, improvement in labor productivity is a major factor in improving the quality of livelihoods; this, however, decreases the quantity of livelihoods if there is no commensurate increase in output (Carswel, 1997). As regards opportunity for growth or improvement in smallholder farmers' income, Sustainable Food Lab (2017) outlined some levers based on their studies in India and Uganda which combine to improve farmers' income in a sustainable way.

These include:

· Agricultural services: improving knowhow, inputs (seeds, fertilizer, tools), warehouses, drying sheds, postharvest machinery
· Growth of markets, including domestic markets
· Provision of financial services: credit, loans, savings, insurance
· Decent market access: stable demand, fair prices, favorable terms of trade
· Gender: women's participation and equal economic empowerment
· Provision of basic services: including water (domestic and irrigation), quality education and health
· Strengthening of agricultural and non-agricultural sectors in the local economy

Hystra (2015) concluded that investments in farmers' productivity increase their income significantly, transform their lives and boost businesses' revenues and profits.

3.3 The Right Business Mind-Set and Expansion Opportunities

It is now common to find smallholders with the right business mind-set. According to Mukasa et al. (2016), transforming smallholder agricultural enterprises into functional and viable ventures has become central to the strategies for helping millions of smallholder households out of poverty. Kahan (2012) stated that "there are two parts to entrepreneurship. The first is the managerial skills needed to start and run a profitable farm business. The second is 'entrepreneurial spirit'; both are important. Managerial skills can be taught, but an entrepreneurial spirit cannot be taught." This means that smallholder farmers must develop the right business mind-set to become entrepreneur. Farming for profit calls for a different approach to farming. Farmers are not only concerned with the day to day tasks involved in making a living, but also increasingly plan for the future in an effort to make money. For business-minded farmers, profit is the goal of business. The performance of a farm is best be understood from the business perspective, when the goals set by the farmer are measured as indices (Kahan, 2010).

According to GrowAfrica (undated), agribusinesses commercially engaging with smallholders need the farmers to take up services and practices that will increase productivity and secure volumes. Also, "farming as a business" emphasizes the shift from subsistence to profit-oriented production and improved livelihoods. Farmers who can critically examine the costs, risks and benefits of different technologies can make quality management decisions and optimize available resources. Mukasa et al. (2016) pointed out that smallholder farmers have severally been criticized for the lack of entrepreneurship. As earlier stated, entrepreneurship is generally defined by two characteristics: the managerial skills needed to start and run a profitable business, and an entrepreneurial spirit.

> There are two parts to entrepreneurship. The first is the ***managerial skills*** needed to start and run a profitable farm business. The second is ***'entrepreneurial spirit';*** both are important

Despite this criticism, however, several smallholders have proven to be good managers of their farm enterprises, as they take quality decisions at farm level. AASR (2017) defined commercial small farms as those selling 50% or more of their production; and subdivided them into two: specialized commercial farms (if their non-farm income share is less than 33%) and diversified commercial farms (if otherwise).

There are three critical issues with regard to farm entrepreneurship: risk taking, innovativeness, and the desire for growth and expansion. Lwakuba (2011) added that the focus of a farmer business should be guided by the fact that entrepreneurship is a process and action of being consistently and gainfully engaged in the management of the farming enterprise while innovatively applying relevant skills and experience to achieving sustainable growth. The farmer would also periodically be in position to shoulder the level of uncertainty associated with the enterprise by undertaking calculated economic risk to maximize profits. Teklehaimanot et al. (2017) noted that about 600 million African smallholders are becoming integrated into the supply chains of supermarkets, fast food chains, and exporters. This process gradually transforms the smallholders into profit-oriented businesses that can make important contributions to rural development and food security. The authors argued that to equip smallholders with knowledge of market functions and customers' value, their capacity needs to be built in that regard. Rao and Qaim (2013) indicated that supermarkets, fast food chains and processing companies are pushing the market frontier deeper into rural Africa; hence, smallholders who sold their produce increased their market participation, while new groups entered the markets. With increased participation, they contributed more to food security and rural development matters (Barrett, 2008).

The focus of capacity building is shifting from primary production to agribusiness, based on market-led integration and development of value chains. Nain et al. (2019) stated that agriculture, being the engine of national economic development, should be adequately supported with infrastructure, such as a marketing system, postharvest management tools, and technologies for growing high value crops. This will help smallholders develop the right business mind set. While incentives change for smallholders with regard to the desire to sell, their market orientation is often based on individual capacity and attitudes, which are not easily transformed or measured (Bard and Barry, 2000). Measures based on transaction costs seem to take it for granted that smallholder producers have commercial objectives and possess the technical competence and strategic planning ability required to incorporate these measures effectively into their farming systems. Business training, which can potentially fill this gap, has grown in emerging markets as a means of enhancing the knowledge and skills of entrepreneurs to improve their livelihoods (ILO, 2014).

For small-scale farmers to become entrepreneurs, they need all of these qualities and more. They need to be innovative and forward-looking. They need to manage their businesses as long-term ventures with a view to making them sustainable. They need to be able to identify opportunities and seize them (Kahan, 2012).

Figure 1: Characteristics of a profit-making farmers

3.4 Increased Profit through Scale of Production and Marketing

Agarwal (2019) has observed that an economy of scale is achieved when the scale of production is systematically increased and long-term average cost is drastically reduced; it is a known fact that the cost of production per unit decreases as we produce more units. Reducing per unit cost is the most significant benefit of economies of scale. Thus, economy of scale would make smallholders become commercialized, more efficient and more profitable. Piana (2004) opined that economies of scale increase profits more than proportionally when sales grow. Economists have identified division of labor and specialization as the two key means to achieving a larger return on production. From the smallholder point of view, these two factors help farmers move toward commercialization through improved knowledge and skills. Hence, through such efficiency, time and money are saved while production levels increased. In support, Zhou et al. (2013) stated that the change from subsistence to commercialization can significantly increase the income and welfare of smallholders, as well as contribute to national economic growth and poverty alleviation.

The commercialization of smallholder agriculture entails that farmers become market-oriented, basing their production decisions on market demand (Abafita et al, 2016). However, Pingali and Rosegrant (1995) noted that this goes beyond selling in output markets and extends to profit-making in all economic decisions and choices. Seville et al. (2011) added that nongovernment organizations (NGOs) are always linking small-scale producers to regional and global formal markets. Formal market requirements include quality, consistency, traceability, food safety and third-party certified standards; these directly affect coordination along the supply chain. While these requirements constitute barriers to new entrants (smallholders), particularly those with fewer assets, they hold opportunities for diversification, increased income generation and professionalization.

Pingali et al. (1995) indicated three levels of market orientation in food production systems: subsistence, semi-commercial, and commercial systems. The categorization is based on the farm households' objective for producing a certain crop, their source of inputs, product mix and income. Farmers Income Lab (2018) has shown that pricing arrangement is useful for famers to make profit; such arrangements are aimed at shielding producers from price volatility and/or ensuring that profit margins are fairly distributed among different actors of a value chain. The arrangements can take a number of forms, but they generally involve a guaranteed minimum price that is either set by the government or negotiated by representatives of producers, as well as premiums for meeting quality standards. This intervention refers to public and public-private pricing arrangements. Public interventions are cases in which the government sets legally binding price restrictions or requirements. In public-private interventions, marketing boards or other professional organizations, comprising representatives of the private sector (e.g., producers, and exporters), are consulted in setting price levels.

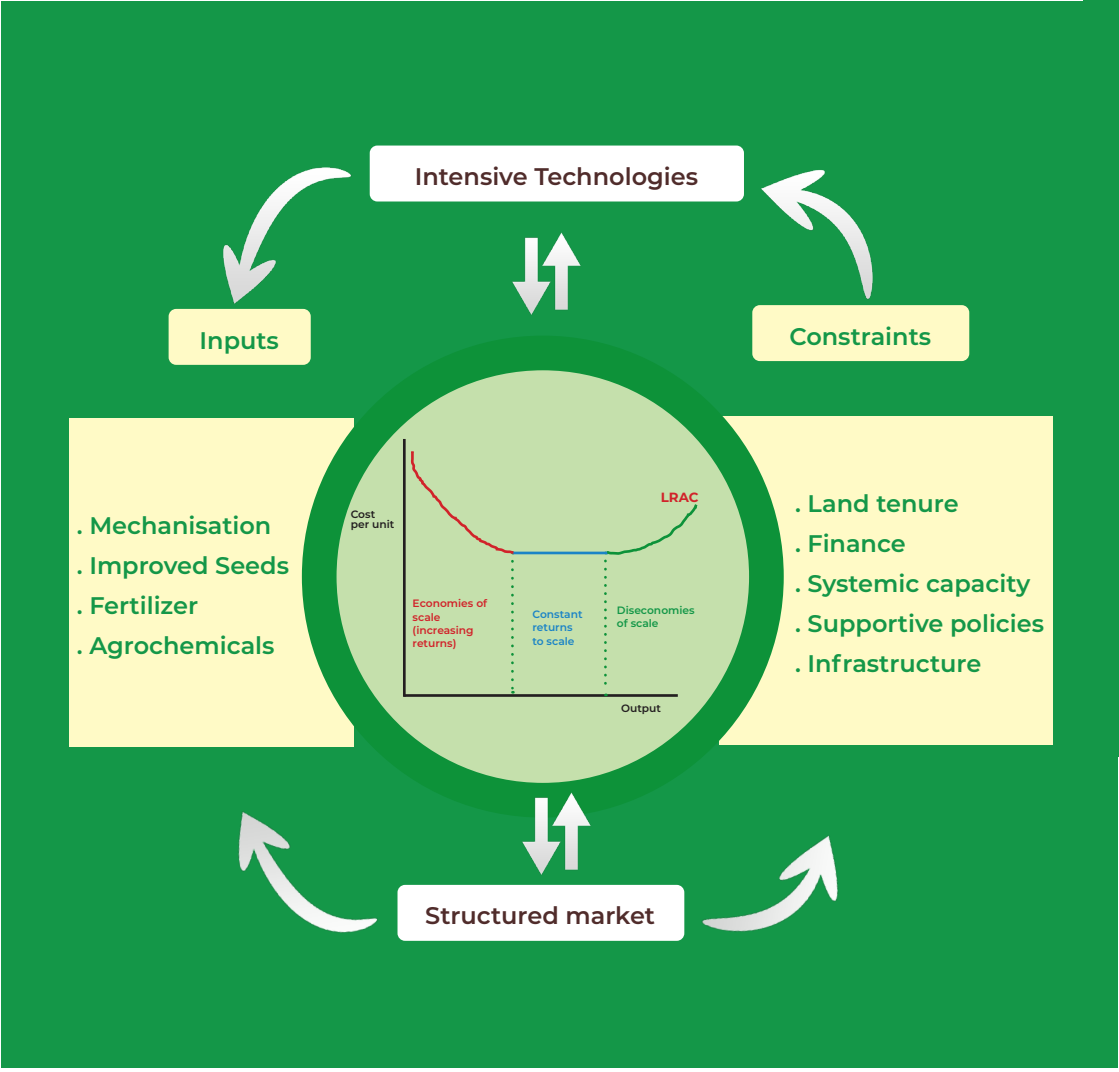


Figure 2. Key constraints and required external inputs for achieving farming at scale

Apparently, modelling the transformation of the smallholder system in Africa following the scale of production approach is the most logical. It opens the space for maximizing the economy of scale for production, marketing and distribution. Production of scale uses external inputs and maximizes mechanical advantage through the use of machineries, biological advantage through the use of improved varieties and breeds, and chemical advantage through fertilizer and agrochemical uses. A major constraint to production at scale is poor access to arable land. The prevailing land tenure systems in most African countries are largely based on family inheritance, where land is shared among children and passed down from one generation to another. Therefore, a systematic land tenure approach is needed to foster production at scale.

3.5 Knowledge-Enhanced Production through Access to Technologies and Information

The non-provision of agricultural information is a key limitation to agricultural development in Africa. A good source of agricultural transformation is technology, which characterizes modern agriculture and improved cultivation practices (Otsuka, 2016). The non-provision of agricultural information affects both the commercial and small-scale farmer and information is a key factor that has greatly limited most importantly other constraints against small holder agricultural development in developing countries. There is very limited access to modern improved technologies and their general circumstance does not always merit tangible investments in capital, inputs and labor. Agricultural technology for the small scale farmer must help minimize the drudgery or irksomeness of farm chores. It should be labor-saving, labor-enhancing and labor-enlarging. The farmer needs information on production technology (cultivation, fertilizer application, pest control, weeding and harvesting). This sort of information is at the moment being diffused by extension workers, other farmers, government parastatals and agricultural equipment dealers but the impact is yet to be felt.

Mgbenka et al. (2015) thus noted that there is very limited access to modern technologies and that there is low investments in capital, inputs and labor. Improved agricultural technologies help minimize the drudgery or irksomeness of farm work. A good technology is labor-saving, enhancing and enlarging. Farmers also need information on production technology (cultivation, fertilizer application, pest control, weeding and harvesting). Although such information is at the moment being diffused by extension workers, other farmers, and agricultural equipment dealers, the impact is yet to be felt. WDR (2008) explained that the only way out of poverty is by improving the productivity of smallholder farmers, by expanding the area under cultivation and crop yields through increased adoption of improved technologies. Research and technological improvement are also necessary to increase the productivity of agriculture sector without degrading the natural resource base (Asfaw et al., 2012).

Source-saving and yield-enhancing technological innovations and adoption are indeed core to the smallholder commercialization process. Evidence from Ethiopia showed that these factors increased smallholders' " market participation, in the case of adopters of high-yielding varieties" (Hagos and Geta, 2016). In a research on how technology adoption promotes commercialization, using a double-Hurdle model, Asfaw et al. (2010) found that farmers who knew more varieties also had better information of their advantages, and were more likely to adopt and allocate lands for varieties in subsequent seasons. Kristjanson et al. (2005) and Kaliba et al. (2000) found a similar result in their studies on cowpea and maize varieties, respectively

. They found that technology awareness positively affected adoption of high-yielding varieties and that the level of adoption of improved varieties were strongly related to a range of household wealth indicators. There was also a direct relationship between adoption of high-yielding varieties and increased allocation of land for the crops, as well as marketing surpluses. These results stressed the need to avail farmers with information on improved technologies, to increase adoption, income, and standard of living.

To help smallholder farmers make the most of their harvests, they need access to a range of information, which helps them decide when best to buy inputs or sell produce, saving them time and money; plan for weather changes; pick the best varieties; and manage diseases and pests appropriately. Radio and face-to-face consultations are identified as the farmers' primary sources of information; but they are less efficient than mobile phones.

Improved agricultural technologies help minimize the drudgery or irksomeness of farm work. A good technology is labor-saving, enhancing and enlarging.

CHAPTER 4
Pros and Cons of theories and philosophies of change for Smallholder farmer's Transformation in Africa

4.1 Increasing Yields and Productivity through Intensification Practices

The debate on pros and cons of the theories and philosophy of change for smallholder farmers' transformation has been more pronounced in the area of increasing yields and productivity through intensification practices. Rural people partake in a number of strategies, including agricultural intensification, migration and livelihood diversification, to help them attain sustainable livelihood. Agricultural intensification requires labor and capital to increase inputs necessary to raise the value of output per hectare. Intensive farming is an agricultural system that aims at maximum yield from an available land. This farming technique is also applied in livestock. Under this technique, food is produced in large quantities with the help of chemical fertilizers and pesticides.

Agricultural intensification is defined as 'increased average inputs of labor or capital on a smallholding, either cultivated land alone, or on cultivated and grazing land, for the purpose of increasing the value of output per hectare (Tiffen et al. 1994). Agricultural intensification may occur as a result of increase in the gross output due to inputs expanding proportionately, without technological changes; this is a shift towards more valuable outputs or technical progress that raises land productivity. However, in practice, according to Carswell (1997), the intensification process may occur as a combination of these, but the relative feasibility of the three components is likely to vary greatly in different areas.

Intensive farming helps farmers to easily supervise and monitor the land and protect their livestock from danger, solve the problem of hunger and malnutrition to a great extent. Carswell (1997), however, showed that intensive farming affects and alters the environment in multiple ways. Forests are destroyed to create large open fields, causing soil erosion; the natural habitat of wild animals is also affected.

The use of chemical fertilizers also contaminates soil and water bodies. Increase agricultural production is more easily achieved through sustainable agricultural intensification. The technique increases access to inputs, including the use of "smart" subsidy policies, encourages adoption of innovations and increases access to resources for women and youth. Support is offered as a matter of priority to family farms for optimal use of resources. For sustainable intensification to be achieved, external impetus is often required in the form of support to actors in value chains of selected commodities. The support should also embrace investment in infrastructure and provision of policy incentives to achieve the overall goal of agricultural development. The rationale is that where all the necessary inputs and institutional arrangements are available, there will be increase in yields and productivity.

By increasing the value of output per hectare, agricultural intensification increases the quantity and/or quality of livelihoods. Although agricultural intensification is usually conceived as a positive action that should be encouraged, there are a few negative effects of intensification with regard to quantity and quality of livelihoods. For most people, improvements in labor productivity is an opportunity to improve the quality of their livelihoods. This may however be at the cost of the quantity of livelihoods, especially if there is no commensurate increase in output (Carswell, 1997).

There has also been a debate on the relationship between land use intensification and poverty. de Janvry and Sadoulet (2009) showed evidence that economic growth from agricultural intensification affects poverty. Dawson et al. (2016), however, questioned this in terms of the short and long-term effects on the poor and the vulnerable groups, as well as on the environment. Some Hertel et al. (2014) indicated that intensification do negatively impact on the environment; hence, there is a general call for "sustainable intensification", which is understood to mean increasing the productivity of land while reducing or eliminating adverse environmental impacts (Pretty and Bharucha, 2014 and Rockström et al., 2017). This is very important if we desire to transform smallholders into entrepreneurs, as it is contingent on high productivity and increased incomes.

Increase agricultural production is more easily achieved through sustainable agricultural intensification.

4.2 Redirecting Labor Out of (Smallholder) Farming into Agro-Industrial Processing and Services

It is argued that historically, countries that have managed to pull out of poverty were first successful in increasing agricultural surpluses and using these as a basis for diversifying their economies (Mulangu, 2016). A surplus-generating agricultural sector can provide cheap food, ensure adequate nutrition for the population, and increase the disposable incomes of individuals and families. This generates demand for other goods and services, creating direct and indirect jobs and surplus production in raw materials for industry, setting off positive chain reaction from production to consumption.

FAO and UNIDO (2009) asserted that the development of competitive agro-industries is crucial for generating employment and income opportunities. It also enhances the quality of and demand for farm products. Agro-industries have the potential to provide employment for the rural population in on-farm and off-farm activities, such as handling, packaging, processing, transporting and marketing agricultural products. There are indications that agro-industries have significant impact on global economic development and poverty reduction. However, the full potential of agro-industries as engine of economic development has not been realized in many developing countries, especially in Africa.

Furthermore, the accelerated growth of agro-industries in developing countries also poses risks in terms of equity, sustainability and inclusiveness. FAO and UNIDO (2015) noted that, where there is unbalanced market power in agrifood chains, value addition is often concentrated among a few chain participants. Jayne et al. (2014) indicated that development of a rural nonfarm economy that can absorb surplus farm labor and link agricultural to nonfarm economic activity is essential. However, in the last 20 years, African rural off-farm employment has not taken off in the way that it did in Asia; hence, the creation of rural employment has been limited.

Furthermore, the growth of unemployment in urban Africa means that there is only limited 'pull' to urban areas for gainful employment, in contrast to what occur in Asia (Gollin et al., 2014; Headey and Jayne, 2014). In addition to leveraging existing agricultural value chains to increase smallholder participation, there is tremendous potential in the creation of new value chains for high-quality, nationally sourced nutritious food products. Such value chains can increase rural business opportunities, raising demand for enterprises providing credit, infrastructure, transportation, and other services needed to make a strong supply chain.

4.1 Fostering Large Scale Agriculture (through Farm Estates and Incentives)

There has been a debate on the relative merits of large and small farms, their implications for labor absorption, rural livelihoods and growth in Africa (Lipton 2009, Collier and Dercon, 2014 and Hall et al., 2017). Some researchers have argued that this debate is due to the recent land grab (Borras et al. 2011) and sign of large-scale farming in Africa in the assumed thinking of land scarcity (Scoones et al., 2014). For decades, there has been debate on the pros and cons of small and large-scale farming. Crops and contexts are different, and the comparative advantage of the two types of farming can change over time, such as with technological innovations. Small and large-scale farming work together in many places.

According to Wiggins et al. (2010), there is strong evidence that in poorer countries, small farm development cannot only provide a commercially viable option but can also maximize the pursuit of poverty reduction and environmental protection, mainly because of its more labor-intensive production methods. On the other hand, it is also believed that the spread of large-scale, mechanized, intensive farming in fragile environments, and where there are a few off-farm livelihood opportunities to absorb rural labor, can impoverish those who lose land to plantation agriculture.

In trying to classify the types of commercialization of agriculture, Ruth-Hall et al. (2017) indicated that, in addition to the plantation or estate and out-grower and contract farming models that have been widely discussed in literature, there is a third form of commercial agriculture worthy of attention. Small and medium-scale commercial farming by independent farmers has been an important part of the African landscape since the colonial period. There is evidence of these farmers growing in numbers and importance across Africa, even though it has not been much feasible in literature.

Plantation/Estate

Ruth Hall et al. (2017) identified five core characteristics of plantations that apply across cases and provide a useful distinction from other farming models: (1) plantations that grow one main cash crop; (2) that require capital investment; (3) that are larger than an average-sized holding, although some land may be left uncultivated; (4) that rely on hired resident or non-resident labor, often including migrant labor; and (5) that are centrally managed. Although some specify that plantations are always owned by private corporations, the definition suggested here allows for corporate, state or individual ownership; the alternative term 'estate' is not used consistently, and it appears less frequently in the literature.

Five core characteristics of plantations

(1) Plantations that grow one main cash crop
(2) That require capital investment
(3) That are larger than an average-sized holding, although some land may be left uncultivated
(4) That rely on hired resident or non-resident labor, often including migrant labor
5) That are centrally managed.

Plantations generally have high capital investment requirements and are sometimes described as capital-intensive. However, they are also known historically for their reliance on abundant land and labor and for their labor-intensive production methods. Plantations/estates may involve outright takeover of land and related resources, displacing other land users and uses, and there is some evidence that they are typically poorly integrated into their surrounding society and economy.

It is generally assumed that colonialism brought large-scale farming to Africa, promising modernization and jobs but often dispossessing people and exploiting workers. After several decades of independence, and with investor interests growing, African governments are once again promoting large plantations and estates. However, because of the new corporate interest in African agriculture, it has been criticized as land grab (Borras et al., 2011). Some researchers have seen large plantations as "enclaves" (Ferguson, 2006), having few linkages with local economies. They buy farming inputs from afar, usually from overseas, and sell their produce in global markets, bypassing local intermediaries.

Plantations are large, self-contained agribusinesses that rely on hired labor and are vertically integrated into processing chains (often with on-farm processing). They are usually associated with one major crop. In Africa, these started with colonial concessions, especially in major cash crops, such as coffee, tea, rubber, cotton and sugarcane. Some later became state farms after independence, while others were dismantled and the land returned to local farmers. Many plantations do create jobs, especially if they have on-site processing plants. Plantations may also support local farmers if they process crops that local smallholders are already growing. For example, oil palm plantations in Ghana buy from local smallholders and give them access to processing facilities and international value chains they would otherwise not reach (Ruth Hall et al, 2017).

Table 6: Typical Characteristics and Variables of Plantations

Typical characteristics	Variables
Mono-crop cultivation	Crop characteristics, farming practices
Requires capital investment	Level of capital investment and ratio of factors of production (capital-labor-land); degree of mechanization Whether it includes a processing plant
Large holding	Size of estate; proportion left uncultivated Original land use; whether the land was a greenfield site or converted from prior farm use How the land was acquired
Large hired workforce	Living conditions for workers, unionization, adherence to labor laws Balance between permanent, casual, seasonal and piece workers The origins of the workers: were they peasants, landless and/or already wage laborers? Are they local or migrants?
Centralized management hierarchy	Ownership (foreign or domestic, private or state) Export orientation, although plantations are almost never intended to feed citizens of the host country
Integration into the global economy	
Risky	Extent of vulnerability of operation to risks: of land being seized by squatters or the state; production risk; asset specificity; a fall in commodity prices
Political and changeable	Extent and frequency of struggle over land and labor conditions Extent of state support, and forms of support received (e.g. cheap land, subsidies, low wage costs) Extent to which competitive production is restricted Relationship with political elites

Typical characteristics	Variables
Artificial	Aspects of artificiality, e.g. if the crop is non-indigenous, use of extended growing seasons, if intercropping is allowed, if the workforce is imported

Source: Smalley (2013)

Typically, plantations have limited connections with the local economy beyond the wages they pay. Where production is mechanized (as it is in Zambia, for example), they create only a few jobs. The major issue is that plantations take up lands and generally do not give back to the local economy; although, a few benefits do accrue from their operations. Smalley (2013) compiled useful characteristics of plantations in sub-Saharan Africa (Table 6). There is a search for alternatives to large plantations and estates that can bring in private investment without dispossessing local people but supporting livelihoods by creating jobs and strengthening local economies. The real choice and trade-offs between large plantations or estates, contract farming by out-growers and individual medium-scale commercial farms is the major issue. According to Ruth Hall et al (2017), two possible models stand out.

Contract farming

According to Ruth Hall et al. (2017), contract farming has been in existence in Africa since colonial times. As with plantations, these arrangements were largely for the major cash crops, including cocoa, cotton, tobacco and sugarcane. Contract farming is a system in which farmers agree in a written or verbal contract to supply produce to a buyer, usually at a predetermined price, on a specific date and to a certain quality. One of the characteristics is that the buyer provides the necessary inputs and services to the farmers on credit and exercises some control over the conditions of production. The contracted farms may be small; what makes this large-scale is when the total area under contract is extensive in order to guarantee the buyer large volumes. Small farmers are often organized into village groups or cooperatives. The buyers are usually agribusiness processing companies or parastatals (Lotula, 2010).

Prouse (2012) indicated that some definitions of contract farming emphasized that the farmers' production decisions are dictated by the contracts, or that the buyer has legal title to the crop, hinting at the power dynamics inherent in the model. However, Smalley (2013) pointed out that no definition pointed out one of the key characteristics of contract farming, which is that some inputs and/or services are typically advanced by the firm on credit and that, occasionally, they are provided by the state or third party, to be repaid with interest by contract farmers. Also, many definitions do not specify the ownership of land that is farmed; although the land is often assumed to be owned by the contracted farmers, there are cases where farmers do not cultivate their own land, or where the ownership status is not clear.

Several analysts from donor agencies and research institutes have suggested contract farming as solution to the problem of land displacement; it also creates a 'win-win' outcome for local communities and private investors (Kay, 2012). However, contract farming is often taunted as an "inclusive business model" that links smallholders with commercial value chains. In this arrangement, smallholder farmers produce cash crops on their own lands as 'out-growers' on a contract to agro-processing companies (Ruth Hall et al,, 2017). Contract farmers are smallholders who enter into contracts with companies that buy and process their crops. Sometimes, members of out-growers' households get jobs on larger "nucleus" estates run by the companies. Whether or not they benefit or get stuck in debt and dependency depends entirely on the terms of these contracts.

Contract farming has been hailed by some as the "win-win" solution, enabling commercial investment for global markets without dispossessing local farmers. People farm on their own lands using their own family labor while also accessing commercial value chains rather than being displaced by large farms.

However, there are different kinds of arrangements that determine who benefits. Contract farming provides an effective avenue for smallholders to commercialize; this means that smallholders take on both the risks and the benefits of connecting to commercial value chains.
According to Key and Runsten (1999), contract farming is a form of vertical integration, less tightly coordinated than plantations, where the owner has direct control over production on his land, but more so than buying produce in the open markets. Oya (2012) explained that contract farming links capital to out-growers via contracts, providing opportunities for accumulation by 'smallholders', but in terms of incorporation that may be more or less advantageous, depending on the institutional arrangements. Smalley (2013) also compiled the characteristics of contract farming (Table 7).

Contract farming has been hailed by some as the "win-win" solution, enabling commercial investment for global markets without dispossessing local farmers.

Table 7: Characteristics and Variables of Contract Farming Scheme

	Typical characteristics	Variables
Contract	There is a written or verbal contract, agreed at or before planting time. Volumes or acreage, quality and delivery date are pre-agreed	Complexity of contract Length of contract. Annual contracts are common, but perennial crops require longer-term contracts Pricing. Most contracts specify pricing in advance using fixed prices. Alternatives include formula or consignment prices calculated after harvesting, or split pricing (part fixed, part consignment) Frequency of payment Arrangements for delivery or collection
	Conditions of production are specified to some extent	The degree of control. The following might be specified: seed varieties, input application, timing of field operations, harvesting methods, other cultivation techniques
	Typically, contractor retains right to reject produce that doesn't meet standards, and farmers may sell rejected produce elsewhere	Insurance, rights and sanctions (e.g. if contractor has legal title to the crop, whether farmer is insured or compensated for crop failure, if contractor guarantees to buy output, whether contractor has right to take over land)

	Typical characteristics	Variables
Resource provision	Farmers are provided with some resources	What resources are provided (e.g. seeds, credit, fertilizer, ploughing services, extension). This can change during the scheme Who supplies the resources (e.g. firm, state banks, government, donors, intermediaries), and whether they have a monopoly over provision Nature of supervision; ratio of extension officers to farmers Whether tasks are done by farmers or the contractor
	Typically, some resources are advanced on credit	Alternatively, farmers are paid a lower producer price to cover deductions, or credit is forbidden. Some resources may be provided free of charge
Participation		Methods for selecting and screening participants If there is variation in contracts and incentives for farmers of different size and productivity
Operation		Ownership (e.g. private, state, public–private joint venture, multipartite with donor agencies, farmer stake holding) If intermediaries are used, and what their duties are (e.g. distribute inputs, payments) Type of crop grown (e.g. staple, plantation crop, and horticulture) and its labor intensity, input intensity, perishability, etc. Degree of vertical integration; whether a processing or packing plant is incorporated Relationship with international buyers, investors and agribusiness in global agro-food value chain If scheme includes a nucleus estate Export orientation

Typical characteristics	Variables
Land	Land ownership and tenure security. Usually, farmers produce on their own land (freehold or de facto). Alternatively, farmers lease land, clear community land, or settle on state or customary land Whether clearance or deforestation occur
Scale	Size(s) of participating farms Share of farmers' land that is devoted to the crop Extent of participation (number of farmers, percentage of total farming population) Presence of rival contractors and/or markets

Source: Smalley (2013)

Medium-scale farming

Between large plantations and small contract farms is a model: medium-scale commercial farms owned by individuals or small companies. Ruth Hall et al. (2017) defined commercial farming as being dominated by medium-scale farms that are generally larger than those in the surrounding area, and are owned by individuals or small companies. They see medium-scale farming as a promising option to estate and contract farming. Although medium-scale farming has been reported to also have colonial origin, the past two decades have witnessed massive growth in mid-level farming. Many of these farmers are male, wealthy, middle-aged or retired, often from professional positions. According to Ruth Hall et al. (2017), such farmers typically invest in agriculture with off-farm incomes, and may acquire land through an endogenous process of agrarian differentiation, or through state-led schemes to establish commercial farming areas. These are often educated business people and civil servants who are investing money earned elsewhere into medium-scale commercial farms which they own and operate themselves.

Commercial farms are distinct from plantations in that they tend to practice mixed farming rather than monoculture (Smalley, 2013). Jayne et al. (2015) stated that this new capitalist class of farmers have considerable access to land in Africa.
Some studies suggest that they may cumulatively be significant in altering agrarian structures and spurring patterns of land concentration and accumulation as the expansion of estate farming.

The medium-scale commercial farming model has a lot to offer. Ruth Hall et al. (2017) indicated that it creates more jobs and stimulates rural economies more than plantations or contract farming. However, cumulatively, such farms may threaten to dispossess smallholders, just as the large colonial and more recent plantations and estates have done. The push behind the explosion of the "middle farmers" in some countries in Africa has been due to investment by the educated and (relatively) wealthy people; their expansion has also displaced smallholders. Similarly, modest-sized farms have led to substantial dispossession and reduced access to land. Their informal employment patterns mean poor working conditions and few permanent jobs. But unlike the plantations, these farms are well-connected with the local economy. Building on social networks, these "middle farmers" often buy inputs and services from local businesses. At least, some of their produce are sold in local markets.

Moreover, medium-scale farms provide access to markets and services for nearby smallholders. For example, many medium-scale farms have attracted tractor rental providers, who then provide mechanization services to smallholders. This allows them to farm their land with much less labor input, freeing up opportunities to work in off-farm pursuits. Literature also indicate that medium-scale farms are good for the local economy because they inject cash into the local economy through their expenditures, stimulating off-farm employment opportunities for many rural people who were formerly dependent on subsistence farming.

Many medium-scale farms have attracted tractor rental providers, who then provide mechanization services to smallholders. This allows them to farm their land with much less labor input, freeing up opportunities to work in off-farm pursuits.

Table 8: Typical Characteristics and Variables of Commercial Farming

Typical characteristics	Variables
Several farms in a block or more-or-less contiguous area	Overall extent Number of individual farms
Medium- or large-sized farms	Sizes of individual farms Proportion of land left uncultivated Origin of land (e.g. previously cultivated, state, customary)
Individual and/or private ownership and operation	Indigeneity of farmers Expertise and endowments of farmers; sources of farmers' accumulated capital Any participation criteria
Typically mixed farming, either at block or individual farm level	Types and proportions of crops and livestock produced: plantation crops (e.g. bananas, coffee, sisal, tobacco), staples (e.g. barley, cassava, maize, sorghum, wheat), agro-fuel (e.g. soya, sunflower); high-value horticulture; livestock (e.g. cattle ranching, dairy, poultry)
Commercial production	Integration into value chains (may be less vertically integrated than many plantations) Export orientation
Some use of hired labor	Labor intensity Seasonality
Requires capital investment	Degree of mechanization and irrigation usage, input intensity, level of investment and upfront costs
Typically accompanied by infrastructure for the area(e.g. roads, boreholes, electricity, processing plant)	Level and quality of pre-existing or new infrastructure
Typically involves some form of planning, support or collective action among the farmers	Degree of external planning Nature and extent of preferential support from government; degree of support from local elites Terms of finance and land tenure

Source: Smalley (2013)

The debate on which model should be encouraged has generated an interesting discussion. Ruth Hall et al. (2017) indicated that, while policy choices are political, they can and should be informed by research on the implications of these different pathways of agricultural commercialization; what is also clear is that different kinds of commercial farming will have different effects on the economy. It is not just about efficiency but ultimately about who wins and who loses. However, a recent diagnostic study in the Huambo Province of Angola's Central Highlands revealed that 75% of smallholders see no benefit from the commercial farms near their communities. Only 1% of them had some benefit from the exchanges between the community and the commercial farmers; there was zero report that the commercial farms brought to the community improved access to services like water and electricity. About 10% of the smallholder said that because many farms were acquired forcefully they felt threatened by the presence of commercial farmers in their communities and that with the passage of time they feared conflicts could lead to the further expropriation of community lands (Cain, 2019). While the number of medium-size farms is rising, it is believed that increased smallholder productivity is their greatest growth driver (Goedde et al., 2019).

Commercial agriculture plays a significant role, but is limited to certain countries and subsectors. In Southern and Eastern Africa, a higher concentration of land has been inherited from the colonial period. These agricultural models have been heavily funded and are accompanied by a gradual loss of control of production options for commercial farmers, while investment funds and banks benefit. The same has happened in the export subsector. Respect for international standards often foster commercial farming methods or the vertical integration of subsectors in the framework of contract work (green beans in Kenya, supplied to European markets). Changes in the distribution sector, with the establishment of supermarkets, mini-markets and fast food restaurant chains (especially on the initiative of South African and Nigerian groups), restructured supply methods and standardize production.

Debates on the balance among providing support for subsistence farming, linking family agriculture to markets and commercial agriculture have been revived because of agricultural price hikes and renewed government investment in the sector. The facts and lessons are, however, quite clear: Family farming is best placed to create employment and to enable greater land use while reducing the risk of breaching local rules on resources (AGRA, 2018).

Hazell (2017) and AASR (2017) stated that a farm with a large agribusiness approach can leave millions of small farms and businesses without adequate livelihoods. "We think agriculture can power Africa's economic transformation," said Yaw Ansu, the Chief Economist at ACET. "If we increase productivity in farms, we immediately increase the incomes and livelihoods of about 60-70% of people.

Also, we can use agriculture to develop industry that will improve food security in urban areas and use it to make us competitive in terms of manufacturing." Ansu insisted that this does not mean large corporate farms. "You can have small and medium-scale farms using modern technology and run professionally."

Finally, it is noteworthy that the four proposed models (plantation, contract farming, medium-scale and smallholding) for the transformation of smallholders have key limitations. While plantation agriculture requires large investment for land clearing, mechanization, agrochemicals and management functions, the out-growers model requires a systematic teamwork that gives smallholders a system in the determination of commodity prices. The different models of out-grower schemes still keep the smallholders at the bottom of the returns on investments and labor productivity. The bottom line is the realization of a good profit margin and incomes that sustain modest quality of life, achieved through a structured production system that uses modern technologies and expanded production land area in a supportive policy environment.

4.4 Providing Training, Extension and Funding to Enhance Smallholding Productivity

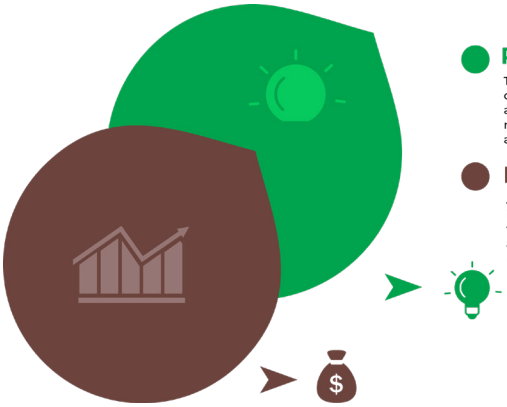
Not much has been highlighted on the effects of training, extension and funding on smallholder farming; but these variables have been found to have significant positive relationship with the productivity of smallholder farmers. Professor Kenneth King of the University of Edinburgh, in December 2009, indicated that training is very important to increased productivity and adaptability to change; it helps diversify and manage means of livelihoods. Integrating agricultural training with enterprise training can help smallholders market their farm produce more effectively, and take advantage of new agricultural opportunities. Enterprise training can help farmers take and manage the risks involved in production technologies. There are several approaches to successfully integrating enterprise development in smallholder farming.

In parts of Kenya, Tanzania, and Mozambique, AGRA and other organizations have helped nongovernment organizations and the private sector give smallholders training on seeds, fertilizer, and other inputs, using local extension agents. The extension agents who live with the farmers helped find appropriate technologies and demonstrated them in situ. Unlike many suppliers, the extension agents sell products in small batches to take some of the risk out of new technologies. This peer-to-peer system costs the government nothing; as it is paid for by the private sector and farmers.
Agricultural extension programs are one of the main conduits for addressing rural poverty and food insecurity. Extension is the means to transfer technology, support rural adult learning, assist farmers in problem-solving and get farmers actively involved in the agricultural knowledge and information system.

Hence, it helps provide training and services to smallholders to improve their productivity. Bonye et al. (2012) stated that extension provides information on new farming technologies, which when adopted, can improve production, incomes and standards of living. Asfaw et al. (2012) also pointed out that increased productivity in the agricultural sector can only be achieved through the dissemination of improved agricultural technologies to farmers. The small-scale nature of rural farmers has been attributed to inadequate access to land, credit, market, and extension services. However, among these constraints, inadequate extension services are major limiting factors.

In his contribution to the roles of extension in the transformation of smallholder farmers, Berthe (2015) indicated that with the degradation of natural resources, it is becoming increasingly difficult for most smallholder households to maintain their productivity levels. Some national extension systems have begun refocusing attention on improving rural livelihoods, emphasizing diversification and intensification of farming systems. Berthe further indicated that, to achieve agricultural growth and increase farm income, extension focus (including farm management, marketing, and credit programs) needs to be broadened; and that extension systems should switch from merely "delivering messages" to engaging farmers in the learning process.

Overall, extension has proven be a cost-effective means of bringing about greater economic returns to farmers through increased knowledge, adoption, and productivity. Davis (2009) indicated that studies on extension productivity rate the returns from 13 to 500 percent. A recent study demonstrated that receiving at least one extension visit in Ethiopia reduced smallholders' likelihood of being poor by 10 percent and increased consumption growth by 7 percent. Extension is also a cost-effective tool for dealing with the impacts of climate change while increasing productivity and reducing poverty.



Providing Training

Training is very important to increased productivity and adaptability to change; it helps diversify and manage means of livelihoods. Integrating agricultural training with enterprise training can help smallholders market their farm produce more effectively, and take advantage of new agricultural opportunities.

Providing Extension & Funding

Agricultural extension programs are one of the main conduits for addressing rural poverty and food insecurity. Extension is the means to transfer technology, support rural adult learning, assist farmers in problem-solving and get farmers actively involved in the agricultural knowledge and information system

CHAPTER 5

The Challenge of Limited access to Land and Contraints of Land tenure Laws on African Smallholder farmers

5.1 Introduction to Land Tenure Systems in Africa and their Effects on Smallholder Farming

Lawry (2015) indicated that part of the development discourse over the past 40 years has been that African agriculture will not take off unless people have clear tenure security. There is also an underlying assumption that this is delivered through land rights certification or titling, as it is in Latin America and parts of Asia. This means that for the past 40 years, several efforts have been made to convert non-formally tenured regimes into formally tenured regimes, based on certification by states. Lawry et al. (2014) also indicated that secure access to land as a productive resource is key to the livelihoods of millions of farmers around the world; and that secure land tenure enables farmers to invest in long-term improvements in the expectation of huge returns on and without fear that their land will be confiscated arbitrarily. Formal and informal land rights are therefore seen as key to improving the conditions of the poor in developing countries in terms of economic growth, agricultural production, food security, natural resource management, gender-related issues, conflict management and local governance processes.

Land tenure can be defined as the way by which land is held or owned within societies, or as indicated by a set of legal and/or customary relations among people as individuals or groups, with respect to land and other natural resources (FAO, 2005). Land tenure is central to a many issues, as land is the main means of subsistence and vector for investments and accumulation of wealth that can be transferred from one generation to another. According to FAO (2005), land tenure is often categorized as:

- **Private:** the assignment of rights to a private party who may be an individual, a married couple, a group of people, or a corporate body, such as a commercial entity or non-profit organization. For example, within a community, individual families may have exclusive rights to residential parcels, agricultural parcels and certain trees. Other members of the community can be excluded from using these resources without the consent of those who hold the rights.
- **Communal:** a right of commons may exist within a community, wherein each member has a right to use independently the holdings of the community. For example, members of a community may have the right to graze cattle on a common pasture.
- **Open access:** In this case, specific rights are not assigned to anyone and no-one can be excluded. This typically includes marine tenure, where access to the high seas is generally open to anyone; it may also include rangelands, forests, etc, where there may be free access to the resources for all. (An important difference between open access and communal right is that under the latter, non-members of the community are excluded from using the common areas.)

However, Africa land tenure system has become a debatable issue among planners and policymakers at local, national and international levels. The debate focuses on land tenure security and challenges, especially in areas of poverty alleviation and social insecurity (Boboya, 2015).

According to the French Development Agency (AFD), access to land is pivotal to poverty reduction, because land tenure is a key factor in the economic development of agricultural production, natural resource management, management of flood-plains and irrigated croplands and other development programs in urban and rural areas (Tribune, 2012). For this reason, issues on secure land tenure concern the whole range of stakeholders from local farmers, local area authorities and public service providers through to national and foreign investors. Large-scale investments in agriculture have drawn the attention of the media in recent years, showing that regulating access to land is a major social and political issue: food security and sustainable natural resources management. However, the development of a land tenure policy is a bit tedious, because it builds on the political will of the state.

The outcomes of land reforms, according to Boboya (2015), include food security, reduction in social polarity, increased investment, transparent production incentives, poverty reduction, increased employment, and greater equity. In much of sub-Saharan Africa, land ownership rights are complex, with conflicts between formal legal claims and traditional or customary claims. Even when the state asserts ownership rights to a land, its claims may be contested by local communities. Thus, government support for large-scale land acquisitions almost inevitably involves contestation; there is little hope for willing seller/willing buyer transactions. According to Lawry (2015), in Africa particularly, 90 percent of farming is done on lands held under customary tenure regimes, where land rights are not certified formally. Under customary tenure, people gain access to land as a social right, granted by virtue of their membership of the community.

The imposition of colonial rule in many parts of Africa, especially in sub-Saharan Africa, led to land alienation and settlement of European commercial farmers. This was the case in Kenya, Malawi, Zimbabwe and Zambia. These settlers were granted individual freehold or lease hold tenure on what became crown or state land. In Zambia, like elsewhere, this process created two different legal systems: the long established customary land law and English land law (Mvunga, 1980). Byamugisha (2016) indicated that the customary tenure regime and the low level of documentation of land rights in Africa are embedded in the continent's colonial history. During colonial rule in Africa, the major powers did not launch national programs of systematic land titling and registration, except where large-scale expropriation of lands for white settlements or commercial plantations was undertaken, primarily in Kenya, Zimbabwe, South Africa and North Africa.

A lot of farmers cultivate lands owned by the state. Land issues and land tenure reform in sub-Saharan Africa are characterized by state bureaucracy, especially in rural land administration and legal systems; traditional leaders are provided with limited responsibilities over land management and people in areas where unstructured rights to the land are still practiced. This needs to be addressed for Africa to achieve sustainable rural development (Boboya, 2015).

The transformation of Africa's agriculture faces at least two challenges in the area of land tenure systems. The first is land tenure insecurity; hence, there is the need to increase security of land tenure to provide incentives for long-term investments and enhance agricultural productivity and commercialization. The problem of poor access to land is the second; thus, there is a need to increase the fluidity of land markets to provide easy and secure access to enterprising farmers who want to buy or lease land (Byamugisha, 2016). Hall and Paradza (2012) also highlighted the challenge of formalizing customary land rights in private titled systems, which has exclusively entrenched (gender and other) inequalities, which downgrade or ignored the entitlements of secondary right-holders. Land rights are often a vital element when rural households balance their capability and assets, and determine their strategies to cope with daily production.

However, the right to land is not just a source of economic production but is also a basis for social relations and cultural values, and source of prestige and, often, power.

The fragmentation of land encourages the scattering of holdings in different locations. Though the fragmentation of land is as essential for meeting farmers' land needs, it inhibits the optimal use of land resources. The dispersal of holdings which fragmentation entails allows farmers to plant different crops on several distant plots. Since planting is not staggered, however, this prevents the productive use of land, as it creates bottlenecks such as non-flexibility in the use of labor time. Moreover, efficient land use is compounded, as the shifting system of cultivation encourages extensive use of land. Particularly, the scattered nature of the plots makes farmers to waste time that would have otherwise been put to agricultural activity traveling between distant plots. This also makes the transportation of inputs and crops to and from the various plots challenging to farmers.

African customary systems provide access to land as a social right to qualified members of land-holding communities. Conversion to title extinguishes the social basis for the right, which is particularly important to poor households who may lack the financial resources to secure a land. Formal and informal land rights are therefore seen as key to improving the conditions of the poor in developing countries in terms of economic growth, agricultural production, food security, natural resource management, gender-related inequalities, conflict management and local governance processes more generally.

With the exception of a small proportion of African countries with matrilineal systems, women's rights to land and property are very limited and often depend on their marital status. This limited access to land and other productive resources has made women less productive than their male counterparts, with female farmers in Tanzania, Uganda, Niger, Ethiopia, Nigeria, and Malawi producing 6 percent, 13 percent, 19 percent, 23 percent, 24 percent and 25 percent less than their male counterparts, respectively (World Bank, 2014a). FAO (2011) also estimated that, worldwide, if women can have equal access to productive resources such as fertilizers and land as men, they would raise farm yields by 20 to 30 percent and total agricultural output by 2.5 to 4 percent. This means that agriculture alone can lift 100 to 150 million people out of hunger.

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In a workshop in Bangkok (of 28-30 January 2009) on "Providing access to land: Challenges and solutions," the international land coalition outlined seven solution areas in land tenure systems which we see as useful:

However, the good news is that there are many land reforms going on in many African countries. Rwanda is said to have provided a benchmark in this, with over 10 million land parcels now titled and owned individually. The World Bank (2009) has stated that the provision of secure and transferable land rights is critical to protecting the interests of indigenous populations while allowing entrepreneurial farmers acquire unused land in regions of low population density. This allows lands to change hands over time for productive use; this in turn serves as investment incentives. The new Mozambican land policy and land law provide a state-of-the-art framework for balancing competing interests; the legal frameworks of Madagascar and Zambia are also well designed. The World Bank (2009) also indicated that without land-tenure reforms and improved land administration, proposals for agricultural commercialization would likely to lead to widespread abuse and dispossession.

5.2 Status of Agricultural Labor Force in Africa

There has been a general opinion that about 60% of labor force is engaged in agriculture in Africa, but without substantial statistics supporting this. In 2010, the Food and Agriculture Organization (FAO) reported that 58.8 per cent of the total sub-Saharan African workforce was in agriculture, with a slightly higher proportion (63.6 per cent) of this number being in rural areas and smallholder agriculture. Approximately 3.4 billion people or 45 per cent of the world population live in rural areas. Roughly 2 billion people (26.7 per cent of the world population) derive their livelihoods from agriculture. In 2016, an estimated 57 per cent of people in Africa lived in rural areas, with 53 per cent of them being economically active in agriculture.

The agricultural population in Africa stands at 530 million people, and is expected to exceed 580 million by 2020. The population relying on agriculture accounts for 48 per cent of the total African population (almost 70 per cent in East Africa). A special feature of African agriculture in comparison to the rest of the world over the last 30 years is that the sector has continued to absorb a large proportion of the working population; half of all new entrants to Africa's working population have turned to agriculture, whereas in Asia, this statistic is only 30%. In the developed world, the number of farmers is declining.

FAO (2018) indicated that in 2017, an estimated 866 million people were officially employed in the agricultural sector: Of these, 292.2 million were in Southern Asia; 148.4 million in East Asia and 215.7 million in sub-Saharan Africa. The agricultural sector accounted for 57.4% of total employment in sub-Saharan Africa and 42.2% in Southern Asia. Although the share of total employment in agriculture has declined over the past decade, the total number of workers in agriculture in sub-Saharan Africa has grown.

Gollin (2014) reported that most African agricultural activities take place in smallholder systems. Very few farms employ large numbers of hired workers; these are large plantations that produce tea, rubber and other export crops.

Roughly 2 billion people (26.7 per cent of the world population) derive their livelihoods from agriculture.

As a result, most of the workers in the agricultural sector are self-employed; very few are employees. Although relatively few countries report these data, the figures are striking in those countries that do. For instance, from 2001 to 2010, only 1.2 per cent of the agricultural workforce in Benin consisted of employees, as defined by the International Labor Organization (12,000 out of nearly one million).

Similarly, less than 2 per cent of the agricultural workforce worked as employees in Guinea, Ethiopia, Tanzania and Sierra Leone. This is a measure of the dominance of smallholder modes of production in all, but a few countries with large-scale production of plantations of export crops. Notwithstanding, there are a few countries with relatively small overall shares of agricultural employment (compared to total employment), but with a large fraction of the agricultural workforce consisting of 'employees'. These are Botswana (11.2 per cent), South Africa (59.1 per cent), and Mauritius (55.3 per cent).

Although African smallholders depend on agriculture for sustenance and cash income, many of them also engage in nonfarm activities. The degree of dependence on agriculture varies substantially across and within countries. Rural nonfarm employment offers a number of benefits to agricultural households. It serves as a form of diversification and risk coping, provides a vehicle for managing seasonal fluctuations in agricultural labor demand, and provides cash income to complement and supplement the in-kind income from farming (Haggblade et al., 2010).

Haggblade et al. (2010) argued that rural nonfarm employment is growing in importance in many developing countries, and many studies point to large continuing flows of population from rural to urban areas. Certainly agriculture's share of total employment has been falling steadily in almost all countries in the region. But due to the rapid rural population growth, the number of people working in agriculture and living in rural Africa may rise in the next few decades (Masters et al., 2013). Moreover, in sub-Saharan Africa, nonfarm employment and urban employment are primarily in the trading and informal services subsectors; there is little or no manufacturing employment (Gollin et al., 2014). Table 10 presents data on employment in agriculture across Africa.

Table 10: Employment in agriculture, % of total employment in Africa, 2018

1. Burundi	91.96	27. Ivory Coast	48.00
2. Chad	81.61	28. Cameroon	46.31
3. Niger	75.90	29. Liberia	46.15
4. C.A. Republic	72.80	30 Sudan	43.40
5 Somalia	72.44	31. Benin	41.40
6 Malawi	71.91	32. E. Guinea	41.36
7 Mozambique	71.69	33.Morocco	38.09
8. Uganda	70.76	34. Gabon	37.61
9. DR Congo	68.65	35. Nigeria	36.62
10. Madagascar	68.17	36. Republic of Congo	35.04
11. G. Bissau	68.03	37. Togo	34.53
12. Zimbabwe	67.20	38. Ghana	33.86
13. Lesotho	66.86	39.Senegal	32.13
14. Rwanda	66.59	40. Gambia	29.73
15. Guinea	66.54	41. Burkina Faso	28.69
16. Tanzania	66.35	42. Egypt	24.87
17. Ethiopia	66.20	43 S.T.&Principe	23.70
18. Mali	65.30	44. Botswana	22.95
19. Eritrea	62.70	45. Namibia	19.71
20. Sierra Leone	58.85	46. Tunisia	15,04
	57.45		
22. Comoros	56.88	47. Cape Verde	13.44
23. Mauritania	55.36	48. Swaziland	13.04
24. Zambia	53.92	49. Algeria	9.30
25. Djibouti	49.88	50 Libya	7.86
26. Angola	49.06	51. Mauritius	7..08
		52 South Africa	5.16

CHAPTER 6
Strategies for Transforming Smallholder Farming in Africa

6.1 The Need to Change Smallholder Farming Structure to Real Business Commercial /Industrial Farming

The African Center for Economic Transformation (ACET) defines agricultural transformation as a process that leads to higher productivity on farms, commercially oriented farming, and strengthens the link between farming and other sectors of the economy. In support of smallholder farmers moving from subsistence to commercial agriculture, Gebreselassie and Sharp (2007) indicated that through commercialization, smallholders can earn more profit and thereby increase their family income and standard of living. Also, commercialization makes for better welfare outcomes of farmers, as consumption of high valued food would increase. Moreover, higher expenditure on education, healthcare, non-food consumption and durable goods for the smallholder farmers can be achieved by commercializing agriculture.

Dorsey (1999) indicated that agricultural commercialization has comparative advantages over subsistence production. Zhou et al. (2013) added that the move from subsistence to commercialization can significantly increase the income and welfare of smallholders, as well as contribute to economic growth and poverty alleviation. In support of this, Gebreselassie and Sharp (2008) stated that commercialization of agriculture is also a means of helping smallholders achieve improved living conditions. Experience and case studies in Africa have shown that smallholder farmers have to change from subsistence to commercialization. Dorsey (1999) showed that households with commercial specialization scheme earned significantly higher annual net income than others; and farm households who shifted from maize production to sugarcane out-grower schemes earned higher incomes in South Nyanza District of Kenya.

The role of smallholders in national development is increasingly being seen in a broader economic context. Thus, discussions on smallholder farms should be expanded beyond a strict focus on small versus large-scale farming. There is need to also strengthen institutions for the profit of smallholder farmers. These are institutions that provide such critical services as access to finance, market intelligence, and marketing and business development services. This will require investment in inputs, infrastructure, and markets to open up the possibility of full participation by millions of Africa's smallholders in commercial agriculture.

The current situation in Africa requires that farming is modernized to replace its ageing workforce. The transformation from small-scale subsistence farming to mechanized and commercially viable one is essential. Farmers and other stakeholders must be sensitized and shown the urgency of this move to knowledge-based farming systems or face extinction. Okuti Boroa (2012) noted that "Gone are the days when farming was a past time, a way of life, and the business of the unfortunate rural folk. Small-scale farmers should take advantage of the opportunities provided by information communication technology for agriculture to grow from subsistence to commercialization." Wiggins et al. (2010) reported that in poorer countries, small farm development is a commercially viable option for poverty reduction and environmental protection.

Subsistence agriculture is basically an underperforming system. But rather than being a challenge, it should be seen as an opportunity. It means Africa has to optimize the agricultural potential by maximizing existing conventional technologies and systems, not to mention the tremendous opportunities waiting to be exploited in unused agricultural land. Ferris et al. (2014) classified marketing strategies for land-constrained farmers and more endowed farmers to switch from subsistence farming to commercialized farming. They then recommended that the focus of smallholder transformation should not be about converting small-scale farmers into large enterprises, but on transforming them into "more commercial-minded operations."

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A good example how smallholder farming structure was transformed to real business commercial /industrial farming is the case study of the CAVA2 Project in Nigeria. The overall goal of CAVA2 was to assist in increasing the incomes of smallholder farmers (SHFs) and community processors through participation in profitable and sustainable value-added cassava value chains. The premise was that if new markets for cassava can be developed and smallholder farmers linked to them at scale, these farmers would increase their productivity by adopting new productivity enhancing technologies thus enhancing their incomes and ultimately improving their livelihood. CAVA2 Nigeria, in collaboration with partners, pursued these goals by exploring and developing new market opportunities for fresh cassava roots, and by building and linking smallholder farmers to profitable large markets.

Thus, one of the significant achievements of CAVA2 Nigeria was the meeting up with its target of facilitating the establishment of six large scale starch and ethanol factories by 2018/19. There were also establishment of many SMEs utilizing fresh cassava roots (FCR) for other industrial products. The volume of FCR that went into the new value chains like chips/grits, starch and ethanol increased from about 16,890 tons in 2014 to about 183,751 tons in 2018/19. This was due to new available markets for farmers who were put in clusters around the big industries.

These industries have extension officers who assist the farmers in their production. The smallholder farmers sell their fresh cassava roots directly to the SMEs and the large industries. As a result, farmers were able to get good price better than their selling to local markets and therefore farmers are now producing on a commercial level to the SMEs and the big industries. One significant lesson from smallholder farmers moving from subsistence level to commercialization level as seen in this project is that it provides them the advantage of having access to good average commodity price.

Box 2: An example of a smallholder transformation initiative

6.2 Strategies to leveraged agricultural land for smallholder transformation

Given the increasing scarcity of land, land tenure security must be established to achieve efficient allocation of land among farm households and promote investment in land improvement (Holden and Otsuka, 2014). Access to land is crucial to smallholder transformation; hence, the need for land tenure reforms. In a recent study, up to 45% of agribusiness enthusiasts described access to land as a major constraint to productivity and growth. Thus, there is the need to build institutions that increase access to land for profitable agriculture (Ehui, 2016).

Knight (2016) mentioned that a single strategy is rarely enough to effectively address the challenges of smallholders' transformation. While access to land is key, environmental advocates across the world are pioneering new strategies to protect and conserve community lands and natural resources, many of which also support communities to leverage the momentum on land protection efforts to create positive intra-community change. The key challenge is striking a balance between conserving the land and its associated natural resources and opening it up for production of food and fiber in a sustainable way. The question is: Should new lands be opened up for farming, or should we develop a system that aggregates already opened up lands and systemize its use for profitable farming?

Land tenure reform, according to Adams et al. (1999), is a planned change with terms and conditions (e.g. the adjustment of the terms of contract between land owners and tenants, or the conversion of more informal tenancy into formal property rights). The goal is to enhance and secure people's land rights. This may be necessary to avoid arbitrary evictions and landlessness. It may also be essential if rights holders are to invest in the land and use it sustainably. A World Bank study in 2003 reported that "providing secure land tenure can improve the welfare of the poor, in particular, by enhancing the asset base of those, such as women, whose land rights are often neglected. At the same time, it will creates the incentive needed for investment, a key element underlying sustainable growth" (Deininger, 2003).

Byamugisha (2016) said that from the reforms implemented so far on accelerating land registration and increasing land use efficiency, there are emerging best practices. These are largely based on the use of new cost-effective technologies. To accelerate the titling and registration of individual lands quickly and inexpensively, a geo-referenced photomap was used by Rwanda as a base map to implement its national program of demarcating and certifying lands in less than 5 years at a cost of US$8 per parcel. This was done in a participatory manner, and particularly protected the land rights of women. The pace and cost of the program, which was completed in 2013, were globally impressive. Knight (2016) reported the cross-cutting lessons learnt on leveraging lands:

1. **Involve all community members, recognizing that communities are diverse and that different stakeholder groups may have conflicting interests;** support the healing and reunification of communities fragmented by conflict or outside interference. It may be necessary to use mediation and conflict resolution to arrive at intra-community agreement before moving forward with land protection efforts.

2. **Remember that leaders' interests may differ from community members' interests;** Build direct connections with community members and leaders to ensure that continued community support is possible even when leaders act against community interests.
3. Build a unified community vision to challenge outsiders' "divide and conquer" efforts. Companies and other actors seeking land and natural resources often use divisive tactics to weaken communal opposition to investment projects. Building a critical mass around a community-created vision can strengthen community cohesion and unite members around common goals.
4. Build on community expertise and skills and strengthen community capacity to advocate for their land and natural resource rights. Community members are generally "experts" on their lands and natural resources; therefore, strategy advocates should leverage on existing skills, assets, knowledge and resources of the community; they should also invest in capacity building so that the community can resist injustice without over-reliance on external support.
5. Leverage community land protection efforts to strengthen local governance. Drafting and formally adopting community by-laws for good governance and electing a representative, diverse land governing body can significantly strengthen local land and natural resource governance.
6. Ensure that communities understand the benefits and costs of a proposed investment. To ensure that communities make informed decisions about whether to share their lands with an investor, it is important to support communities to understand the socioeconomic returns of conserving their natural resources as compared to the promised financial payoff of selling or leasing their land to investors.
7. Work closely with government actors to build their understanding and support. Government agencies are not monolithic advocates can often find ministers and high-level administrators who will strongly advocate for community rights. To ensure authentic, enduring success of a community land and natural resource protection effort, government decision-makers must be convinced of the efforts' value and legitimacy.
8. Leverage the media and use it to ensure that all voices are heard. Target print, radio and social media to spread advocacy and community land protection messages out to the wider region, nation and world. Ensure to include women's, youth's and elders' voices different messages may resonate with different audiences.
9. Link community land protection efforts to wider networks for support. This entails forming strong networks of like-minded organizations and actors (at the local, national and international levels). Such networks energize efforts, encourage the sharing of experiences and strategies, and may help in influencing policymakers.
10. Link small community-driven initiatives to a "bigger dream." Community-driven development may be challenging and time-consuming. To help motivate a community towards its future visions and goals, break "big dreams" into smaller tasks and initiatives that can be accomplished with limited resources in shorter periods.

Given the increasing competition for land, large-scale expansion of agriculture is no longer the preferred option in many places, leaving four alternative and potentially complementary strategies for future food security: (1) increasing yields through intensification; (2) reducing demand by eliminating overconsumption and reducing meat consumption; (3) reducing wastage, to estimate 1.3 billion tons of food lost annually (Gustavsson et al., 2011); and (4) improving distribution (Martin et al., 2018). Martins et al. (2018) reported how land use intensification has improved the wellbeing in Mozambique (Box 3).

Box 3:
Impacts of Land Use Intensification on Multi-Dimensional Wellbeing, Mozambique

The ESPA-ACES project explored three case studies in Mozambique and examined how multi-dimensional wellbeing and inequality changed with three common land use intensification activities: Intensification of smallholder commercial agriculture, small-scale charcoal production and subsistence cultivation. The study used the conceptual framework of Erb et al. (2013) to analyze differences across multi-dimensional land-use intensity gradients, including three dimensions of land use intensification:

(1) inputs to the production system (e.g. land, technology);

(2) outputs from the production system (e.g. product yields); and

(3) modifications to system properties and functions (e.g. soil quality and biodiversity).

Site-specific measurements of inputs, outputs and system-level modifications were used to create three multi-dimensional gradients, and villages were classified post hoc along the gradients. The project also applied the Multi-dimensional Poverty Index (Alkire and Seth, 2016), measuring 15 indicators of wellbeing to reflect the multiple deprivations the poor face in terms of health, living standards and education. Multi-dimensional wellbeing improved with intensification of both commercial and subsistence agriculture, suggesting that socioeconomic benefits from agricultural intensification and expansion may overcome localized environmental trade-offs, at least in the short term. However, some regulating services may be being undermined by intensification, as smallholders reported more climate shocks in the most deforested areas and a loss of bird predators of crop pests. In contrast, a boom–bust pattern of wellbeing was observed following charcoal intensification, whereby multi-dimensional wellbeing initially increased but subsequently declined. There were limited productive investment opportunities for charcoal-derived income, due to unconducive national policies, and hence resource extraction and related income were unsustainable. In all sites, intensification only improved endogenous aspects of a house - hold's wellbeing where beneficial outcomes are mediated by a household's agency (e.g. housing material, affordability of healthcare). Exogenous benefits that are beyond the agency of a single household, such as the construction of a village borehole, require additional structural support, irrespective of land use intensification.

Source: Case contributed by ESPA-ACES project team (http://bit.ly/ESPA-ACES) as reported by Martins et al (2018).

6.3 Creation of Value Chains for Transforming Small-holder Farming

Agricultural value chains encompass the flow of products, knowledge and information between smallholder farmers and consumers. They offer the opportunity to capture added values at each stage of the production, marketing and consumption process. Smallholder farmers need to better engage in value chains in order to gain added value for improving their livelihoods while reducing risks and increasing resilience.

Linking smallholders to agrifood value chains is an impor¬tant component of building their resistance to shocks and improving their productivity and livelihoods. However, many smallholders in transforming and trans¬formed economies are unable to participate in value chains because they cannot meet increasingly specific and strict quality standards, high volume requirements, and logis¬tics specifications. For obvious reasons, companies tend to contract with larger farmers first and prefer farmers with certain non-land assets, such as irrigation or access to paved roads. These preferences act as barriers to smallholder participation in domestic (especially urban) and international markets.

According to Mukasa et al. (2017), improving the performance of Africa's agricultural value chains is also required for agricultural transformation and inclusive growth. The absence of a strong and efficient agricultural value chain implies that many African countries risk being trapped into producing low-skill, low-value products and services, thereby struggling to obtain a significant value-added share in global trade. Overcoming these barriers requires institutional innovations for vertical and horizontal coordination among smallholders, including group lending, rural marketing cooperatives, and producer associations. These mechanisms will provide smallholder farmers with reduced transaction costs, improved access to market information, and increased bargaining power. However, such coordination mechanisms require strong institutional capacity and the active promotion of smallholder participation not just membership within these organizations to gain the maximum benefit for smallholders (Fischer and Qaim, 2012).

A related concern within current agrifood supply chains is that roughly one-third of global food production is lost or wasted in the journey between farmers' fields and consumers' plates (Gustavsson et al. 2011). Most posthar¬vest losses in developing countries occur before the farm ¬gate (not at the consumer level, as is the case in developed countries) because of factors such as poor postharvest handling and storage that increase crop vulnerability to bio-deterioration, pests, and unfavorable weather (Hodges, Buzby and Bennett, 2011). However, Ricker-Gilbert and Jones (2012) stated that the dearth of postharvest capacity and infrastructure among smallholders and the subsequent loss of output significantly limit smallhold¬ers' profit potential, conservation of natural resources, and participation in high-value markets. In fact, evidence from Malawi shows that smallholder farmers with access to postharvest storage technologies are more likely to adopt higher-value maize varieties.

In response, public and private investments in agriculture and economic transformation should focus on reducing food loss along the supply chain, from the development of crop varieties with better postharvest traits to better storage equipment and facilities that have low initial and recurring costs. Extension services should help smallholders build their post-harvest crop manage¬ment skills and maximize the benefits of postharvest tech¬nologies (Bokusheva et al., 2012). If agricultural value chains are to offer pro-poor opportunities for growth, then those markets in which smallholders can have a 'comparative advantage' need to be identified and the producers actively assisted. Smallholders with a strong social network can draw upon their " social capital to strengthen their position within a value chain. For example, an effective producer organization or cooperative can help smallholder farmers increase their bargaining power by helping them enter into high-value supply chains and providing support for information on market prices and requirements.

Efforts to trigger the transformation of smallholder farmers through a more developed value chain should entail a comprehensive but systematic approach. Such approach will need to give consideration to all the components of the system and facilitate optimum productivity and/or efficiency for mutual gains. The research system needs to consistently develop new products to mop up increased production from the farm. This effort would moderate the forces of demand and supply and stabilize the commodity price. The result will be achievement of stable margin for the farmers as well as sustainability of the livelihood.

Development of the value chain at the scale required for substantial transformation of smallholders will, along with other issues, require the prime attention of the policymakers for infrastructural development to enhance production and reduce postharvest losses. Poor access road to farms has been a major cause of postharvest losses.

Stable electricity supply, public communication facilities and other social facilities that enhance living in the rural area are also needed. The policymakers also need to generate supportive policies that enhance production and support input and output markets.

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(Gustavsson et al. 2011).

6.4 Development and Scaling of Technologies for Transforming Smallholder Farming

Many institutions working with smallholder farmers have shown that it is possible to increase yields and also make production more sustainable and profitable with suitable technologies.

Africa is overdue for its own green revolution, similar to the one that happened in Asia and Latin America in the 1960s and 1970s, which resulted in increased commodity yields. The projections for Africa's agricultural revolution may follow a more comprehensive approach, although green in nature, and will embrace all the elements in the Asia model, as well as other issues in industrial development, sustainable production, effective policies for external trade and balancing nutrition and gender.

Rosenstock *et al.* (2016) reported that the introduction of technologies will be a key interventions for transforming smallholder farming. For example, Climate Smart Agriculture (CSA) technologies are premised on three main principles: addressing climate-related risks while improving food, income and/or nutrition security; achieving productivity and livelihood benefits; and having technologies that suit the specific climatic metrics of an area. Many institutions working with smallholder farmers have shown that it is possible to increase yields and also make production more sustainable and profitable with suitable technologies. Researchers have promoted direct seeding in rice fields rather than transplanting nursery-grown sprouts. This practice reduced labor costs and decreased maturity periods. The non-profit One Acre Fund has significantly transformed the livelihoods of over 400,000 farmers in six Africa countries by the provision of access to technologies and training in application of farming techniques. This has increased their income by 55 percent and improving their access to credit for seeds and fertilizers.

West *et al.* (2014) asserted that sustainable agriculture, as well as food and nutritional security can be achieved and also promoted by focusing on a small set of leverage points in the global food system. In principle farmers will produce commodities provided there is a ready market that gives sufficient margin for the commodities.

The same way farmers will willingly invest into technologies and other production inputs, if they are assured of market that yield good profit. Apparently, the principal leverage point for transformation is profitable market for produce from the smallholder farms.

Goedde *et al.* (2019) argued that to realize Africa's full agricultural potential, significant investments are needed, sub-Saharan Africa will need eight times more fertilizers, six times more improved seeds, at least $8 billion investments in basic storage (not including cold-chain investments for horticulture or animal products), and as much as $65 billion in irrigation to fulfil its agricultural promise. Continued smallholder production growth will require increased investments in intensification. In order for smallholders to increase production with less additional land and without major increases in labor inputs, they will need to increase their own productivity through greater capital and technology investments. Work also needs to be done on scaling up investments in infrastructure and technology, particular technology that helps farmers produce more food. Neglecting to invest in agricultural research and the creation of many small, underfunded research institutions has caused setbacks that will need to be addressed (Ehui, 2016).

IFPRI (2014) as cited by Linn, (2014) has confirmed what is known about the crucial role technology plays in the expansion of farm output. Agricultural technologies have the power to drive economic development and improve food and nutritional security around the globe. While many technologies have been known for some time and have been tested quite successfully within research stations and experimental fields, their adoption has been inconsistent. In those settings where they have been successfully tested, the evidence is that they can double, triple or even quadruple the yield of crops grown in the farming systems (Linn, 2014). In demonstrating the efficacy of technology in closing the agricultural yield gap, the IFPRI (2014) as cited by Linn, (2014) revealed that their impacts are so strong that as much as 100 million people in Africa can be rescued from the risk of hunger and starvation. Given the extreme deprivation over much of the continent, the expectation was that technology adoption rates would be high, but this has not been realized.

In practice, many technologies are either not useful on-farm or are not reaching nearly enough farmers. Technologies can solve farmers' problems and provide opportunities for productivity growth, improved food safety and greater farm income (Lele et al. (2010). However, scaling out does not just happen by itself; it needs to be well planned and facilitated. Providing better technologies to smallholders is essential, but their uptake is often limited. As a result, smallholders are faced with artificial constraints and higher costs that limit their ability to access and invest in existing, proven agricultural technologies (USAID, 2014). Therefore, there is a great need to rapidly scale up agricultural technologies. This is because of the great scope for increasing agricultural production, especially among smallholders and with-it great potential to reduce rural poverty and hunger and to realize this potential, the use of agricultural technology must be rapidly scaled up (Linn; 2014).

6.5 Linking Smallholder Farmers to Markets and Industries

Markets are very important determinants of the productivity and profitability of the value chain. Attempting greater value capture through better markets may be more efficient than efforts at increasing farm-level productivity. Improving markets will require attention to marketing and branding, product development, and market channel development. Mgbenka and Mbah (2016) also indicated that one of the most destructive factors that hinder productivity in smallholder farming is the lack of market.

The successful transformation of smallholding farming has the effect of providing markets for farm products, which in themselves act as incentives for increased farm output. Therefore, it has now been established that markets, and not technologies, are increasingly becoming the drivers of agricultural development in many countries. Thus, linking smallholders with well-functioning local or global markets ranging from local 'street markets' to formal global value chains plays a critical part in long-term strategies to reduce rural poverty and hunger. Understanding how to link poor producers successfully to markets, and identifying which markets can benefit what kinds of producers, are critical steps for the development community (Seville et al., 2011). Once farmers realize that there are available markets around them, they will want to produce more and, therefore, require more technologies; many others will demand for such technologies, thus increasing adoption. If a farmer cannot profitably market her surplus, there is no logical reason to produce more than her family can store and/or consume. There is thus no motivation to adopt productivity enhancing technologies.
According to HLPE (2013), smallholders are fully part of different markets, but their position in these markets is weak. The position can be weakened when the production system is based on a few products: the smallholder has to sell at harvest time when prices are low, and often to buy again when prices have increased. This directly affects incomes (by reducing them at harvest) and also food security when it is difficult for the household to get enough food for the family when prices are high. Smallholder agriculture can effectively reduce poverty and hunger if well developed. It is only through sustainable markets access can poor farmers increase the income from their labor and lift themselves and their families out of poverty (Wiggins and Keats, 2013).

Ferris et al. (2014) stated that linking smallholder farmers to markets is generally considered a critical part of any long-term development strategy to reduce poverty and hunger. The development and research communities are finding that agronomic support services alone are not enough to achieve large-scale poverty reduction and resilience in rural communities. There has been a number of efforts to promote mechanisms to assist in shifting from production to market-based investment programs.

These include market analysis, contract farming, certification, and strategies to strengthen local business development and support value chain investment. These methods have complemented production-based systems to facilitate market access. The effects of market-based approaches can be dramatic for farmers who are poised to engage with markets but who lack the necessary support. This is especially true when farmers link to high value, formal markets.

While this growth is encouraging, a more general analysis of smallholder prospects reveal a sobering picture. Studies from several countries in Africa and Asia show that 50-70% of smallholders are not transitioning from subsistence to commercial farming. Studies in Zambia show transition for poor smallholders to high productivity agriculture, ranging from 5%–25% each generation. The clear message is that most farmers, particularly those working with 1-2 hectares (ha), face challenges that leave them locked in poverty. Experience shows that for agriculture to be modernize, there must be fewer farmers with larger land holdings. In developed countries, agricultural modernization occurred alongside industrialization, resulting in market forces that incentivized reallocating assets, such as land and labor, to support a more efficient, leaner agricultural sector, thereby reducing the number of farmers.

Increasing access to markets comes up prominently in rural poverty reduction strategies. While agro-ecological and location constraints will continue to impede a significant share of smallholders from participating in more integrated supply chains, the potential benefits for smallholders of participation are well recognized. Farmer organizations, such as the Network of Peasant Organizations and Producers of West Africa (ROPPA), are now focused on helping members become competitive suppliers of high value products for domestic markets.

Box 4:

Small Benkadi Women's Cooperative of Shallot Producers in the Segou region of Mali

Members of the small Benkadi women's cooperative of shallots producers in the Segou region of Mali were experiencing difficulties getting a good price for their produce and as a result were unable to invest and expand their production. By reaching out and coming together with 21 other small associations of women shallot producers, they were able to integrate the larger Faso Jigi farmers' cooperative. Faso Jigi invested in 19 shallot storage facilities and marketed the produce where prices were more advantageous, offering the women a better income and the opportunity to invest in their businesses and expand their production. Currently, 920 of the Faso Jigi's 4,200 members are women shallot producers whose needs and concerns are taken into account in the cooperative's operations.

Source: FAO (2013).

The private sector is expected to provide stable, predictable demand for purchased crop, with transparent pricing and terms of trade that ensure smallholders can cover cost of quality inputs required for sustainable agriculture. Where companies have committed to a specific certification scheme, they pay a premium to farmers for meeting the required standards, as incentives for producing higher quality crops. The government should provide incentives and skills development programs such as tax breaks, export facilitation schemes, guidance/ regulation on decent wages. They should create suitable policies and an enabling environment to support growth of local agricultural sectors and investment from global companies. In order for these small-scale farmers to make agriculture a business that thrives, they need to be able to sell their produce in a profitable and reliable market. To that end, businesses, governments and civil society are seeking partnerships and business models to link them up.

Similarly, information and communication technologies (ICTs) can offer smallholder farmers a wealth of opportunities to acquire real-time market information on, for example, prices, demand, quality standards, and weather. With this information, farmers can make informed production and marketing decisions and participate more actively in value chains. Access to such technologies needs to be accompanied by efforts from the public and private sectors to improve both the information content of ICTs and the ability of potential users to employ these technologies.

According to Khalid Bomba, the Chief Executive Officer of the Ethiopian Agricultural Transformation Agency, some appropriate digital applications are already in use, and more are in development. In 2014, for example, Ethiopia's Agricultural Transformation Agency launched an agricultural hot line, and it has already logged about 6.5 million calls. It also sends text messages and automated calls containing up-to-date agronomic information to 500,000 users. The agency is also developing the Ethiopian Soil Information System, or EthioSIS, a digital soil map analyzing the country's soils down to a resolution of ten by ten kilometers. Eventually, these two systems will merge, transmitting cutting-edge, highly tailored information to millions of farmers.

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Digital technology can also revolutionize farmer organizations. Membership in agricultural cooperatives has always lagged in Africa, because smallholders are too spread out. New digitally powered organizations, however, can succeed in doing what farmer cooperatives are supposed to do, purchase seeds and fertilizer in bulk and pass on the savings to their members, serve as trusted sources of information on farming practices, and help farmers aggregate and warehouse produce and negotiate fair prices. The digital infrastructure for interacting with smallholders is already being put in place; now is the time to make sure it gets done right. This means making sure that all farmers, especially the poorest and most remote, are included from the start.

Baumüller (2019) indicated that the potential for digitalization to transform African agriculture has been gaining traction over the past 15 years. Digital technologies are a fast-evolving field. Starting with mobile phones in the mid-2000s, the world has moved on to advanced technologies, such as artificial intelligence, big data and block chains. Baumüller (2019) indicated that access to mobile phones among end-users is now widespread. However, there are still large discrepancies in terms of quality, stability and speed of mobile networks as well as affordability of ICT services. On the issue of farmers using mobile phones, the founder and executive chairman of Econet Wireless and the chairman of AGRA gave an example of how Ecofarmer was launched for the benefit of farmers to use mobile phones to access agricultural information (Box 5).

Box 5: Experience of Service Provider on Farmers Use of ICT Facilities

"When we launched EcoFarmer in 2013, we deliberately avoided the conventional payments-first approach to providing mobile financial services to smallholders, and instead focused on a tailored set of products. We started with two initial offerings: an information service that sends advisory extension services through SMS to farmers, and a weather-indexed insurance product."

Farmers receive daily updates on three topics: farming tips, market prices, and weather data. They have already provided information on their district, ward, and frequently grown crops; this allows us to customize the messages they receive, such as market prices for different crops in their region and daily temperature and expected rainfall forecasts from the closest weather station covering their field. Farmers are then able to use the information to improve their crop planting and farm management practices, such as the best time to plant and the best place to sell their harvest.

Source: Strive Masiyiwa, Founder and Executive Chairman, Econet Wireless; Chairman, AGRA.

The rapid expansion of mobile networks even into rural areas has led to a proliferation of ICT-enabled agricultural services (ICT4Ag) in Africa since the late 2000s. In Kenya, Nigeria and Ghana, the expansion was driven by the establishment of innovations hubs that offered a space for start-ups to develop their ideas which they can then pitch to the growing number of 'angel investors' or at one of the numerous competitions (Baumüller, 2019). Smallholders' organizations play a crucial role in strengthening the institutional environment in three main areas: building services adapted to the needs and resources of smallholders, especially the poorest of them; increasing their market power or bargaining power and market access to remote places; and influencing the decision-making process at the local, national, sub-regional and international levels, to promote agricultural and rural policies that take into account the specificities of smallholders and their role in challenging poverty (HPLE, 2013).

6.6 Developing Business Pathways for Smallholder-Farming

It is a fact that farming at any scale is a business Businesses are increasingly aware of the rising expectations and of the positive business and societal impacts that could be achieved by strengthening smallholder competitiveness and incomes. Many businesses have already set goals related to the sustainable sourcing of commodities and to improving farmer livelihoods.

GrowAfrica and AGRA (www.growafrica.com) indicated that agribusinesses that will engage smallholders in a business mode need to take up services and practices that will increase productivity and secure volumes. They also indicated that farming as a business emphasizes a shift from farming for subsistence to farming for profit and improved livelihoods. Farmers who are able to critically examine the costs and risks related to different technologies and the benefits that accrue through improved efficiencies, are able to make better informed management decisions that better optimize available resources. Improving smallholders' business skills helps the farmers to change the way they identify and assess the range of options for farm management and investment. Equipping farmers with the tools for this kind of income-oriented decision making, combined with strategy development to diversify income, can increase productivity, and improve profitability and better livelihoods. One thing that is certain, however, is that moving out of poverty into a more sustainable income model at the farm level requires knowledge, planning, profits and investment (FAO, 2014).

The research by Dolan and Humphrey (2000) focused on shifting smallholders towards high-value crop production to increase smallholder profitability and address related challenges, often from the perspective of contracted production or inclusion in market and supply chains. However, there has been less work on specific strategies for market-driven production of staple commodities (Barrett, 2008).

Beyond this, however, little is known about smallholders' agricultural decision-making or profitability throughout the season from a business perspective. According to GrowAfrica, for most smallholders, it is challenging to develop their farms as businesses. Most learnt farming from their families as a subsistence activity rather than as a business enterprise and they do not keep records. For this reason, the mainstream industry must understand the new business environment in order to benefit from the market growth. Corporations are seeking new types of partnerships with local private sector entities, governments, and civil society to support a new generation of business models that can integrate smallholder farmers into their supply chains and thereby create more security.

Kahan (2012) stated that small-scale farmers all over the world have shown a remarkable ability to adapt. They look for better ways to organize their farms. They try new crops and cultivars, better animals, and alternative technologies to increase productivity, diversify production, reduce risk and increase profits. They have become more market oriented and have learnt to take calculated risks to open or create new markets for their products. Many small-scale farmers have several qualities of an entrepreneur.
Seville Buxton and Vorley (2011) explained that in broad terms, there are three basic market types that value chain projects can target: (i) informal markets, which have few regulations and often no taxation; (ii) more regulated formal markets, which operate using standard weights and measures and where transactions are agreed upon based on clearly defined legal frameworks; and (iii) structured public markets that are organized by public sector buyers who offer standardized contractual buying arrangements with specific conditions (e.g., buying a percentage of the total procurement from smallholder farmers).

Formal markets are characterized by modern value chain systems. These markets can link the more commercial or competitive smallholder farmers with larger commercial buyers. Formal markets can offer smallholder farmers prospects for growth (Seville et al., 2011). These markets provide an opportunity for farmers to link to a consistent source of income, with clear market signals coming from the buyers. In addition to the more consistent income, farmers who succeed in linking to formal markets generally access more support services. To work within the formal market sector, farmers must comply with the stringent quality standards and regular volume requirements of formal buyers as well as be willing to accept that prices may be below those in informal markets.

However, as for formal market requirements for smallholder famers, Vorley et al. (2008) indicated that it is common for firms to require traceability of lots along a supply chain. Each actor in the supply chain must adhere to a series of best practices for the production and handling of goods due to food safety standards. Failure to comply with such standards is penalized. Higher volumes in formal markets require a greater level of organization of smallholders through groups, associations and cooperatives, and access to specific services in order to maintain quality, volume, and flow. Farmers agree to lower prices in exchange for longer term buying arrangements, access to services, and social investments.

Whatever the situation, GrowAfrica and AGRA stated that training can provide farmers with appropriate analytical skills and business management tools for making quality business decisions, thereby decreasing costs and risks while increasing profits. Kahan (2012) opined that, for small-scale farmers to become more 'entrepreneurial', assistance from extension workers and supporting institutions is needed. Strong farmers' organizations can provide smallholders with technology, advisory services, and training. Innovation platforms are showing promise as a way to bring stakeholders together with a value chain framework.

6.7 Capacity Building and Extension Services for Transforming Smallholder Farming

The failure in the rice revolution in the past in sub-Saharan Africa stems from the lack of extension, particularly on agronomic management practices in rice production. The findings that productivity in rice farming was significantly improved after management training is prima facie evidence that productivity in rice production can be improved by extension of available technologies and management knowledge even without improvement of marketing, credit availability, and so on (Otsuka, 2016).

Ojijo et al. (2016) indicated that capacity in all its dimensions is key to effective knowledge generation, dissemination and use for agricultural transformation. There is a felt need to revitalize the extension system if agricultural production is to increase. Even where techniques and technologies are relevant and available, smallholder farmers often have no access to them. For this reason, extension systems and input distribution systems are mutually reinforcing the contribution of extension to agricultural productivity growth depends on functioning input distribution systems and vice versa. Agricultural technologies are also rapidly changing. Farmers need to be made aware of what technologies work best, know how to use them, and generate effective demand for viable new technologies to provide signals to input distribution system to supply them. (Jama and Pizarro, 2008).

In Africa, where the Green revolution did not work, the extension goal was to help small-scale farm households, especially among the rural poor, improve their livelihoods by: i) increasing their farm income, ii) achieving household food security, iii) organizing into producer groups (i.e., empowerment), and iv) increasing their access to health services and education for their children. To increase farm income and to improve rural livelihoods, many nations and some agricultural extension systems are shifting their attention to the broader goal of improving rural livelihoods (Berthe, 2015). Unfortunately, agricultural extension is poor and declining in many in Africa countries. Where extension services exist, the ratio of agricultural officers on the ground to farmers is often huge.

Agricultural advisory services (AASs) are the activities that provide the information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organizational and managerial skills and practices so as to improve their wellbeing (Christoplos, 2010).

The low adoption of agricultural technologies is widely recognized as a main contributor to low agricultural productivity in sub-Saharan Africa. This may be due to several issues such as discrepancy between available technologies and farmers' needs, lack of credit, marketing constraints and poor policies. However, farmers' knowledge and access to these technologies are critical (Jack, 2013). Inadequate and ineffective knowledge-sharing approaches on the supply side and lack of understanding of farmers' needs and information pathways they currently use on the demand side contribute to a mismatch of information and skills necessary for successful adoption of technologies and access to inputs and markets. Equally important is assessing attitudes and other trade-offs farmers make in choosing whether to adopt a technology. Insights from these will help identify strategies that can be used to improve technology adoption.

According to Carr et al. (2016), capacity building will also enlarge the market for bank credit among small and marginal farmers and among other marginalized sections of the rural poor, particularly women. Nain et al. (2018) added that the focus of capacity building has been shifting from primarily production to agribusiness, based on market-led integration and developing other value chains aiming at enhancing farmers' income. It requires identification of and supporting rural enterprises through technology and skill training, entrepreneurship training, market information, access to institutionalized credit, and other infrastructure. Economic growth can only be designated as inclusive if it creates productive employment opportunities that enable target groups to lead levels of livelihood above the poverty threshold.

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Carr et al. (2016),

CHAPTER 7
Policy Action/ Reforms for Transforming Smallholder Farming

Literature has shown the roles of policy in agricultural transformation for the improvement of smallholders' livelihood. Nwanze (2013) stated that the provision of fertilizers, improved seed and access to irrigation for smallholders is half of the equation. The other half concerns food and nutrition security, including the right policies, investment in rural infrastructure and access to land and local, national and regional markets. Africa's research for development does not give enough attention to policy issues and the social dimensions of development. This must change if the goal is long-term, sustainable, transformational development.

Literature has shown that governments have the broadest range of roles in creating the conditions necessary for improving smallholders' incomes. These include setting the right policy framework, from land rights (in particular women's title to land) to taxes. Basic services, such as health and education, are also central to the enabling environment, alongside the creation and maintenance of infrastructure essential for market access. Governments have an essential role in developing the resilience of farming and freshwater systems in the face of climate change. They also need to play a central role in the delivery of effective agricultural extension and research services.

According to Pingali (2006), governments are expected to help develop policy environments for smallholder commercialization through investing in rural infrastructure and undertaking institutional reforms that could encourage the private sector to participate in the development of rural economy. Obiechina (2012) pointed out that the main reason for poor performances of smallholder farmers is inadequate commitment by all tiers of governments to implement the right policies. Most times, interventions that succeed in improving productivity or living standards for smallholder farmers are seen as having high social returns. It has been argued that the size and significance of the smallholder sector do not, by themselves, imply that investments targeting smallholders have a high expected return either in growth or poverty reduction.

This depends on the feasibility and efficacy of interventions aimed at small farms and rural households. Hazell et al. (2007) indicated that interventions that allow smallholders to overcome transaction costs such as support for farmer organizations or cooperatives might benefit smallholders.

Also, there might be ways to target interventions to small farmers that focus on input supply and information. In supporting the previous submissions, Hazell et al. (2007) included investments in rural roads and infrastructure, the provision of basic public goods and a range of activities suitable for a modern developmental state. These are not necessarily interventions or activities that would specifically favor smallholders, but they have the potential to promote rural development and agricultural growth more generally.

In their contribution to policy issues, Shenggen (2013) indicated that moving from subsistence to more commercially oriented activities requires increased capital and investment flows that focus on smallholder farmers and their specific constraints and needs during times of both price stability and volatility. Increasing capital flows toward rural areas requires innovation in the channels and instruments through which financial services are offered to smallholders, including young people. The potential for novel approaches is wide and includes value-chain finance, rural leasing, loan-guarantee funds, and ethical and Islamic banking. When it comes to smallholders, however, more research is needed to explore the viability and benefits of these innovative services before they can be scaled up. For example, loan-guarantee funds under the Innovative Financing Program of the Alliance for a Green Revolution in Africa (AGRA) have been used to leverage much larger loans from commercial banks and have lowered interest rates for smallholders, but questions remains; whether this program has actu-ally reached new customers who previously were unable to access such loans (Poulton and Macartney, 2012).

Increased efforts are needed to examine and promote ICTs, such as mobile phones and Internet kiosks that can boost access to affordable payment, savings, and credit services for smallholders. Such financial products can be bundled with other development services, such as capacity-building and extension services. The focus of financing efforts should also be shifted toward more medium and long-term mechanisms to support commercially oriented capital investments of smallholders, such as machinery and storage facilities. Areas that are worth exploring and piloting include the provision of long-term loans through producer organizations, development of financial leasing schemes, and the expansion of accepted collateral through the introduction of movable asset registries. ICTs can also be used to establish an electronic credit history for smallholders, thereby giving them a foundation for access to longer-term financing mechanisms (IFC, 2011b). Above all, a vibrant rural financial system is needed that includes a diverse mix of financial institutions and networks that work together to support innovation and rural access among smallholders.

According to ACET (2015), policies should be keenly focused on making the markets work better so that demand becomes the primary driver of production. Supported production structures should allow the agricultural sector to respond effectively to demand, especially as new markets are being spawned rapidly in the wake of urbanization.

Increased efforts are needed to examine and promote ICTs, such as mobile phones and Internet kiosks that can boost access to affordable payment, savings, and credit services for smallholders.

Similarly, a holistic value chain approach is needed to ensure that policy does not address a bottleneck in one aspect of the chain only to create another bottleneck in a different part. For instance, higher yields, if not managed well, can create challenges of logistics and processing. A sound legal and regulatory environment is needed to maximize the private sector's contribution to smallholder productivity and to protect the property rights of smallholders and their surrounding natural resources. In conjunction, more research is needed to define appropriate instruments and strategies for integrating public-private partnerships and foreign direct investment (FDI) into local economies. For example, regional and local governments could work with private businesses (foreign and domestic) to design and provide supportive services, including techno-logical and organizational support, to smallholder farmers who serve as their suppliers (Jordan, 2011). The promotion of foreign direct investment (FDI) from other developing and emerging countries also has the potential to generate greater spillover of more contextually appropriate technologies and skills to smallholders (UNCTAD, 2012). Sound evidence-based research, information systems, and regulations at the national and global levels are needed to enhance the transparency of transactions and to understand the opportunities and threats for smallholders.

Table 12 shows workable innovation systems interventions for the transformation of smallholders, taking a cue from Farmers Income Lab (2018). In seeking to lower risks and increase opportunities for smallholder farmers, there seems to be a pronounced tendency to search for new technical solutions while often ignoring the potential to strengthen the impact of existing investments. There is a predisposition among development practitioners (academics, officers of international financial institutions or staff of nongovernment organizations) to look for new solutions to rural poverty alleviation, food security and income generation. Improved seed varieties, micro-dosing of fertilizers, more crop per drop irrigation schemes, sustainable agronomic practices, innovative financial instruments and the like all certainly have a role to play in improving the lives of the rural poor in Africa. To transform smallholding farming, policies will need to be restructured, physical infrastructure improved, and political will gathered until a way forward is found into a better future. Africans leaders and followers must rise to the enormous challenges that face them by taking decisive and concrete action to transform the lives of hundreds of millions of rural and urban people (Olaniran, 2016).

Table 12.Workable Innovation systems intervention to Improve Smallholder Farmers Livelihood

Finance & Business	Value Chain	Technology delivery
Access to finance	**Agricultural Park**	**Climate Change Adaptation**
Agricultural finance includes a broad range of financial services—e.g., loans, savings accounts, leasing arrangements, and insurance—that can be utilized for activities across the agricultural value chain	Aggregation of agricultural producers and value chain actor from the same geographical area to merge their enterprise in specific ways that ensure the benefits from economies of scale and complementarity.	The provision of climate smart technologies and practices to ensure stability of production and sustainability in the face of climate change scourge. It also includes provision of policies and needed infrastructures.
		New Extensionist Approaches
Crop Insurance	**Certification**	This involves effective models of getting technologies across to smallholders' farmers. It involves hand on training, ICT based communications etc.
This is a mechanism to reduce the risk involved in agricultural investment. It provides insurance to farmers and other stakeholders to bounce back to production in case of losses due to innate risk in agricultural businesses	The process of ensuring quality of product and standard delivery by censoring and validating the producers. Producers are certified in categories and should inform the pricing of commodities.	**Facilitate Productivity**
Market Information Systems		All efforts to ensure farm level productivity, such as development of improved agricultural technologies and practices. Information dissemination and provision of needed incentives to ensure the use of productivity enhancing inputs.
The use of traditional and modern communication tools to provide real time information on marketing of commodities. It could also include, information on weather, pest incidence, prices etc.	**Prevention of post-Harvest Loss**	
	The provision and use of technologies, equipment's and infrastructures to ensure drastic reduction of post-harvest deterioration.	

Policies

Input Subsidies

The provision of agricultural inputs to smallholder farmers at affordable price. It will also include efforts to ensure the availability of the inputs at the right time, as well and good distribution system.

Land tenure security

Policy incentive to ensure that farmers have access to and ownership of land to stimulate the needed investment in land for sustainable production.

Structured Pricing of Commodity

Structured pricing of commodities will prevent the smallholders from the vagaries of demand and supply forces. It may involve the commodity committee or boards to define fair price for commodities based on prevailing prices of input.

Innovation systems

Set up Innovation Platforms

This is a multistakeholders grouping of stakeholders along the commodity value chain. They work together to solve problems and produce in a business mode. The ultimate outcome is mutual benefit from complementarity and synergy. Created. Often, the policy makers are also engaged on the platform to facilitate supportive policies and infrastructural development

Poverty prevention interventions

This include the provision of financial services, skill training, seed capital and mentoring to ensure that poverty circle is broken in the smallholder farming family. The smallholder is able to earn consistent income.

CHAPTER 8

Agricultural Innovations Systems and the Transformation of Smallholders' Systems in Africa

The Integrated Agricultural Research for Development (IAR4D) concept is based on the innovation systems approach which involves multi stakeholders' collaboration and partnerships towards resolving the multi-faceted challenges in agricultural research and development. The essence of proffering diverse solutions to the challenges is to foster improved livelihood and quality of life of the stakeholders, especially the smallholders' agricultural practitioners. The IAR4D concept relies on active interactions among actors to identify, analyze and prioritize challenges, and source and implement solutions using feedback, reflection and lesson-learning mechanisms from different processes. This requires drawing on the knowledge of the relevant actors at each stage. The IAR4D concept enables the creation of a network of actors that facilitates learning and resolution of technical, social and institutional constraints that limit the potentials for growth in agricultural research for development. The purpose of IAR4D is to generate and/or facilitate innovative solutions to address challenges in AR4D rather than mere research products or technologies. Often, as the IAR4D involves complex mechanisms and interactions, it could facilitate fundamental changes in the broader policy and institutional framework. The approach largely builds on the experiences of previous approaches, including integrated soil fertility management (ISFM) and integrated natural resource management (INRM), and encompasses market and policy domains (von Kaufmann, 2007).

IAR4D is an action research concept for engaging several relevant stakeholders as it integrates the technological, natural resource management, policy and institutional dimensions in resolving a development challenge. The goal is to find an innovative commercial, social and institutional solution in responding to agricultural development challenges in the face of changing market and policy conditions. Its strength lies in its ability to engage policy and market, in addition to fostering systemic linkages among actors under diverse contexts. Therefore, the approach enables actors to have a stake in the process of generating, disseminating and using knowledge for socio-economic gains. The IAR4D seems to be an iterative process that makes it difficult to arrive at a precise definition. This notwithstanding, Hawkins et al. (2009b) summarized the concept as comprising a set of individual and organizational behaviors that promote the integration of stakeholder concerns, knowledge, actions and learning around a theme of mutual interest.

FARA (2007) describes the concept as an action research approach for investigating and facilitating the organization of groups of stakeholders (including researchers) to innovate more effectively in response to changing complex agricultural and NRM contexts for improved developmental outcomes. In general terms, IAR4D is regarded as a broad set of processes that, through their interactions, lead to the generation and use of knowledge (Hawkins et al., 2009).

IAR4D is considered as a framework for engagement and partnership of multi-stakeholders along the commodity value chain for the purpose of learning and sharing information and knowledge that may be innovatively applied in specific and/or broad terms to resolve challenges to increase productivity and enhance the livelihoods of the concerned actors. It is an innovation process that seeks to empower actors in technical, social and economic terms and in such a manner that they are never left worse off than when they were first expose to it. As an integrated approach, the IAR4D shortens the period it takes for actors in research and development to achieve meaningful outcomes as benefits for adoption. It is an approach that allows for quick diagnosis of challenges as well as exposes opportunities for enterprising actors to explore development products and services that promote visible means of livelihoods.

The IAR4D goes beyond its acceptance as new approach to doing things to include changes in personal skills, mind-sets and attitudes of actors as well as the organizational practices and culture, and the ways in which these organizations interact to achieve the desired outcomes, as part of the wider 'innovation system'.

IAR4D is considered as a framework for engagement and partnership of multi-stakeholders along the commodity value chain for the purpose of learning and sharing information and knowledge that may be innovatively applied in specific and/or broad terms to resolve challenges to increase productivity and enhance the livelihoods of the concerned actors.

According to Fatunbi et al. (2015), the guiding principles of the IAR4D concept include:

1. The integration of perspectives, knowledge and actions of different stakeholders around a common theme or 'entry point'.

The concept encourages the collation of the perspective of the different stakeholders on the constraint around the commodity of interest and system of production. This defines the entry point for generation of solutions, implementation of action and lesson learning in such a way that a win-win situation is achieved.

2. Integration of learning through working together.

The IAR4D concept recognizes that stakeholders have relevant knowledge that could be harnessed in sourcing solutions. The integration of the different actors also foster mutual learning and the complementary effect towards the generation of innovation. Learning takes place at individual, organizational and institutional levels

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3. Holistic analysis of change.

The IAR4D concept considers all the issues that surround and affect the needed change. It follows the system configuration and recognizes that an alteration in any of the components of the system will create a new equilibrium with trade-off. The magnitude of the trade-off will determine the benefits of the change.

4. Analysis, action and change at different levels.

IAR4D concept applies the innovation systems perspective and understands that research is not the only driver of change and development. The agricultural innovation systems perspective sees research as only one of the sub-processes of the framework that encompasses the value chain and the knowledge and information system, as well as policies and institutions that determine the change process.

In addition to the foregoing, IAR4D ensures a smooth public-private partnership in ARD; it essentially carries out activities in a commercial mode to ensure socioeconomic benefits to the stakeholders. It simultaneously addresses research and development as a fused continuum for generation of innovation. This bridges the gap between knowledge and technology generation and its use. It fosters the understanding that research should lead to development, while the trade-offs from development efforts represent the subject of new research endeavors. IAR4D essentially generates innovations that benefit all stakeholders on the platform. This ensure a win-win scenario based on investment by the different stakeholders, since it works in a commercial mode, the concept demands investment from partners. The sustainability of the action on an IAR4D platform requires the contributions of policymakers in terms of development of informed policies and provision of infrastructures.

These principles imply a new way of doing research to ensure development outcomes and impact. The approach gives attention to (a) intensification of subsistence oriented smallholder farming systems; (b) prudent management of natural resources while intensifying their use; (c) development of more efficient markets; (d) creation of enabling policies; €attention to development of new product; and (f) consideration for nutrition and gender as crosscutting issues. To foster the integration of the various dimensions of agriculture development, IAR4D requires additional supportive mechanisms in: (i) the promotion of organizational and institutional changes to enable cross-disciplinary research and development and multi-institutional collaborations; (ii) capacity building for stakeholders on the innovation platform viz., farmers, other private sector partners, extension agent and scientists; (iii) information and knowledge management; and (iv) continuous monitoring and evaluation with a systemic approach to impact assessment. The essential character of the IAR4D concept that supports the scaling of agricultural technologies is its unique blend of research and development confines. This necessitates an operation in a commercial mode and ensures effective partnership of the public and private sector actors. It is known that where commercial opportunities abound, users will necessarily embrace the needed technologies to aid production and profit.

CHAPTER 9

The role of Science, Technologies and regional bodies in fostering-smallholders' Transformation in Africa

Puja Sharma, a Consultant at Sesta Development Services (2018), stated that "agriculture is also called 'agricultural science' because it involves the use of techniques. In agriculture you not only need to grow crops but must know the entire life cycle of a crop, its whole biology of growth and maturing, and the effect of climate and environment on it. If you go deeper, you can find that even a microbe, the type of soil, air, water, manures everything has an effect on it. So when you know the science of growing a crop, you create ways of getting a better produce; you know what amount of water, manure, soil, and chemicals, which insects can affect it, and what quantity of these inputs help it grow better and give fantastic yield."

Peter Acland also in 2018 indicated that "Science has been the basis of agriculture since its formation". On the basis that, agriculture means the deliberate growth or culture of various plants and animals in a particular region, as opposed to 'hunter/gatherer' mode of living. It is highly likely that the early farmers soon learned the value of irrigation/nutrient supply/ selective breeding/planting/pest control and harvesting timetables, etc. All of these, no doubt, learnt by trial and error, and essentially by 'scientific' observations, although they did not realize this at the time. Gradually, most of these observations became incorporated into practice and techniques developed with corresponding improved production."

Punyasloka Mohanty in 2017 indicated that, "Science has enormous areas in the branch of agriculture, which are not possible to describe. For modernizing agriculture, science took a large field in it. Science has a great foundation for innovation of different hybrid crops and chemicals used in agriculture. Besides, it gives a lot of ideas about Robot farming. After all, science has too much impact on agriculture in different points of view."

The above quotations show that rapid agricultural growth occurs when the bulk of small-scale commercial farmers make decisions to apply a steady stream of science-based innovations, make investments that increase their net incomes, and increase their labor input.

The farmers then become financially prosperous. Profitable science-based innovations are largely generated in public agricultural research institutions and their public sector extension programs connect farmers with the research results and, just as important, researchers with farmer's problems.

FARA (2014) reported that science crucially contributes towards making agriculture in Africa more productive, competitive, sustainable, and inclusive. Scientific solutions for agricultural transformation need to be pursued further without losing sight of the fragility of African environments, the continent's rich biodiversity and the complexity of its agricultural production systems. Transforming Africa's agriculture requires a science system that produces both 'technical' and 'institutional' innovations. It is therefore essential that science is mainstreamed into agriculture-led social and economic transformation in Africa. This is why the Science Agenda was established. The Science Agenda represents a delayed, yet urgent and realizable, opportunity for Africa to fulfil this destiny. It articulates the science, technology, extension, innovations, policy and social learning that Africa needs to apply in order to meet its agricultural and overall development goals. The Agenda identified issues and options for increasing and deepening the contributions of science to agriculture in Africa, at the local, national, regional and continental levels.

The Science Agenda (S3A) acknowledges that several studies have attempted to describe an agenda, and indeed to outline priorities for science and research in Africa. Furthermore, the S3A has drawn out lessons from pertinent past continental visions, such as the Special Program for African Agricultural Research (SPAAR), the NEPAD's Science and Technology Consolidated Plan of Action (CPA), as well as the AU STISA and AU Agenda 2063. The Agenda does not purport to be a continental blueprint on how science should be nurtured and applied in support of agricultural transformation in a linear and undifferentiated manner. But rather, it is an evolving and living framework that provides the inspiration and choices available for countries, regional, continental and global institutions and other key stakeholders in the private and not-for-profit sectors. S3A is about connecting, with a renewed vigor, science with the various dimensions and players that are critical for bringing about rapid agricultural transformation on the continent. These include connecting farmers operating at different scales with agricultural research, the new extension, and value chains. There is need for better connection between universities and agricultural research as well as communicating science more effectively with decision-makers as well as among professionals. Moreover, science has to be better connected at the national, regional and continental levels with open portals to global science (FARA, 2014).

The S3A specifies four thematic areas: i) sustainable productivity in major farming systems; ii) food systems and value chains; iii) agricultural biodiversity and natural resource management; and iv) responses to megatrends and challenges for agriculture in Africa. These thematic areas are underpinned by cross-cutting issues on sustainable intensification, modern genetics and genomics, and foresight capabilities (FARA, 2014).

According to FARA (2015), the S4AC seeks to better support the S3A implementation at country level and give impetus to the "Accelerated Africa Agricultural Growth and Transformation" based on the post-Malabo CAADP Roadmap and Strategy. Its priority work streams are: i) supporting implementation of the CAADP national agricultural investment plans at country level; ii) engaging the policy agenda on fertilizer, seed, agribusiness, value chains and food markets; iii) strengthening institutional systems for knowledge management, innovation systems and platforms at national, regional and continental levels; and iv) developing foresight capabilities for megatrends for R&D.

The roles of sub-regional organizations in Africa in transforming smallholder farmers cannot be overemphasized. For example, Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) is tackling challenges of smallholder farmers in Eastern and Central Africa in a regionally coordinated manner by working with critical partners that include farmers; national, regional and international research institutions, extension and training organizations; public and private sector actors, NGOs, Regional Economic Communities and development agencies. This is because many smallholder farmers use poor quality inputs such as seeds and farm implements. Their farms are often under the threat of attack by menacing pests, diseases and weeds. This situation is aggravated by variable weather and declining natural resource base. As a result, farmers get poor yields from their crops and animals. In addition, lack of access to input and output markets, coupled with an environment of limiting trade policies, make farming a challenging business. These factors contribute to high levels of poverty among the farming communities in the sub-region. Owing to low returns from agricultural enterprises, the youth have abandoned farming in search of money-making ventures in urban areas leaving farming to the elderly, women and children.

Similarly, CORAF sees a future where people and communities in West and Central Africa achieve food and nutrition security and are prosperous. Its primary objective is to improve livelihoods in West and Central Africa through sustainable increases in agricultural production and productivity, as well as promoting competitiveness, and markets. To achieve its Vision and Mission, the CORAF Strategic Plan was developed to strengthen agricultural research, extension and advisory services, stakeholder capacities, and to establish and coordinate communities of practice in agricultural research and development in the region. The Strategic Plan is a framework for the development and promotion of successful pathways for scaling up and scaling out agricultural technologies and innovations to achieve widespread impact.
It has also been aligned with regional and continental policy frameworks that aim to accelerate agricultural growth and rural development, and improve food and nutrition security and livelihoods, including for women and young people. Ultimately, implementation of the Strategic Plan will enable smallholders, peri-urban farmers and producer organizations to become market-oriented and to become competitive entrepreneurs in sophisticated markets, while ensuring food and nutritional security for the population of West and Central Africa.

CHAPTER 10
Conclusion

This chapter tends to describe the conclusions that can be derived from this study/review based on the observations and findings from literature on strategies to transform smallholder farmers in Africa.

Smallholder farming have served as the dominant economic activity for people in sub-Saharan Africa and it will remain enormously important for the foreseeable future. The desired Africa Green Revolution is yet to happen even though there are pockets of successes already recorded but these have not reached the desired scale to trigger significant change.
From all the reviews, it has become obvious that smallholder farmers in Africa still face various challenges that impede their growth and ability to effectively contribute to food security issues and relative to commercial farmers.

Some of the problems include lack of access to land and poor physical infrastructure. This review/study has shown that access to land is essential to poverty reduction as land tenure is a key factor in the economic development of agricultural production and natural resource management. Therefore, the transformation of Africa's agriculture needs to tackle at least two areas as regards land tenure systems which is the need to increase security of land tenure to provide incentives for long-term investments and enhance agricultural productivity and commercialization. There is also a need to increase the flexibility of land markets to provide easy and secure access to enterprising farmers who want to buy or lease land. Similarly, it can also be concluded that land reform policy going on in many African countries such as Rwanda, Madagascar, Mozambique, and Zambia which allow land parcels to be titled and owned individually as well as allowing entrepreneurial farmers acquire unused land may be one of the major solutions to the transformation of African agriculture.

This study has also shown that inadequate linkage to modern value chains is a major problem and so it can be concluded that improving the performance of Africa's agricultural value chains is also required for agricultural transformation and inclusive growth. Therefore, linking smallholders to agrifood value chains is an important component of building smallholder resistance to shocks and improving their productivity and livelihoods.
Similarly, the reviews have shown that increasing agricultural production can only be achieved through sustainable intensification of agriculture that creates surpluses for urban areas, limits rural migration and lowers production costs while increasing individual incomes and curtailing the expansion of land under cultivation.

This will entail better use of agricultural land and greater access to inputs, including the use of "smart" subsidy policies that encourage the adoption of innovations and securing access to resources for women in particular.

It is essential that state intervention should focus on the provision of public goods such as rural infrastructure, irrigation, research support, information sharing, extension and professional training. Also, supports should be offered as a matter of priority to family farms that make optimal use of land and labor on small surface areas. If governments truly want agriculture to have a profound impact on poverty and hunger, they must invest in rural infrastructure. Farmers need processing and storage facilities so they are not forced to watch their harvested crops eaten by pests or spoil in uninsulated sheds. Therefore, public and private investments in agriculture and economic transformation should focus on reducing food loss along the supply chain, from the development of crop varieties with better post-harvest traits to better storage equipment and facilities that have low initial and recurring costs.

It has become very crucial that certain factor such as market needs to be attended to for smallholders' commercialization to happen. This is because it has been established that markets, and not technologies, are increasingly becoming the drivers of agricultural development in many countries. Thus, linking smallholders with well-functioning local or global markets ranging from local 'street markets' to formal global value chains plays a critical part in long-term strategies to reduce rural poverty and hunger. For example, smallholder farmers need access to markets and industries to earn their fair share of the profit pool in the value chain. Good markets, in turn, provide food security for the population and facilitate Africa's agricultural self-sufficiency. Governments and private investors need to ensure that good roads, functional warehouses, processing facilities and other infrastructure are in place to get products to increasingly urbanizing markets. Farmers need access to information to deliver products to the markets that offer them the best price. There is no doubt that information and communication technologies (ICTs) can offer smallholder farmers a wealth of opportunities to acquire real-time market information on, for example, prices, demand, quality standards, and weather. Farmers can therefore make better-informed production and marketing decisions and participate more actively in value chains. However, farmers having access to market is one part of the process as there is a need to link smallholder farmers to markets as it is generally considered as a critical part of any long-term development strategy to reduce poverty and hunger. This is because once farmers are aware that there are available markets around them, they will want to produce more.

At the regional and country levels, government and market actors need to create the markets that allow the trade of homegrown products. These initiatives, in general, cut across the wide spectrum of crops and produce. Enabling smallholder farmers to grow more food and sell in formal markets for a fair price would change life for almost every poor person in Africa. The keys to fixing this problem are: supplying smallholders with appropriate seeds and fertilizer, providing education and training, and ensuring easy access to markets and larger economic networks.

This study has established that source-saving and yield-enhancing technological innovations and adoption are indeed core to the smallholder commercialization process in Africa and evidence from Ethiopia has shown that these factors increase smallholders' market participation, in the case of adopters of high-yielding varieties. Therefore it is evident that technology awareness positively affected adoption of high-yielding varieties and that the level of adoption of improved varieties can strongly be related to a range of household wealth. However, it is not just using proven technologies alone but there is a great need to rapidly scale up proven agricultural technologies for the transformation of smallholder farmers to become commercialized.

It is certain that for the transformation of smallholder farmers to become commercialized and moving them out of poverty, they need knowledge of farming as a business that will involve planning, profits and investment. However, to accelerate investment for smallholder farming in Africa, communication and information technology is important and digital technologies are fast-evolving; even starting with mobile phones may be a good way to go.

For agricultural transformation of smallholders, capacity building in all its dimensions is key to effective knowledge generation, dissemination and use. Enablement in areas like education, infrastructure, water management and regulation is crucial as well. Public-private initiatives can ensure capacity-building support and the development of structures in areas like financing.
The low adoption of agricultural technologies is widely recognized as a main contributor to low agricultural productivity in sub-Saharan Africa. It can therefore be concluded that the role of improved Agricultural Advisory Service (AAS) cannot be overemphasized in improving the transformation of smallholders in sub-Saharan Africa. This is because Agricultural Advisory Service will provide the information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organizational and managerial skills and practices so as to improve their wellbeing.

It has been pointed out that the main reason for poor performances of smallholder farmers is inadequate commitment by all tiers of governments to implement the right policies. Therefore, the roles of government in creating the conditions necessary for transforming smallholders' farming cannot be overemphasized. These include setting the right policy framework for land rights (in particular women's title to land), investing in rural infrastructure and undertaking institutional reforms that could encourage the private sector to participate in the development of rural economy and making the markets work better so that demand becomes the primary driver of production among others. More importantly, the non implementation of the agreed CAADP policy of investing 10% of the national annual budget into agriculture is seriously affecting the growth projection for the sector at the continental level. It is however expected that with the major decline in the price of oil globally, African countries that have not signed CAADP compacts and have not attained the 10 percent budget threshold for agriculture will use this opportunity to design and implement a transformative agenda for smallholder farming to reduce poverty and develop economic growth.

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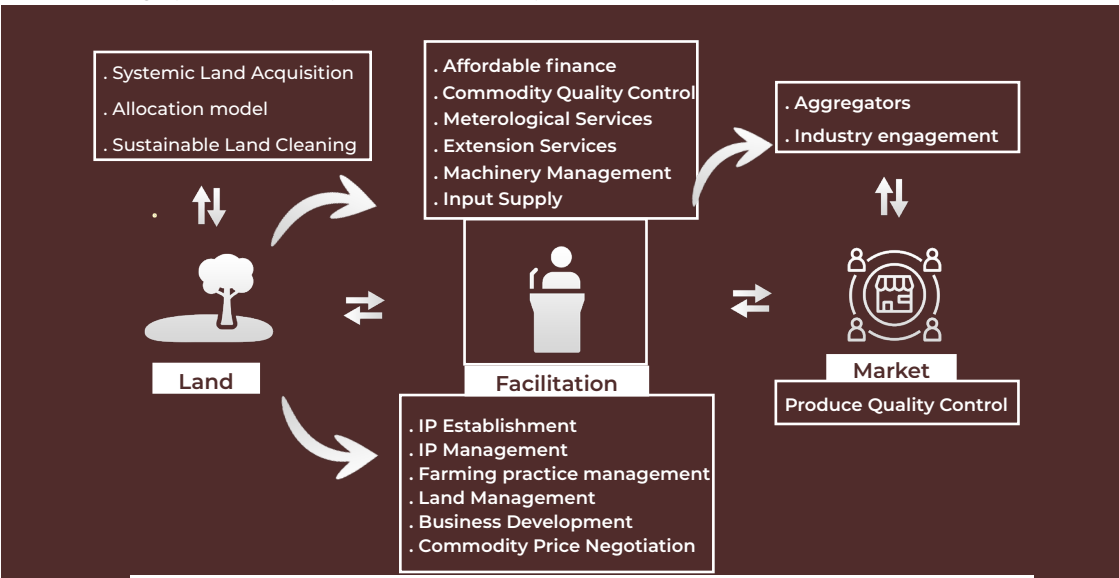
Finally, this study has shown that the role of smallholders in national development is increasingly being seen in a broader economic context. Experience from the case studies reviewed in Africa have shown that smallholder farmers have to change from subsistence to commercialization. The current situation in Africa therefore requires that farming is modernized to replace its ageing workforce. The transformation from small-scale subsistence farming to mechanized and commercially viable one is essential. However, the focus of smallholder transformation should not be about converting small-scale farmers into large enterprises but on transforming them into more commercial-minded operations. Through commercialization, smallholder farmers can earn more profit, increase family income and standard of living.

Model for leveraging land for sustainable business farming in Sub Saharan Africa Countries

Background

The issues confronting the systematic transformation of the smallholders can be aggregated into three blocks which include; (1). Access to land, (2). Production inputs and (3) Efficient market. The three blocked issues have both technical, institutional and infrastructural components. This write up aims to proposed a systematic approach to provide a smooth solution and ensure the smallholders transformation.

The graphics below depicts the relationship between the issues



Interlinkages of issues in systemic transformation of the smallholders farming.

A. Making land available for farming

Land availability and tenure is a major constraint to farming as a business in Africa countries. Generally, land is a prime asset in households and communities, it constitutes the biggest inheritance that is jealously passed from one generation to another. In some culture, land is never sold outrightly outside the family in other to preserve the family inheritance, rather it is rented out or leased for a period of time to individuals within the same family. In modern times, countries do have land tenure law that guides the exchange of land for different use between individuals. For instance, in Nigeria, the land tenure law of 1978, stipulated that all land belongs to the state and can only be allocated for specific use by the state approval. This law limits the traditional family and community land ownership and it often creates crises situation for acquisition of land for various developmental uses. In case of private development, land acquisition will start by purchase or lease from the owners after which series of payments will be made to secure the state approval document called the "certificate of occupancy". Lands are often owned by individuals that are not interested in agriculture or not using the land, but owns it as an investment or in trust for the next generation.

Proposed model for agricultural land acquisition for agricultural use

1. Conduct broad based agrarian land capability studies and segregate land into commodity production zones. Create a detailed map that indicate land status.
2. Have a discussion with communities and traditional land owners on government intentions.
3. Carry out exhaustive land ownership survey and create a georeferenced map of land.
4. Provide land owners with certificate of ownership that prevent individuals from selling off agricultural land but ascertain the ownership. Such process should have an updateable record of likely inheritors.
5. Government should acquire the land for certified owners with a leasehold of 100 years for development into agricultural production estate. The payment for the land will be on annual basis to current owners. Fund for payment will be drawn from rent of land by prospective business farmers.
6. Having established a geo-referenced coordinate for individuals' owners. Government should invest into land clearing and preparation into two-hectare blocks with farm layout roads for equipment movement from plot to plot. The land clearing and preparation activities must use the best practice to remove the surface and underground biomass without destroying the shallow top soil or subjecting the land to degradation by erosion and run off. Bulldozing and windrowing should be avoided.
7. Smart agronomic advice based on techniques to maintain soil fertility should be provided.
8. Other useful infrastructure such as laying of irrigation pipes and canals should be facilitated.
9. Farm allocation to users should follow a free and fair public process, the following is proposed;

a. Individuals could apply for the acquisition of a minimum of five blocks of 2 hectares making a total of 10 hectares. This land size is the minimum that would guarantee benefit from economies of scale.
b. Priority should be giving to indigenes of the area in land allocation.
c. Prime attention will be giving to unemployed youths, females and individuals that are socially excluded.
d. Land allocation is contingents on provision of evidence of fund availability to run farm activities for at least one year.
e. Farm allotment is for an initial period of five years and it is renewable.
f. Prospective allottee would also provide evidence of knowledge of farming, either by training (long or short term) or practice.
g. Allocation will only be made to individuals who have time to attend to farming as a full-time endeavour and or commit substantial time to the farm business.
h. Allocation will be giving to individuals that can pay the rent for the land

10. The rent from the land will service the following;
a. Payment of annual honorarium to original land owners (not more than 20% of the rent pro-rated on size owned).
b. Repayment of the government investment (30%).
c. Annual repair of the inter-plot roads, cleaning of canals, drainages, dredging of dams or water reservoir etc. (40%)
d. Reserve for expansion or major repairs (10%)
11. Farm land allocation to any allottee will depend on effective utilization of the land in consonance with the IP business plans and adherence to the guiding principles of the estate. In a situation where land is not utilised, the allottee will loose its allotment and it will be offered to someone else for effective utilization.

B. Facilitating effective production and utilization of resources

Sustainable agricultural production largely embraces the use of technologies in an environment with supportive institutional and infrastructural factors. The use of the agricultural innovation platform is proposed as a viable model to facilitate a complete loop from production to marketing. Earlier chapter of this book has explicated the efficacy of the Innovation platforms model. The IP model will establish the following instruments;

a. The estate will establish a strategic IP that works on the overall strategy for the operation of the estate from production to marketing and utilization in a business mode. The strategic IP will comprise of both public and private sector actors selected from commodity groups. The strategic IP will have an oversight role on the functionality of the estate.

- It will engage private sector service providers as part of the estate business models to provide mechanization functions efficiently. Such mechanization outfits will own and manage its own equipment as a business and provide services to farmers in the estate.

- It will engage the service of input dealers to supply high quality inputs to farmers in the estate based on demand in alignment to the agreed business model.
- It will engage and manage the services of irrigation service handlers (a private sector actor) to provide services to farmers in the estate as need may arise.
- It will manage the services of soil testing services
- It will facilitate the services of meteorological services for weather predictions and irrigation planning.
- It will align with research institutes and extension services to source best-bet technologies and organize it transfer to farmers.
- It will facilitate the linkage with commodity end users for collective bargaining, engagement of aggregators where necessary and storage and warehousing where necessary.
- It will facilitate the provision of finance for production and market chain.
- It will liaise with government agencies and policy makers for subsidies and government policy incentives.
- It will oversee the development of business plan for the estate to prevent overcharging, ensure fair trade among stakeholders and a win-win situation.
- It will facilitate and manage the security of estate farms and properties.
- It will provide guideline on the maintenance of soil fertility and prevention of soil physical degradation.

b. The estate will also establish operational IPs on commodity basis. The commodities will respond to the competitiveness of such commodities based on the land and climate in the estate. The operational IP will respond to the estate business model and domesticate the operational plans for the different commodities. It will liaise with service providers and provide data on efficiency of service delivery. The operational IP will organize casual farm labor (service gangs).

c. The strategic IP will establish its management and governance framework. The management could be by election among members that have key stake in the business of the estate. A smooth blend of public and private sector partnership is envisaged as indicated in the operational principles of the IAR4D concept and the IP. Fund for financial sustenance of the estate operation could be drawn from contributions from the profit of the stakeholders, about 2% of the various stakeholder's profit margin is proposed.

d. The estate will organize regular training for its stakeholders on different aspect of business farming. Ranging from basic science behind agronomic practices, the essence of soil fertility maintenance, business farming personal fund management etc.

C. Market arrangements and end user linkages

The farm estate will aim at the complete loop operations. The market component is often the missing link and has the tendency to disrupt the entire profit flow. Many at times the farmers are made poorer from good technologies because there is ready market for the commodities. It is better not to produce if the market is not certain. This model follows the innovation systems approach and projects an effective market as the entry point into the production chain. The farm estate model needs to do the following on market;

1. The stakeholder's configuration needs to start from the demand end. The Strategic IP need to seeks out and effectively engage the commodity end users. Since the estate is modeled to produce commodities at scale multiple industries, produce merchants, commodity off-taker outfits and exporters needs to be targeted. The IP needs to have a strong MoU and leveraged it for the farmers in the estate.
2. Negotiation on commodity quality standard must be arranged, defined and agreed.
3. The level of guaranteed production by the farmers must be communicated at the beginning of cropping season to inform production level.
4. Price prospection will be done based on available data prior to purchase of inputs and production.
5. Facilitation of delivery to the end users needs to be agreed in terms of time and packaging.

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Design and Layout by FARA Communications team